MOH/S/IPSK/160.19(BUL)

MINISTRY OF HEALTH MALAYSIA
INSTITUTE FOR HEALTH SYSTEMS RESEARCH

Q BULLETIN

Ministry of Health Malaysia

VOLUME 1, NO 32,
JAN - DEC 2023
ISSN: 1985-0131

Journal for Quality Assurance/
Quality Improvement in Healthcare

Q BULLETIN

Ministry of Health Malaysia

VOLUME 1, NO 32, JAN-DEC 2023

Editorial Board

The Editorial Board of Q Bulletin was established in 2019

Editor-in-Chief

Dr Samsiah Awang
Head of Centre for Healthcare Quality Research
Institute for Health Systems Research (IHSR)

Associate Editor

Dr Izzatur Rahmi Mohd Ujang
Medical Officer
Institute for Health Systems Research

Editorial Members

Dr Nur Ezdiani Mohamed
Public Health Medicine Specialist
Institute for Health Systems Research

Dr Divya Nair Narayanan
Medical Officer
Institute for Health Systems Research

Dr Nurhayati Shaharuddin
Medical Officer
Institute for Health Systems Research

Mrs Khalidah Maruan
Pharmacist
Institute for Health Systems Research

Mrs Normaizira Hamidi
Research Officer
Institute for Health Systems Research

Mrs Roslina Supadi
Nursing Manager
Institute for Health Systems Research

Mrs Mariyah Mohamad
Nursing Supervisor
Institute for Health Systems Research

Online (MyJMS) Journal Manager

Mrs Khalidah Maruan
Pharmacist

Administrative Co-ordinator

Norbaiti Mustaffa Kamal

Suggested individual article citation for the first article:

Kwek LL, Lai SM, Fatin S, Lee WY, Venthen K. Improving Appropriateness of Injectable Antibiotics Dilution and Administration in The Multidisciplinary Wards in Tanjung Karang Hospital, Q Bulletin, 2023; 1 (32): 6-18.

ISSN: 1985-0131
e-ISSN: 2716-6554

The Q Bulletin of the Ministry of Health Malaysia is a peer-reviewed journal addressing quality assurance/improvement study related to health care. The journal welcomes original contribution from representatives of all health professions from health-related backgrounds in the discipline of quality assurance/quality improvement

Copyright reserved @ 2023

Ministry of Health Malaysia
Secretariat Address:
Institute for Health Systems Research
Block B2, National Institutes of Health Complex,
No. 1, Jalan Setia Murni U13/52,
Seksyen 13, Setia Alam,
40170 Shah Alam, Selangor
Tel: 03-3362 7500
Email: ihsrqa@moh.gov.my

The views expressed in the articles are those of the authors and do not necessarily reflect the views of the Institute for Health Systems Research.

Acknowledgements

The Editorial Board Q Bulletin Journal would like to thank the Director General of Health, Malaysia for the permission to publish the articles in this journal. We would like to convey our gratitude to all reviewers for their time and contributions towards the publication of this journal.

Dr Raja Zarina Raja Shahardin
Former Paediatric Dental Consultant
Department of Paediatric Dentistry
Tunku Azizah Hospital, Kuala Lumpur

Dr Akmal Hafizah Zamli
Rehabilitation Physician Consultant
Head of Rehabilitation Medicine Department
Sungai Buloh Hospital, Selangor

Dr Yushaini Ahmad
Paediatric Dental Specialist
Cyberjaya Hospital, Selangor

Mr Lau Boon Tiang
Pharmacist
Port Dickson Hospital, Negeri Sembilan

Dr Cheah Wee Kooi
Physician and Geriatrician
Head of Medical Department and Clinical Research Centre,
Taiping Hospital, Perak

Our heartfelt appreciation to the proofreaders below for proofreading of the manuscript.

Mr Sivaraj Raman
Pharmacist
Institute for Health Systems Research (IHSR)

Dr Farhana Aminuddin
Research Officer
Institute for Health Systems Research (IHSR)

Mrs Devi Shantini Rata Mohan
Pharmacist
Institute for Health Systems Research (IHSR)

Dr Marhaini Mostapha
Research Officer
Institute for Health Systems Research (IHSR)

Dr Awateef Amer Nordin
Public Health Medicine Specialist
Institute for Health Systems Research (IHSR)

Contents

Editorial 4

Improving Appropriateness of Injectable Antibiotics Dilution and Administration in the Multidisciplinary Wards in Tanjung Karang Hospital 6

Reducing the Percentage of Fissure-Filled Teeth Failure among Primary Schoolchildren in Perlis 20

Increasing the Adherence Towards Oral Iron Intake among Pregnant Women at Kota Bharu District Health Clinic 34

Improving the Management of Unclaimed Bodies in the National Institute of Forensic Medicine, Kuala Lumpur Hospital 46

Towards Reducing the Heavy Usage of Controlled Antibiotics in Seberang Jaya Hospital 58

Increasing the Percentage of Exclusive Breastfeeding Mothers in Dungun, Terengganu 72

Guideline for Authors 85

EDITORIAL

Dear Readers,

Welcome to Q Bulletin's 2023 edition.

This volume presents you with a diverse topic with different strategies for change. However, educational intervention strategies appear as common similarities across most papers targeting patients, healthcare workers or both groups.

In providing patient education, there are four steps of the patient education process: assessment, planning, implementation and evaluation (APIE), which are essential and cannot be skipped for effective patient education [1, 2].

- Assessment : The healthcare professionals assess the patient (e.g. knowledge, goals, language)
- Planning : The health care professional and patient partner to develop an education plan
- Implementation : The healthcare professional puts into action the evidence-based teaching plan
- Evaluation : The patient's knowledge/behaviour and the health professional's ability to teach are evaluated

On the other hand, for healthcare workers, continuous medical education (CME) is one of the common strategies used to maintain, develop, or increase the knowledge, skills, and professional performance and relationships that healthcare uses to provide services for patients, the public, or the profession[3].

Conducting an effective CME activity requires careful planning and design. CME should move from a traditional, passive approach that is primarily teacher-focused, not learner-centric, to more interactive, relevant, and meaningful by limiting the time for formal lectures, incorporating case studies, and allowing sufficient time for discussion and for learners to work in groups to share, reflect on, and solve problems[4]. The technology role should be used to enhance involvement, participation, and maximum interactivity, such as polling using smartphones, which will allow participants to learn their attitudes, knowledge, or problem-solving abilities and compare those with their peers[4].

In conclusion, empowering patients with the knowledge and involving them in decision-making ensures patient-centered care while educating healthcare staff equips them with the skills and mindset needed to drive continuous quality improvement. By combining these strategies, healthcare organisations can enhance the quality of care, improve patient outcomes, and create a culture of safety and excellence.

Enjoy your reading!

Dr Samsiah Awang
Editor-in-Chief

[1] *Bastable, S. (2017). Patient education essentials. Jones & Bartlett Learning.*

[2] *Healthcare Education Association (2021). Patient Education Practice Guidelines for Healthcare Professional*

[3] *National Institute of Health. What is CME Credit? https://www.nih.gov/about-nih/what-cme-credit*

[4] *McMahon, G. T. (2016). What do I need to learn today? The evolution of CME. New England Journal of Medicine, 374(15), 1403-1406.*

IMPROVING APPROPRIATENESS OF INJECTABLE ANTIBIOTICS DILUTION AND ADMINISTRATION IN THE MULTIDISCIPLINARY WARDS IN TANJUNG KARANG HOSPITAL

Kwek Lih Ling, Lai Shu Mei, Fatin Sarahani, Lee Wei Yang, Keerthy Venthen

Pharmacy Department, Tanjung Karang Hospital
Ministry of Health Malaysia

Corresponding Author: Kwek Lih Ling
Email: lihling@moh.gov.my

Abstract

Injectable antibiotics with rapid delivery to infection sites are preferable in hospital settings, particularly in treating patients with moderate to severe infections. Therefore, inappropriate dilution and administration of injectable antibiotics can cause antimicrobial resistance, thrombophlebitis and mortality. A verification study conducted from August to September 2018 in Tanjung Karang Hospital (HTK) demonstrated that only 14.2% of injectable antibiotics had appropriate dilution and administration out of 148 samples. Subsequently, a cross-sectional study was undertaken from August 2018 to February 2019 to improve the dilution and administration of injectable antibiotics among nurses in the HTK. This was followed by the intervention phase (October to December 2018) and post-intervention evaluation (January to February 2019). The indicator measured was the percentage of appropriate injectable antibiotics dilution and administration out of the total injectable antibiotics. The standard was set at 100%. Observations of the six aspects of the appropriateness of injectable antibiotics dilution and administration were carried out. A data collection form was used to document the observations in this study. Results showed that the least appropriate aspects were administration duration and reconstitution concentration. Pareto chart analysis identified the major factors contributing to inappropriate dilution and administration of injectable antibiotics as being unaware of uncommon procedures, unavailability of local protocols, inadequate references and reminders, insufficient knowledge or experience, and a lack of monitoring. Therefore, strategies introduced were the “SWeFT” approach, improving ward pharmacists’ roles in monitoring dilution and administration of injectable antibiotics and antimicrobial stewardship. The percentage of appropriate injectable antibiotics dilution and administration successfully improved to 49.3% after interventions. Among the six aspects assessed, reconstitution concentration and administration duration revealed marked improvements. The rates for uncommon antibiotics also substantially improved by up to 100%. Strategies introduced, especially the “SWeFT” approach, were shown to be effective and hence should be enhanced to include other medications and disciplines.

KEYWORDS: Antibiotics, Dilution, Administration, Error

Problem

Injection is one of the most common routes of medication administration in healthcare. It comprises intravenous (IV), intramuscular (IM) and subcutaneous (SC) routes. IV antibiotics are administered directly into the vein, allowing rapid delivery to the infection sites to achieve rapid clinical response. Hence, they are preferable in inpatient care, where patients are often moderately to severely ill (1-4). One of the key aspects of IV antibiotics is the appropriateness of their dilution and administration. They are crucial to ensure optimal antibiotic efficacy and further prevent the possibility of antibiotic resistance.

Tanjung Karang Hospital (HTK) is a non-specialist government hospital located in Tanjung Karang, Selangor, Malaysia. This district hospital was built in 1966 with 114 beds, encompassing one paediatric ward, one obstetrics and gynaecology ward and two multidisciplinary adult wards, namely Ward 1 (male) and Ward 2 (female). Ward 1 accommodates a maximum of 45 male patients, while Ward 2 has a maximum of 35 female patients. The healthcare staff assigned to each multidisciplinary adult ward consists of an average of three medical officers, one nursing supervisor, 11 nurses and one clinical pharmacist.

Visiting specialists from various disciplines in Sungai Buloh Hospital will attend to patients in HTK on scheduled days every week. It is often observed that visiting specialists tend to prescribe antibiotics uncommon to the HTK setting in many complex and complicated cases. As a result, there is a higher likelihood of making medication errors for nurses who are unfamiliar with the method of diluting and administering these antibiotics.

A verification study in HTK revealed that the percentage of appropriate injectable antibiotic dilution and administration was only 14.2%. This low magnitude was the focus of our study. Several initiatives were planned, with the hope of reducing these errors and achieving 100% appropriate antibiotic dilution and administration across the multidisciplinary wards of HTK within three months.

Background

Medication errors are one of the major clinical issues affecting patient outcomes (5). It is defined as any preventable event that can contribute to inappropriate medication use or patient harm. Medication errors can happen at any stage, including prescribing, transcribing, preparing, administering and monitoring (6).

In the United States of America (USA) alone, medication errors lead to at least one death daily and injure about 1.3 million people annually (7). In France, 10 to 21% of the medication errors that occurred were severe and life-threatening (8,9). In Vietnam, 23.5% of the errors had a moderate impact, with 3.5% being potentially serious (10). According to Malaysia's e-Incident Reporting (e-IR) Report before 2017, 5,689 medication errors were reported, of which 366 reports came from Selangor, Malaysia. About 30% of the reported medication errors in Selangor had resulted in severe harm to the patients (11). A study demonstrated that medication errors related to antibiotics were observed to be more common among nurses (78%) compared to doctors (22%) (12).

Injectable antibiotics, especially via the IV route, can be safe and effective only when reconstitution, dilution, and administration are appropriate. It entails various risks of errors, which have been documented globally and locally. For instance, about 60% of reported life-threatening medication errors in the USA and the UK involved injectable drugs (5,13). A study conducted in a government tertiary care hospital in Selangor showed that errors during the administration phase were higher than those in the preparation phase, at 88.6% and 32.8%, respectively (14).

Focusing on IV antibiotics, medication errors similarly may occur at any stage, from reconstitution to the

administration phase (1,4,14,15). There is also a higher chance of errors as most injectable antibiotics are not designed for use readily and require reconstituting and/or further dilution before administration. The most frequent error was administering IV antibiotics within an inappropriate duration (usually too rapidly), while the second was reconstituting or diluting the IV antibiotics with inappropriate diluents (16). According to a multicentre audit on IV-related medication errors, errors in duration or rate of administration in UK and German centres were 49% and 21%, respectively (16). Besides that, the usage of inappropriate diluents was 49% in Germany and 18% in France (16).

Medication errors need to be tackled and prevented, as they reduce treatment efficacy and may conversely harm the patients. For example, any inappropriate diluents used for reconstitution can cause reduced solubility of antibiotics powder, inactivation, and eventually, administration of precipitates to the patients (16,17). The high incidence of inappropriate injectable antibiotic dilution and administration errors may also cause inadvertent complications such as antimicrobial resistance, thrombophlebitis, morbidity and even mortality (5,8-10,11,13,14,18-21). Antibiotic resistance, for instance, can develop when concentration-dependent antibiotics such as aminoglycosides are diluted less than the recommended optimal concentration (12).

Some of the possible factors leading to these medication errors include inadequate knowledge and skills, heavy workload, ambiguous manufacture leaflets on dilution methods, poor communication between healthcare practitioners, distractions, personal problems and equipment errors (1,4,5,20,22-24). These factors can be further classified into personal, contextual, and knowledge-based factors (22). In personal causes, for example, an individual might feel stressed and tired during work, while some may be confused about the prescriber's prescription. Contextual and knowledge-based factors, on the other hand, include inadequately skilled staff, heavy and long working hours, crowded wards and insufficient knowledge and experience (22).

According to a study in the Czech Republic that assessed nursing students in infusing and administering drugs, it was shown that those with master's degrees had the most extensive knowledge compared to those with bachelor's (24). It also highlighted those delegating responsibilities to less qualified healthcare practitioners for medication management were risky, especially if the facility had limited human resources (24). These factors may result in a wrong mixture or incorrect administration duration.

Most inappropriate drug preparation and administration are preventable with proper measures. Adopting correct guidelines and training, increased roles of clinical pharmacists and involvement of multidisciplinary teams can help increase awareness, knowledge, and abilities among nurses and other healthcare practitioners (14,25). Implementation of value-added clinical practices also has an important role. For instance, a study has shown that using an IV-drug compatibility-alert card and permanent supervision by clinical pharmacists can help in a better quality of IV medication preparations and administrations (25).

Measurement

The Patient Safety Goals Guideline highlights avoidable medication errors that can occur at various points of patient care (26). Realising the problems and challenges in HTK, our study focused on the preparation and administration of injectable antibiotics while adapting to the guidelines. The clinical indicator measured was the percentage of appropriate injectable antibiotics dilution and administration. The appropriateness was explored for six aspects - correct reconstitution concentration, dilution concentration, diluents for reconstitution, diluents for dilution, routes, and duration

of administration. The percentage of appropriateness was calculated using the formula below:

$$\text{Percentage of appropriate injectable antibiotics dilution and administration} = \frac{\text{Appropriate injectable antibiotics dilution and administration observed}}{\text{Total number of injectable antibiotics dilution and administration observed}} X\ 100\%$$

In the reconstitution process, a drug manufactured as a dry powder ingredient is mixed with a liquid known as a diluent to produce a particular concentration of drug solution. Dilution, conversely, is a procedure of making the specific concentration of the drug solution more dilute. These aspects were identified from the critical steps highlighted in the Model of Good Care (Table 1). It was only considered appropriate when all these aspects were performed correctly. A data collection form was used to document observations in this study. Since all the observed injectable antibiotics were freshly prepared, the means of storage were not observed in this study. The standard set was 100% in accordance with the Patient Safety Goals 2013 (26).

This quality improvement study was undertaken in the two adult multidisciplinary wards, Ward 1 (W1) and Ward 2 (W2), from August 2018 to February 2019. Our study was conducted in three phases, namely the verification phase, the intervention phase and the post-intervention phase. The study included injectable antibiotics prescribed in W1 or W2 during the study period. Exclusion criteria were adult patients with end-stage renal failure, fluid restriction, and critically ill patients, as these patients have their specific dilution guidelines. A sample size of 148 was calculated using the Raosoft Sample Size Calculator and was selected via convenient sampling in each pre-intervention and post-intervention phase. Patients who met the criteria were selected by a ward pharmacist (observer). The observer would go on any day or shift to observe staff nurses preparing and administering injectable antibiotics to the patients.

During the verification phase, a direct observation method was used to verify the percentage of appropriate injectable antibiotic dilution and administration from August to September 2018. This observational method, established by Barker and Mac Connell, was chosen over self-reporting or questionnaire survey methods, as it has been shown to provide the most reliable data (14,27-30). Consent was obtained prior to observation. During observation, any improper antibiotic dilution and administration likely to cause imminent harm to the patient was verbally intervened in the usual manner. Nevertheless, it was still included as an error in the data collection form.

In order to further explore the underlying factors that may contribute to the failure of the aspects to meet their standards, a focus group discussion was conducted. It was conducted in a non-intimidating environment among two pharmacists (moderator and assistant moderator) and eight staff nurses with similar backgrounds and experiences. All the information obtained through the focus group discussion was manually recorded and kept confidential.

Subsequently, a self-administered questionnaire consisting of the possible factors was designed and distributed to 42 staff nurses from W1 and W2 to collect their opinions about the factors that most likely contributed to the inappropriate injectable antibiotic dilution and administration. The data collected were then converted into a Pareto chart to determine the major contributing factors.

The results of this study were analysed using the Statistical Package for the Social Sciences (SPSS) software for Windows Version 22 (SPSS Inc., Chicago, IL, USA). Descriptive statistics was employed, whereby categorical data were presented as percentages. The verification phase revealed that the percentage of appropriate injectable antibiotics dilution and administration by nurses in the adult multidisciplinary wards was only 14.2% (n=21) out of 148 observations.

Table 1: Model of Good Care (MOGC) in improving appropriateness of injectable antibiotics dilution and administration

No	Process	Criteria	Standard	Verification	Post-Intervention
1	Check and verify injectable antibiotics order	• Screening for 5R by pharmacists			
		a) Right patient	100%	100%	100%
		b) Right drug (i.e., injectable antibiotics)	100%	100%	100%
		c) Right dose	100%	100%	100%
		d) Right route	100%	100%	100%
		e) Right time (frequency and duration)	100%	100%	100%
2	Countercheck injectable antibiotics order	• Countercheck all drugs filled (i.e., injectable antibiotics) against the medication order	100%	100%	100%
		• Detect and correct any filling errors	100%	100%	100%
		• Supply reminder on uncommon drug administration procedures (i.e., Injectable antibiotics)	100%	**10%**	100%
3	Prepare injectable antibiotics	• Apply aseptic method	100%	100%	100%
		• Correctly prepare drug (i.e., injectable antibiotics) by staff nurses or doctors			
		a) The right drug is chosen (i.e., injectable antibiotics)	100%	100%	100%
		b) Appropriate reconstitution (concentration)*	100%	33.8%	93.8%
		c) Appropriate dilution (concentration)*	100%	100%	100%
		d) Appropriate diluents (reconstitution)*	100%	74.4%	75.2%
		e) Appropriate diluents (dilution)*	100%	100%	100%
4	Administer injectable antibiotics	• Correctly identify patient	100%	100%	100%
		• Assess administration site	100%	95%	98%
		• Correctly administer the drug (i.e., Injectable antibiotics) by staff nurses or doctors:			
		a) Appropriate route of administration*	100%	100%	100%
		b) Appropriate duration of administration (rate)*	100%	18.9%	52.7%
5	Monitoring	• Monitor drug reconstitution, dilution and administration (i.e., Injectable antibiotics)	100%	**10%**	50%
		• Detect and correct any errors	100%	100%	100%

** indicates six aspects identified used to measure appropriateness*

Initial Assessment of the Problem

Figure 1 demonstrates the usual process of care involving injectable antibiotics, starting with the order of prescription from the ward until the administration of medication in the ward. Critical steps where errors are more common were identified with asterisks. The Model of Good Care (MOGC), as shown in Table 1, highlights and further details the critical steps from the flowchart in Figure 1.

A total of 148 samples were recruited in the verification phase, which revealed that only 14.2% (n=21) of injectable antibiotics dilution and administration were appropriate. This was lower than the standard, set as 100%, leading to an Achievable Benefits Not Achieved (ABNA) of 85.8%.

Among the six aspects, the least percentages scored in terms of appropriateness was administration duration (18.9%), followed by reconstitution concentration (33.8%) and reconstitution diluents (74.4%) (Table 1). Two additional areas (results bolded) did not meet their standards, for which strategies were also implemented to address them.

As depicted in Table 2, dilution and administration procedures of amoxicillin/clavulanate, ceftriaxone, ampicillin/sulbactam, metronidazole, and cefuroxime were the most observed antibiotics, as they were commonly prescribed in HTK. Among them, only metronidazole achieved 100% appropriateness. This suggested that antibiotics without reconstitution and dilution, such as metronidazole, had fewer errors in addition to being convenient for the nurses.

On the other hand, some antibiotics such as cefepime, meropenem, piperacillin/tazobactam and vancomycin were inappropriately diluted and administered by the staff nurses. This was due to the initiation of these antibiotics by the visiting specialists and HTK staff nurses were less familiar with them. Hence, strategies targeting uncommon antibiotics were also devised.

Our study also showed that the most inappropriate administration duration occurred in slow intravenous (SIV) bolus antibiotics rather than intravenous infusion (IVI). Of the 148 samples in the verification phase, 102 received SIV bolus antibiotics, all of which were inappropriately administered within less than a minute.

In terms of reconstitution, 74.4% of the samples were reconstituted with appropriate diluents. Water for injection was more likely to be used appropriately as reconstitution diluent compared to sodium chloride 0.9% (NS), at 73.7% and 26.2%, respectively. Despite the common usage of amoxicillin/clavulanate in adult multidisciplinary wards, it was still reconstituted inappropriately. For instance, a 1.2g amoxicillin/clavulanate powder was reconstituted with 10 ml NS instead of 20 ml water for injection (WFI).

According to Pareto analysis (Figure 2), factors that majorly contributed to the inappropriate injectable antibiotics dilution and administration were being unaware of uncommon procedures, unavailability of local protocols, inadequate references, no reminders upon antibiotics' dispensing, insufficient knowledge or experience, and inadequate monitoring by pharmacists.

Strategy

Various remedial measures were implemented during the intervention phase from October to December 2018 to improve the appropriate practice. Firstly, a new approach, named "SWeFT", consisting of five different strategies, was implemented, where "S" represents Sticker, "W" represents an antibiotic wheel, "e" represents education material such as protocol, "F" represents form, and "T" represents a table.

A new administration sticker with a Quick Response code was designed and supplied together with uncommon injectable antibiotics by the inpatient pharmacy. The sticker acts as a means to alert nurses to be cautious of their dilution and administration. This sticker also contains medication details such as the generic and brand names, compatible diluents, reconstitution and dilution procedures, as well as storage

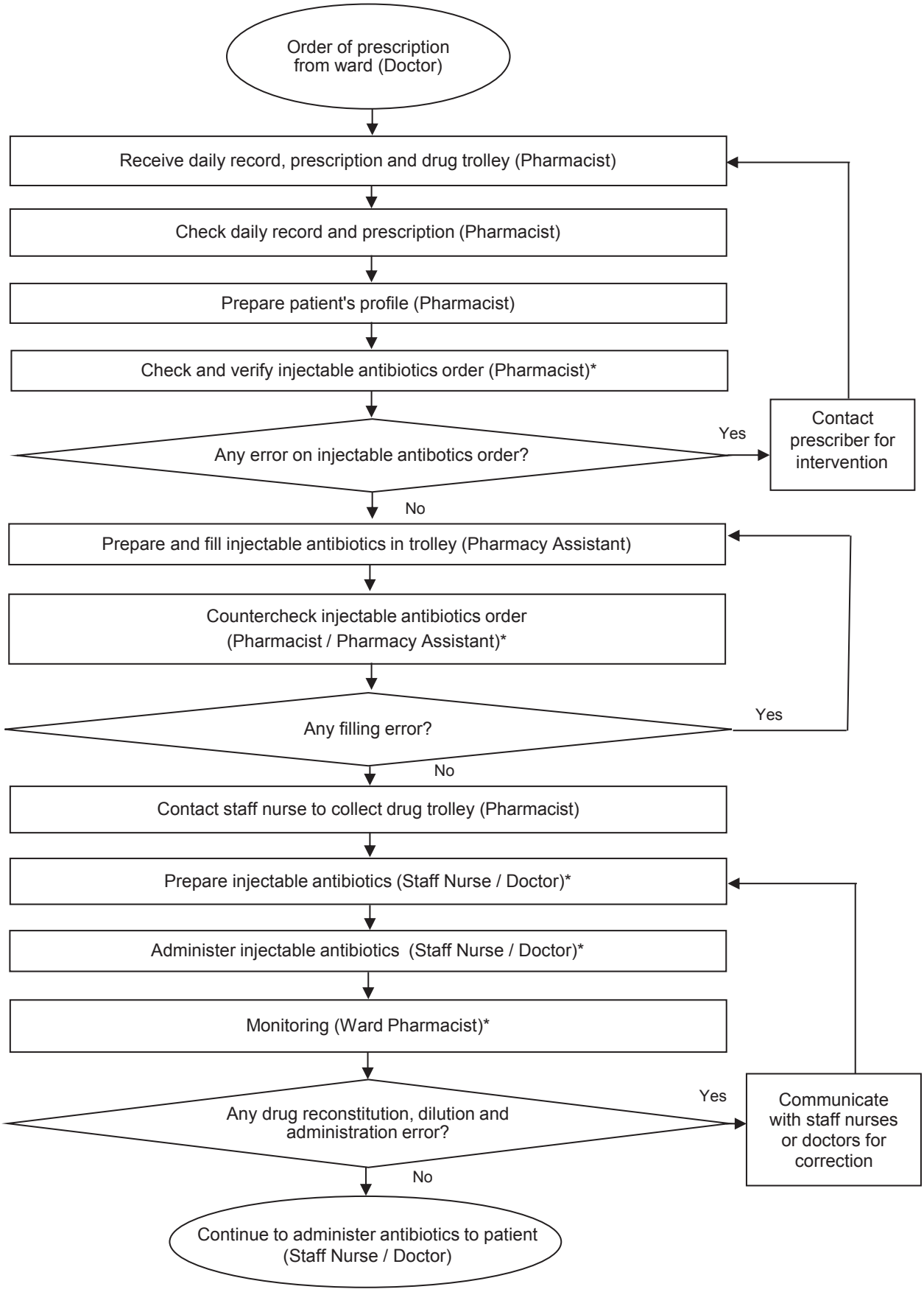


Figure 1: Process of care for injectable antibiotics (* indicates critical steps)

Table 2: Comparison of appropriate injectable antibiotics dilution and administration among different antibiotics between the verification and post-intervention phases

Injectable Antibiotics	Verification Phase		Post -Intervention Phase	
	Observed (n)	Overall Appropriateness, n (%)	Observed (n)	Overall Appropriateness, n (%)
Amoxicillin/Clavulanate	60	0 (0)	62	16 (25.8)
Ampicillin	NA	NA	1	0 (0)
Ampicillin/Sulbactam	15	0 (0)	17	7 (41.2)
Benzylpenicillin	1	1 (100)	1	1 (100)
Cefoperazone	3	3 (100)	NA	NA
Ceftazidime	1	0 (0)	NA	NA
Ceftriaxone	26	2 (7.7)	34	21 (61.8)
Cefuroxime	10	0 (0)	10	5 (50)
Cloxacillin	1	0 (0)	8	5 (62.5)
Metronidazole	15	15 (100)	3	3 (100)
Others				
Cefepime	1	0 (0)	5	5 (100)
Meropenem	10	0 (0)	2	2 (100)
Piperacillin/ Tazobactam	4	0 (0)	3	3 (100)
Vancomycin	1	0 (0)	2	2 (100)

NA: Drug not in use during the observation period
Others: Antibiotics that are infrequently used/rarely prescribed by visiting specialists (i.e., Cefepime, Meropenem, Piperacillin/Tazobactam and Vancomycin)

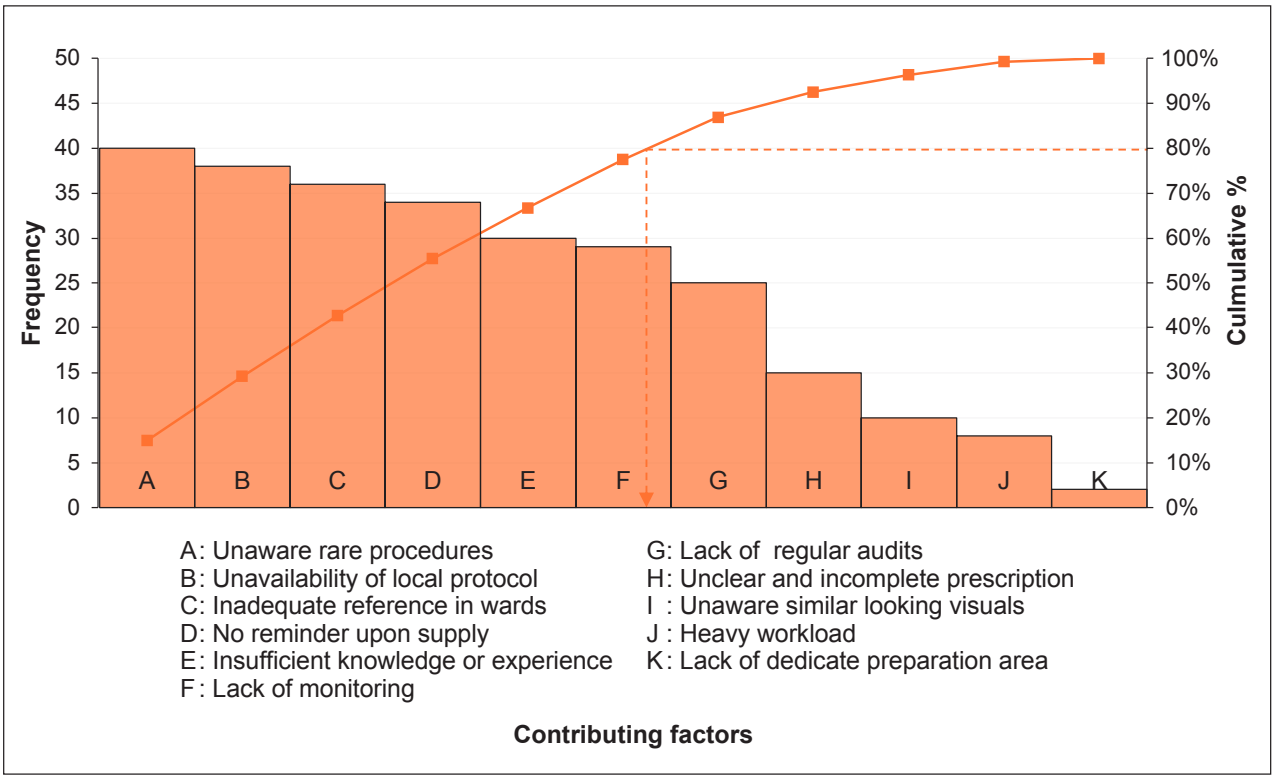


Figure 2: Factors contributing to the low incidence of appropriate injectable antibiotics dilution and administration

requirements. It was attached to the new medication administration form (HTK/531 form) and kept in the medication chart for easy access for the nurses and served as a guide for the administration of unfamiliar antibiotics. Prior to this, there were no reminder stickers with QR codes provided upon dispensing antibiotics to the wards.

A Summary Wheel and the Summary Table, which contained summarised information on all available injectable antibiotics in HTK, were also designed and kept beside the drug trolley. Previously, there were inadequate references regarding all injectable antibiotics in the wards. Hence, with this more readily and easily available information, the usage of inappropriate diluents and administration duration was hoped to be reduced.

Additionally, knowledge empowerment and adherence to the latest dilution protocol were enforced through the distribution of Dilution Protocol HTK 2018/2019 to each ward. This local protocol consists of information on reconstitution, dilution, diluents, routes, administration rates and stability for all antibiotics available in the HTK formulary. The protocol was developed based on the latest product information and guidelines, as well as the state dilution protocol. Before this, no proper references or local protocols were kept in the wards. This strategy can improve the knowledge and understanding of the various medication preparations and administrations among nurses.

The role of ward pharmacists, too, was enhanced by increasing pharmacist rounds, frequent monitoring of injectable antibiotics and better cooperation through a multidisciplinary team, especially the Antimicrobial Stewardship (AMS). Pharmacist-led education sessions or small group training in the ward provided nurses with regular updates on the knowledge of injectable antibiotics. Nurses were also educated on the correct clinical practices regarding dilution and administration of injectable antibiotics, risk factors, signs and symptoms, as well as complications if antibiotics were not diluted and administered appropriately. They were also encouraged to consult inpatient or ward pharmacists whenever there were doubts related to the dilution and administration of injectable antibiotics.

Although a better outcome was anticipated, some unexpected factors may have affected the strategy outcomes. For instance, it was acknowledged that more time and effort were required to change personal behaviours, especially for those with longer working experiences. More efforts were also needed to advocate using correct references and guidelines instead of merely following routine practices. In addition, the high workload in the wards may also influence adherence to the strategies implemented.

Results

The post-intervention evaluation was conducted from January to February 2019. It showed improvement in the appropriate antibiotic dilution and administration percentage from 14.2% (n=21) to 49.3% (n=73). However, it did not achieve the standard target of 100%.

Upon re-evaluation, all uncommon antibiotics initiated by the visiting specialist demonstrated substantial improvements, thus meeting the 100% standard (Table 2). The “SWeFT” approach, particularly the HTK/531 form with the sticky reminders and QR codes, showed its effectiveness in improving the dilution and administration of uncommon antibiotics.

Post-intervention, the reconstitution concentration and administration duration, which were initially the least appropriate scoring aspects, demonstrated the most improvements, from 33.8% to 93.8% and 18.9% to 52.7%, respectively (Table 1). There was, however, only a marginal improvement in the appropriate reconstitution diluents aspect (Table 1).

It was noted that more SIV bolus antibiotics were generally administered appropriately for up to 3 minutes. Before the strategies, the SIV bolus antibiotics were administered in less than 1 minute. Despite improvement in the administration duration, about 66% of all SIV bolus antibiotics were

still inappropriately administered. This was likely due to inadequate infusion pumps, which can regulate drug delivery at the recommended duration. It was also noted that some staff nurses found it difficult to adhere to the administration duration, as they found it increased their workload burden over time. Despite being the most widely used antibiotic, amoxicillin/clavulanate was found to be the most inappropriately reconstituted antibiotic compared to ampicillin/sulbactam and cefuroxime.

Overall, the ABNA was successfully reduced from 85.8% to 50.7%. All six critical aspects, which were subpar prior to the interventions, showed improvements following the implementation of the strategies. Nonetheless, there is room for improvement as it has yet to achieve its standard of 100%.

Lessons and Limitations

This study looked into more specific aspects of dilution and administration of antibiotics in the non-specialised hospital setting in Malaysia. The "SWeFT" approach also appears feasible and generalisable to other hospitals, as it can be easily conducted with minimal cost. Through this study, this approach has proven beneficial in improving appropriate antibiotic dilution and administration outcomes. However, it has yet to achieve its target of 100%.

Despite the success, this study has several limitations and challenges. One of the limitations recognised was the presence of an observer, which may have affected the nurses' behaviour. In addition, when the data was analysed later on, a trend was noted wherein most of the data collected by the observer occurred during the peak hours of antibiotic administration (1100H – 1300H). This could lead to the predictability of when an observation would be done and the possibility of night observations being missed out. Another possible limitation was the biases among the different observing pharmacists. A simple interrater reliability measure was conducted to minimise the bias. However, there might still be biases among the two pharmacists observing these processes during the verification and post-intervention phase.

Insufficient equipment in this resource-limited setting amplified the nurses' difficulty in administering SIV bolus antibiotics. This was one of the setbacks to which limited strategies could be implemented currently. This study has only completed one Plan-Do-Study-Act (PDSA) cycle so far, which may also be a limitation. In the future, there is a need to focus on SIV bolus antibiotics as they contribute largely to the inappropriate administration duration.

Furthermore, this study did not assess the clinical effects of inappropriate administration, such as thrombophlebitis risk. It was difficult to identify the clinical consequences of the errors due to the delay between the occurrence of complications and the identification of medication errors. It will be of value if future studies explore the incidences of complications due to inappropriate antibiotic dilution and administration.

Conclusion and the Next Steps

This study added value by identifying critical errors in injectable antibiotics dilution and administration as well as the factors causing them. By formulating relevant strategies that targeted these factors, the percentage of appropriate injectable antibiotics dilution and administration improved to 49.3%. These strategies incurred minimal cost and were self-sustainable for the next cycles. Further innovative strategies will be implemented in the subsequent cycles to achieve the standard of 100%. One of the proposed strategies was the innovation of a syringe that allows only safe and slow IV administration of antibiotics. This can allow nurses to continue with other work during antibiotics administration.

Moreover, regular updates of reference guides, continuous education and training, and more involvement with the antimicrobial stewardship team, especially for new staff, are essential in achieving the standards. Periodic audits on antibiotics' dilution and administration

are also useful in identifying the aspects requiring further remedial actions. These audits can be applied to counter-check and provide feedback on aspects of practice that are not compliant with the standard of procedure. In the future, studies can be expanded to include other injectable medications and all disciplines in HTK to ensure patients' overall clinical outcomes and safety.

Acknowledgement

The authors would like to thank the Director-General of Health Malaysia for his approval to publish this work. In addition, the authors would also like to thank the HTK Hospital Director and Chief Pharmacist for supporting this study. Besides, the authors would also like to extend our appreciation to all the Ward 1 and Ward 2 doctors, nurses, as well as pharmacists for their kind cooperation and assistance in this study. This study was approved by the Ministry of Health Medical Research and Ethics Committee (MREC) (NMRR-18-2434-43767).

Conflict of Interest

The authors declare that there was no conflict of interest.

Funding

This study received no specific grant from any funding agencies from the public, commercial or non-profit sectors.

References

1. Zarea K, Mohammadi A, Beiranvand S, Hassani F, Baraz S. Iranian nurses' medication errors: A survey of the types, the causes, and the related factors. Int J Africa Nurs Sci. 2018; 8: 112–6.

2. Cheragi MA, Manoocheri H, Mohammadnejad E, Ehsani SR. Types and causes of medication errors from nurse's viewpoint. Iranian Journal of Nursing and Midwifery research. 2013; 18(3): 228.

3. Cloete L. Reducing medication errors in nursing practice. Nursing Standard. 2015; 29(20): 50.

4. Sona Mackova PS, Karel Urbanek ZM. Medication Errors in Intravenous Drug Preparation and Administration: A Brief Review. J Nurs Care. 2015; 04(05).

5. Fekadu T, Teweldemedhin M, Esrael E, Asgedom SW. Prevalence of intravenous medication administration errors: a cross- sectional study. Integrated pharmacy research & practice. 2017; 6(47).

6. Strbova P, Mackova S, Miksova Z, Urbanek K. Medication errors in intravenous drug preparation and administration: A Brief Review. J Nurs Care. 2015.

7. WHO Launches Global Effort To Halve Medication-Related Errors in 5 Years [Internet]. World Health Organisation. [cited 2019 Feb 2]. Available from: https://www.who.int/news/item/29-03-2017.

8. Tissot E, Cornette C, Limat S, Mourand JL, Becker M, Etievent JP, et al. Observational study of potential risk factors of medication administration errors. Pharm World Sci. 2003;25(6):264–8.

9. Tissot E, Cornette C, Demoly P, Jacquet M, Barale F, Capellier G. Medication errors at the administration stage in an intensive care unit. Intensive Care Med. 1999;25:353–9.

10. Nguyen HT, Nguyen TD, Van Den Heuvel ER, Haaijer-Ruskamp FM, Taxis K. Medication errors in Vietnamese hospitals: Prevalence, potential associated factors. 2015;10(9):1–12.

11. Aishah N, Bakar A. Patient Safety Unit Ministry of Health Malaysia e-IR Report 2017. 2017.

12. Kadam AM, Ganachari MS, Bhise SB, Gurunath S. Medication Errors Related To Antibiotics in Medical Intensive Care Unit in a Tertiary Care Teaching Hospital in South India : A Prospective Study . J Pharm Res. 2009;2(8):1245–1248.

13. Koumpagioti D, Varounis C, Kletsiou E, Kletsiou E, Nteli C, Matziou V. Evaluation of the medication process in pediatric patients: a meta-analysis. Jornal de pediatria. 2014; 90(4): 344-355.

14. Ong WM, Subasyini S. Medication errors in intravenous drug preparation and administration. Med J Malays. 2013; 68(1):52–7.

15. Ding Q, Barker KN, Flynn EA, Westrick SC, Chang M, Thomas RE, et al. Incidence of Intravenous Medication Errors in a Chinese
Hospital. Value Heal Reg Issues. 2015;6:33–9.

16. Cousins DH, Sabatier B, Begue D, Schmitt C, Hoppe-Tichy T. Medication errors in intravenous drug preparation and administration: A multicentre audit in the UK, Germany and France. Qual Saf Heal Care. 2005;14(3):190–5.

17. Taxis K, Barber N. Ethnographic study of incidence and severity of intravenous drug errors. Br Med J. 2003;326(7391):684–7.

18. Glavin RJ. Drug errors: Consequences, mechanisms, and avoidance. Br J Anaesth. 2010;105(1):76–82.

19. Gould IM, MacKenzie FM. Antibiotic exposure as a risk factor for emergence of resistance: The influence of concentration. J Appl Microbiol Symp Suppl. 2002;92(1):78– 84.

20. Keers RN, Williams SD, Cooke J, Ashcroft DM. Prevalence and nature of medication administration errors in health care settings: A systematic review of direct observational evidence. Ann Pharmacother. 2013;47(2):237–56.

21. Matthew E. Levison, Julie H. Levison. Pharmacokinetics and Pharmacodynamics of Antimicrobial Agents. Infect Dis Clin North Am. 2009;23(4):1–29.

22. Shahrokhi A, Ebrahimpour F, Ghodousi A. Factors effective on medication errors: A nursing view. J Res Pharm Pract. 2013;2(1):18.

23. Scott L. World Health Organisation Technical Series on Safer Primary Care: Medication errors. Vol. 30, Nursing standard (Royal College of Nursing (Great Britain) : 1987). World Health Organisation; 2016. 61–62 p.

24. Heczková J, Bulava A. Nurses' knowledge of the medication management at intensive care units. Pielegniarstwo XXI wieku / Nurs 21st Century. 2018;17(1):18–23.

25. Vijayakumar A, Sharon E, Teena J, Nobil S, Nazeer I. A clinical study on drug-related problems associated with intravenous drug administration. J Basic Clin Pharm. 2014;5(2):49.

26. Abu Bakar NA, Abdul Rahman MoN, Md Nujid M. Malaysia Patient Safety Guideline. 1st ed. Ministry of Health Malaysia Malaysia, Patient Safety Council of Malaysia: Ministry of Health Malaysia Malaysia, Patient Safety Council of Malaysia; 2013. 1–72 p.

27. Barker KN, McConnell WE. The Problems of Detecting Medication Errors in Hospitals. Am J Heal Pharm. 1962;19(8):360–9.

28. Flynn E. A., Barker K. N., Pepper G. A., Bates D. W. MRL. Comparison of methods for detecting medication errors in 36 hospitals. Am J Heal Pharm. 2002;59:436– 46.

29. Meyer-Massetti C, Cheng CM, Schwappach DLB, Paulsen L, Ide B, Meier CR, et al. Systematic review of medication safety assessment methods. Am J Heal Pharm. 2011;68(3):227–40.

30. Berdot S, Gillaizeau F, Caruba T, Prognon P, Durieux P, Sabatier B. Drug Administration Errors in Hospital Inpatients: A Systematic Review. PLoS One.2013;8(6):1

REDUCING THE PERCENTAGE OF FISSURE-FILLED TEETH FAILURE AMONG PRIMARY SCHOOLCHILDREN IN PERLIS

Nuranida Hani Ruslan[1], Nur Izanti Mohd Surat[2], Anis Ezrina Abdul Rahman[2], Amalina Mohamed Zakaria[2], Idham Hafize Supi[3], Husna Hussain[3], Sumaiyyah Md Shukri[3], Mabel Mun Yen Chi[4], Mohamad Hafizal Harudin[5]

[1]Kuala Sanglang Dental Clinic, Perlis State Health Department, Ministry of Health Malaysia

[2]Kangar Dental Clinic, Perlis State Health Department, Ministry of Health Malaysia

[3]Arau Dental Clinic, Perlis State Health Department, Ministry of Health Malaysia

[4]State Deputy Director (Dental) Office, Perlis State Health Department, Ministry of Health Malaysia

[5]Oral Maxillo-facial Surgery Department, Hospital Tuanku Fauziah, Perlis State Health Department, Ministry of Health Malaysia

Corresponding Author: Nuranida Hani Ruslan
Email: dr.nuranida@moh.gov.my

Abstract

Fissure sealant covers tooth fissures to prevent caries in children. A verification study showed that 84.4% of fissure-filled teeth failed after six months of application among primary schoolchildren in Perlis. Failure of fissure sealant leads to caries of vulnerable teeth and worsened clinical outcomes. The key indicator for improvement was measured using the percentage of fissure-filled teeth failure after six months of application among primary schoolchildren. A standard of 15% was set based on expert consensus. Data were collected from January 2018 to December 2020 involving three phases: i) verification study, ii) implementation of remedial measures (two cycles) and iii) re-evaluation post-intervention (two cycles). The study population included primary schoolchildren from selected high caries-risk schools in Perlis. Data were collated from clinical oral examinations and patient records. Potential contributing factors include improper isolation techniques (30.8%), improper material mixing (81.5%), two-handed dentistry practice (30.8%) and incorrect tooth selection (49.2%). Remedial measures include a checklist designed for fissure sealant application procedure, continuous dental education (CDE) with chair-side training on proper sealant application techniques, redistribution of portable suction to the dental school team, and the introduction of our innovative product – a dental suction anchorage instrument (Suction Anchorage Utility Holder – SAUH) to aid in two-handed dentistry in a limited-resource setting. The first evaluation cycle showed a reduction in fissure-filled teeth failure percentage to 43.1%. Upon implementing the SAUH project and redistribution of portable suction units, a further reduction to 10.8% was achieved, exceeding the standard set of ≤ 15%. We aimed to replicate the SAUH instrument at the national level to benefit the limited resource facilities in providing high-quality dental care.

KEYWORDS: Fissure sealant, Preventive dentistry, Application technique, Quality improvement study

Problem

In Perlis, primary school dental services are provided using an incremental dental care approach delivered by dental therapists from nine primary dental clinics under Perlis Oral Health Division. The services are provided to 76 primary schools in Perlis, with an estimated enrollment of 24,000 primary schoolchildren per year. Each primary school in Perlis will be visited by a school dental team consisting of at least two dental therapists, one dental surgery assistant and one healthcare assistant (*Pembantu Perawatan Kesihatan*) once a year. During these visits, dental check-ups are conducted for all the enrolled primary schoolchildren, and those who require treatment and preventive care will receive appropriate dental services. These include preventive dental care (fissure sealant, fluoride varnish/mouth rinse, preventive resin restoration) and treatment (dental filling, scaling, and loose extraction). During the study period, 68 dental therapists were posted under Perlis Oral Health Division. However, out of these 68 therapists, only 51 were selected for this study, while the remaining 17 were excluded as they were not involved in school incremental dental care delivery during the period of this study.

Traditional caries management strategies that emphasised restorative treatment have gradually shifted towards caries prevention and conservation of tooth structure as the latest approach (1). This includes the use of fissure sealants as one of the main preventive measures against caries. Fissure sealant is a dental material applied on the grooves of a tooth's biting surface, which forms a protective layer against food debris and bacteria, preventing them from getting trapped into the grooves, thus helping to prevent development of caries. Fissure-filled tooth refers to a tooth which is sealed with fissure sealant. There are two main types of materials used for fissure sealant, which are resin-based and glass ionomer-based.

A verification study was carried out from January to June 2018 at Putra Primary School with a total enrolment of 402 students from Standard 1 to 6. Due to a high number of caries cases among the students in 2017, Putra Primary School was rated as a high caries-risk school, which led to its selection for this study. Following dental check-ups on all 402 students, 36 students who required fissure sealant application were identified, and a total of 77 teeth were involved. Their teeth were applied with fissure sealants and re- reviewed again six-month post-application. It was found that 65 out of these 77 teeth showed partial or total loss/ dislodge of fissure sealants, indicating an 84.4% failure rate. This is quite alarming as the effectiveness of fissure sealants as preventive measures against caries for primary schoolchildren becomes questionable. In the event of dislodged fissure sealants, the tooth becomes more susceptible to the development of caries, which may eventually affect oral tooth function through episodes of oral discomfort, pain, and infection. Therefore, this study aimed to reduce the percentage of fissure-filled teeth failure in six-month post-application from 84.4% to 15% or less.

Background

Carious lesions can be prevented by averting their onset and managed through interventions which can halt the progression from the early stage of the disease, characterised by enamel demineralisation to the point of frank cavitation (2). Fissure sealant is a type of intervention that breaks the caries cycle, therefore, considered as a preventive measure. The effectiveness and preventive ability of fissure sealants are related to the complete retention of the material on the occlusal surfaces (biting surfaces of the tooth) (3). If retention is compromised, the overall anti-carious effectiveness of the sealants becomes uncertain (4).

After fissure sealant application, patients need to be scheduled for recall appointments to assess retention and marginal adaptation of the sealants. A fissure sealant is considered failed if there is partial or total loss of a previously applied sealant. Multiple studies have shown

variations in fissure sealant retention rates and the possible factors contributing to fissure sealant failure. For example, a 79.8% retention rate of fissure-filled teeth among Kuwait schoolchildren was reported after one-year application and it was found that retention rates improved when good moisture control was achieved (5). Another study by Behroozian et al. reported a retention rate of 74.3% with the primary reason for the failure of fissure sealants being marginal discolouration (6). Additionally, Anson et al. documented an 85% retention rate of fissure sealants in six months, with a failure rate of 4% occurring at each subsequent six-month period (7). In Malaysia, a study conducted at Bangsar Dental Clinic in 2008 reported that only 65% of fissure sealants remained intact after a one-year review (8). The main causes of fissure sealant failure include lack of adequate isolation and tooth contamination by saliva or gingival fluid (9), poor application technique (7) and improper morphological details of the occlusal surface of the sealed tooth (10).

Various strategies have been proven to increase the retention rates of fissure sealants. One of these strategies is the use of strict isolation techniques (11). Long-term clinical success is closely related to effective moisture control at each application stage (12). This can be achieved by isolation techniques using a rubber dam or cotton roll to prevent the tooth from being contaminated with saliva during fissure sealant application. While rubber dam isolation may not be practical in a school dental setting, isolation with a cotton roll has been demonstrated to be as effective and yields similar retention results to those using rubber dam isolation (11). Additionally, isolation control can be optimised by implementing four-handed dentistry, where a dental surgery assistant uses a dental suction tip to maintain a dry field during the procedure (13).

Furthermore, the success of fissure sealants also depends on the pit and fissure morphology, making it crucial for the tooth selection criteria to be well-evaluated clinically by operators. The retention of sealants relies upon the ability of the sealant to fill pits and fissures thoroughly and remain completely intact and bonded to the enamel (14). Thus, consideration for tooth selection criteria of caries-free permanent molars exhibiting deep and/or complex fissure patterns will greatly influence the success rate of fissure sealants (15). There are two main types of fissure sealants currently used by dental therapists under Perlis Oral Health Division; resin-based and glass ionomer (GI)-based sealants. Hence, it is reasonable to reference the Clinical Practice Guidelines of the American Academy of Paediatric Dentistry (11) that suggests operators to consider the likelihood of experiencing retention challenges when choosing the type of sealant material most appropriate according to the specific patient and clinical scenario. In situations where dry isolation is proven to be challenging, a more hydrophilic material (GI-based sealant) is preferable, whereas situations where isolation can be effectively achieved, a resin-based sealant is recommended (11).

Measurement

This quality improvement study involved two cycles that were conducted from the period of January 2018 until December 2020. The objective of the study was to reduce the percentage of failure of fissure-filled teeth in six months post-application by dental therapists among primary schoolchildren in Perlis. The percentage of failed fissure-filled teeth in six months post-application was used as the indicator for improvement. This was calculated based on the total number of failed fissure-filled teeth after six months of application of fissure sealant by a dental therapist over a total number of fissure sealants applied, as shown in the formula below:

$$\text{Percentage of failed fissure-filled teeth in six months post-application} = \frac{\text{Total number of failed fissure-filled teeth after six months of application (n)}}{\text{Total number of fissure-filled teeth (N)}} \times 100\%$$

Fissure sealants were considered failed if they were partially or completely dislodged upon six months post-application review. A standard of ≤15 % for the failure rate of both resin and Glass Ionomer (GI) fissure sealant was set based on the study by Crall et al. (2015)(16).

The selected study population was standard 1 to 6 primary schoolchildren from selected schools in two districts of Kangar and Arau, Perlis, who received incremental dental treatment during the study period. The first round of this study (Cycle 1) involved the participation of 24 dental therapists and 37 students from 7 primary schools, while Cycle 2 involved 27 dental therapists and 27 students from 13 primary schools. These schools were categorised as high caries risk schools based on *Penilaian Risiko Sekolah* (PERSIS). Inclusion criteria were all primary schoolchildren with fully erupted permanent molar teeth. Exclusion criteria were schoolchildren with partially erupted permanent molar teeth, schoolchildren without consent for treatment, primary teeth, teeth with dentinal caries, non-compliant patients and teeth with existing restoration.

Data were collected using patient card records (LP.8), clinical oral examinations, and on-site observation by dental officers trained and calibrated in the Modified Ministry of Health International Caries Detection and Assessment System (MM-ICDAS) charting. These trained dental officers assessed the dental therapist's fissure sealant application technique regarding tooth selection criteria, moisture control handling and post- operative care through observation. In evaluating the operator's knowledge and the general approach used for applying fissure sealant, questionnaires were distributed to dental therapists before and after chair-side briefing and training. All the collected data were tabulated and further analysed using Microsoft Excel.

The verification study found that the failure rate of fissure-filled teeth was as high as 84.4%. With the standard of fissure-filled teeth failure set at ≤15% (16), the Achievable Benefit Not Achieved (ABNA) was noted as 69.4%.

Initial Assessment of the Problem

The current process of care for the fissure sealant application procedure conducted at primary school setting was reviewed (Figure 1) to determine the critical steps involved in the fissure sealant application procedure. Additionally, the steps involved in the six-month review post-fissure-sealant application are illustrated in Figure 2. Both figures are also applicable in cases of fissure sealant re-application.

Each school dental team will allocate at least a month to conduct dental check-ups and provide treatment for primary schools with approximately 400 to 500 students spanning from standard 1 to 6. At the start of the school dental team's visit to a primary school, all primary schoolchildren are called for a dental check-up in groups (typically according to class). The operator (in this case, the dental therapist) will first identify patients with teeth requiring fissure sealants based on patient and tooth criteria as mentioned in Guidelines: A School-Based Fissure Sealant (15). Primary schoolchildren will be assessed based on the inclusion and exclusion criteria and identified during dental check-ups by the dental therapist. Students who meet the inclusion criteria will have fissure sealant application on the same day following the identification of teeth suitable for the procedure. The first step is tooth prophylaxis which is done by applying pumice powder using a rubber cup/brush and irrigation from the three-way syringe. The tooth will be dried and isolated with a cotton roll to ensure good moisture control. The tooth is then conditioned/ etched, rinsed, and dried for the final time before applying sealant. The sealant will be light-cured/self-cured, according to the manufacturer's instructions, and checked for occlusal interference. Once the occlusion is restored, the patient will be given post-operative instructions and an appointment card for review of the fissure sealant in six months and is finally dismissed. From this process of care, critical steps identified

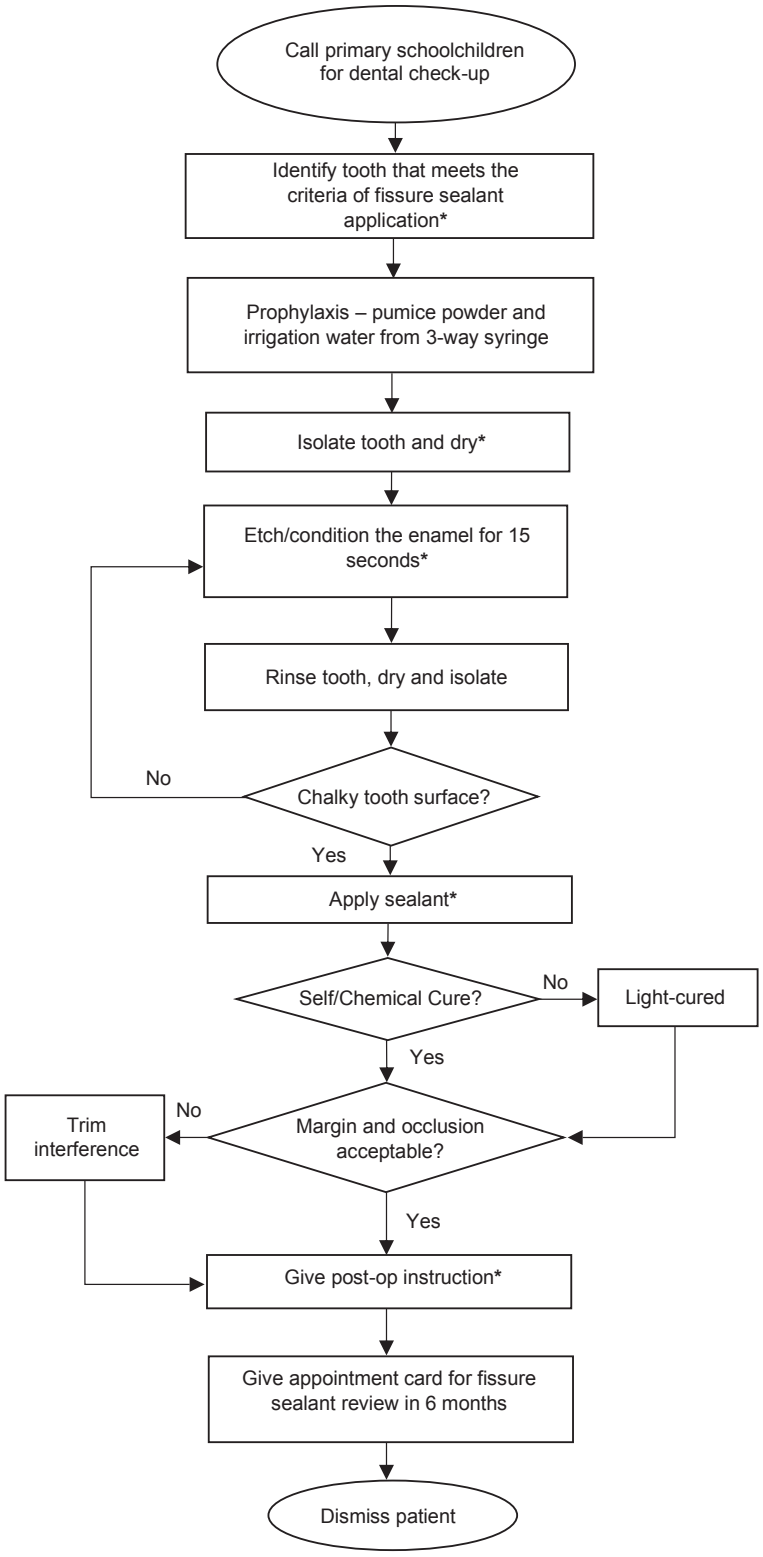


Figure 1: Process of care for fissure sealant application procedure (* indicates critical steps)

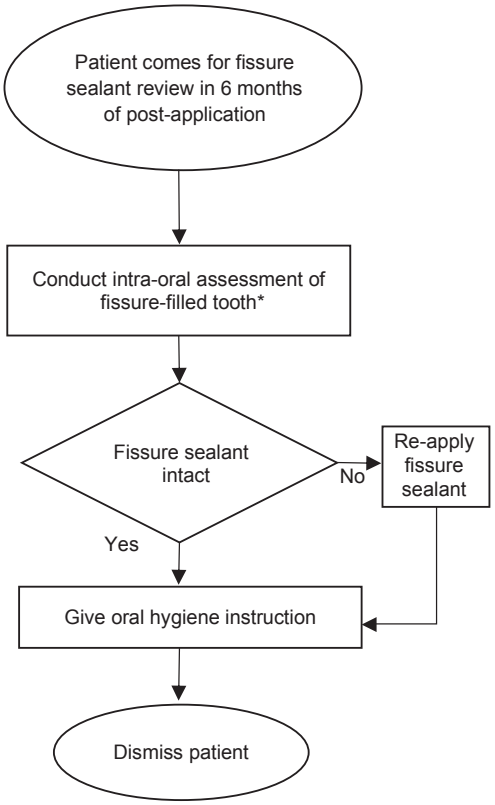


Figure 2: Process of care for fissure sealant review in six months of post-application (* indicates critical steps)

were tooth selection, tooth isolation, etch/condition of the enamel, sealant application and post-operative instructions. Improper techniques, incorrect tooth selection, insufficient moisture control and poor post-operative care were identified as the contributing factors of fissure-filled teeth failure, as observed by the trained dental officers during the application of fissure sealant by the dental therapists. A validated questionnaire adopted from an Indian study (17) was distributed to all 68

dental therapists involved in pre and post-session of continuous dental education (CDE) to assess their knowledge of fissure sealant requirements. Results showed that all dental therapists had fair levels of knowledge, with an average score of 74.3% (a score of 80% or more indicates good knowledge). Figure 3 illustrates possible contributing factors identified during the initial assessment of the problem.

The verification study was conducted from January to June 2018 to measure the percentage of fissure-filled teeth failure in six months post-application and identify possible factors contributing to the failure. Findings of the study showed that 30.8% of fissure-filled teeth failed to be isolated properly, thus failing to achieve good moisture control, which is essential in the fissure sealant procedure. In this case, poor isolation was defined as failure to isolate teeth with a cotton roll and/or the absence of a portable suction machine. This was supported by the lack of an assistant to help hold suction for better isolation in addition to standard isolation with cotton rolls (61.5%). The ideal situation for any dental procedure requiring a portable suction machine is to incorporate four-handed dentistry; to have a dental surgery assistant that helps in holding dental suction tip to ensure a dry working area intra-orally. The absence of assistance implies that the patient needs to hold the suction tip themselves, creating a non-ideal situation in moisture control handling. Apart from that, improper mixing of material by the operator due to using hand-mixed material and failure to follow the manufacturer's instructions according to each material used contributed to 81.5% and 38.5% of fissure-filled teeth failure, respectively. This suggests that the operator mishandled the material and did not follow the product's instructions, thus decreasing the retention ability of the fissure sealant material. Moreover, incorrect tooth selection added to 49.2% of fissure-filled teeth failure. The criteria for tooth selection are as outlined in the "Guidelines: A School-based Fissure Sealant Programme" failed to be adhered to. Unsuitable tooth morphology, such as shallow and non-complex fissure, increases the risk of fissure sealant dislodgement. Lastly, no proper written post-operative instructions were provided for all fissure-filled teeth due to absence of readily available written post-operative care. Delivering post-operative instructions verbally is believed to result in lower patient adherence compared to written or printed instructions (18).

Strategy

Remedial actions involved the implementation of a total of seven strategies, carried out from July to December 2018. Firstly, to address improper techniques that could lead to fissure-filled teeth failure, Continuous Dental Education (CDE) was conducted by trained dental officers in three sessions (at least two hours for each session) involving all 68 dental therapists in Perlis. Tooth selection criteria and fissure sealant application techniques were highlighted during the CDE, which aimed to improve knowledge and awareness of the procedure. Additionally, live chair-side training was also conducted by trained dental officers for dental therapists who were involved in all selected schools in this study. During the live chair-side training sessions, correct techniques of tooth preparation and sealant application were further emphasised to dental therapists to eliminate errors during the fissure sealant application procedure. Fissure Sealant Procedure Checklist (Appendix 1) was created as a reference for every operator before starting the fissure sealant procedure, which contains information on ideal patient selection criteria, tooth selection criteria and overall steps involved in the fissure sealant application procedure.

Furthermore, if the dental therapist preferred Glass Ionomer-based sealant, we substituted the use of Hand-mixed Glass Ionomer-based sealant with Capsulated Glass Ionomer-based sealant. This was to prevent material inconsistency during mixing when using Hand-mixed Glass Ionomer-based sealant. In terms of tooth selection, the use of the Modified Ministry of Health International Caries Detection and Assessment System (MM-ICDAS) Dental Charting among dental

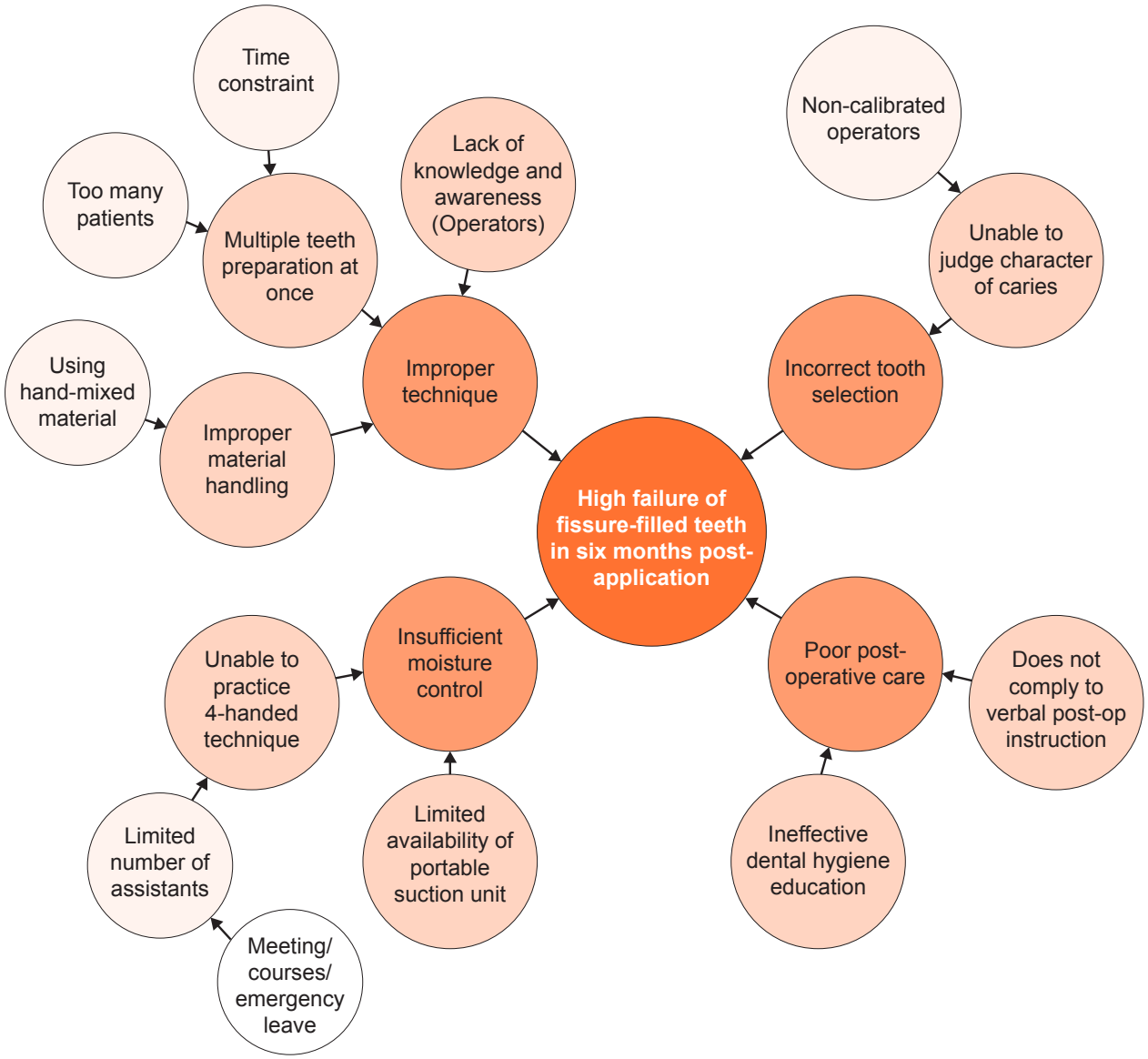


Figure 3: Problem analysis chart for failure of fissure-filled teeth in six months of post-application

therapists was made compulsory to ensure that more specific treatment needs and preventive measures would be planned and provided accordingly. The MM-ICDAS Dental Charting (which is more specific in distinguishing the stages of caries progression in enamel and dentin) was implemented to all dental officers and dental therapists in Perlis with recommendations from the Oral Health Division, Ministry of Health Malaysia to replace existing standard charting starting from the year 2018.

Besides that, all dental therapists must be assisted by either a dental surgery assistant or a healthcare assistant (*Pembantu Perawatan Kesihatan*) during the fissure sealant procedure, in accordance with the guideline's recommendation of four-handed dentistry. This approach (one operator with one assistant) ensures effective moisture control throughout the procedure. The dental surgery assistant's role is to manage the intra-oral moisture (saliva or blood) by holding the dental suction tip, thus ensuring adequate moisture control. In enhancing the care provided, we reinforced chair-side dental hygiene education to motivate schoolchildren to maintain optimal oral hygiene. Written post-operative care instructions were provided as flyers, serving as a take-home message to all schoolchildren who received fissure sealant application. The flyers included reminders for a soft diet in the 24 hours following fissure sealant application, instructions on proper toothbrushing to prevent dislodging of the sealant, as well

as the importance of regular dental check-ups at least twice a year.

Results

In the post-intervention (Cycle 1) stage, the standard of ≤15% was not achieved. Further investigations were carried out to identify the factors contributing to the failure of fissure-filled teeth. It was noted that improper isolation technique and the absence of assistance during the procedure to hold the suction tip for better isolation were factors contributing to the failure, accounting for 45.5% and 54.5% of the failures, respectively. Complying with proper isolation technique was not achievable due to the limited availability of portable suction tips for four dental teams, making it impractical to achieve proper isolation and moisture control. In terms of the absence of assistants, it was largely due to the limitation of human resources within the four school dental teams. Findings of the factors contributing to fissure-filled teeth failure in the verification study, post- intervention (Cycle 1) and post-intervention (Cycle 2) are enlisted as in Table 1. Additional interventions were formulated and reinstituted in Intervention Cycle 2 based on the newly identified contributing factor: inadequate moisture control resulting from the inability to fully implement four-handed dentistry due to a shortage of available assistants. Thus, an innovative product named SAUH (Suction Anchorage Utility Holder) (Appendix 2) was designed. SAUH aids in positioning the dental suction tip accurately without requiring assistance during the fissure sealant procedure. At the same time, it also ensures the efficacy of moisture control and patients' comfort. This matches the situation where limitation in human resource is considered a concern in this study. Furthermore, a redistribution strategy was implemented to optimise the utilisation of existing portable suction units, assigning them to at least two operators per unit. This was to overcome the problem of portable suction apparatus shortage.

Significant improvements were observed following the implementation of interventions planned in Cycle 1 and Cycle 2. All operators were 100% trained in MM-ICDAS charting. Awareness, training, and hands-on sessions provided to dental therapists and assistants significantly improved their level of knowledge, particularly on tooth selection criteria for fissure sealant. There was a significant increase from 49% to 100% in the selection of teeth with suitable morphology (deep, complex fissure). The isolation technique of the tooth during fissure sealant application, which is the most crucial step, also displayed improved from 31% to 68.6% in Cycle 1 and ultimately achieved 100% in Cycle 2. This was achieved by providing each school dental team a saliva ejector unit (portable suction machine) with the ratio of 1 machine to 2 operators (dental therapist). Efficiency in isolation technique also increased with usage of the newly invented SAUH, which also indirectly resolved the issue of staff shortage during a dental procedure.

All in all, it can be concluded that the interventions were regarded as successful in reducing the failure of fissure- filled teeth among primary schoolchildren in Perlis from 84.4% to 43.1% (Reevaluation 1) and later to 10.3% (Reevaluation 2). Detailed improvements of all criteria enlisted in the Model of Good Care are shown in Table 2.

Lessons and Limitations

This study was the first initiative of Perlis Oral Health Division to assess the overall picture of fissure-sealant retention and failure rates in school dental treatment. The involvement of operators, supervisors of primary dental clinics and the top management during the study had facilitated communication and overcame the barriers in delivering the best preventive measure and treatment in school, specifically in providing fissure sealants as caries preventive action. The results of this study have proven that the outcome of fissure-sealant retention can be improved with proper training and techniques supported by adequate material and equipment. The remedial actions are also presumed suitable and can be used by all operators in a school dental setting.

Apart from that, several

Table 1: Contributing factors to the failure of fissure-filled teeth in six months post-application in the verification study and post-intervention cycles

No	Factors identified	Verification Study		Post Intervention (Cycle 1)		Post Intervention (Cycle 2)	
		No. of teeth affected	% of non-compliance	No. of teeth affected	% of non-compliance	No. of teeth affected	% of non-compliance
1	Improper isolation technique	20/65	30.8%	10/22	45.5%	0/37	0%
2	Failure to follow manufacturer's instruction for material used (e.g., does not apply conditioner prior to GI sealant placement)	25/65	38.5%	0/22	0%	0/37	0%
3	Absence of assistant during the procedure to hold suction for better isolation in addition to standard isolation with cotton rolls	40/65	61.5%	12/22	54.5%	0/37	0%
4	Improper mixing of material (e.g., hand-mixed GI sealant)	53/65	81.5%	0/22	0%	0/37	0%
5	Wrong tooth selection	32/65	49.2%	0/22	0%	0/37	0%
6	Improper written post-operative instructions were given to the patient	65/65	100%	0/22	0%	0/37	0%

brainstorming sessions involving all members of the Quality Unit of Perlis Oral Health Division have produced a great, cost-effective product called Suction Utility Anchorage Holder (SAUH) that resolved the issue of limited human resources in the school dental team. This demonstrates that innovation and a creative work environment can greatly improve the outcome and performance of one's organisation. Safety inspection for SAUH was conducted in collaboration with the Department of Occupational Safety and Health (DOSH), and an official safety recognition is anticipated shortly. This product is currently in the process of obtaining patent

Table 2: Improvements of the critical steps in Model of Good Care (MOGC).

Steps	Process of care	Criteria	Standards	Pre Remedial	Post Remedial 1 (Cycle 1)	Post Remedial 2 (Cycle 2)
1	Examination and diagnosis	Operators trained in Modified MOH International Caries Detection and Assessment System (ICDAS) Charting (MM-ICDAS)	100%	40%	100%	100%
2	Tooth selection for fissure sealant	• Fully erupted	100%	100%	100%	100%
		• Non-carious	100%	100%	100%	100%
		• The tooth with a complex, deep fissure	100%	49%	100%	100%
3.	Fissure Sealant Procedure Checklist	Must be included in every patient LP.8 as operator guide	100%	0%	100%	100%
4.	Tooth isolation	• Isolation with cotton rolls plus saliva ejector	100%	31%	68.6%	100%
		• Availability of assistant to help with moisture control and material handling	100%	31%	88.2%	100%
5.	Application of dentin conditioner/ etching /light cure	• Follow the manufacturer's guide	100%	38%	100%	100%
		• One tooth preparation at a time	100%	46%	100%	100%
6	Occlusal verification	Ensure no bite interference with articulating paper	100%	100%	100%	100%
7	Post-op instruction	Written post-op instructions are given to patients	100%	0%	100%	100%
8	Review in six months of post application	Appointment cards are given to patients	100%	100%	100%	100%

rights and will be promoted for commercial production.

Despite all the planned strategies, the COVID-19 pandemic which struck in early 2020, has disrupted dental services to patients, including School Dental Services. School Dental Services were temporarily halted as all schools had to be closed during the pandemic, which greatly affected the study plan and negatively impacted the implementation of remedial actions. Nonetheless, modifications of the study Gantt chart were made after School Dental Services were resumed in August 2020, enabling team members to continue with remedial action implementations and evaluations.

Conclusion and the Next Steps

As we had successfully reduced the percentage of fissure-filled teeth failure in 6 months of post-application to 10.3%, the new Gold Standard will be set at 5% and assigned at the Perlis state level to step up our efforts in ensuring better study outcomes. Further reevaluation will be conducted to identify other possible factors that still contribute to this current failure rate.

Intervention plans will be implemented across all primary dental clinics in Perlis. Additionally, a state-level committee will be formed to develop a training module that can be used as a guide for the operators (both dental officer and dental therapist), which will be shared subsequently with other states in the future. Results from this study can be used as a reference to review current guidelines and provide primary data for the Malaysian context, which can later be used to set a new national standard as an indicator to monitor fissure-filled teeth failure. We also aim that the SAUH product will be patented and replicated nationally to benefit facilities with limited resources in providing high-quality dental care.

Acknowledgement

The authors would like to thank the Director General of Health Malaysia for his approval to publish this work. Also, the authors would like to extend our greatest appreciation to the State Deputy Director (Dental), Public Health Specialist, Dental Officers-in-charge of Primary Dental Clinics in Perlis, dental therapists and all Perlis Oral Health Division personnel involved in this study.

Conflict of Interest

The authors declare that there was no conflict of interest.

Funding

This study received no specific grants from any funding agencies from the public, commercial or non-profit sectors.

References

1. Lee Y. Diagnosis and Prevention Strategies for Dental Caries. J Lifestyle Med. 2013 Sep;3(2):107-9. Epub 2013 Sep 30.

2. Beauchamp J, Caufield PW, Crall JJ, Donly K, Fiegal R, Gooch B, Ismail A, Kohn W, Siegal M, Simonsen R. American Dental Association Council on Scientific Affairs. Evidence-based clinical recommendations for the use of pit-and-fissure sealants: A report of the American Dental Association Council on Scientific Affairs. J Am Dent Assoc 2008; 139(3):257-68.

3. Kervanto-Seppälä S, Pietilä I, Meurman JH, Kerosuo E. Pit and fissure sealants in dental public health - application criteria and general policy in Finland. BMC Oral Health, 2009; 4; 9:5.

4. Lobo MM, Pecharki GD, Tengan C, da Silva DD, da Tagliaferro EP, Napimoga MH. Fluoride-releasing capacity and cariostatic effect provided by sealants. J Oral Sci, 2005; 47:35-41.

5. Francis R, Mascarenhas AK, Soparkar P, Al-Mutawaa S. Retention and effectiveness of fissure sealants in Kuwaiti school children. Community Dent Health. 2008 Dec;25(4):211-5. PMID: 19149297.

6. Behroozian A, Aghazadeh Z, Sadrabad ZK, Aghazadeh M, Alizadeh V, Esmaili Z, Pirzadeh Ashraf M. Evaluation of the success rate of pit and fissure sealants on first molars: 12 months follow-up study. Int J Dent Hyg. 2022 Aug;20(3):465-470. doi: 10.1111/idh.12566. Epub 2022 Jan 11. PMID: 34902222.

7. Anson RA, Retention of Pit and Fissure Sealants Placed in a Dental School Pedodontic Clinic; A Retrospective Study.1982. The American Academy of Pedodontics/Vol. 4, No. 1.

8. Hajar HR, Vijayamanohar K, Nadia DB, Umi A, Wan Aini WY. Increasing retention rate of fissure sealant application among primary schoolchildren, Bangsar Dental Clinic, 2012.

9. Nogourani MK, A 12 month clinical evaluation of pit-and-fuissure sealants Placed With and Without etch-and-rinse and self-etch adhesive systems in Newly Erupted Teeth, J Appl Oral Sci. 2012 May- Jun; 20(3): 352–356.

10. Muntean A, Sarosi C, Sava S, Moldovan M, Condurache AI, Delean AG. Dental Sealant Composition-Retention Assessment in Young Permanent Molars, Materials (Basel). 2021 Apr; 14(7): 1646.

11. Wright JT, Crall JJ, Fontana M,Gillette EJ, Nový BB, Dhar V, Donly K, Hewlett ER, Quinonez RB, Chaffin J,Crespin M, Iafolla T, Siegal MD, Tampi MP, Graham L, Estrich C, Carrasco-Labra A. Evidence-based Clinical Practice Guideline for the Use of Pit- and-Fissure Sealants. American Academy of Pediatric Dentistry, American Dental Association. Pediatr Dent 2016;38(5): E120- E36.

12. Bandi M, Mallineni SK, Nuvvula S. Influence of Isolation Methods on Retention of Pit and Fissure Sealants in Young Permanent Teeth based on Simonsen's Criteria: A Randomised Clinical Trial, Journal of Clinical and Diagnostic Research. 2021 Apr, Vol-15(4): p6-9.

13. Griffin S, Jones K, Kolvic Gray S, Malvitz D, Gooch B. Exploring four-handed delivery and retention of resin-based sealants. J Am Dent Assoc. 2016;139 :281–289.

14. Kumaran P. Clinical evaluation of the retention of different pit and fissure sealants: a 1-year study. Int J Clin Pediatr Dent. 2013 Sep;6(3):183-7. doi: 10.5005/jp-journals- 10005-1215. Epub 2013 Oct 14.

15. Oral Health Division, Ministry of Health Malaysia. Guidelines; A School-Based Fissure Sealant Programme Second Edition. Oral Health Division, 2003.

16. Crall JJ, Donly KJ. Dental sealants guidelines development: 2002-2014. Pediatr Dent. 2015 Mar-Apr;37(2):111-5. PMID: 25905651.

17. Asawa K, Gupta VV, Tak M, Nagarajappa R, Chaturvedi P, Bapat S, Mishra P, Roy SS. Dental Sealants: Knowledge, Value, Opinion, and Practice among Dental Professionals of Bathinda City, India. Adv Prev Med. 2014; 2014:469738. doi: 10.1155/2014/469738. Epub 2014 Apr 10. PMID: 24818028; PMCID: PMC4003741.

18. Shenoi RS, Rajguru JG, Parate SR, Ingole PD, Khandaitkar SR, Karmarkar S. Compliance of Postoperative Instructions Following the Surgical Extraction of Impacted of Impacted Lower Third Molars. Indian J Dent Res 2021;32: 87-91.

Appendix 1

Fissure Sealant Procedure Checklist

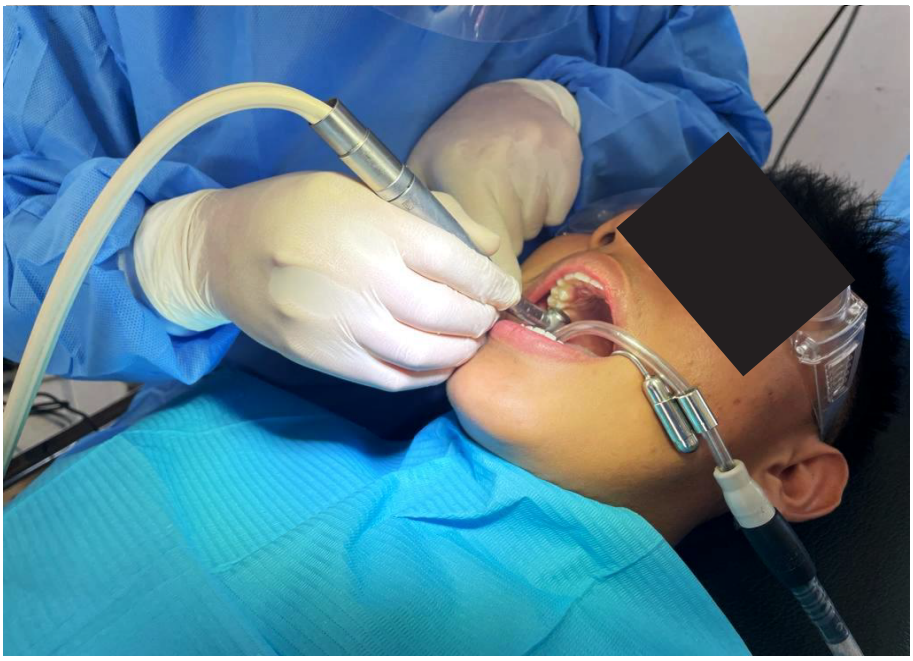
PATIENT (FULL NAME)			
ID NUMBER :		**Please tick (/)**	
DATE:		**DENTAL THERAPIST**	**ASSISTANT**
1. Verification of patient's identity			
2. Verification of patient indication for fissure sealant			
a) Patient selection (caries experience, fair to poor oral hygiene)			
b) Tooth selection – fully erupted teeth, deep and/or complex fissures			
3. Verification of tooth to be treated			
4. Verification of assistant to assist			
5. Verification of informed consent signed by parents/guardian			
6. Verification that the area has been properly prepared	6.1 Working area disinfected		
7. Availability of instruments and equipment necessary and is well-sterilised	7.1 Examination kit 7.2 Gauze 7.3 Cotton roll 7.4 Light cure 7.5 GIC/resin* 7.6 Portable dental suction 7.7 Articulating paper 7.8 Etchant/conditioner		
8. Duration of placement	8.1 At least 10 minutes (monitor with timer)		
9. Verification of procedure	9.1 Surface cleaning 9.2 Moisture control (isolation) 9.3 Using conditioner/ etchant* 9.4 Follow conditioner /etching time 9.5 Washing (15 seconds) 9.6 Dry the tooth with a 3-way syringe (30 seconds) 9.7 Application of sealant 9.8 Occlusal adjustment		
10. Verification of post-op instruction	10.1 Post-procedure care leaflet is explained and given to the patient		
11. Verification of proper record of the procedure was noted in the patient's card record (LP.8)			
Operator's Signature			

Appendix 2

Innovative products reinstituted in Intervention Cycle 2



Suction Anchorage Utility Holder (SAUH)



SAUH application during procedure

INCREASING THE ADHERENCE TOWARDS ORAL IRON INTAKE AMONG PREGNANT WOMEN AT KOTA BHARU DISTRICT HEALTH CLINIC

Foo Yen Yie[1], Shahirah Saipoddin[2], Nur Thaqifah Md Adnani[3], Muhammad Solleh Rahim[4]

[1]Kubang Kerian Health Clinic, Kelantan State Health Department, Ministry of Health Malaysia

[2]Badang Health Clinic, Kelantan State Health Department, Ministry of Health Malaysia

[3]Ketereh Health Clinic, Kelantan State Health Department, Ministry of Health Malaysia

[4]Urban Transformation Centre Health Clinic, Kelantan State Health Department, Ministry of Health Malaysia

Corresponding Author: Foo Yen Yie
Email: fooyenyie@moh.gov.my

Abstract

Poor adherence to antenatal oral iron intake among pregnant women remains a major concern, despite various research efforts and treatment interventions. This issue may lead to the development of anaemia, which carries severe complications for both mother and fetus, including the risk of premature birth and spontaneous abortion. In Kota Bharu district, a notable 5.75% of antenatal patients were diagnosed with anaemia at 36 weeks out of a total of 4648 mothers in the year 2017. A verification study done in 2018 at three health clinics under the Kota Bharu District Health Office (KBDHO), namely Badang, Kubang Kerian, and Ketereh Health Clinics, revealed that adherence towards antenatal oral iron intake was only 34%. Thus, a quality improvement project was initiated, aiming to increase adherence to a target of 80%. The adherence to oral iron intake was measured among the antenatal mothers using MyMAAT, a tool adapted from a local study. On the other hand, two additional questionnaires were administered to both antenatal mothers and pharmacists to identify factors contributing to the problem. This study unveiled contributing factors, including poor understanding of the importance of iron during pregnancy, poor nutritional knowledge, fear of potential iron's side effects, poor attitudes towards taking the medication, and less effective communication techniques by pharmacists. Nine strategies were then implemented, namely antenatal class talks, use of poster wheels, application of daily chart labels, introduction of All-In-One bookmarks, deployment of iron replicas, establishment of Mommy Hotline, the use of IRON Scan-ME, adoption of iron counselling checklists, and distribution of infographics. The Achievable Benefit Not Achieved (ABNA) gap was 46% in the pre-remedial phase, improved to 12% and 9% in the post-remedial phases. The percentage of antenatal mothers with haemoglobin levels ≥11g/dl at the 36-week increased from 57% to 64% following these interventions.

KEYWORDS: Adherence, Antenatal iron, Anaemia

Problem

The Kota Bharu District Health Office (KBDHO) serves the majority of Kelantan's population, amounting to approximately 608.6 thousand individuals out of a total of 1.88 million in the year 2017 (1). Within this population, an average of 15 thousand antenatal mothers were provided services by 12 health clinics under the KBDHO (2). Typically, each health clinic comprises an Outpatient Department (OPD) and Maternal and Child Health (MCH) units. All clinics under KBDHO are equipped with in-house pharmacies, laboratories, and dental services, except for the UTC Health Clinic (formerly known as 1Malaysia UTC Health Clinic), which does not offer laboratory services. A health clinic is overseen by a Family Medicine Specialist (FMS) or a senior medical officer who is responsible for supervising both the OPD and MCH units. The MCH unit is dedicated to women's health including pre-pregnancy care, antenatal care, postnatal care and child health care. This unit is led by a Nurse Manager, followed by the Head of Staff Nurse and staff nurses. On a daily basis, the total attendance of antenatal mothers across all clinics under KBDHO ranges between 80-100 individuals.

Anaemia has consistently ranked among the most frequently diagnosed issues in pregnant women, even though it has been extensively studied and addressed (3,4). One of the ways to overcome or prevent anaemia is by the intake of oral iron supplementation throughout the course of pregnancy (3). To facilitate this, pregnant women will receive antenatal iron supply from the attending pharmacist at the dispensing counter. Additionally, they will receive counselling if deemed necessary during each follow-up visit. Iron supplementation can be initiated for all antenatal patients as early as the fourth week of gestation.

In 2017, the incidence of anaemia among antenatal patients at 36 weeks was 5.75% (267 cases out of 4,648 mothers), a 0.75% higher than the target allowed nationally (2). A verification study conducted in April 2018 within three health clinics under KBDHO - Badang Health Clinic, Kubang Kerian Health Clinic and Ketereh Health Clinic - revealed that only 34% of antenatal patients adhered to the recommended oral iron intake. Given the substantial prevalence of low adherence to antenatal oral iron intake and the limited local studies addressing this issue (3), a quality improvement study was initiated. The primary aim of this study was to propose strategies to increase antenatal oral iron intake among pregnant women from 34% to 80% within 18 months. This initiative was intended to decrease anaemia, consequently attaining the recommended haemoglobin levels among pregnant mothers.

Background

Haemoglobin (Hb) is the red pigment present in the red blood corpuscle, responsible for transporting oxygen from the lungs to the body's tissues and myoglobin, which acts as an oxygen reservoir within muscles (3,4). The formation of Hb necessitates iron, folic acid, other vitamins, and trace elements (4). Iron, an essential mineral for humans, is crucial in bolstering Hb production and generating additional red blood cells. During pregnancy, the demand for iron intensifies due to the augmentation of the red blood cell mass and the transfer of increased iron quantities to both the growing fetus and the placental structures. Despite dietary iron intake, the increased requirement cannot be met, hence giving rise to the need for oral iron supplementation (5). Compounded by the decreased bioavailability of nutrients among pregnant women, solely relying on dietary intake proves insufficient to meet the required iron demands (6). Various studies have advocated for 100mg of iron supplementation with 5mg of folic acid for pregnant women (7-9), which ideally commence between the 10th and 12th week of gestation (3).

According to the World Health Organization (WHO) classification, the cut- off value indicating anaemia in pregnant women is a Hb level <11.0 dL/g (4). Notably, a WHO survey conducted

in Malaysia in 2009 reported that 38% of pregnant women experienced anaemia (10). A cross-sectional study conducted by Jamaiyah in 2007 revealed that within 56 primary healthcare clinics across Malaysia, the prevalence of anaemia among pregnant women was 35% (11). Hassan's study in 2005 further supported this observation by reporting a prevalence rate of 34.6% for anaemia in the Kubang Kerian Kelantan antenatal clinic (12).

Anaemia during pregnancy has been associated with adverse effects on both maternal and child health, substantially increasing the risk of maternal and perinatal mortality (13,14). The maternal repercussions include fatigue, reduced work capacity, impaired immune function, increased risk of cardiac diseases, and even mortality (14-16). This was further evidenced by a study that showed anaemia during pregnancy contributed to 23% of indirect causes of maternal deaths in developing countries (17). The repercussions extend to the fetus or neonate, where anaemia during pregnancy can result in fetal growth retardation, stillbirth, premature birth as well as slow intrauterine growth (17).

One of the common causes of anaemia in pregnancy is low adherence to iron supplementation. A study undertaken in an urban slum area in India found that the overall adherence to iron intake among pregnant mothers was 61.7% (18). Similarly, in Malaysia, a cross-sectional study aimed at assessing adherence to vitamin and mineral supplementation among pregnant women attending public antenatal clinics, both in urban and rural areas in 2010, revealed that only 49.2% of subjects adhered to the vitamin and mineral supplementation (3). This study also showed that the prevalence of anaemia was lower in the group that demonstrated adherence compared to the non-adherent group (3). Another study conducted in North-Western Tanzania showed that the adherence to iron-folic acid supplementation among pregnant women in Kasulu Communities was notably low, which was 20.3% (19). Meanwhile, in Northwest Ethiopia, a study reported that the adherence rate to iron and folic acid supplementation among pregnant women in Aykel town was 47.6% (6).

Low adherence to antenatal iron intake among pregnant women can be attributed to several common factors. These include gastrointestinal side effects, such as loss of appetite, epigastric pain, nausea, vomiting, dark-coloured stools, abdominal cramps and constipation (20,21). Furthermore, factors related to healthcare providers could also impact adherence. These include insufficient patient education provided by healthcare professionals. Additionally, various patient- related factors such as inadequate utilisation of antenatal health services, poor nutritional knowledge, attitudes, and behaviours influence the women's understanding of tablet utilisation as well as their concerns regarding the taste and smell of the tablets (20,21). Moreover, within the community, misconceptions exist that iron supplementation might lead to having a larger baby or cause an increase in the mother's body weight (20,21).

A study conducted in the United States showed significant improvement in adherence through various strategies. Ensuring the consistent availability of iron supplements, giving advanced warnings about potential iron-related side effects, involving patients in the therapeutic strategy, and providing reminders such as posters and calendars were all found to enhance adherence (22). In an urban slum area in India, compliance with iron pills corresponded to the level of education, early antenatal booking, increased frequency of antenatal visits, awareness of haemoglobin levels, and knowledge of the prescribed iron pill dose (18). Similarly, the role of health professionals in counselling was found to be important in enhancing compliance with iron supplementation, as reported in a study in India (23).

Measurement

We used the Malaysia Medication Adherence Assessment Tool (MyMAAT) to assess adherence, where good adherence

was defined as having a score of ≥50% and having a score of <50% was considered poor adherence (24). The indicator for the percentage of adherence was calculated as the number of pregnant women with good adherence to antenatal oral iron over the total number of pregnant women taking antenatal oral iron as below:

$$\text{Percentage of adherence towards antenatal oral iron intake among pregnant women} = \frac{\text{Number of women taking antenatal oral iron showing good adherence}}{\text{Number of pregnant women taking antenatal oral iron}} X\ 100\%$$

The MyMAAT tool was developed by the Pharmaceutical Services Program in collaboration with the Faculty of Pharmacy, *Universiti Kebangsaan Malaysia* (UKM), to measure the level of patient adherence to medication in Malaysia. This tool was prompted by the discontinuation of the 8- items Modified Morisky Medication Adherence Scale (MMMAS) in 2017. Instead, the MyMAAT tool has been introduced, encompassing a total of 12 items specifically tailored for pregnant mothers who have commenced oral iron supplementation. These items are designed to measure various aspects of medication-taking behaviour and to identify potential reasons contributing to non-adherence.

This study included all pregnant women receiving follow-up care at the three selected clinics who have been prescribed oral iron for a minimum of one month. However, certain exclusions were applied, including antenatal patients who received iron injections, experienced miscarriages, were transferred to different clinics, had a history of anaemia-related illness, or refused to answer the MyMAAT survey. The pregnant women considered for inclusion had been prescribed oral iron supplements in alignment with their next scheduled appointment, which commonly took place a month after the initiation or supplied with iron supplements.

The baseline or verification phase was done in April 2018 to determine the magnitude of non-adherence to oral iron intake among pregnant mothers. At the same time, two different types of questionnaires were given to the non-adherent pregnant women and to the pharmacists in order to determine the contributing factors to non-adherence. These questionnaires were adapted from previous studies that explored potential causes of non-adherence and the effectiveness of counselling provided by pharmacists (22,23). Our study focused on three types of iron supplements, namely ferrous fumarate 200mg, Zincofer® and Maltofer®. The standard was set at 80% as advocated by the District Chief Pharmacist and unanimously agreed upon. This benchmark exceeds the adherence rate of a study done in Ethiopia where the standard was set at 65% (25).

The post-remedial phase I (Cycle 1) and phase II (Cycle 2) data were subsequently collected in August 2018 and January 2019, respectively. The verification phase result showed that out of the 239 samples taken in April 2018, 34% (n=82) demonstrated adherence and 66% were classified as non-adherent.

Initial Assessment of the Problem

The existing process of care was reviewed and the critical step identified was the counselling process (26). It was observed that the adherence of pregnant women to antenatal oral iron intake could be influenced by the counselling sessions provided by the pharmacists (27). During the pre-remedial data collection phase, it was noted that only simple advice with correct dose, frequency, indication and administration time was given instead of emphasising the importance of iron supplementation, iron-food interaction, and complications of anaemia due to iron insufficiency. The process of care was revised to enhance the counselling sessions. Following consultation with doctors or nurses in the MCH unit, pregnant women were prescribed antenatal oral iron and received counselling on proper administration from pharmacists, with documentation. During the counselling sessions, the pharmacist also assessed adherence to antenatal oral iron intake and explored the potential factors contributing

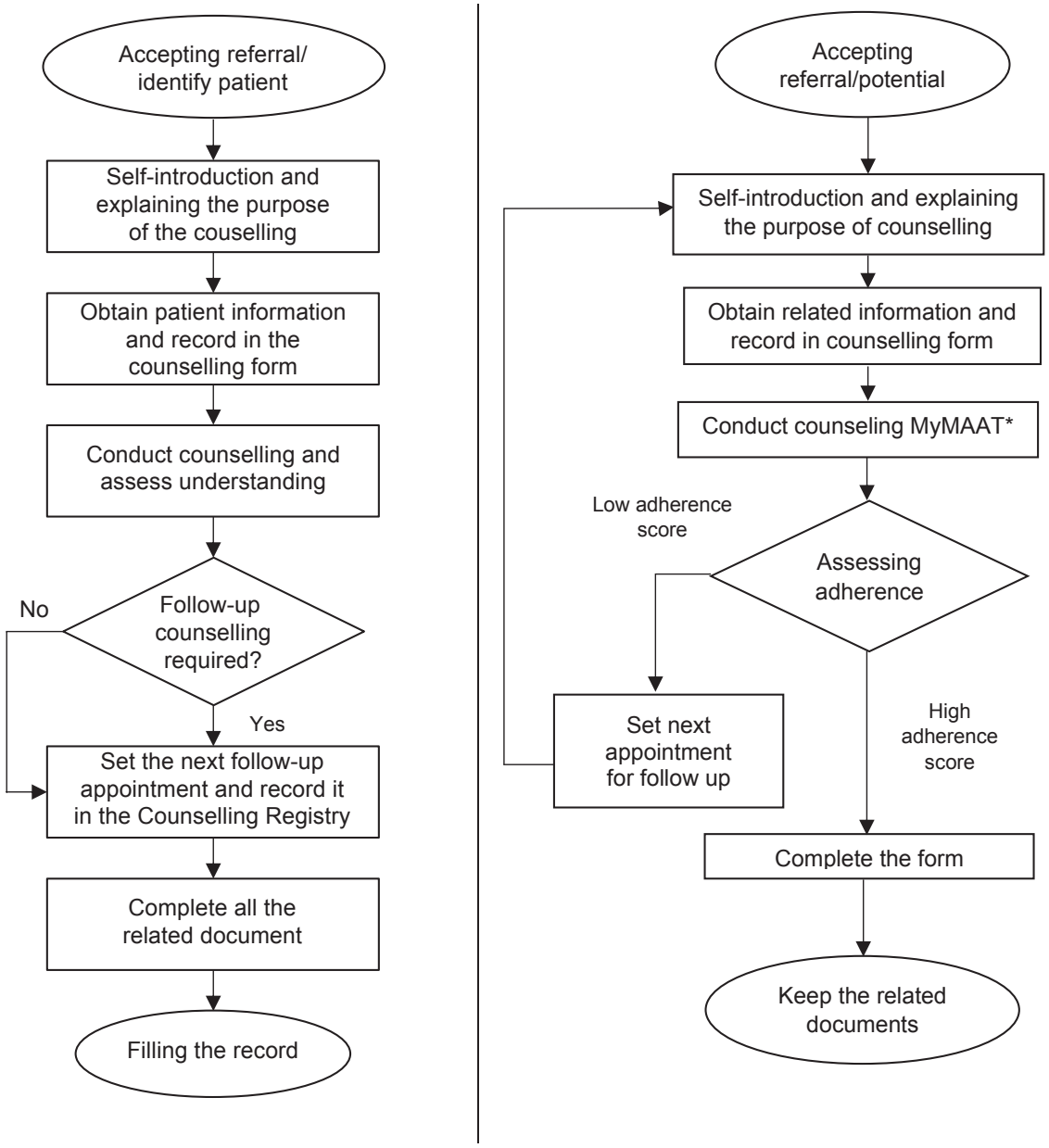


Figure 1: The initial (left) and revised (right) process of care for patient counselling at the pharmacy (* indicates critical step)

to non-adherence. Pregnant women who were found to be non-adherent were scheduled for follow-up counselling during their subsequent appointments. The initial and revised process of care is illustrated in Figure 1.

Of the 66% (n=157) sample with non-adherent, we identified that poor understanding of the importance of iron, fear of the iron's side effects, lack of nutritional knowledge, hesitancy towards oral iron intake, and perceived ineffectiveness of counselling by pharmacist had contributed to the problem (Figure 2).

The result revealed that only 31% of pregnant women exhibited a good understanding of the importance of antenatal iron. Additionally, 32% showed better nutritional knowledge, 36% were able able to accept the side effects of iron, 37% showed a positive attitude towards antenatal iron intake, and only 47% rated the communication technique of pharmacists as effective.

Strategy

The post-remedial phase involved two QA cycles where the first cycle (Cycle 1) was carried out from May to July 2018,

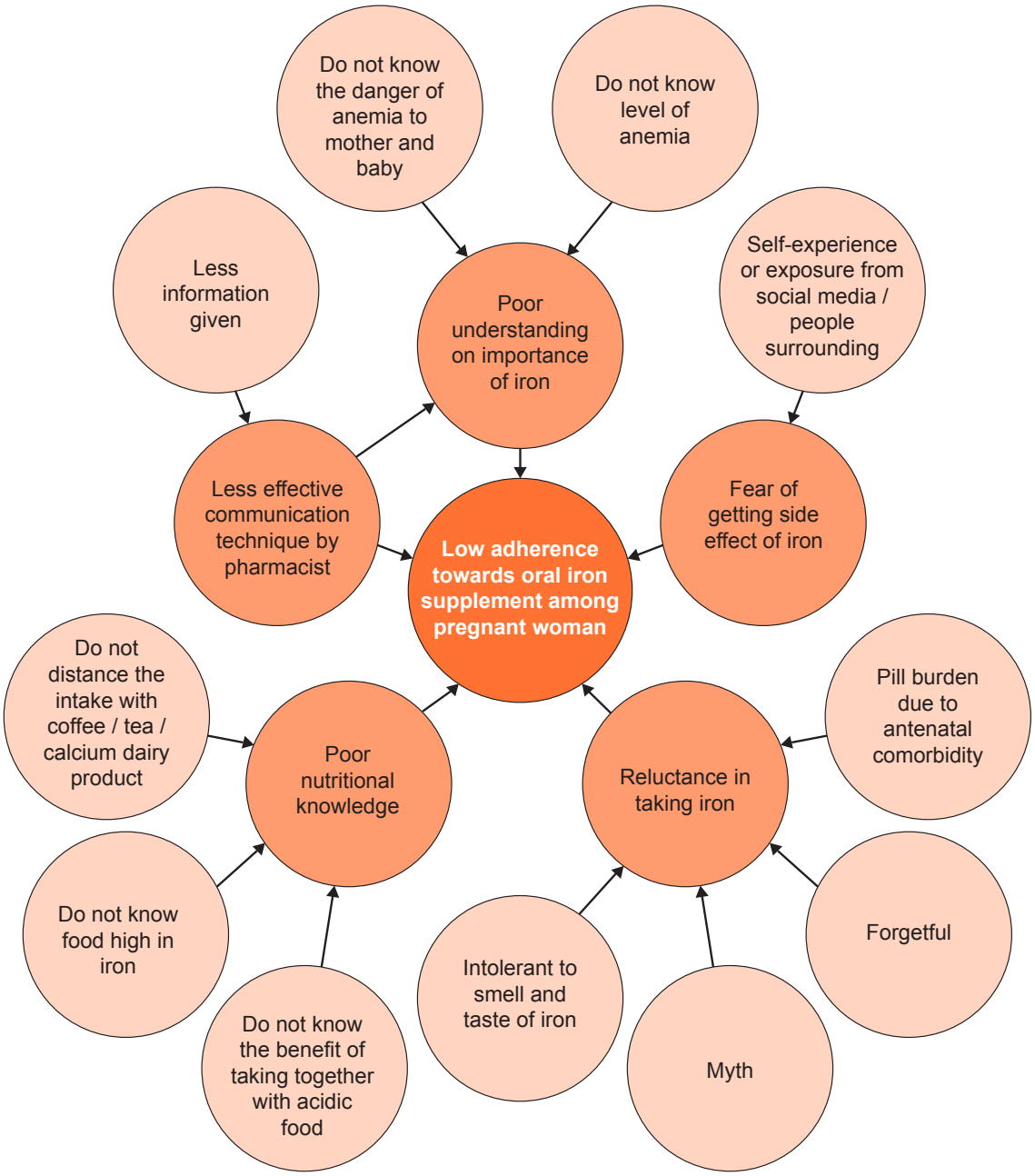


Figure 2: Problem analysis chart for failure of fissure-filled teeth in six months post-application

followed by evaluation in August. The second cycle (Cycle 2) was executed from September to December 2018, followed by evaluation in January 2019. We introduced six strategies during Cycle 1 and three additional strategies during Cycle 2.

During Cycle 1, Strategy 1 used an All-In-One bookmark consisting of important information related to anaemia, a column for tracking Hb levels with emoticons to mark progress during each follow-up appointment, as well as a diagram illustrating a high iron diet to enhance the patient's understanding. With this approach, the monitoring of Hb levels by prescribers and nurses became easier as it eliminated the need to flip through the extensive antenatal book and search page by page for Hb levels. Instead, a glance at the bookmark provided a comprehensive overview of Hb progression. However, it was noted that some patients lost the bookmark between follow-up appointments.

Conversely, Strategy 2 focused on enhancing the nutritional knowledge among pregnant women to avoid unnecessary drug-food interactions, and expansion of the pharmacists' role in patient care. Pharmacists were directly involved with patients and healthcare

professionals during antenatal class as opposed to their distance engagement before. In this strategy, pharmacist talks were incorporated into the antenatal classes, emphasising the interaction of iron with certain foods or beverages. The talks were scheduled to occur regularly every month on weekdays, hosted in the meeting room. Lunch and small tokens like goody bags and pens were provided to encourage patients' participation. However, unanticipated factors, such as logistic issues and adverse weather conditions, resulted in low attendance rates, with only 72% attendance recorded despite the expectation of full attendance across a total of 30 sessions.

In Strategy 3, we created a poster wheel to assist pharmacists and nurses in conveying information related to the side effects of iron supplementation and strategies to overcome them. The poster wheel featured main side effects designed in two sizes for MCH and the pharmacy counter. Although we managed to increase the subject's acceptance towards the side effect of iron up to 55% at the end, however, nurses expressed their concerns that using the poster wheel was time- consuming. Patients were occasionally reluctant to spend time listening to the explanation by the nurses or pharmacists on managing the side effects. Based on this feedback, we realised that the implementation was unlikely to be sustainable after the project ended.

In Strategy 4, we activated Mommy Hotline, facilitating direct communications between patients and pharmacists. This was intended to make it more convenient for patients to reach out with any concerns, especially those related to iron side effects. Although we expected to receive calls from pregnant women or patients on iron-related questions, there were instances where patients mistakenly assumed that the hotline was a customer service helpline, prompting them to ask to be connected to the MCH clinic for other matters.

In Strategy 5, a comprehensive iron counselling checklist was developed and used as a pharmaceutical counselling aid to increase the effectiveness of delivering iron-related information to patients and enhance communication between pharmacists and pregnant women. The pharmacist provided the counselling points step-by-step according to the information stated in the checklist. Despite showing potential benefits, this strategy revealed certain drawbacks. The implementation of the checklist might be time-consuming, especially during peak hours.

In Strategy 6, to address the attitude issue, we affixed a daily chart label containing 30 tick boxes (equivalent to 30- day period) to the medication envelope. Each box was marked daily to signify pregnant women's discipline in daily iron intake. This approach received much encouraging feedback from patients highlighting the benefits of this measure, as it helped in their routine monitoring of daily iron intake.

During the Cycle 2, we introduced three new additional strategies. In the first additional strategy, Strategy 7, we made a QR Code sticker (IRON-ScanME) to improve the patient's understanding of the importance of iron. The QR code sticker served as an easy platform for patients to access educational videos covering anaemia and iron deficiency topics. Positioned on the antenatal book, patients could scan the QR code using their smartphones at their convenience.

In the second additional strategy, Strategy 8, we made a large replica of the different types of iron supplements available in the health clinics, which included information such as the onset of action, administration instructions, and the quantity of elemental iron contained in each supplement.

In the third additional strategy, Strategy 9, we distributed infographics related to Myth versus Fact on oral iron to rectify some individuals' negative perceptions about iron supplementation. Concurrently, the antenatal classes were strengthened and expanded, in which educational materials were gradually distributed to other nine health clinics within the Kota Bharu district.

Table 1: Model of good care for the counselling of antenatal woman receiving oral iron supplement in pharmacy

No	Critical step	Criteria	Standard	Pre-remedial phase	Post-remedial Phase 1 (Cycle 1)	Post-remedial Phase 2 (Cycle 2)
1.	Counsel antenatal mother receiving the oral iron supplement	Giving instruction on dose, frequency, indication, time of administration	100%	100%	100%	100%
		Giving instruction on the side effects of iron supplement	100%	36%	55%	55%
		Assess understanding towards the importance of iron and anaemia	100%	31%	81%	85%
		Provide effective communication techniques throughout counselling sessions	100%	47%	89%	89%
		Assess adherence towards the oral iron intake	100%	34%	68%	71%
		Assess attitude towards the oral iron intake	100%	37%	69%	72%
		Educating on drug-food interaction	100%	32%	76%	79%

Results

All standards set in the model of good care showed improvements from the pre- remedial phase to the post (Table 1). In terms of adherence, we observed a remarkable improvement from 34% to 68% and 71% in Cycle 1 and Cycle 2, respectively as in Figure 3. The result revealed that there remained a 9% gap in achieving the targeted 80% standard for adherence to oral iron intake.

Overall, there was an improvement in all five factors during Cycle 2 when compared to the pre-implementation phase although a minimal increment was observed in the later Cycle. The three additional strategies applied during Cycle 2 (QR code sticker, replica of irons and infographics) involved relatively less interaction between healthcare professionals and subjects compared to the antenatal class programme in Cycle 1. These strategies depended on self-driven motivation and self-awareness, differing from Strategy 6 (chart label strategy), where pregnant women were obligated to tick the box daily. Despite this, all three approaches (QR code sticker, replica of irons and infographics) were used throughout the project due to their efficiency in terms of time and resources and their ability in conveying information to the subjects. Upon these implemented strategies, pregnant women showed a better understanding of the importance of iron (a substantial increase from 31% to

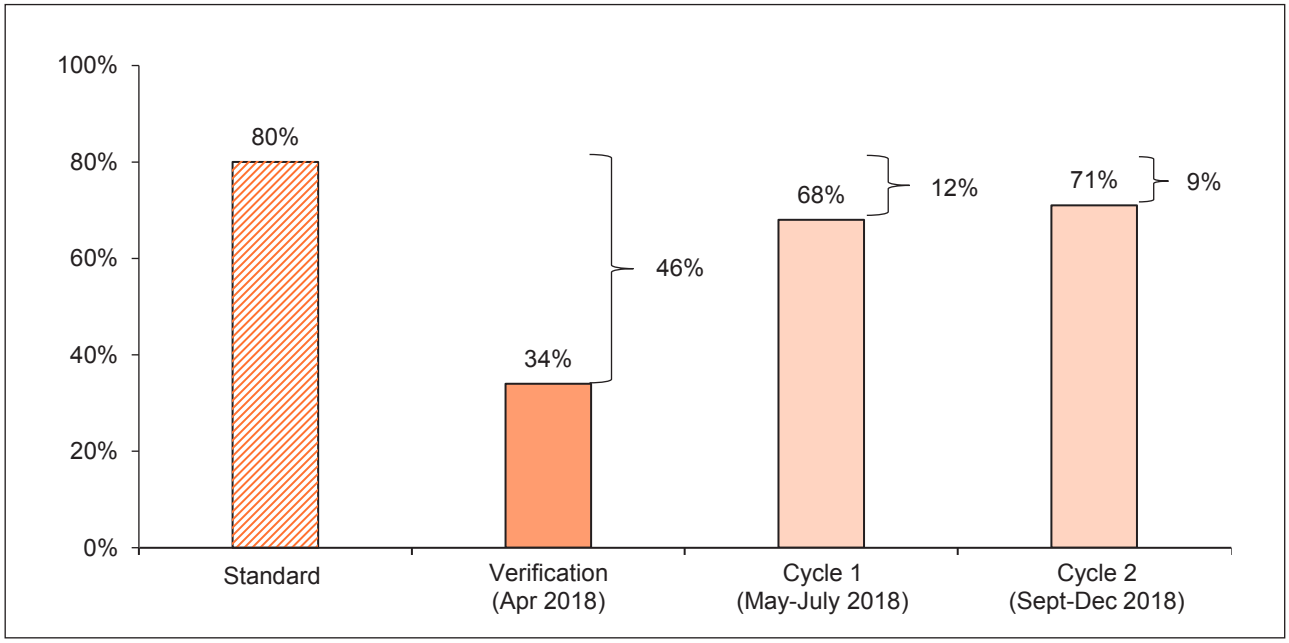


Figure 3: Percentage of adherence towards iron intake among pregnant women.

85%). Similarly, their nutritional knowledge improved from 32% to 79%. They also demonstrated better acceptance towards iron's side effects (36% to 55%) with an improved attitude towards iron intake (32% to 72%). Through these remedial actions, the communication between pharmacists and patients became more effective, as evidenced by the improved pharmacist score based on the iron counselling checklist (47% to 89%). We also managed to reduce the ABNA readings from 46% to 9% following the second cycle of the QA study (Figure 3). This study also led to an increase in the patient's normal Hb readings (Hb≥11). Overall, the prevalence of anaemia among the pregnant mothers attending these clinics decreased from 73% during the pre-remedial phase to 36% after Cycle 2.

Lessons and Limitations

This study imparted a crucial lesson to us that multidisciplinary collaboration among healthcare professionals, especially uniting the pharmacy and nursing units could help achieve better patient care by enhancing the current work process and focusing on patient-related perspectives. Effective counselling provided by pharmacists also contributed to bolstering patient adherence to medication intake; hence, continuous education and awareness activities need to be emphasised.

One of the strengths of this project was its implementation as a multi-centre project. The result from this project allows us to gather insights regarding adherence towards antenatal oral iron intake among pregnant women locally.

Despite the desired outcome obtained, it is important to acknowledge the challenges that we encountered during the course of this project. One noteworthy challenge was the potential for missing data due to the absence or unavailability of the designated individual responsible for data collection. To address this problem in future, we suggested that data be collected daily by any pharmacy staff, ensuring a consistent and reliable data collection process. In addition, certain strategies, such as Strategy 1 (bookmark), Strategy 3 (poster wheel), and Strategy 7 (QR code), posed a burden on the workload of staff nurses, who perceived that explaining the purpose of the bookmark, information in the poster wheel and QR code was time-consuming.

Apart from that, the use of convenience sampling also imposed potential bias into our study. The approach relied on the availability of healthcare

workers and patients on specific data collection days, which might not accurately represent the entire population of pregnant women in the Kota Bharu district. Therefore, the findings restrict the generalisability to the broader population of Malaysia. Another major challenge in this study was the rapid turnover of project members due to the dynamic nature of their job scopes and responsibilities.

Strategies such as antenatal bookmarks, daily chart labels, and Iron Scan-Me can be replicated in other healthcare clinics following positive feedback from both staff and patients. This was evidenced by the continuity in the strategies implementation, indicating their sustainability over time. These strategies were mainly monitored by the pharmacist in collaboration with the MCH department.

Through the improvement measures implemented, we observed that pregnant women had improved adherence to iron intake, potentially contributing to the improvement of their Hb levels. Nevertheless, it is important to acknowledge that subjects' heightened awareness of their involvement in the study might influence their responses to the MyMAAT questionnaire, possibly leading to more conscientious answers. Interestingly, this study demonstrated a reduction in drug waste as evidenced by the reduced return of unused iron medication to the pharmacy for 18 months following the introduction of the improvement steps in March 2018.

Conclusion and the Next Steps

The project team identified the contributing factors and devised targeted interventions to address these issues. Consequently, there was a noticeable increase in the percentage of adherence to antenatal oral iron intake among the pregnant women enrolled in the study. At the end of this project, the adherence rate surged from 34% during the pre-implementation phase to 71% after the second cycle. Furthermore, the prevalence of normal Hb levels among the study respondents had increased from 27% during the pre-remedial phase to 64% after the second cycle. In summary, the positive results in the adherence to oral iron intake among pregnant women at the KBDHO underscore the effectiveness of the implemented strategies that were improved during this project.

Moving forward, we would like to continue the educational activities for pregnant women through engaging group sessions. These sessions are aimed at enhancing awareness and understanding of the value of adherence to oral iron intake. We also committed to publishing this study in written publications and informative posters through suitable avenues to help standardise and improve the development of antenatal care initiatives. We also plan to extend the reach of our strategy materials to all health clinics across Kelantan to help other facilities that encounter similar challenges.

Acknowledgement

We would like to thank the Director-General of Health Malaysia for his approval to publish this article. We are grateful to our former chief pharmacist, Mr Shahrul Izwan, for his kind support. We would also like to thank staff nurses from the MCH unit and KBHDO pharmacists for their enthusiastic participation in this study.

Conflict of Interest

The authors declare that there was no conflict of interest.

Funding

This study received no specific grants from any funding agencies from the public, commercial or non-profit sectors.

References

1. Department of Statistic, editor. 2019. In: Laporan Sosioekonomi Negeri Kelantan. 1st Edition. Jabatan Perangkaan Malaysia; 2019. p. 63.

2. Pejabat Kesihatan Daerah Kota Bharu. Reten Antenatal Prestasi. 2017.

3. Milman N. Iron Deficiency and Anaemia in Pregnant Women in Malaysia? Still a Significant and Challenging Health Problem. Journal of Pregnancy and Child Health. 2015;02(03).

4. World Health Organization. The prevalence of anaemia in women: a tabulation of available information. 2nd edition. 1992. 5–6.

5. Bothwell TH. Iron requirements in pregnancy and strategies to meet them. American Journal of Clinical Nutrition. 2000;72(1 SUPPL).

6. Assefa H, Abebe SM, Sisay M. Magnitude and factors associated with adherence to Iron and folic acid supplementation among pregnant women in Aykel town, Northwest Ethiopia. BMC Pregnancy and Childbirth. 2019 Aug 14;19(1).

7. Mikhail A, Brown C, Jennifer Ann Williams. CPG Anemia of CKD. 2017. P. 26.

8. Tee ES, Noor MI, Azudin MN, Idris K. Nutrient Composition of Malaysian Foods. Malaysian Food Composition Database Programme, Institute for Medical Research, Kuala Lumpur. 1997;4th Edition.

9. Kementerian Kesihatan Malaysia. Perinatal Care Manual. 2013. 37–67.

10. McLean E, Cogswell M, Egli I, Wojdyla D, De Benoist B. Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. Public Health Nutrition. 2009;12(4):444–54.

11. Haniff J, Das A, Onn LT, Chen WS, Nordin NM, Rampal S, et al. Anemia in pregnancy in Malaysia: A cross-sectional survey. Asia Pacific Journal of Clinical Nutrition. 2007;16(3):527–36.

12. Hassan R, Abdullah WZ, Nik Hussain NH. Anemia and iron status of Malay women attending an antenatal clinic in Kubang Kerian, Kelantan, Malaysia. Southeast Asian Journal of Tropical Medicine and Public Health. 2005;36(5):1304–7.

13. Allen LH. Anemia and iron deficiency: Effects on pregnancy outcome. American Journal of Clinical Nutrition. 2000;71(5 SUPPL.):1280–4.

14. Mbule MA, Byaruhanga YB, Kabahenda M, Lubowa A. Determinants of anaemia among pregnant women in rural Uganda. Rural remote health. 2013;13(2):2259.

15. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, De Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet. 2013;382(9890):427–51.

16. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: A systematic analysis of population-representative data. The Lancet Global Health. 2013;1(1).

17. World Health Organization. Iron Deficiency Anaemia Assessment, Prevention, and Control. 2001. 7–10. 2014; 2014:469738. doi: 10.1155/2014/469738. Epub 2014 Apr 10. PMID: 24818028; PMCID: PMC4003741.

18. Dutta AJ, Patel P, Bansal RK. Original article Compliance to iron supplementation among pregnant women: a cross sectional study in urban slum. njcmindia.org. 2014;5(4):457–62.

19. Lyoba WB, Mwakatoga JD, Festo C, Mrema J, Elisaria E. Adherence to Iron-Folic Acid Supplementation and Associated Factors among Pregnant Women in Kasulu Communities in North-Western Tanzania. International Journal of Reproductive Medicine. 2020 Jun 5; 2020:1–11.

20. Ejidokun OO. Maternal anaemia and morbidity in South-western Nigeria. PQDT - Global. 1996;(January):316.

21. Taye B, Abeje G, Mekonen A. Factors associated with compliance of prenatal iron folate supplementation among women in Mecha district, Western Amhara: A cross- sectional study. Pan African Medical Journal. 2015;20(January).

22. Galloway R, McGuire J. Determinants of compliance with iron supplementation: Supplies, side effects, or psychology? Social Science and Medicine. 1994 Aug 1;39(3):381–90.

23. Palivela D, Shehnaz SI, Chaturvedula L. Effect of direct monitoring by family members and counseling by health professionals on iron-folic acid supplementation: A cross-sectional study among pregnant women in Puducherry, India. Journal of Family and Community Medicine. 2021 May 1;28(2):85–93.

24. Universiti Kebangsaan Malaysia (UKM). Malaysia Medication Adherence Assessment Tool (MyMAAT). 2017.

25. Gebremariam AD, Tiruneh SA, Abate BA, Engidaw MT, Asnakew DT. Adherence to iron with folic acid supplementation and its associated factors among pregnant women attending antenatal care follow up at Debre Tabor General Hospital, Ethiopia, 2017. 2019; 7;14(1).

26. Bahagian Amalan & Perkembangan Farmasi. Garis Panduan Kaunseling Ubat- ubatan Edisi Ke-3. 2019.

27. Fouelifack FY, Sama JD, Sone CE. Assessment of adherence to iron supplementation among pregnant women in the Yaounde gynaeco-obstetric and paediatric hospital. Pan African Medical Journal. 2019; 34: 211.

IMPROVING THE MANAGEMENT OF UNCLAIMED BODIES IN THE NATIONAL INSTITUTE OF FORENSIC MEDICINE, KUALA LUMPUR HOSPITAL

Lai Poh Soon, Siti Rabiyah Othman, Hisham Mohd Nordin, Khoo Lay See, Siti Wira Md Yaro, Mohamad Azaini Ibrahim, Siew Sheue Feng

National Institute of Forensic Medicine (NIFM), Kuala Lumpur Hospital
Ministry of Health Malaysia

Corresponding Author: Lai Poh Soon
Email: pslai@moh.gov.my

Abstract

Proper management of unclaimed bodies in a timely manner could maintain adequate body storage at the mortuary and counteract the medicolegal issue. The verification study in January 2019 to June 2020 revealed that 57.6% of the unclaimed bodies had obtained approval for disposition in more than 28 days. The inadequate of inter-departmental and inter-agency cooperation, and the lack of initiative and monitoring measures by forensic staff, are some of the contributing factors identified. As the outcome-based indicator, the standard was established at 100% for the proportion of unclaimed bodies whose disposition was authorised within 28 days of the body's receipt date. This quality improvement study involved unclaimed bodies, which were Malaysian and unidentified bodies who had died in the wards of Kuala Lumpur Hospital and had not been claimed by any claimants after more than three days upon arrival at the National Institute of Forensic Medicine. Brought-in-dead post-mortem cases, known foreigner bodies, body parts and foetus were excluded. Remedial actions were implemented in June–December 2020. Forensic Science Officers were assigned to work closely with the supervisor and monitor all the unclaimed bodies using a newly created Excel monitoring matrix. Inter-departmental and inter-agency meetings have been conducted with the support of the Hospital Director. The post-interventional data was gathered from January 2021 through December 2021 with a total of 90 unclaimed bodies, and Cycle 2 was completed from January through September 2022 with 24 unclaimed bodies. After two cycles, we were able to get National Registry Department response rates of 94.1% within 14 days and achieved 89.7% (Cycle 1) and 100% (Cycle 2) for the approval of body disposition within 28 days. The institute plans to further improve the body disposition procedure by working closely with the local authorities to ensure the appointment date of disposition given by them can be expedited.

KEYWORDS: Unclaimed body, Forensic Medicine, Body disposition management

Problem

Unidentified bodies, also known as "unknown" bodies, could be either received within the hospital or brought in dead (BID) by the police or public members from outside the hospital (1-3). Unclaimed bodies can be classified as unidentified or known bodies left unattended by their next-of-kin (NOK) or any potential claimants (2). A deceased body would be monitored if it has not been claimed after three (3) days upon arrival in the National Institute of Forensic Medicine (NIFM) and would be kept for at least fourteen (14) days while the identity and NOK were being traced (3).

The increase in unclaimed bodies occupying the limited body freezers available for an extended period without proper identification and tracking of NOK may lead to insufficient body storage and decomposition. The inefficient and improper management of unclaimed bodies could be a serious problem if efforts to track the NOK have never been undertaken by the hospital. This situation could give rise to medico-legal issues to be raised by the NOK, who come forward after the hospital has buried or cremated the unclaimed bodies. Hence, improving the human identification procedure and tracking of NOK for the final rite is necessary, as it would directly impact customer satisfaction.

For the police cases, the NIFM relies solely on the police to assist in identifying the body through the relevant authorities, i.e., Bukit Aman Police Headquarters or Immigration Department. Additionally, the police initiate the search for the NOK, which involves visiting their registered address or publishing notices in relevant media. This process can take a considerable amount of time due to the police's busy administrative duties and official investigation tasks. However, assistance from the police may not be applicable for non-police cases, especially for patients who passed away in the hospital, even if the hospital staff have filed police reports. In such circumstances, the police report would be categorised as "Refer Other Agencies" and the police would take no further action as the responsibility for hospital death cases rests with the hospital (3).

The fingerprints and personal data of unclaimed bodies could be referred to the National Registration Department (JPN) through the Medical Social Work Department (JKSP) at the hospital. If the identification of the deceased is successfully verified based on the available fingerprints, the family tree indicating the address and contact numbers of the deceased NOK can be traced with the assistance of local authorities, especially police officers, by visiting their addresses. Effective management of unclaimed bodies should encompass all feasible efforts to identify the deceased and locate the NOK, serving humanitarian and last-rite purposes (3).

The NIFM serve as national referral centre and training facility for professionals in Forensic Medicine and Science. It operates under the management of Kuala Lumpur Hospital. It has the strength of human resources with 60 to 70 personnel, including specialists, medical officers, scientific officers, paramedics, and record administrative staff. Annually, the NIFM handles an average of over 3000 bodies, encompassing both police cases and deaths occurring within the hospital wards. The forensic medicine specialists and medical officers conduct an average of over 600 post-mortem cases per year, as requested by the police investigating officers. However, despite this workload, the NIFM is equipped with a limited number of body storage freezers: i.e., 36 for adults and 24 for paediatric cases. Paramedics are responsible for body management within the NIFM, whilst the forensic scientific officers are involved in the human identification procedures. The body management may include the local population and foreigners within the covered area, some of whom might be unidentified or unclaimed by their NOK. This situation ultimately leads to an accumulation of unclaimed bodies within the NIFM, highlighting potential inefficiencies in the disposition of these bodies.

Based on the department's daily record, the NIFM encountered that 4 to

6% of total received dead bodies being unclaimed from the year 2016 to 2020, showing a fluctuating trend. A verification study conducted in 2019 to 2020 revealed that 57.6% of the unclaimed bodies were disposited of after more than 28 days, deviating from the time frame of 14 days stated in the national standard operating procedure (2,3). Hence, this study aims to increase the percentage of unclaimed bodies that have been reported and authorised by the Head of Department (HOD) for disposition within 28 days.

Background

The number of dead bodies was increasing worldwide, especially during the pandemic of COVID-19 starting in the year 2020, as declared by the World Health Organization (4). Worldwide, on average, 4-10% of the total dead bodies reported to mortuaries are unidentified and this proportion rises to 25% in India (5). Based on the standard operating procedure (SOP) and the circular guidelines of the Ministry of Health, unclaimed bodies could be disposited if all the necessary efforts have been made before the deceased is classified as an unclaimed body based on the particular time frame, i.e., Muslim body (after three days), non-Muslim body (after 14 days), foreigner body (after 14 days) and unknown body (after 14 days) (1-3). The proper management of unclaimed bodies requires close cooperation with other authorities as this is important to optimise the allocated time frame and the limited body storage to avoid any disruption in the service provision. In some developed countries, unclaimed bodies are turned over to the State Anatomy Board after 72 hours if no claimant can be located through a “reasonable search” or declared as abandoned after more than three months duration used in Benin (5,6). The community and public understand that a deceased person’s rights are at least a decent burial within an appropriate, timely manner. Hence, the NIFM imposed the hospital burial for the disposition of unclaimed human remains respectfully by interment or cremation according to their belief and ritual aspect (2,6).

There were several factors contribute to the increase in unclaimed dead bodies, as highlighted in the literature. Failure to identify the unknown bodies, especially involving illegal immigrants and decomposed bodies, through various identifier methods, including deoxyribonucleic acid (DNA), dentition and fingerprints, would be the main challenge and abominable problem within the forensic fraternity (7). These could delay the identification process and hence the disposition process. Furthermore, the NOK may abandon the bodies left unclaimed in the mortuary, especially in third world countries, but not excluding some developed countries as they could have faced economic hardship due to the expensive cost of the funeral services, especially the purchase of burial sites and cremation charges (6,8). Certain groups of people, likewise the divorced, separated, or unmarried people, homeless poor, unemployed people, as well as substance abusers whom often presented with poor health-seeking behaviour, may also be some of the reasons from the social perspective causing them to be abandoned by their NOK even after death (6,9,10).

Unclaimed dead bodies could be the vital group in hospital mortuaries as the process of discharging them from the hospital in a respectful and dignified manner involves numerous administrative, legal, and social challenges (6). From the administrative perspective, a uniform mechanism may need to be developed to facilitate timely management to fulfil the standard of care. The intervention that has been highlighted in the literature was to assign a designated person among the staff of a mortuary to perform the task of keeping the record of unidentified dead bodies and facilitate their disposition with the help of local police under whose jurisdiction the case falls on the legal aspect and collaborate with all stakeholders in accordance to an algorithm (6).

Establishing a database and DNA databank for missing persons would be the way forward at the national

and international levels to facilitate the identification of unclaimed bodies (7). Perhaps a strategy could be taken by the government agencies to collaborate with a non-profit organisation and subsidise the burial or cremation of unclaimed bodies (8). To tackle the social challenges, social workers could also have been involved in identifying resources and making final arrangements for people who passed away without NOK, who may be institutionalised or unknown to the community, or whose bodies may be unclaimed for burial (11).

Measurement

This Quality Improvement (QI) study was conducted to improve the management of unclaimed bodies by increasing the percentage of unclaimed bodies that have been reported and approved by the HOD for disposition within 28 days. The indicator was calculated as the percentage of unclaimed bodies with notification forms approved by HOD for body disposition within 28 days from the date of the body receipt at the NIFM. The standard was set at 100% based on the consensus of the specialists, scientific officers, and supervisors of NIFM only.

$$\text{Percentage of unclaimed bodies' disposition within 28 days} = \frac{\text{Number of unclaimed bodies' disposition within 28 days}}{\text{Total number of unclaimed bodies}} \times 100\%$$

The 28-day timeframe is determined based on the availability of 36 body freezers within NIFM, allowing for an average of one unclaimed body received per day. This could accommodate up to 80% of the freezers to allow 20% temporary storage of new coming active cases awaiting handover to the respective claimants.

This QI study involves unclaimed bodies from inpatient deaths at Kuala Lumpur Hospital, where no claimants have come forward within three days of arrival at NIFM. This includes both known Malaysian bodies and unidentified or unknown bodies. BID post-mortem cases, known bodies of foreign nations, body parts and foetus were excluded from the study.

The daily unclaimed body data were collected manually and retrospectively from January 2019 to June 2020. A total of 88 unclaimed bodies in NIFM were included during this period. The data were descriptively analysed using Microsoft Excel. Implementation of the strategy was performed from June to December 2020. Post-intervention (Cycle 1) data were collected from January 2021 to December 2021 with a total of 90 unclaimed bodies. The percentage of Achievable Benefit Not Achieved (ABNA) was then computed. Cycle 2 was then conducted from January to September 2022.

Initial Assessment of the Problem

A cause-and-effect analysis was conducted to brainstorm contributing factors to the problem. An in-depth discussion with the four supervisorial staff, who are senior medical assistants with several years of experience in the management of unclaimed bodies, was conducted during the audit session on the unclaimed body management procedures and documentation to explore the factors contributing to the problem. These contributing factors were refined according to their similarity in context after the discussion and brainstorming session. The audit and brainstorming session aimed to produce the questionnaire indicated with the list of multiple choices for the identified contributing factors. The questionnaires were distributed to the officers and paramedics who were involved in the process of care. All 25 participants were allowed to independently complete the questionnaire and select the four primary causes of the issue of managing unclaimed bodies.

Based on the Pareto Chart, six key contributing factors were identified as highlighted that led to 80% of the problem, as shown in Figure 1. The contributing factors were lack of monitoring (n=20), lack of interagency meetings (n=16), lack of communication (n=15), lack of proper interagency workflow (n=12), lack of virtual referral to JPN (n=9) and lack of collaboration with authorities (n=7).

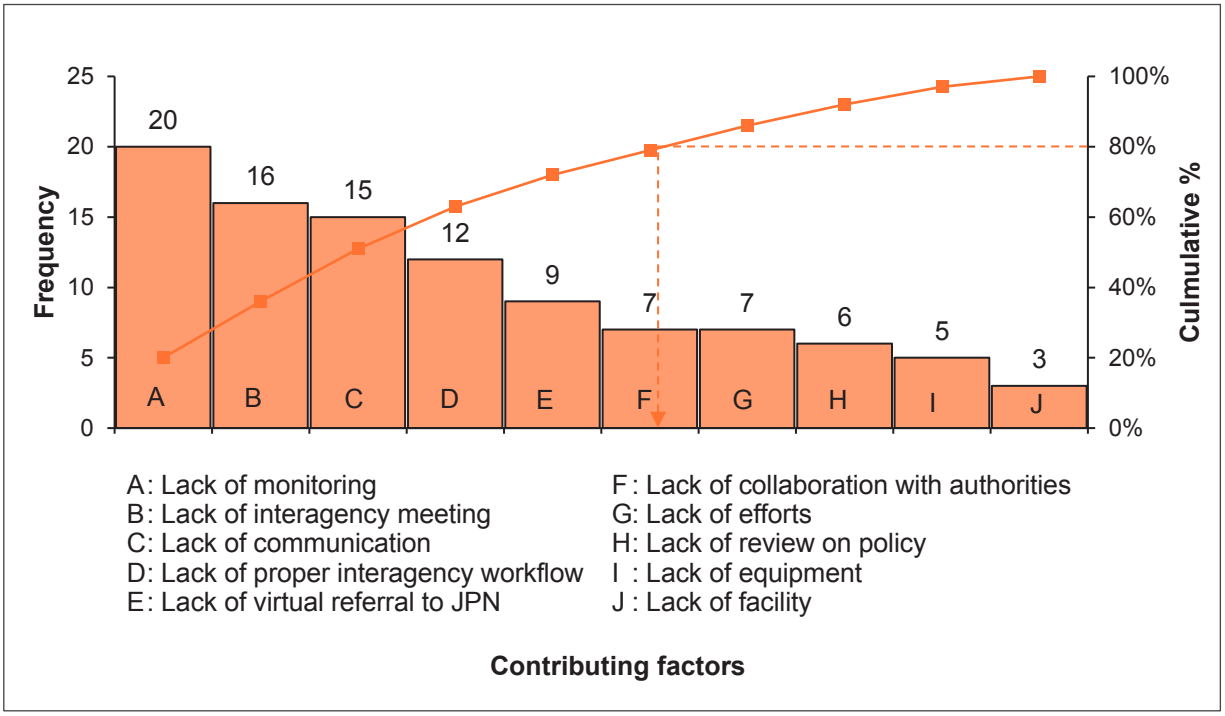


Figure 1: Factors contributing to the delay in the disposition of unclaimed bodies

According to the audit session during the verification study, none (0%) of the NOK were successfully contacted by the NIFM to claim the unclaimed bodies due to a lack of communication between JKSP and the NIFM regarding the available information on the family tree. Besides that, only 33.0% of unclaimed bodies were referred to JPN through JKSP , possibly due to a lack of inter-departmental and inter-agencies meetings.

However, non-availability of equipment (n=5) and facility (n=3) factors, including a portable fingerprint detection device that could establish a direct link with the JPN database system, cannot yet be tackled in these cycles due to potential legal and confidentiality implications. The authorisation of the device system is rendered impossible at this moment. Lack of review of the ministerial policy on the unclaimed bodies (n=6) may be an important factor, especially in standardising the identification procedure and efforts to track the NOK within an acceptable time frame before the body disposition. Addressing this matter would necessitate higher management to initiate the change and tackle the issue from the top down.

Strategy

There were two cycles conducted in this project using similar strategies. Four main strategies were implemented during the first remedial phase from June to December 2020. Two dedicated Forensic Scientific Officers (FSOs) were assigned to monitor the unclaimed bodies. The FSOs work closely with supervisors and periodically keep track of all the unclaimed bodies in the NIFM by using an Excel monitoring matrix. The introduction of the monitoring database using the Excel template in this study has systematically recorded the status of each unclaimed body (more than three days) in terms of identification and searching of NOK by the respective departments, including JKSP and other authorised agencies, including JPN and police officers.

Furthermore, inter-departmental and inter-agency strategies were implemented. One of these strategies includes establishing a new referral workflow to JPN through JKSP, as shown in Figure 2.

The patient's arrival at the hospital may be undocumented and registered

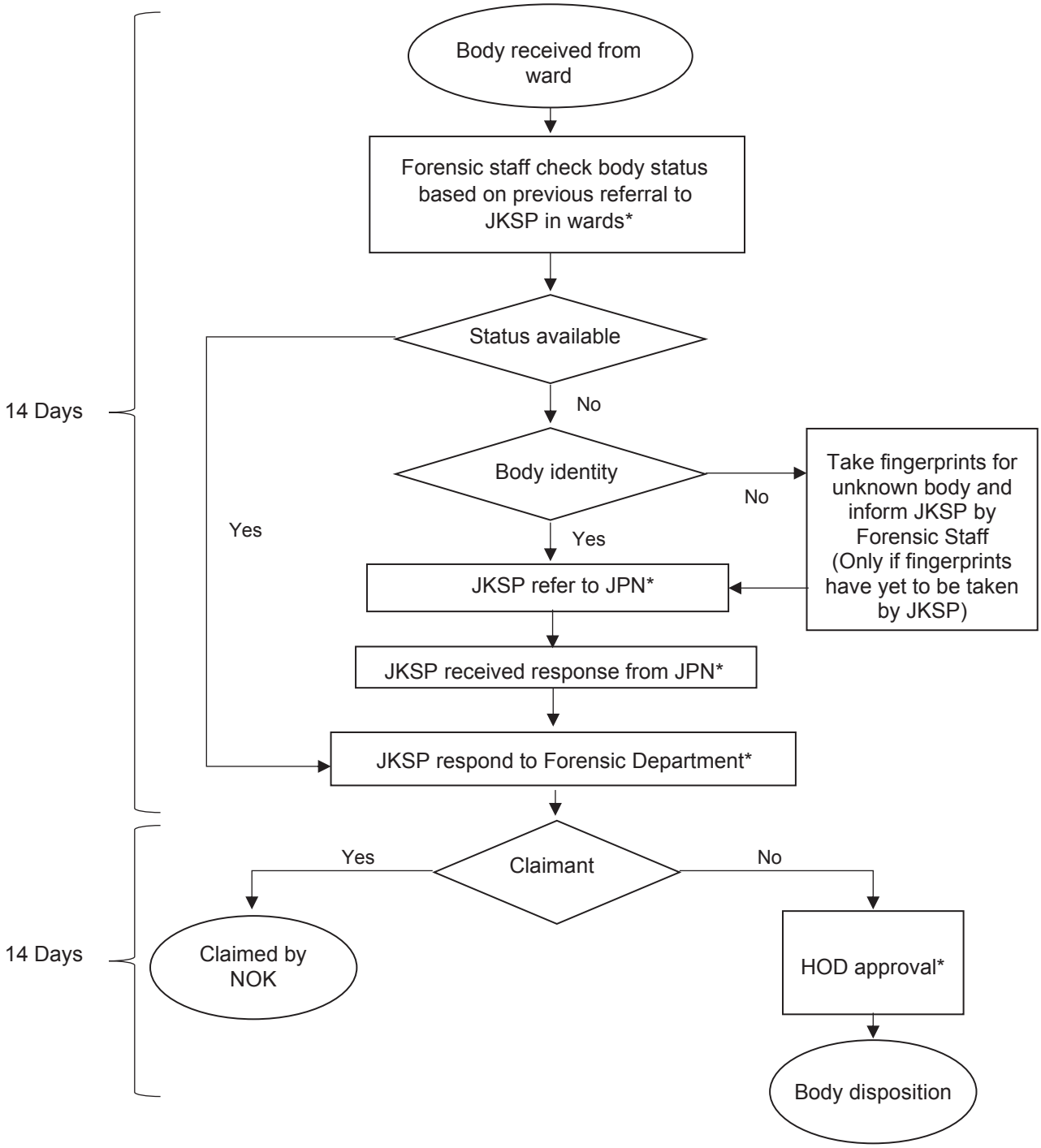


Figure 2: Process of care for the management of unclaimed bodies (* indicates critical steps)

as an unknown patient. Occasionally a known patient may be unconscious without any contact information of the NOK upon registration at the emergency department. These patients should have been referred to the JKSP by the hospital staff. Subsequently, these patients may have collapsed and passed away in the emergency department or the ward while receiving treatment and remained as unidentified or unclaimed bodies before being sent to the NIFM. The process of care starts with the body receiving in ward cases and ends with body claiming or disposition. Five main critical steps were identified as criteria in this QI study to formulate the model of good care, as displayed in Table 1.

Prior to the remedial phase, JKSP was only involved in handling the issues

of living patients in the hospital. The main job scope of the JKSP is to restore balance in a patient's personal, family and social life in order to help them to recover and strengthen their ability to reintegrate into society. The tracking of the identity and NOK of the deceased could be one of the humanitarian initiatives provided by the medical social workers in the hospital. The Hospital Director agreed in the meeting that JKSP acted as the hospital's referral centre, including alive patients and unclaimed bodies, by referring cases to JPN for identification and searching of NOK.

Another strategy involved conducting inter-departmental and inter-agency collaboration meetings to address issues related to unclaimed bodies. These meetings, scheduled once or twice a year, were chaired by the Hospital Director, and attended by the NIFM Director, JPN representative, HOD of JKSP and other relevant agencies. JPN agreed to allow virtual referral via email, providing the fingerprints or identification numbers of the unclaimed bodies for further verification, as well as search the family tree of the unclaimed bodies to trace the NOK. JPN has committed to response to the referral in a timely manner during the meeting.

Results

After implementing the remedial measures, data from Cycle 1 and Cycle 2 were collected, as shown in Table 1. In Cycle 1, there were a total of 90 unclaimed bodies, and in Cycle 2, there were 24. The percentage of unclaimed bodies with notification forms approved by HOD for body disposition within 28 days of the body receiving increased from 42.4% to 89.7% and 100% during both cycles, respectively. The ABNA has reached 0%, as shown in Figure 3. There was a great improvement in status checking with JKSP on the previous referrals from the ward by forensic staff, which subsequently referred to JPN through JKSP. The achievement reached to 100% during Cycle 1 and maintained 100% throughout the two cycles of the QI study. This could be attributed to the new workflow implemented in this study. There was an increasing percentage of response within the time frame of 14 days by JPN from 33.3% to 91.1% during Cycle 1 and further increase up to 94.1% during Cycle 2. JKSP responded 100% to the status of referral to NIFM during both cycles, compared to the prior 0% before the implementation of the new workflow. We identified a delay in response rate within 14 days from JPN, accounting for about 5.9%, equivalent to only 1 case, even during the pandemic period.

In addition, about 47% of cases were identified through the fingerprints of the deceased throughout the study. About 68% of the family trees received throughout the study was indicated with details of the NOK for the respective deceased, including contact numbers and residential addresses; otherwise, only the details of the deceased indicated might not be useful, but it would be subsequently posted on the official social media of the hospital. There would be fewer unclaimed bodies if NOK were successfully traced.

From the post-remedial data, about 53.5% (n=47) of the unclaimed bodies being referred to JKSP have been successfully claimed by the NOK of the deceased during Cycle 1. Indirectly, this could reduce the unclaimed rate from the total body being received by the NIFM.

Lessons and Limitations

We encountered significant challenges while coordinating with multiple agencies and departments to ensure the success of this study. Cooperation from all parties, including inter-departments and inter-agencies, is the key to achieving this improvement. The main contributing factor to the delay in the response rate within 14 days from the JPN was the COVID-19 pandemic. In July 2021, most of the staff were working from home, which could have affected the service provision of the JPN.

The other reason could be that the quality of the retrieved fingerprints might make the identification process more difficult. This is because fingerprint retrieval from a deceased body may not

Table 1: Model of Good Care (MOGC) of Verification, Cycle 1 and Cycle 2 phases

No	Process	Criteria	Standard	Verification (n=88)	Cycle 1 (n=90)	Cycle 2 (n=24)
1	Forensic staffs check body status based on a previous referral to JKSP in wards	The referral letter should be indicated with the SMRP reference number (if any)	100%	0%	100%	100%
2	JKSP refer to JPN	The referral letter from JKSP to JPN is attached with the deceased's thumbprint or indicated with the identity number	100%	33.0%	100%	100%
3	JKSP receive a response from JPN (cc to NIFM)	Reply letter with indicated status and received within 14 days	100%	33.3%	91.1%	94.1%
4	JKSP respond to Forensic Department	Reply copy of the JPN email with indicated ID status and respond within 14 days	100%	0%	100%	100%
5	HOD approval	The notification form is approved by the HOD for disposal within 28 days from the body receiving date	100%	42.4%	89.7%	100%

Note: The number of days includes the public holidays. SMRP refers to Sistem Mengurus Rekod Pesakit

be as optimal compared to alive patient. With these limitations during Cycle 1, the response rate within 14 days from the JPN has impacted and contributed to the ABNA for the body disposition within 28 days. In Cycle 2, the ABNA had further improved in terms of the delayed response rate within 14 days from the JPN as well as the HOD approval of body disposition within 28 days. Hence, this study exhibited sustainability as all remedial actions were maintained.

Conclusion and the Next Steps

The objective was achieved throughout the study. The post-remedial performance proved to be sustainable, as demonstrated in Cycle 2. The managment of unclaimed bodies, both Muslim and non-Muslim, was facilitated by the respective local authorities, namely *Jabatan Agama Islam Wilayah Persekutuan* (JAWI) and Kuala Lumpur City Hall (DBKL). The NIFM

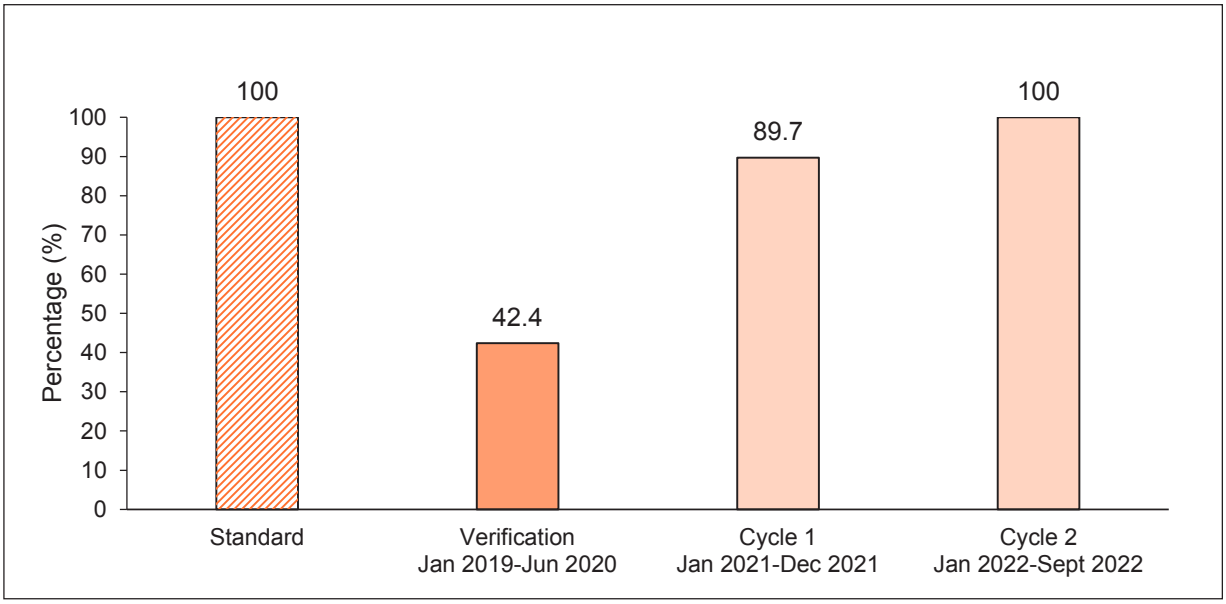


Figure 3: Percentage of unclaimed bodies that have been notified and approved by HOD for body disposition within 28 days.

aims to further improve the body disposition procedure by fostering close collaboration with the local authorities. This collaboration will ensure that the appointed dates provided by them can be expedited with the cooperation of the responsible personnel at NIFM. We are also in the process of establishing a new internal referral system at the hospital level with the workflow shown in Appendix 1 to break the silo and bring all the interested parties together. This could assist all interested parties in tracking the up-to-date status of each referral from the beginning of admission of each patient at the emergency department and wards.

Acknowledgement

The authors would like to thank the Director General of Health, Malaysia, for his permission to publish this paper. Special thanks to the Director of Kuala Lumpur Hospital, Dr Rusilawati Jaudin, Dr Mohamad Azaini Ibrahim, and colleagues in NIFM, HKL. We also would like to express our appreciation towards the full support of the Medical Social Work Department (JKSP) and Corporate Communications Unit (UKK).

Conflict of Interest

The authors declare that there was no conflict of interest.

Funding

This research did not receive any specific grant from funding agencies from the public, commercial or not-for-profit sectors.

References

1. Ministry of Health Malaysia. Surat Pekeliling KPKM Bil 5/2008 – Garis panduan Penyerahan Mayat-mayat Yang Tidak Dituntut Di Hospital KKM kepada Fakulti Perubatan Universiti Tempatan bagi Maksud Pendidikan dan Penyelidikan Perubatan.

2. Ministry of Health Malaysia. Surat Pekeliling KPKM Bil 17/2008 – Garis panduan Bedah siasat Mayat di Hospital-hospital KKM. [Internet}. 2008. [cited 2022 Dec 5]. Available from: https://hrpb.moh.gov.my/baru/phocadownload/InfoKesihatan/Lampiran%20A%20Garis%20Panduan%2Bedah%20Siasat.pdf.

3. Ministry of Health Malaysia. Surat Pekeliling KPKM Bil 10/2012 – Standard Operating Procedures of Forensic Medicine Services. [Internet}. 2012. [cited 2022 Dec 5]. Available from: https://www.moh.gov.my/index.php/database_stores/attach_download/312/220

4. Domenico C, Maurizio V. WHO declares COVID-19 a pandemic. Acta Biomed. 2020;91(1):157–160.

5. Pankaj A, Singh BR. Dealing with the unclaimed dead bodies – embrace the challenge. Int J Community Med Public Health. 2017;4(4):992-996.

6. Nwafor CC, Kudamnya IJ. Retrospective study of abandoned dead bodies in the morgue of a tertiary health institution: the identified, unidentified and unclaimed. Niger Med J. 2021;62;(5):226-231.

7. Reid KM, Martin LJ, Heathfield LJ. Understanding the burden of unidentified bodies: a systematic review. Int J Legal Med. 2023; 2:1-0.

8. Zezima KA. Indigent burials are on the rise. The New York Times. [Internet]. 2009. [cited 2022 Dec 5]. Available from: http://www.nytimes.com/2009/10/11/us/11burial.html?_r=2&hp=&pag.

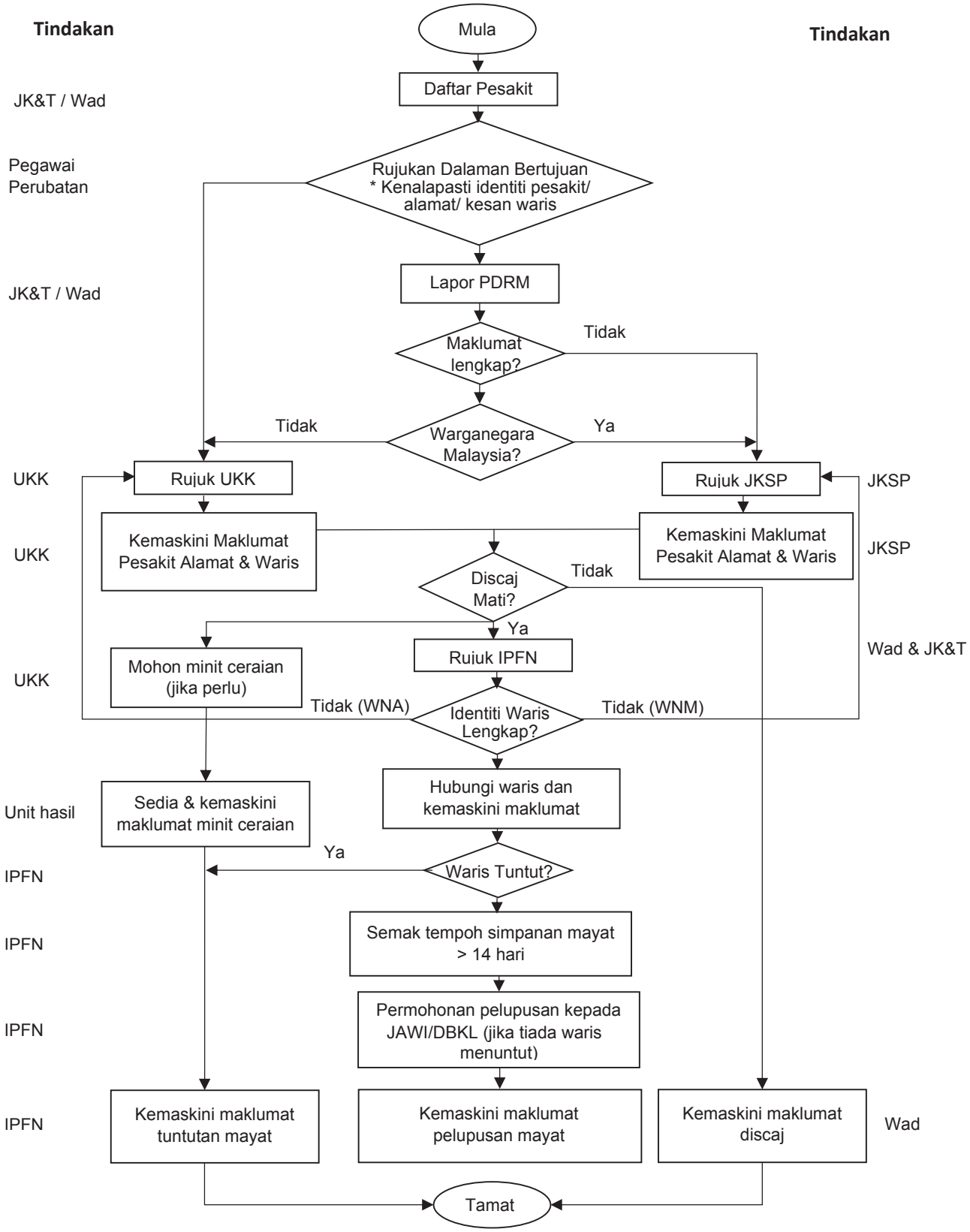
9. Raghavendra Babu YP, Joseph N, Kadur K. Mortality among homeless and unclaimed bodies in Mangalore city – An insight. J Forensic Leg Med. 2012;19(6):321–3.

10. Sohn H, Timmermans S, Prickett PJ. Loneliness in life and in death? Social and demographic patterns of unclaimed deaths. Latham-Mintus K, editor. PLOS ONE. 2020;15(9): e0238348.

11. Castex GM. Social Workers' Final Act of Service: Respectful Burial Arrangements for Indigent, Unclaimed, and Unidentified People. Soc Work. 2007;52(4):331–9.

Appendix 1

User Requirement Specification (URS)
Carta Alir Sistem Rujukan Dalaman Perkhidmatan Kejururawatan - JKSP, UKK dan IPFN



Abbreviation:

JKSP : Jabatan Kerja Sosial Perubatan
UKK : Unit Komunikasi Korporat
IPFN : Institut Perubatan Forensik Negara
JK&T : Jabatan Kecemasan dan Trauma
PDRM : Polis Diraja Malaysia
WNA : Warganegara Asing
WNM : Warganegara Malaysia

TOWARDS REDUCING THE HEAVY USAGE OF CONTROLLED ANTIBIOTICS IN SEBERANG JAYA HOSPITAL

Ann Lisa Arulappen[1], Gaiyathri Shanmugam[1], Lim Mei Chen[1], Elsie Teoh Yuen Ling[1], Mohd Ashraf Nor Muhammad[1], Lim Choo Hau[2], Cheng Joo Thye[3], Siti Hawa Hamzah[4], Woo Yen Yen[4], Adawiyah Bakar[5]

[1]Pharmacy Department, Seberang Jaya Hospital, Penang State Health Department, Ministry of Health Malaysia

[2]Infection Control Unit, Seberang Jaya Hospital, Penang State Health Department, Ministry of Health Malaysia

[3]Medical Department, Seberang Jaya Hospital, Penang State Health Department, Ministry of Health Malaysia

[4]Microbiology Unit, Seberang Jaya Hospital, Penang State Health Department, Ministry of Health Malaysia

[5]Aneasthesiology Department, Seberang Jaya Hospital, Penang State Health Department, Ministry of Health Malaysia

Corresponding Author: Ann Lisa Arulappen
Email: annlisaarul@yahoo.com

Abstract

Seberang Jaya Hospital (HSJ) has been listed as Penang's highest controlled antibiotic user since 2018. It has led to the prevalence of resistant microorganisms and increased antibiotic expenditures. Therefore, reducing the usage of controlled antibiotics was an attempt done to reduce the defined daily dose (DDD)/1000 patient-days (PD) and improvise on the antibiogram and cost. The study aimed to reduce the DDD/1000 PD by over 30% from the baseline upper limit (UL) in 2019 for HSJ. A quality improvement study involving four cycles was conducted from July 2019 to June 2022. The sampling was done utilising a controlled antibiotic order form, an antimicrobial stewardship database and knowledge assessment questionnaires. During the verification study, the DDD/1000 PD was above the UL (4.5%), which was 25.5% below the standard. The contributing factors were the incomplete review of antibiotics after 72 hours (84%), inappropriate selection of antibiotics during the initial therapy (61%) and after review (88%), pending relevant culture results (36%) and unclear Standard Operating Procedure (SOP) in supplying the antibiotics (49%). Strategies developed were continuous education for healthcare professionals, formulation of new antibiotic guidelines and formulary restrictions, and development of an electronic antibiotic application. The Achievable Benefit Not Achieved (ABNA) was reduced from 25.5% to -6.7%. Improvement in the Model of Good Care (MOGC) was shown to affect the appropriate selection of antibiotics during the initial therapy from 39% to 99% and after review from 12% to 87%; active tracing of relevant results from 64% to 100%; active review of antibiotics from 16% to 100%; and proper supply of antibiotics based on the SOP from 51% to 90%. Approximately RM 165,000.00 (USD 36,600.00) of cost savings were accomplished. Improvement was seen in the antibiogram. Several strategies were implemented at the other hospitals, such as the electronic antibiotic application.

KEYWORDS: Controlled antibiotics, Defined daily dose (DDD), Antimicrobial resistance

Problem

Seberang Jaya Hospital (HSJ), one of the district hospitals with specialists in the Penang state, with 393-bed occupancy, serves a population of approximately 900,000 patients in Seberang Jaya. The hospital provides various specialist services, including Medical, Paediatric, Surgical, Orthopaedic, Anaesthetic, Obstetrics and Gynaecology, Dental, Emergency and Trauma, as well as Ear, Nose, and Throat. As one of the leading hospitals in the region, numerous diseases, including life-threatening infections, are treated in the wards daily. The common types of bacterial infections encountered among hospitalised patients from July to December 2020 are pneumonia (including community-acquired pneumonia [n=37], hospital-acquired pneumonia [n=51], and ventilator- associated pneumonia [n= 34]), urinary tract infection (including catheter- associated [n=36], non-catheter-associated [n=13]), bloodstream infections (including central line bloodstream infection [n=42], occult bacteremia [n=21]), skin and soft tissue infection (n=42), intra- abdominal infection (n=36), and surgical site infection (n=43). Due to the various infections of different severity, HSJ has been listed as one of the high users of several antibiotics, especially controlled antibiotics, since 2018 by the Ministry of Health (MOH), Malaysia (1).

Heavy usage of controlled antibiotics can lead to longer hospital stays, an increase in the cost of medications and other relevant accessories, a rise in the prevalence of resistant microorganisms, and an increased mortality rate (2-4). Antibiotic usage is monitored closely by the National Surveillance on Antibiotic Utilisation, MOH, in terms of the defined daily dose (DDD)/1000 patient-days (PD) across 91 hospitals nationwide. These include 44 government and 41 private hospitals, as well as three hospitals under the Ministry of Education and three more under the Ministry of Defense (5). An upper limit (UL) will be calculated based on the yearly usage data submitted by the hospitals listed above. A hospital will be labelled as an outlier if its antibiotic usage exceeds the UL of the yearly national antibiotic use. HSJ has been an outlier since 2016 (1), with a total cost increment estimated at approximately MYR 38,000.00 (USD 8,500.00) solely for antibiotic usage within a year. The number of estimated carbapenem-resistant Enterobacteriaceae (CRE) in this facility had also increased by 7 folds from 2018 (n=7) to 2019 (n=49).

In HSJ, the controlled antibiotics are meropenem, imipenem, ertapenem, vancomycin, ciprofloxacin, cefepime and piperacillin-tazobactam. It has become a serious problem as there is no restriction in the prescribing policy of controlled antibiotics. Antibiotics given empirically can be prescribed for a prolonged duration in this facility. A recent point prevalence survey (PPS) conducted at HSJ revealed that approximately 85% of antibiotics prescribed for various infections did not follow the local hospital guidelines. Therefore, the aim of this study was to reduce DDD/1000 PD by 30% from the baseline UL in 2019 within two years.

Background

Antimicrobial resistance is a global threat that refers to the resistance of a microorganism to the antimicrobials that were initially efficacious in eradicating the infections (4). Injudicious use is regarded as prescribed antibiotics that are not as per the established guidelines' recommendation such as the use of a broad-spectrum antibiotic for a bacterial strain that has specific sensitivities. This may also lead to worsening antibiogram which is a way to observe the susceptibility rates and monitor resistance trends within an institution itself (4).

Many studies have shown that injudicious use of antibiotics has led to untoward consequences (6-8). A multicenter study in China has pointed out the correlation between increased carbapenem use and increased CRE, and it is highly endemic, suggesting an urgent need to enhance infection control (9). In recent years, the rate of CRE has steadily increased up to 40% globally (1,6). There has been conflicting evidence about the relationship between antibiotic

treatment and antibiotic resistance. While treating certain infections, proving that antibiotic treatment creates a risk for the individual to acquire resistant organisms has been difficult (10,11). Nonetheless, the cumulative effect of using these antibiotics has been proven to increase the prevalence of resistant microorganisms in the population (10,12).

The emergence of antimicrobial resistance may cause resistance to the first-line antimicrobials, which then requires the usage of second or third-line antimicrobials, which are possibly less effective, more toxic, and more costly (2). The pace of antimicrobial development has decreased over the past few decades, and it is alarming that as more resistance is acquired, there will be limited options of available antimicrobials (2-3). Antimicrobial resistance negatively impacts patient outcomes, poses a major threat to patient safety, increases health expenditure, and consequently leads to no treatment options, even for common infections (2-4).

Several factors can contribute to the heavy usage of antibiotics in healthcare settings, and one of the most common is the inappropriate selection of antibiotics during the initial treatment and upon review after 72 hours. These contributing factors were mainly attributed to work culture and intense pressure from senior colleagues or peer practice (13-15). Therefore, prescribing a broader spectrum antibiotic initially and extending its use for one to two weeks has been the norm. Besides that, the lack of resources, such as the culture incubation facility and doctors' perception of the unnecessary antibiotic review, also contributed to the rise in antibiotic usage (16-19). This will subsequently result in pending culture and sensitivity results and thus an incomplete review of antibiotics after 72 hours.

Globally, the heavy use of antibiotics is directly linked to antibiotic resistance (24). This led to the establishment of antimicrobial stewardship (AMS) programs in healthcare settings, which generally involved multidisciplinary players on the ground. These players include microbiologists, pharmacists and infectious diseases specialists (10,20,21). AMS program by MOH was developed to improve and promote the judicious use of antimicrobials through optimal antimicrobial selection. This includes the right choice of antimicrobial, the right route of administration, the right dose, the right time and the right duration to minimise harm to the patients. Enforcement of AMS programs has significantly impacted the healthcare system, including cost savings, improvisation of antibiograms and reduced prevalence of resistant organisms (11,22). The AMS program consists of various activities or initiatives, such as antimicrobial streamlining. One of the principles of streamlining is the de-escalation of therapy. A broader spectrum of antimicrobials is switched to a narrow spectrum antimicrobial as empirical usage of broad-spectrum antimicrobials may exacerbate the risk of antimicrobial resistance. The de-escalation strategy can potentially improve patient outcomes without compromising patient safety and reduce mortality (23, 24).

Monitoring antibiotic usage is another recommended component of the AMS program, which provides information about the patterns and usage trends at intra-facility and inter-facility levels (1). Consequently, these data would provide evidence of injudicious use and reflect the necessity to perform constructive interventions to overcome this problem. It has been proven that implementing local guidelines and compliance with them, frequent audits on antibiotic use and good collaboration among healthcare professionals such as doctors, pharmacists and microbiologists have successfully improved the judicious use of antibiotics (25).

Measurement

This quality improvement study was conducted by an AMS team of two pharmacists, one infectious diseases consultant, one infectious disease/medical specialist, two microbiologists and an anaesthetist. The study was conducted from July 2019 to June 2022 using a convenience sampling method. It involved

two medical wards and one intensive care unit in the first two cycles and expanded to all wards in HSJ from the third cycle onwards once all the strategies were well established. Based on our inclusion and exclusion criteria, the study samples were recruited for one month only for each cycle. The inclusion criteria were all patients 15 years old and above who started on any of the seven types of controlled antibiotics: piperacillin-tazobactam, cefepime, meropenem, imipenem, ertapenem, vancomycin, and ciprofloxacin. On the other hand, the exclusion criteria were untraceable patients.

The study indicator used for this study was the percentage reduction of DDD/1000 PD from the calculated 2019 baseline UL, and the standard was set to be more than 30%. The percentage was computed using the formula below:

$$\text{Percentage reduction of DDD/1000PD from 2019 baseline UL} = \frac{\text{(Baseline average UL in DDD/1000PD) – (current UL in DDD/1000PD)}}{\text{Baseline average UL in DDD/1000PD}} \times 100\%$$

The 2019 baseline UL was obtained by determining the average percentage difference of the DDD/1000 PD from three different state hospitals, namely Pulau Pinang Hospital (11.1%), Kuala Lumpur Hospital (14.6%), and Raja Permaisuri Bainun Hospital (16.1%), which was approximately 15% upon average (1). It was further doubled to 30% in line with the vision of quality assurance and quality improvement concept to achieve the optimum achievable standard. This was also agreed upon through consensus by the AMS team.

The antibiotics consumption was measured as DDD/1000 PD based on the formula from the National Surveillance on Antibiotic Utilization (1) as shown below:

$$\text{No. of DDD per year} = \frac{\text{Antibiotics usage in grams for adult patients in a year}}{\text{DDD for respective antibiotics given by WHO}}$$

$$\text{DDD/ 1000 PD} = \frac{\text{No. of DDD per year}}{\text{Total no. of days adult patients warded for that particular year}} \times 100\%$$

Three data collection tools were utilised to collect the data on indicator and contributing factors concurrently. Firstly, a controlled antibiotic order form was used to briefly summarise the infection treated and previous antibiotic history. It was a crucial tool in tackling the antibiotic review and appropriate antibiotic selection afterwards. The second tool was the antimicrobial stewardship database to facilitate statistical analysis of the antibiotic usage trend, i.e., DDD and DDD/ 1000 PD. It also contained the culture and sensitivity test results of the treated patients. The results were accessible to all doctors and pharmacists, whereas the antibiotic usage trend was only accessible to the AMS team members. The last tool was two sets of self-administered questionnaires targeting doctors and pharmacists. The questionnaire for the doctor was used to assess their knowledge of antibiotic selection, while the other questionnaire for the pharmacist was used to assess their understanding of the SOP in supplying controlled antibiotics. Each questionnaire was distributed to 50 doctors and pharmacists during the first two cycles. All doctors and pharmacists were included during the subsequent cycles. All data collection tools were developed by the Pharmacy Department, Seberang Jaya Hospital and the questionnaires were reviewed and agreed upon by the infectious diseases consultant and senior ward pharmacists.

During the verification study phase, which was done in November 2019, the percentage reduction of DDD/1000 PD was only 4.5% for all the controlled antibiotics. The Achievable Benefit Not Achieved (ABNA) was 25.5%.

Initial Assessment of the Problem

The process of care, as depicted in Figure 1, was reviewed at the beginning to identify the critical steps leading to the heavy usage of controlled antibiotics.

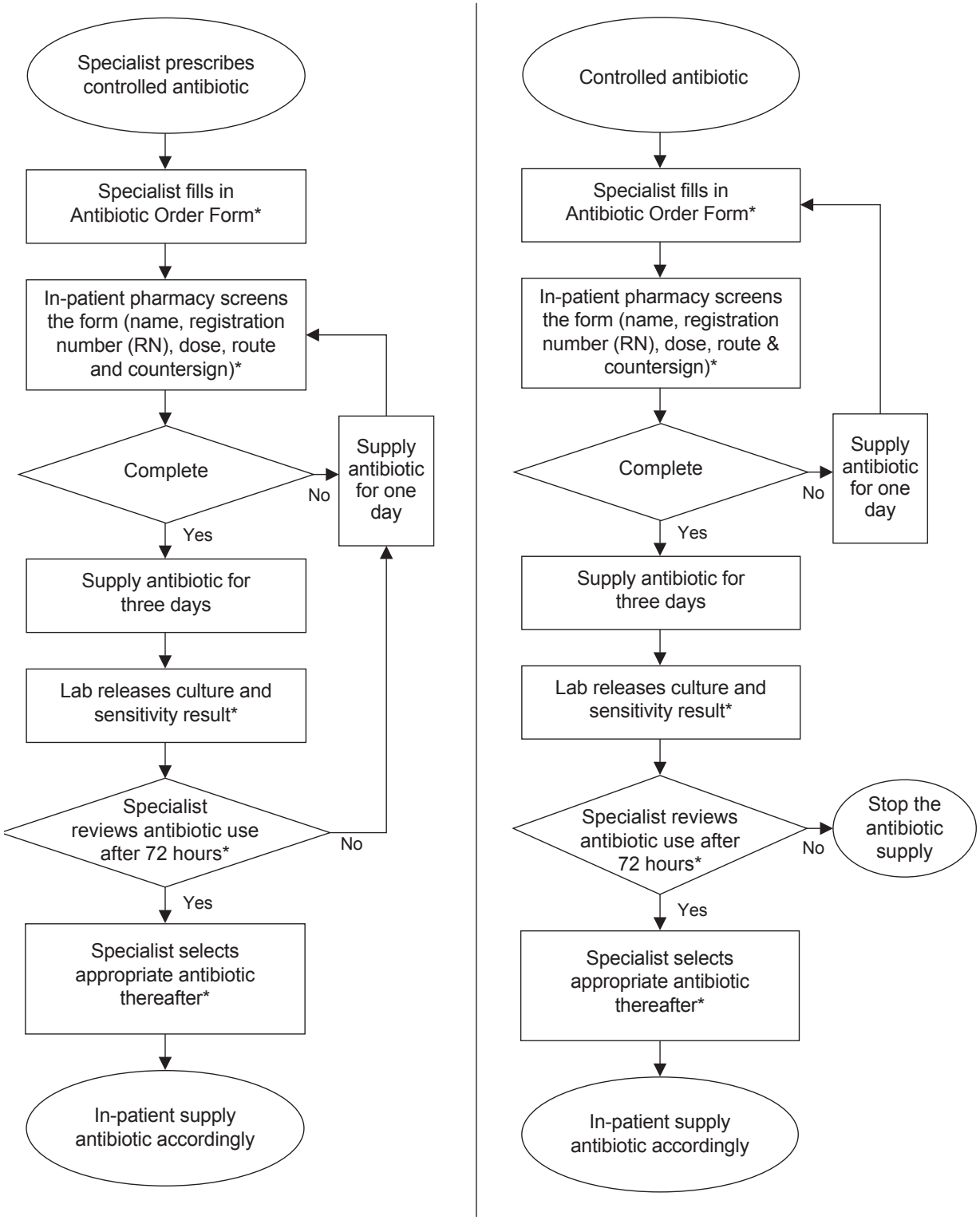


Figure 1: The initial (left) and revised (right) process of care for prescribing and supplying of controlled antibiotics in HSJ (* indicates critical step)

When there is a need to indent a controlled antibiotic, the specialist has to prescribe the in-patient prescription and fill in the antibiotic order form. In-patient pharmacy would screen the form (patient name, RN, dose, route and countersign) and supply it according to the agreed Standard Operating Procedure (SOP). If the specialist countersigns the antibiotic order form, the in-patient pharmacy will supply the antibiotic for three days consecutively, whereas only one day supply is given if the form is yet to be countersigned. The unsigned antibiotic order form will be passed to the specialist for countersign. After three days (72 hours), the relevant

cultures sent prior to initiating antibiotic therapy should be released. The respective specialist must review the antibiotic used and provide feedback. The review is based on the relevant culture results and the patient's condition. Various factors are considered during the decision-making process, such as temperature, white blood cell count, C-reactive protein, procalcitonin, ventilator settings and dependency on any inotropic support. However, the in-patient pharmacy would still supply the antibiotic, although the review process is still pending. Most of the time, the antibiotic prescribed will be continued for 7-14 days empirically. Hence, an audit using the controlled antibiotic order form and the antimicrobial stewardship database was conducted on 65 cases for a month involving the seven types of controlled antibiotics. This was mainly to identify the contributing factors that resulted in heavy usage of antibiotics, as illustrated in Figure 2. The contributing factors identified were the incomplete review of antibiotics after 72 hours (84%), inappropriate selection of antibiotics during the initial therapy (61%) and after review (88%), pending relevant culture results (36%) and unclear SOP in supplying the controlled antibiotics (49%). Each strategy developed was aimed to tackle at least two or more of the contributing factors identified.

Strategy

Remedial measures were implemented in three four-month cycles (Cycle 1: January to April 2020; Cycle

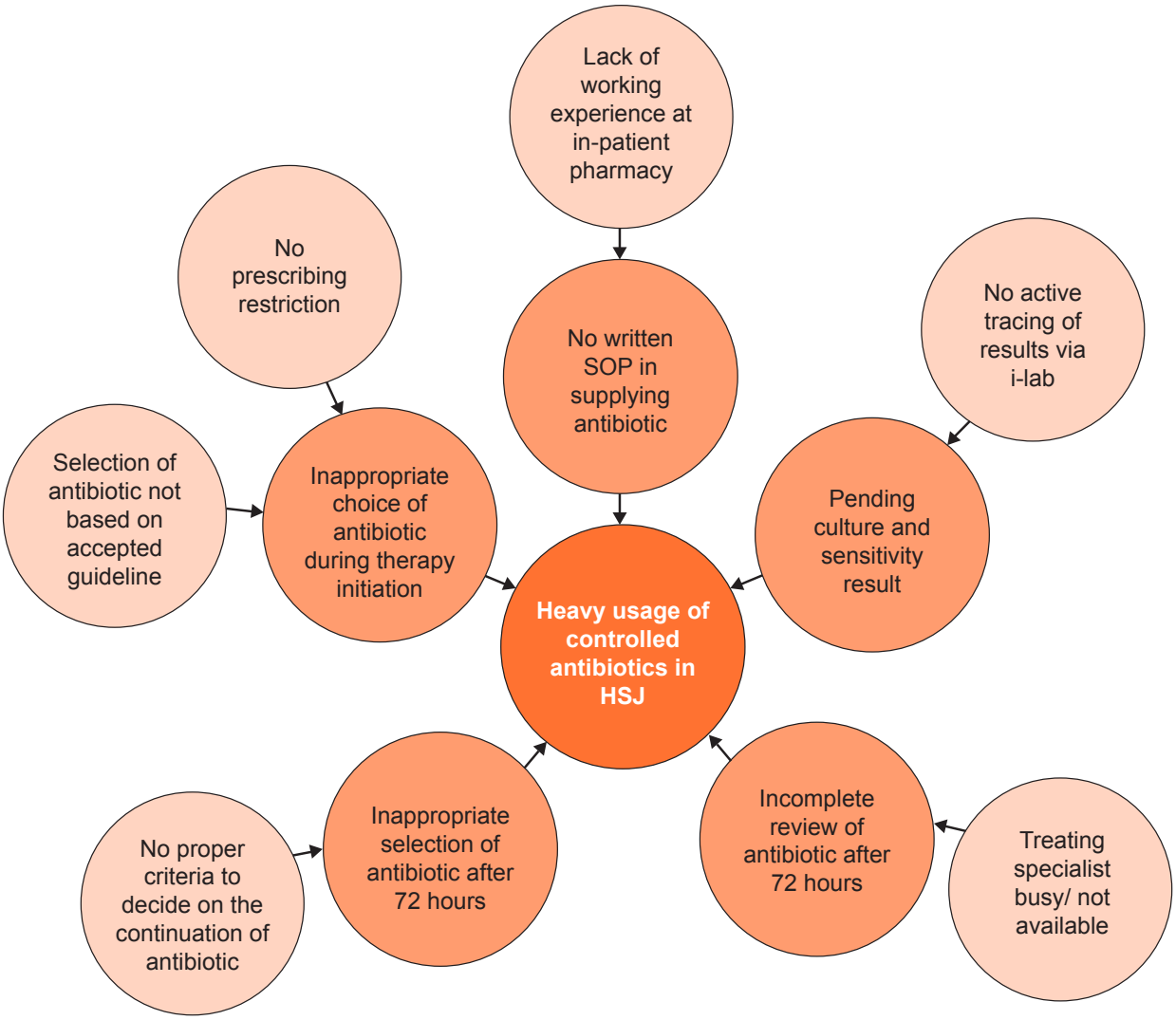


Figure 2: Problem Analysis Chart (PAC) of heavy usage of controlled antibiotics in HSJ

2: August to November 2020; Cycle 3: August to November 2021). The fourth cycle was conducted in June 2022 with no implementation of new remedial measures but to ensure the sustainability of this project. Seven strategies for change were formulated based on the contributing factors identified. All the strategies designed were the collective efforts of the AMS team members.

Three strategies were implemented during cycle 1. The first strategy was implemented to tackle the inappropriate choice of antibiotic selection. A simplified In-patient Empirical Antibiotic Guide was formulated by the pharmacists, microbiologists, and an infectious diseases consultant to facilitate the appropriate initial selection of antibiotics based on various indications and upon the review process after 72 hours. This guide was available on every patient's medication chart, which served as a quick reference for the doctors. Indirectly, this strategy prevented doctors from prescribing broad-spectrum antibiotics as the initial empirical therapy and facilitated the appropriate choice of antibiotic upon review, especially when there were no positive cultures. It was initially challenging for the doctors to adhere to the new guide, and the ward pharmacists emphasised the importance of adherence to the guide.

Besides that, as there were no prescribing restrictions that enabled the use of controlled antibiotics injudiciously, the development of a second strategy through a formulary restriction list between the Pharmacy Department and the Infection Disease Unit was done. This list comprises all antibiotics in HSJ based on the spectrum and their implications if used injudiciously (e.g., over-usage of third- generation cephalosporins leads to extended-spectrum beta-lactamase (ESBL) strains). Therefore, the initial prescribing of controlled antibiotics by the specialists was restricted to three days, whereas only infectious disease consultants can prescribe those restricted antibiotics as listed in the formulary restriction. This strategy could tackle most of the contributing factors, such as inappropriate initial selection of antibiotics, incomplete review after 72 hours, pending culture and sensitivity results and unclear SOP in supplying controlled antibiotics.

Apart from the two strategies above, frequent pending culture and sensitivity results were another significant contributing factor identified. Thus, the third strategy was to ensure consistent updates on the culture by the Microbiology Unit via an electronic database, namely the i-lab system, to aid in completing the review after 72 hours. The Microbiology Unit had requested all doctors and pharmacists to create an account in the i-lab system to facilitate an active culture tracing process. Each ward was equipped with at least two computers in common areas for easy accessibility. In ensuring the success of this strategy, one lab assistant was assigned to update the cultures daily and assist the doctors with the culture updates through phone calls if there were technical glitches. Henceforth, the doctors can trace the culture and sensitivity results conveniently and review the antibiotics used.

Although the three strategies in cycle 1 showed improvement in overcoming the contributing factors, the ABNA achieved in cycle 1 was 13.4%. Despite the helpful quick guide as verbally reported by the users, apparently, the spectrum of diseases covered was limited. Therefore, the fourth strategy during cycle 2 involved the establishment of a more comprehensive guideline based on the local antibiogram, including antibiotic choices for more infections and dosage adjustments in patients with acute or chronic kidney diseases. Both manual and electronic versions of the guidelines were distributed among the healthcare practitioners and existing wards in HSJ to ease the accessibility of the guidelines in a timely manner. This initiative was a group effort of pharmacists, microbiologists, and infectious diseases consultants to facilitate the selection of antibiotics based on various indications, especially when it was not culture-driven. The antibiotics were recommended as the primary choice,

and respective heads of the departments agreed on the alternative options. This strategy had constructively tackled all five contributing factors identified. The ABNA after cycle 2 was 0.2%, with a percentage reduction of 36.7%.

After cycle 2, 100% review of post 72 hours antibiotic prescribed remained the greatest challenge. The fifth strategy involved the development of a technology-driven measure called electronic antibiotic application to ensure a complete review of antibiotic forms and to monitor antibiotic usage based on several prescribing patterns. It is an electronic way to create, approve, and review antibiotic use via the online web-based system, which was also accessible through smartphones. This innovative strategy undoubtedly made a huge impact on the review process. The advantage of this application is that any injudicious use detected through the application is subjected to immediate intervention by the AMS team. This application has indirectly and directly tackled all five contributing factors. User satisfaction feedback was obtained through an electronic survey form, which was distributed to all users. More than 60% voted that this electronic antibiotic application eases their daily work process, is readily accessible to all staff and is user-friendly.

In order to sustain and improvise the technology-driven strategy, further steps were undertaken. The sixth strategy, a detailed flowchart on the supply of controlled antibiotics, was formulated. This provided a quick reference for the in-patient pharmacy and encouraged adherence to the SOP of supplying controlled antibiotics. This flowchart tackled two main contributing factors, including unclear SOP in supplying antibiotics and incomplete review after 72 hours. An improvised version of the process of care was developed, as shown in Figure 1. The seventh strategy was continuous medical education (CME) on antibiotic electronic application use (e-form manual) to facilitate understanding among the application users and ensure smooth flow throughout the prescribing process. This strategy tackled the pending culture and sensitivity result factor compared to the earlier flow chart strategy. It also provided an opportunity to raise issues and overcome the application flaws raised by the users.

Results

The heavy usage of controlled antibiotics gradually improved through the interventions done within two years. The ABNA eventually reduced from 25.5% to -6.7%. The DDD/1000 PD reduced from 126.7 (baseline UL in 2019) to 121 in the pre-remedial phase. Subsequent reductions of DDD/1000 PD were 105.7, 88.9, 80.7 and 80.2 from cycles 1 to 4, respectively, accounting for approximately 36.7% reduction from the baseline UL by the year 2021. A detailed ABNA and conformance to MOGC for every cycle are tabulated in Figure 3 and Table 1, respectively.

An approximate of MYR 165,000.00 (USD 36,500.00) of cost savings (usage of antibiotics) were accomplished through this study; from baseline in 2019 worth MYR 389,265.00 (USD 85,939.00) to MYR 224,265 (USD 49,439.00) during cycle 4. The reported CRE cases also reduced from 49 (2019) to 21 (2021). The antibiogram had shown improvement as well.

Lessons and Limitations

This study has demonstrated that reduced antibiotic usage led to reduced antibiotic expenditures and prevalence of resistant microorganisms (e.g., CRE) and subsequently improved the local antibiogram, which was in line with other literature (8,10,21,25). From the study, it was apparent that persistent continuous education on the judicious use of antibiotics among the doctors by the AMS team had impacted the antibiotic prescribing pattern as per recommendations (2). Secondly, a strong collaboration between the AMS team and staff from numerous departments helped to overcome the alarming antimicrobial resistance rate and high antibiotic usage. Feedback verbally received on the implementation of

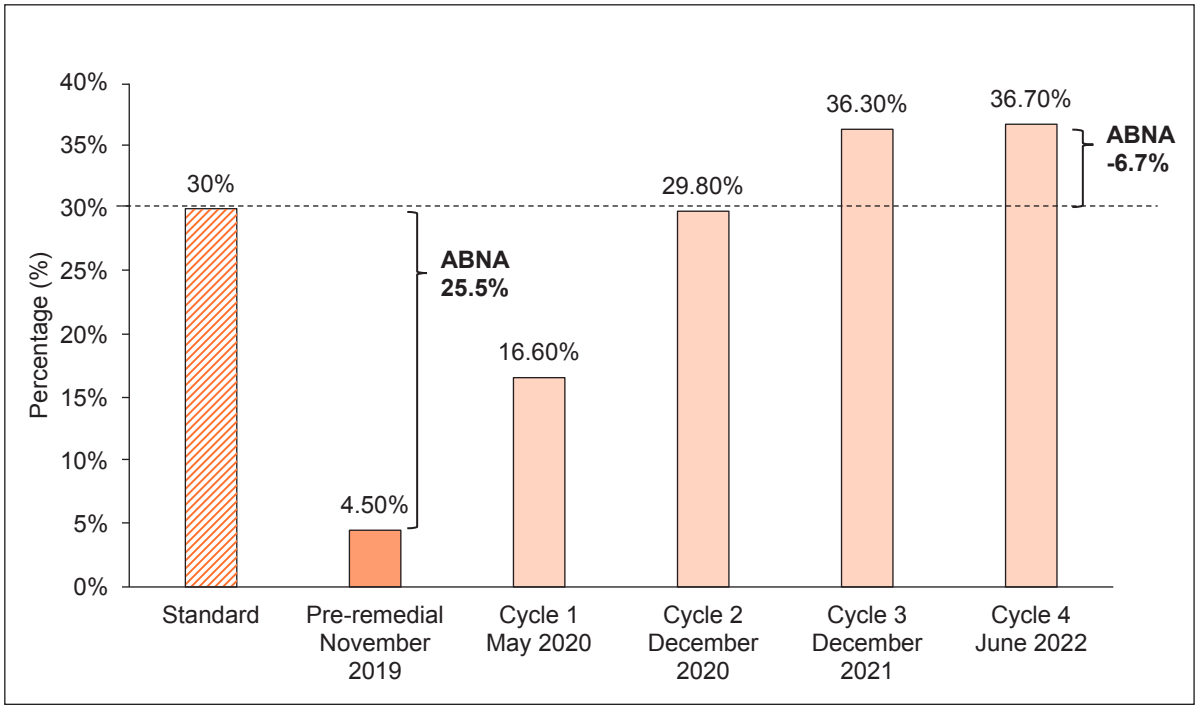


Figure 3: The percentage reduction trend of DDD/ 1000 PD with the identified ABNA. Cycle 1 and 2 involved two medical wards and one intensive care unit whereas Cycle 3 and 4 involved all wards in HSJ.

strategies showed good acceptance with a positive attitude without any significant complaints. Referring to the MOGC in Table 1, it was found that the standard for the three processes was not 100% until cycle 4. The two processes, namely the doctor filling in the antibiotic order form and the in-patient pharmacy screening the antibiotic forms, did not achieve the 100% target, probably due to the high turnover rate of new staff and fair consideration given to certain life- threatening emergency cases where immediate antibiotic doses will be released first, as evidence shows that antibiotics given within an hour of diagnosis reduce mortality rates (26). Therefore, in treating these cases, only prescriptions will be screened, and antibiotics will be released first before receiving the antibiotic order form. The process involving the specialist selection of appropriate antibiotics after 72 hours only attained up to 87%. Many specialists expressed the superiority of their personal experiences over the literature evidence. For instance, vancomycin is still used as surgical prophylaxis for a patient scheduled for implant surgery, although the patient was a non-MRSA carrier (nasal swab negative for MRSA). A separate internal audit on local data is planned to determine the correlation between the antibiotic used as surgical prophylaxis and incidences of surgical site infections (SSI). With this data, it is hoped that practices can be changed to be more evidence-based.

The detailed strategies developed have demonstrated an effect in combating the heavy usage of controlled antibiotics and can be adapted by other facilities. Among the strategies that were adapted by others were the electronic antibiotic application in different hospitals within Penang (e.g., Bukit Mertajam Hospital) and also outside Penang (e.g., Sultanah Bahiyah Hospital in Alor Setar, Kedah) by the visiting specialists. Besides that, our antimicrobial guideline was used as a reference for the development of local guidelines at other respective cluster hospitals and the renal dosing part was published with permission in another separate general renal dosing guideline. With all the efforts put in place, it was more meaningful as the team won the National Quality Assurance Convention in 2022.

There are several limitations in this study. The focus of the study was on controlled antibiotics only as we could not

Table 1: Model of Good Care (MOGC) to reduce the heavy usage of controlled antibiotics in HSJ.

Processes	Criteria	Standard	Pre-remedial Nov 2019 (n=65)	Cycle 1 May 2020 (n=59)	Cycle 2 Dec 2020 (n=71)	Cycle 3 Dec 2021 (n=68)	Cycle 4 June 2022 (n=62)
Specialist fills in Antibiotic Order Form	Specialist fills in antibiotic dose, frequency and duration	100%	39%	70%	75%	99%	99%
In-patient pharmacy screens the antibiotic form	The pharmacist screens for the patient's name, RN, dose, route, and signature by the prescribing specialist, and justification for the antibiotic	100%	51%	78%	86%	87%	90%
Lab releases culture and sensitivity result	Lab technician reports the name(s) of micro-organism(s) in the sample(s) sent, culture and sensitivity patterns, and minimum inhibitory concentration, where applicable	100%	64%	87%	94%	100%	100%
Specialist reviews antibiotic use after 72 hours	Review of antibiotic at 72 hours	100%	16%	59%	55%	100%	100%
Specialist selects appropriate antibiotic, thereafter	Specialist decides the choice of antibiotic, route, dose, and duration based on the culture and sensitivity results and septic parameters	100%	12%	68%	65%	82%	87%

include all the antibiotics, such as third-generation cephalosporins, which could also lead to antimicrobial resistance. Besides that, more time was spent on continuous education and guidance to sustain the outcomes because of the high turnover rate of new staff. The team is still seeking the most suitable and sustainable measures to overcome these limitations.

Conclusion and the Next Steps

Many studies have proven that judicious use of antibiotics prevents the unnecessary prevalence of resistant microorganisms. However, the process involved was not clearly defined and remained ambiguous. This quality assurance study has had multiple positive impacts towards achieving the study endpoints and gained attention in Penang. The project details, from problem analysis to strategies implementation and assessment, are clearly defined for convenience of adaptation by others and the ABNA was achieved (-6.7%). Nevertheless, frequent audits should be conducted at acceptable intervals to evaluate and ensure the outcomes' sustainability.

Our next step will be to extrapolate the electronic application to other drugs such as human albumin, sodium valproate injection and other drugs. Eventually, the usage could be monitored closely to avoid unnecessary wastage and for prescribers to follow its approved indication as in the Ministry of Health Malaysia Drug Formulary.

Acknowledgement

We would like to take this opportunity to thank the Director General of Health for his support and permission to publish this study. We would like to express our appreciation to the facilitators from the Quality Assurance, Penang team for their critical appraisals and continuous support in completing this study. Last but not least, a big thank you to everyone involved in the study, directly or indirectly, up to this publication process.

Conflict of Interest

The authors declare that there was no conflict of interest.

Funding

This study received no specific grants from any funding agencies from the public, commercial or non-profit sectors.

References

1. Ministry of Health Malaysia. The Report On Antibiotic Utilisation In Malaysian Hospitals 2008-2017 Putrajaya: Pharmacy Practice And Development Division Ministry Of Health Malaysia (MOH); 2017 [Available from: https://www.pharmacy.gov.my/v2 /sites/default/files/document-upload/report-antibiotic-utilisation-malaysian-hospitals- 2008- 2017.pdf accessed on 24-03-2024.

2. Society for Healthcare Epidemiology of America. Policy statement on antimicrobial stewardship by the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS). Infection control and hospital epidemiology. 2012;33(4):322- 7.

3. Boucher HW, Talbot GH, Bradley JS, Edwards JE, Gilbert D, Rice LB, et al. Bad bugs, no drugs: no ESKAPE! An update from the Infectious Diseases Society of America. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America. 2009;48(1):1-12.

4. Theuretzbacher U. Future antibiotics scenarios: is the tide starting to turn? International journal of antimicrobial agents. 2009;34(1):15-20.

5. Ministry of Health Malaysia. National Antibiotic Guideline Putrajaya: Ministry of Health Malaysia; 2014 [Available from:https://www.pharmacy.gov.my/v2/sites /default/files/document-upload /national- antibiotic-guideline-2014-full-version jun 2015 _ 1.pdf accessed on 24-03-2023.

6. Chandy SJ, Naik GS, Balaji V, Jeyaseelan V, Thomas K, Lundborg CS. High-cost burden and health consequences of antibiotic resistance: the price to pay. Journal of infection in developing countries. 2014;8(9):1096-102.

7. Agodi A, Auxilia F, Barchitta M, Brusaferro S, D'Errico MM, Montagna MT, et al. Antibiotic consumption and resistance: results of the SPIN-UTI project of the GISIO- SItI. Epidemiologia e prevenzione. 2015;39(4 Suppl 1):94-8.

8. Joseph NM, Bhanupriya B, Shewade DG, Harish BN. Relationship between Antimicrobial Consumption and the Incidence of Antimicrobial Resistance in Escherichia coli and Klebsiella pneumoniae Isolates. Journal of clinical and diagnostic research : JCDR. 2015;9(2):Dc08-12.

9. Yang P, Chen Y, Jiang S, Shen P, Lu X, Xiao Y. Association between antibiotic consumption and the rate of carbapenem- resistant Gram-negative bacteria from China based on 153 tertiary hospitals data in 2014. Antimicrobial resistance and infection control. 2018;7:137.

10. Lipsitch M, Samore MH. Antimicrobial use and antimicrobial resistance: a population perspective. Emerging infectious diseases. 2002;8(4):347-54.

11. Carmeli Y, Samore MH, Huskins C. The association between antecedent vancomycin treatment and hospital-acquired vancomycin-resistant enterococci: a meta-analysis. Archives of internal medicine. 1999;159(20):2461-8.

12. Shallcross LJ, Davies DS. Antibiotic overuse: a key driver of antimicrobial resistance. The British journal of general practice: the journal of the Royal College of General Practitioners. 2014;64(629):604-5.

13. Butler CC, Rollnick S, Pill R, Maggs-Rapport F, Stott N. Understanding the culture of prescribing: qualitative study of general practitioners' and patients' perceptions of antibiotics for sore throats. BMJ (Clinical researched). 1998;317(7159):637-42.

14. Moore M, McNulty C. European Antibiotic Awareness Day 2012: TARGET antibiotics through guidance, education, and tools. The British journal of general practice: the journal of the Royal College of General Practitioners. 2012;62(605):621-2.

15. Hulscher ME, Grol RP, van der Meer JW. Antibiotic prescribing in hospitals: a social and behavioural scientific approach. The Lancet Infectious diseases. 2010;10(3):167- 75.

16. Van Buul LW, van der Steen JT, Doncker SM, Achterberg WP, Schellevis FG, Veenhuizen RB, et al. Factors influencing antibiotic prescribing in long-term care facilities: a qualitative in-depth study. BMC geriatrics. 2014;14:136.

17. Schweizer AK, Hughes CM, Macauley DC, O'Neill C. Managing urinary tract infections in nursing homes: a qualitative assessment. Pharmacy world & science : PWS. 2005;27(3):159-65.

18. Lohfeld L, Loeb M, Brazil K. Evidence-Based Clinical Pathways To Manage Urinary Tract Infections in Long-Term Care Facilities: A Qualitative Case Study Describing Administrator and Nursing Staff Views. Journal of the American Medical Directors Association. 2007;8(7):477-84.

19. Loeb M, Bentley DW, Bradley S, Crossley K, Garibaldi R, Gantz N, et al. Development of minimum criteria for the initiation of antibiotics in residents of long-term-care facilities: results of a consensus conference. Infection control and hospital epidemiology. 2001;22(2):120-4.

20. Owens RC, Jr. Antimicrobial stewardship: concepts and strategies in the 21st century. Diagnostic microbiology and infectious disease. 2008;61(1):110-28.

21. MacDougall C, Polk RE. Antimicrobial stewardship programs in health care systems. Clinical microbiology reviews. 2005;18(4):638-56.

22. Lipsitch M. Measuring and Interpreting Associations between Antibiotic Use and Penicillin Resistance in Streptococcus pneumoniae. Clinical Infectious Diseases. 2001;32(7):1044-54.

23. Routsi C, Gkoufa A, Arvaniti K, Kokkoris S, Tourtoglou A, Theodorou V, et al. De- escalation of antimicrobial therapy in ICU settings with high prevalence of multidrug- resistant bacteria: a multicentre prospective observational cohort study in patients with sepsis or septic shock. The Journal of antimicrobial chemotherapy. 2020; 75 (12) :3665-74.

24. Arulappen AL, Danial M, Haron N, Hau LC, Khan AH. The Impact of Antimicrobial Stewardship Program on Injudicious Use of Cefuroxime. Frontiers in pharmacology. 2020; 11:565818.

25. Arulappen AL, Danial, M. Cheng, J.T. Safety and Clinical Outcomes of Antibiotic De- escalation as Part of Antimicrobial Stewardship (AMS) Program: A Retrospective Observational Descriptive Study in an Intensive Care Unit. Journal of Antibiotics and Antimicrobial Agents. 2021; 1:1-9.

26. Arulappen, A.L; Danial, M.; Ng, L.W.; Teoh, J.C. The Impact of Antibiotics Administration on Mortality for Time in Sepsis and Septic Shock Patients Including Possible Reasons for Delayed Administration in Malaysia. Antibiotics. 2022, 11, 1202.

INCREASING THE PERCENTAGE OF EXCLUSIVE BREASTFEEDING MOTHERS IN DUNGUN, TERENGGANU

Adila Azura Abdullah[1], Nor Fadzila Jusoh[2]

[1]Ketengah Jaya Health Clinic, Terengganu State Health Department, Ministry of Health Malaysia

[2]Kuala Dungun Health Clinic, Terengganu State Health Department, Ministry of Health Malaysia

Corresponding Author: Adila Azura Abdullah
Email: dradila.azura@moh.gov.my

Abstract

The World Health Assembly adopted the infant feeding strategy in 2001, which included the recommendation for exclusive breastfeeding from newborn until six months old, with continued breastfeeding for up to two years while complementary food is introduced. Breastfeeding is the most cost-effective way to reduce childhood morbidity and mortality as well as give benefits to breastfeeding mothers. Although breast milk is the normative feeding for infants, exclusive breastfeeding rates in Dungun were the lowest in Terengganu for three consecutive years from 2014 to 2016. Only 51.8% of mothers did so in 2016, with a reducing trend from 66.8% in 2014 to 58% in 2015. As a result, a quality improvement project was designed to increase the percentage of exclusive breastfeeding mothers in Dungun, involving seven health clinics starting in September 2016, with the first cycle completed in November 2017. Factors contributing to the low percentage of exclusive breastfeeding were poor psychosocial support and a non-conducive environment for breastfeeding practice. Four interventional strategies were formulated and implemented, including establishing a new work process of breastfeeding management, improvising the teaching aids into a more organised, compact, and complete breastfeeding kit, organising breastfeeding educator training courses and last but not least, organising JOM PA & MA classes to improve mothers' knowledge and providing support for them. There were 152 mothers and 157 nurses involved in the pre-intervention study. Subsequently, 100 mothers and 157 nurses were evaluated in the post-intervention period. Our study revealed a significant increase in the percentage of exclusive breastfeeding mothers, from 56% to 86%, exceeding the standard set at 80% after four intervention cycles. These comprehensive strategies effectively improved the percentage of exclusive breastfeeding mothers in Dungun, fostering the development of local breastfeeding guidelines to ensure continuous good healthcare services for breastfeeding mothers.

KEYWORDS: Exclusive breastfeeding, Quality improvement project, Interventional strategies, Dungun

Problem

Exclusive breastfeeding is the gold standard for infant nutrition and contributes to maternal health as well. The Malaysia National Breastfeeding Policy recommends that all mothers exclusively breastfeed their infants for the first six months. It entails feeding infants with breast milk only, including expressed breast milk, excluding water, other liquids, breastfeeding substitutes, or solid foods. Thereafter, adequate complementary foods may be introduced, and breastfeeding should be continued until at least the age of two years old. Breast milk contains all the necessary nutrients for the growth and development of infants and antibodies that protect them from many illnesses (1).

The National Plan of Action for Nutrition of Malaysia III (NPANM) targets at least 70% of infants at the age of six months + one week to be fed exclusively with breastmilk by the year 2025 (2). The latest National Health Morbidity Survey (NHMS) population survey in 2016 reported that 47.1% of zero to six-month-old infants were exclusively breastfed, which showed an increase from 14.5% in 2006 (3). On the other hand, government health clinics in Malaysia reported that 49.4% (2015) of infants aged six months who attended government health clinics were exclusively breastfed, an increase from 23.3% in 2011. However, the rate is still below the recommended standard (2,4).

Dungun District Health Office (DHO) is situated in Terengganu and has seven health clinics providing primary healthcare services to the 189,600 residents that comprise the district's population (5). Led by a Public Health Physician, it has a total of 627 staff who work in clinical settings and public health administration. There are six major services provided by the DHO, namely family health, disease control, occupational health, food quality control, health education, as well as environmental health and water supply services. Apart from the execution of national health policies and strategies at the ground level, it is also responsible for disease monitoring and surveillance and achieving specific health indicators for each activity. One of the activities monitored is the percentage of exclusive breastfeeding among postnatal mothers. On average, a total of 260 postnatal mothers attended health clinics in Dungun monthly for their six-month postnatal check-ups.

According to the 2016 Key Performance Index (KPI) achievement, the percentage of exclusively breastfeeding mothers in Dungun was only 51.8%. This achievement was the lowest among districts in Terengganu for three consecutive years from 2014 to 2016, and it also showed a reduction from 2014 (66.8%) and 2015 (58%). A verification study involving 152 mothers was carried out in September 2016 to verify the rate of exclusive breastfeeding among postnatal mothers attending all health clinics in Dungun. The study showed 56% (n=85) of the 152 postnatal mothers exclusively breastfed their children. Therefore, this study aims to increase the percentage of exclusive breastfeeding mothers in Dungun to 80% within five years.

Background

Optimal breastfeeding can save the lives of 820,000 children under five years old every year. World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) recommend breastfeeding to be started as early as one hour after birth, to give exclusive breastfeeding for the first six months, and to start safe and nutritious complementary foods at six months of age while continuing breastfeeding for up to two years or more (1,6). Exclusive breastfeeding can be defined as a practice of only giving an infant breastmilk for the first six months of life without mixing it with water, other liquids, or food except for vitamins, mineral supplements, and medicines. It is the foundation of child health because it provides essential nutrition for a child's growth and development (1,7). Breastmilk contains all the nutrients and energy an infant needs in the first six months of life, up to half or more during the second half of infancy and up to one-third during the

second year of life (1,8).

Breastfeeding has long been associated with a reduced risk of diseases in infants and mothers. Breastmilk has nutritional, immunological, behavioural, and economic benefits and helps build the bond between mother and infant (9,10). Studies showed that breastmilk improves growth and lowers the risk of getting otitis media, gastroenteritis, respiratory tract infections, sudden death syndrome, obesity, and high blood pressure in children (2). On the other hand, breastfeeding can also reduce the risk of breast and uterine cancer, type 2 diabetes, and even postpartum depression in lactating women (3). In terms of benefits to the community, breastfeeding can indirectly reduce the cost of medical treatment and has been reported to alleviate the problem of absenteeism from work (11).

Despite the well-known importance of exclusive breastfeeding, the practice is neither widespread globally nor in Malaysia, where the achievement of national exclusive breastfeeding percentage in 2016 was only 47.1% (2,12). Meanwhile, a cross-sectional study conducted in Rio de Janeiro, Brazil, involving 1029 mothers, showed only 58.1% of babies were exclusively breastfed for infants under six months old (13). Based on UNICEF and Center for Disease Control and Prevention (CDC USA) data, exclusive breastfeeding rates in the Middle East and North Africa were only 34% and were projected to remain flat at a linear rate until 2030 (14). On the other hand, the South Asia region had a faster rate projection of improvement at 77% of exclusive breastfeeding by 2030. However, it is necessary to accelerate progress in all regions to achieve the WHO target by 2030, which is 70% of six six-month exclusive breastfeeding rate (14).

Various factors affect the decision to initiate breastfeeding and its duration. Psychological, emotional, social, and environmental factors all play a role in determining if the baby will be bottle-fed or breastfed. Some of the reported barriers to breastfeeding include maternal stress over not producing enough milk, uncertainty about whether the infant is getting enough milk, mother or infant discomfort with breastfeeding, nipple or breast problems, embarrassment to breastfeed in public, maternal fatigue, mother returning to work, previous breastfeeding history and concern about baby's weight loss (4). Other studies found that negative attitudes and lack of knowledge on proper breastfeeding techniques among mothers, their partners, family members, and health care professionals were also reported as breastfeeding hurdles (15). Besides that, the hospital and healthcare practices and policies that are not supportive of breastfeeding, lack of adequate skilled support in health facilities and the community, aggressive promotion of infant formula and other breastmilk substitutes, inadequate maternity and paternity leave legislation and workplace policies that support a woman's ability to breastfeed when she returns to work also contribute to the low rates of exclusive breastfeeding globally (15).

Sociodemographic factors are also associated with breastfeeding duration. Younger women with lower incomes and full-time employees were more likely to stop breastfeeding early, within one month after delivery (4). In terms of educational level, better-educated mothers tended to breastfeed their babies longer than 6 months, as evidenced by several studies (4,15,16). Knowledge and attitude are essential modifiable factors that may improve exclusive breastfeeding practice (17).

Increasing exclusive breastfeeding rates requires health systems, community, and policy actions. Evidence shows that countries with policies and programs most closely aligned with recommendations by WHO and UNICEF have the most success in increasing the rate of exclusive breastfeeding (18). Among the global strategies recommended to be implemented were the Baby-friendly Hospital Initiative, the International Code of Marketing of Breast-milk Substitutes and the Innocenti Declaration on the Protection, Promotion and Support of Breastfeeding (2). A study by Heymann et al. in 182 countries showed that the existence of national policies allowing breastfeeding

breaks at workplaces resulted in higher exclusive breastfeeding practices among working mothers (19).

At the policy level, Malaysia's government acknowledges the recommendation of the National Breastfeeding Policy which was formulated in 1993 and revised in 2005; multiple strategies have been advocated to promote exclusive breastfeeding practices such as the Baby Friendly Hospital Initiative (BFHI), Baby Friendly Clinic Initiative, training of health staff via 20-Hour Breastfeeding Course, 90 days maternity leave in the governmental sector and implementation of the Code of Ethics for Marketing of Infant Food and related products (17,20,21).

Another study revealed that healthcare providers are important in promoting breastfeeding practice (21). The success of exclusive breastfeeding promotion depends on the healthcare provider's knowledge, attitude, motivation, and communication skills. The healthcare providers' personal breastfeeding experiences influence their attitude toward breastfeeding and their expertise in counselling and managing breastfeeding issues in the patient (22). Periera et al. showed that 31.9% of the mothers who exclusively breastfed their babies joined the breastfeeding support group initiated by the health care center in Brazil (13). This practice was statistically significant in improving the prevalence of exclusive breastfeeding compared to those who only received individual breastfeeding consultations (13). Meanwhile, another study demonstrated that training health professionals at the Breastfeeding Friendly Primary Care Unit Initiative to address practical issues related to the clinical management of breastfeeding had a positive impact on the survival curve of the exclusive breastfeeding (23). Owing to a high turnover of healthcare providers in many settings, training investment needs to be protected by ensuring follow-up through supervision and refresher training or orientation in health facilities(18) .

Having good community support may empower women's wish to breastfeed exclusively. Other than that, access to prenatal care, where moms receive advice on how to start nursing, also enhances the practice. A mother's likelihood to start breastfeeding within the first hour is proportionate with the number of antenatal appointments and professional antenatal care she receives (1,6). Exclusive breastfeeding practice is significantly improved by providing counselling to mothers during pregnancy, immediately following delivery, and during the neonatal period. However, extending exclusive breastfeeding to six months necessitates greater community and family assistance (18).

Measurement

The indicator of this study was the percentage of exclusively breastfeeding mothers, calculated based on the following formula:

$$\text{Percentage of exclusively breastfeeding mothers} = \frac{\text{Numbers of exclusively breastfeeding mothers with six months + one week old baby}}{\text{The total number of postnatal mothers with six months + one week old baby}} \times 100\%$$

The NPANM III puts the target for at least 70% of infants at the age of six months + one week to be fed exclusively with breastmilk; meanwhile, according to Che Muda et al., it has been estimated that 1.30 to 1.45 million child deaths in 42 high mortality countries could be prevented by increasing the coverage of exclusive breastfeeding up to 90% (2). Thus, the standard set for this study was 80% based on the study team members consensus. This quality improvement study was conducted in all Dungun health clinics, which were Kuala Dungun Health Clinic, Ketengah Jaya Health Clinic, Paka Health Clinic, Kuala Abang Health Clinic, Jerangau Health Clinic, Al Muktafi Billah Shah Health Clinic, and Bukit Besi Health Clinic. All postnatal mothers with babies aged six months plus one week attending clinics during the study period were enrolled. Meanwhile, babies with congenital

diseases (e.g., congenital heart disease, biliary atresia, cleft lips, palate, etc.) and HIV-positive mothers were excluded from the study.

A verification study was conducted based on a pre-developed checklist to review the work process of breastfeeding management in all health clinics. A pre-developed observation form was used for data collection by the Quality Assurance (QA) team members. The observation form contains information on the work process of breastfeeding management and facilities, including a breastfeeding room, breastfeeding support group and breastfeeding teaching aid. We also conducted a survey on 157 nursing staff through a self-administered questionnaire and structured interview session. The survey contains questions regarding breastfeeding knowledge, how to solve breastfeeding problems and how to counsel breastfeeding mothers.

A self-administered questionnaire was distributed, and structured interview sessions were conducted among 100 mothers to further verify the factors contributing to exclusive breastfeeding practice. The questionnaire was adapted from the MOH baby-friendly clinic implementation guideline (24). It consisted of three parts: i) participants' data, ii) knowledge and attitude items and iii) breastfeeding practices checklist. The participant's data included socio-demographic, medical, delivery and breastfeeding history. The knowledge and attitude sections had each 10 questions on breastfeeding topics: the benefits of breastfeeding, breastfeeding duration, feeding cues, breastfeeding problems, breastmilk expression, position and latching, and storage of expressed breastmilk. Each correct answer carried one (1) score for the breastfeeding knowledge question, and an incorrect response scored zero (0) with a total of 10 maximum marks. Meanwhile, for attitude items, Likert Scales scoring from zero to four for "strongly agree", "agree", "unsure", "disagree" and "strongly disagree" were used. The total possible score for correct responses for the attitude aspects was 40. Those who scored at least 40 out of 50 points (80%) were considered to have good knowledge and attitude of breastfeeding. The breastfeeding practice checklist included self-reported practices of breastfeeding, and it was recorded as "never", "seldom" or "always" for each practice. With regard to the choices, "never" meant that the infant was never fed using the chosen method, "seldom" meant that the infant was fed with a specific method for less than seven days a week and "always" was defined as feeding the infant with specific feeding method every day. In this study, exclusive breastfeeding refers to feeding an infant with breast milk only without any additional solid or liquid except for oral rehydration salt, drops, syrups of vitamins and minerals or medicines.

The verification study was conducted in September 2016, followed by one month of data collection phase in October 2016 involving all seven health clinics in Dungun. Remedial measures were developed and implemented for seven months, starting November 2016 until May 2017, followed by four months of data collection from July until October 2017. The first cycle of data analysis was completed in November 2017.

The second cycle of the study was carried out from January to August 2018 with the improvement of remedial measures. This was followed by the third cycle of post-remedial data collection from September until December 2018. Subsequently, similar remedial actions were continued and monitored.

Initial Assessment of the Problem

A cause-and-effect analysis was performed to understand the possible contributing factors to the problem (Figure 1). Among the critical factors identified were poor attitudes and practices among mothers to breastfeed and poor breastfeeding consultation skills by health care providers, which were observed in low knowledge, attitude, and practices.

Based on the observation conducted during the verification study, it was found that some clinics had non-conducive

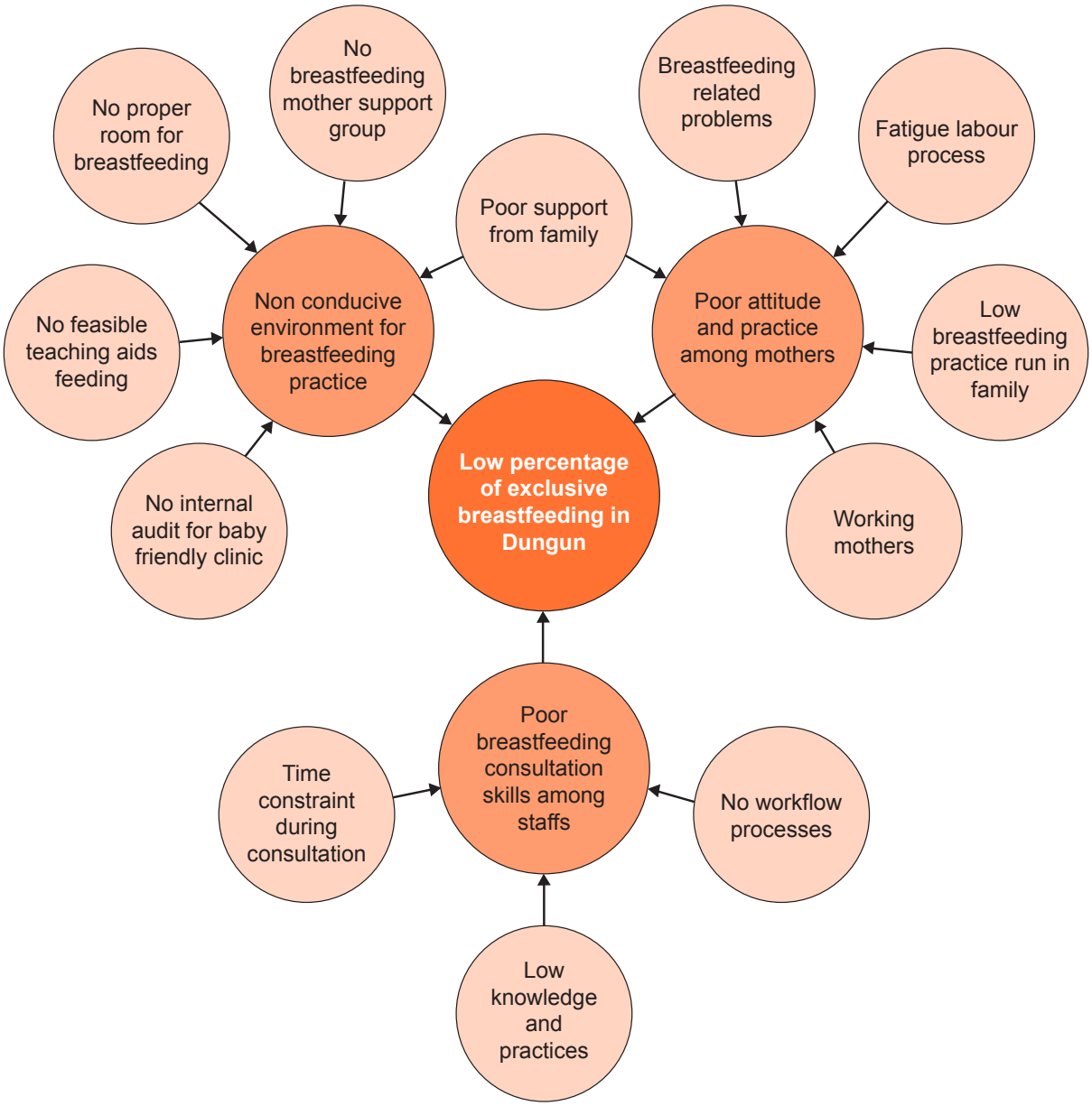


Figure 1: Problem analysis chart of the low percentage of exclusive breastfeeding in Dungun

environments for breastfeeding practice. There was no proper breastfeeding room available, no feasible breastfeeding teaching aids and no active breastfeeding mother support group in the clinic. At a more fundamental level, it was found that no standardised local or national process of care was used for the management of breastfeeding, explaining the reason for the lack of reference in managing breastfeeding issues at local health clinics. Time constraints were also observed during interview sessions conducted by the nurses, as the nurses were responsible for addressing the mothers' main complaints before they started breastfeeding consultations. While further assessing and investigating the mother's main complaint, they faced limited time to consult on breastfeeding.

This study only focused on evaluating nursing staff rather than involving all staff, such as the medical officers (MO). This is because MO routine review is only done at one month postnatal, not at 6 months postnatal, where the data collection was conducted. In addition, the nurses were the mothers' first contact person; among all medical personnel, they were the ones most often seen during maternal and child check-ups. The nurses will make a referral to MO if they find any problem at any time, in accordance with the newly constructed flow chart (Figure 2).

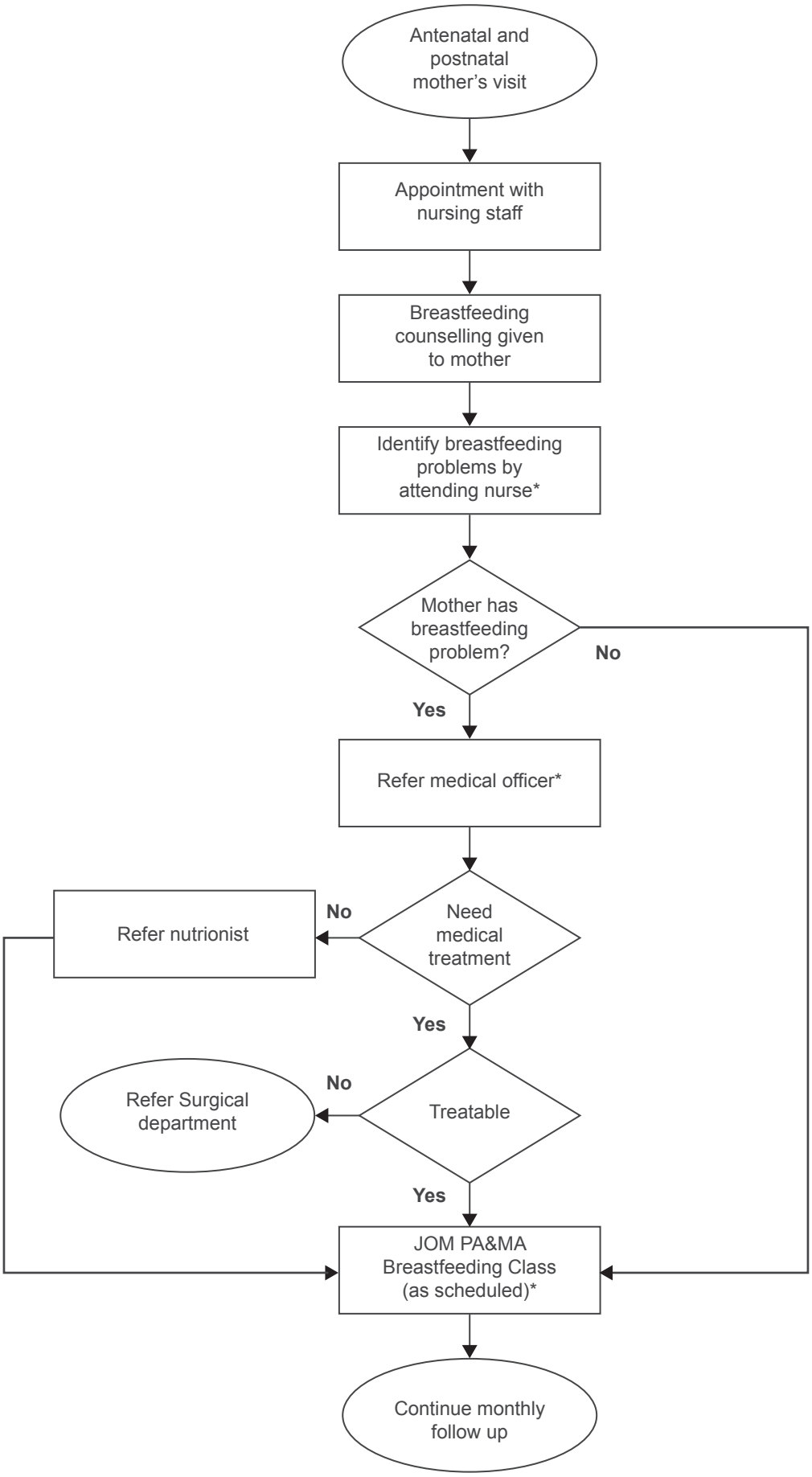


Figure 2: Process of care for breastfeeding management (* indicates critical steps)

The evaluation of the nursing staff's knowledge, attitude, and practices showed that a low percentage of nurses obtained a passing mark of above 80% for knowledge, attitude, and practices of breastfeeding in the preliminary study, corresponding to 52% (n=81), 73% (n=114), and 54% (n=84) respectively. This could possibly be related to the increased number of untrained new nursing staff in the clinic, leading to ineffective breastfeeding consultation. Before the study was conducted, 89.3% (n=200) out of 224 nursing staff had attended the 20-hour Breastfeeding Course in 2016, which was organised annually by the nutrition team. The attendance percentage dropped to 83.7% (n=226) out of 270 in 2017. Consequently, it posed an extra burden on the nutritionist to organise more training courses for the staff. A target of 100% had been set for nurses to attend the compulsory 20-hour breastfeeding course as they are the initial contact for the mothers, however this has not been achieved yet. A survey of mothers' knowledge, attitude and practice on exclusive breastfeeding was also conducted. The results showed that most mothers had good breastfeeding knowledge of 93% (n=93) but low achievement in attitude and practices of breastfeeding, which was only 40% (n=40) for both. We found that poor attitude and practice of exclusive breastfeeding among mothers were the result of poor support from the husband and family, fatigue from the laborious process, and common breastfeeding-related problems such as engorged breast, cracked nipple, inadequate supply, and latching issues, as well as history of poor practice of breastfeeding in the family itself.

In terms of health facility support on exclusive breastfeeding, all health clinics in Dungun were already recognised as Baby-friendly Clinics, which means more than 80% of clinical healthcare personnel have been trained with skills to promote, protect and support breastfeeding mothers. However, there were no periodic internal audits and surveillance of the practice until the following validation assessment after 3 years of certification. This resulted in low motivation for the staff to organise any breastfeeding-promoting activities such as group discussions, talks and awareness campaigns to help in supporting breastfeeding mothers.

Strategy

In the first cycle of the remedial phase (November 2016 until May 2017), the issue of inadequate skills among the staff in promoting breastfeeding among staff was addressed by creating a new work process that improves the flow of breastfeeding management (Figure 2). Before the project was implemented, there was no written standard of care for breastfeeding management to refer to. Hence, the critical steps were identified and emphasised in the flow to aid the personnel in assisting breastfeeding mothers in Dungun. To begin with, all mothers should be given breastfeeding counselling, and proper history-taking and breast examination should be made by the nursing staff to identify any breastfeeding problems that the mothers encounter. Appropriate referrals should be made to MO to investigate and treat medical-related breastfeeding problems such as candida infection, mastitis, flat nipple, inverted nipple, post-breast surgery, lump, mass, swelling, redness, dimpling, sore nipple, engorgement, blocked milk duct, and breast abscess, as well as to the surgical department if required. On the other hand, non-medical breastfeeding problems such as inadequate supply, latching and position issues, mothers' refusal to breastfeed, and slow weight gain in the breastfeeding baby must be referred to nutritionists. The new workflow enabled the staff to properly manage breastfeeding issues and thus helped patients seek medical treatment for their problems.

Another strategy was formulated to manage time constraints by improvising the existing breastfeeding teaching aid and distributing it to all clinics. Before this strategy was implemented, the breastfeeding education materials used during the consultation were fully packed with lengthy words, and fewer pictures and no standardised materials were used

in all health clinics. Most nurses found it challenging to deliver all the information during the consultation. Meanwhile, the new breastfeeding teaching kit was handy, compact, organised, and consisted of essential topics for breastfeeding teaching sessions. It ensured the information delivered to patients was correct, complete, and standardised. It was developed in a form filled with visuals and a simplified flipchart on breastfeeding information with an attached breast model that can be used for demonstration during consultation sessions or home visits. Patients were also given pictorial brochures and infographics to strengthen their understanding and memory of what they were taught and counselled on. We received feedback from the nursing staff that the intervention helped them give the mothers useful and important breastfeeding information within the limited time available.

A new strategy was introduced to train breastfeeding educators in Dungun District. This training program was on a voluntary basis, open for all MO and nurses. The pre-requisite to joining this training was the participant must have attended a 20-hour Breastfeeding Course. They will be provided with a new two-day duration course, including a hands-on demonstration of breastfeeding techniques and practical antenatal exercises. The counselling technique was also taught to ensure the counselling given was effective. The course was intended to increase their self-confidence towards becoming trained instructors who will conduct JOM PA& MA at their respective clinics later. Upon completing the course, they were awarded a certificate of recognition as trained breastfeeding educators in the Dungun district.

In the second cycle of the remedial phase (January to August 2018), JOM PA&MA breastfeeding classes were held in each clinic every three months as a medium to convey and share information related to breastfeeding and maternal and child health care in general. The classes were conducted by the district nutritionists, trained breastfeeding educators and physiotherapists. The modules used were from the Malaysia Ministry of Health guidelines. Besides breastfeeding sessions, classes also included teaching antenatal exercises, breathing techniques, and hands-on sessions on handling newborn babies. This class was open to all expecting and postnatal parents. The JOM PA&MA sessions also allowed the healthcare personnel to deliver better consultations and focus on further discussion with groups of parents regarding health issues or myths about breastfeeding. These sessions subsequently received positive feedback from the participants.

Results

After the first cycle of remedial actions, the percentage of exclusive breastfeeding increased to 66.1% (Figure 3). The level of knowledge, attitude, and practices (KAP) among staff improved after the first cycle of intervention, where 97% of nurses achieved good knowledge, 97% had good attitudes, and 94% had good practices. Meanwhile, the level of KAP among mothers in Dungun was also remarkably improved in the first cycle of remedial actions, where 98% of mothers had good knowledge, 96% had good attitude, and 90% had good practice of exclusive breastfeeding.

In general, the exclusive breastfeeding percentage in Dungun gradually increased after the second cycle of remedial actions and finally surpassed the standard and achieved 86.1% in 2021. The achievable benefits not achieved (ABNA) results for pre-remedial phase, the first and second cycles in the remedial phase, and the three cycles of the sustainability phase are shown in Figure 3. According to the data collected from Dungun District Nutritional Status Report, there is also a reduction in the number of kids below five with low weight from 2.39% in 2019 to 0.52% in 2022.

Lessons and Limitations

This project highlighted the many issues contributing to the low percentage of exclusive breastfeeding among postnatal mothers. With the interventions implemented, multiple benefits were

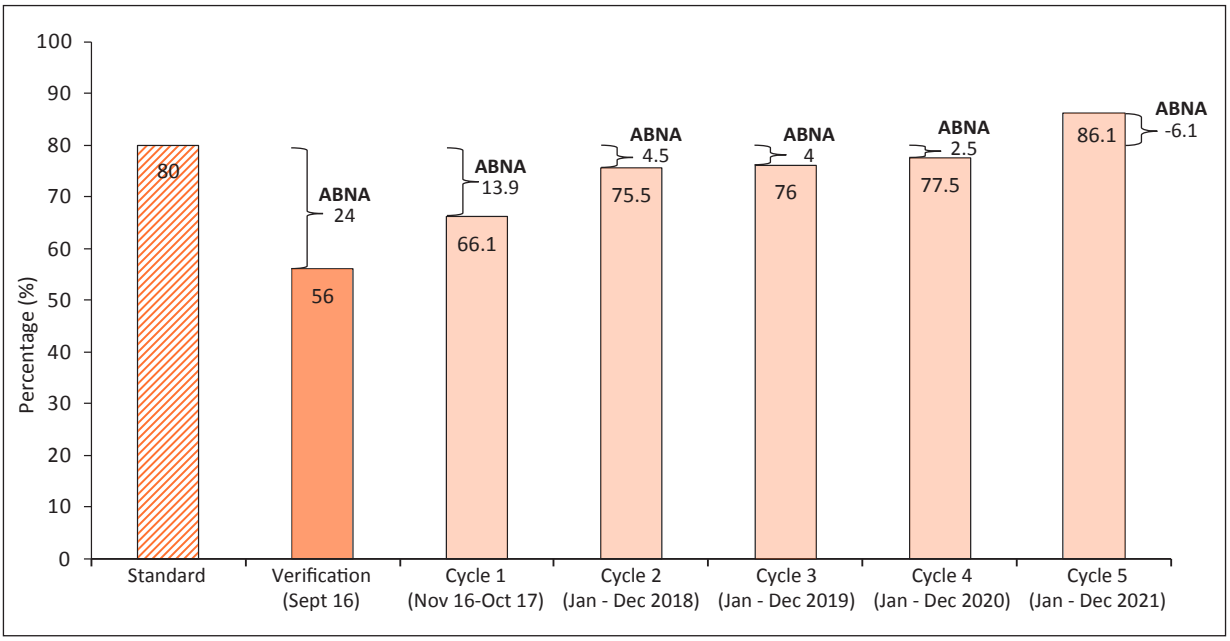


Figure 3: Percentage of exclusive breastfeeding mothers in Dungun from 2016 until 2021

gained, including improved staff confidence to deliver breastfeeding education, mothers able to attend breastfeeding classes organised by nearby clinics, and better time management for the staff. This project also highlighted the importance of staff adherence to the new workflow for more efficient breastfeeding management.

A key lesson learned during the process was the importance of forming a dedicated team; this had a positive impact on formulating effective interventions and had a greater chance of being sustainable. Therefore, consistent and continuous staff training must be held every year.

This project is rather challenging as it needs motivated and dedicated staff to continue the best practice of breastfeeding educators. It is important to continuously engage and train more staff to become breastfeeding educators in the Dungun district.

We also acknowledge certain limitations in our project, where this project only involved the study of breastfeeding practices among mothers in the Dungun district. It may not reflect the population of breastfeeding mothers in Terengganu as they may have different processes of care at the clinics they visit, working environments, cultures and personalities. Further review of the feasibility and suitability of the remedial measures will be needed if implementations of the remedial measures at other places are to be considered.

Other than that, our project only focused on nurses' competency towards breastfeeding management and not the medical officers in health clinics who also play an important role in successful exclusive breastfeeding among mothers. This is an important opportunity to be explored in the future.

Conclusions and Next Steps

In conclusion, this initiative is the first of its kind in Terengganu. We are certain that the strategies within this initiative will serve as a model that can be adapted by other districts in Terengganu and throughout Malaysia. After six years of implementation, there has been a considerable increase in the number of mothers who practice exclusive breastfeeding. This project has proven sustainable since its commencement in 2017. Findings from this study were presented and shared at the Terengganu State Nutritionist Technical Meeting in January 2020. The meeting decided to expand the implementation of the measures to all district health clinics in Terengganu. Hopefully, this study will serve as a starting point for developing an exclusive breastfeeding intervention plan in Malaysia.

Acknowledgement

The authors wish to thank the Director General of Health Malaysia for his permission to publish this work. We would also like to express our gratitude and appreciation to the DHO, family medicine specialists, nutritionists, medical doctors, and nurses in all Dungun health clinics for their assistance and involvement throughout the project. Finally, special thanks to all mothers involved in this project who made it successful till the end.

Conflict of Interest

The authors declare that there was no conflict of interest.

Funding

This research did not receive any specific grant from funding agencies from the public, commercial or not-for-profit sectors.

References

1. National Coordinating Committee on Food and Nutrition, Ministry of Health Malaysia. Malaysian Dietary Guidelines for Children and Adolescents - Summary [Internet]. 2013 [cited 2022 Oct 20]. Available from: https://www.moh.gov.my/moh/resources/auto%20download%20images/589d765c1b95f.pdf

2. National Coordinating Committee on Food and Nutrition, Ministry of Health Malaysia. National Plan of Action for Nutrition of Malaysia III 2016-2025 [Internet]. 2016 [cited 2022 Oct 20]. Available from: https://www.moh.gov.my/moh/resources/Pemakanan/Buku_National_Plan_of_Action_for_Nutrition_of_Malaysia_III_2016-20251.pdf

3. Institute for Public Health (IPH). National Health and Morbidity Survey 2016 (NHMS 2016): Maternal and Child Health. Vol. II: Maternal and Child Health Findings. 2016.

4. Che Muzaini CM, Tengku Alina TI, Rohana AJ, Suhaily MH, Zaharah S, Nazirah J. Maternal factors associated with the initiation of exclusive breastfeeding among mothers at one week after delivery in two selected hospitals in Kelantan, Malaysia. Malaysian J Med Sci. 2018 Aug 1;25(4):112–21.

5. Jabatan Perangkaan Malaysia. Banci Penduduk & Perumahan Malaysia 2020 [Internet]. 2020 [cited 2021 Oct 20]. Available from: https://statsdw.dosm.gov.my/wp-content/uploads/2021/11/DOSM_DOSM.TERENGGANU_1.2020_Siri-85.pdf

6. United Nations Children's Fund. Capture the Moment Early Initiation of Breastfeeding: The best start for every newborn. 1st ed. Maaike Arts, France Bégin, Willibald Zeck CL-L and VMA (UNICEF), editor. New York: UNICEF; 2018.

7. Motee A, Jeewon R. Importance of exclusive breast feeding and complementary feeding among infants. Curr Res Nutr Food Sci. 2014;2(2):56–72.

8. Chowdhury R, Sinha B, Sankar MJ, Taneja S, Bhandari N, Rollins N, et al. Breastfeeding and maternal health outcomes: A systematic review and meta-analysis. Acta Paediatrica, International Journal of Paediatrics. 2015. p. 96–113.

9. Mohapatra I, Roy A. Breastfeeding awareness and perception among antenatal mothers: A cross-sectional study in urban slum population of Bhubaneswar, Odisha. J Educ Health Promot. 2018;7(1):60.

10. Horta BL, Victora CG. Long-term health effects of breastfeeding. A Systematic Review [Internet]. 2013 [cited 2022 Oct 20]. Available from: https://iris.who.int/bitstream/handle/10665/79198/9789241505307_eng.pdf?sequence=1

11. Kebede T, Woldemichael K, Jarso H, Bekele BB. Exclusive breastfeeding cessation and associated factors among employed mothers in Dukem town, Central Ethiopia. Int Breastfeed J. 2020;15(1):1–10.

12. United Nations Children's Fund, World Health Organization. Increasing Commitment To Breastfeeding Through Funding And Improved Policies And Programmes - Global Breastfeeding Scorecard 2020 [Internet]. 2020 [cited 2021 Oct 20]. Available from: https://www.globalbreastfeedingcollective.org/media/546/file

13. Boccolini CS, de Carvalho ML, Couto de Oliveira MI. Factors associated with exclusive breastfeeding in the first six months of life in Brazil: A systematic review. Rev Saude Publica. 2015;49.

14. North K, Gao M, Allen G, Lee AC. Breastfeeding in a Global Context: Epidemiology, Impact, and Future Directions. Clin Ther [Internet]. 2022;44(2):228–44. Available from: https://doi.org/10.1016/j.clinthera.2021.11.017

15. Draman N, Mohamad N, Yusoff HM, Muhamad R. The decision of breastfeeding practices among parents attending primary health care facilities in suburban Malaysia. J Taibah Univ Med Sci. 2017 Oct 1;12(5):412–7.

16. Stamenkovic Z, Matejic B, Djikanovic B, Bjegovic-Mikanovic V. Surprising Differences in the Practice of Exclusive Breastfeeding in Non-Roma and Roma Population in Serbia. Front Public Heal. 2020 Jun 30;8.

17. Mohamad N, Saddki N, Azman KNK, Aziz IDA. Knowledge, attitude, exposure, and future intentions toward exclusive breastfeeding among Universiti Sains Malaysia final year medical and dental students. Korean J Fam Med. 2019 Jul 1;40(4):261–8.

18. World Health Organization. Global Strategy for Infant and Young Child Feeding. UNICEF, editor. World health Organization. Geneva: World Health Organization; 2003. 37 p.

19. Heymann J, Raub A, Earle A. Breastfeeding policy: A globally comparative analysis. Bull World Health Organ. 2013;91(6):398–406.

20. Shohaimi NM, Mazelan M, Ramanathan K, Hazizi MSM, Leong YN, Cheong X Bin, et al. Intention and practice on breastfeeding among pregnant mothers in Malaysia and factors associated with practice of exclusive breastfeeding: A cohort study. PLoS One. 2022 Jan 1;17(1 January).

21. Abdul Hamid H, Szatkowski L, Budge H, Cheah FC, Ojha S. Nutritional practices and growth of preterm infants in two neonatal units in the UK and Malaysia: A prospective exploratory study. BMJ Paediatr Open. 2021 Aug 24;5(1).

22. Hashim S, Ishak A, Muhammad J. Unsuccessful Exclusive Breastfeeding and Associated Factors among the Healthcare Providers in East Coast, Malaysia. Korean J Fam Med. 2020 Nov 1;41(6):416–21.

23. Martín-Iglesias S, Santamaría-Martín MJ, Alonso-Álvarez A, Rico-Blázquez M, del Cura-González I, Rodríguez-Barrientosn R, et al. Effectiveness of an educational group intervention in primary healthcare for continued exclusive breast-feeding: PROLACT study. BMC Pregnancy Childbirth. 2018 Feb 26;18(1).

24. Kementerian Kesihatan Malaysia. Garis Panduan Pelaksanaan Klinik Rakan Bayi Di Malaysia. Malaysia; 2015.

Quality Improvement Report (QIR) for Q Bulletin Guideline for Authors

This guideline is the modified version of the BMJ Open Quality template for quality improvement project report. The original template can be accessed here: https://bmjopenquality.bmj.com/pages/authors/#editorial_policy

Your manuscript should include:

1. Abstract (up to 300 words)
2. Main text (up to 4000 words; excluding abstracts, tables and figures)
3. Maximum of 5 tables or figures.
4. Please use Font Arial, Size 12, double spacing.

Subheading	Description
Title	Indicate that the article concerns an initiative to improve healthcare.
Abstract	This is a summary of your work and is the most important section to attract a reader's attention. Please ensure you include: a) A brief background to the problem, b) The method for your quality improvement project, c) The overall results and d) The conclusion Keep it succinct and factual. Please include 3 – 5 appropriate keywords for your manuscript.
Problem	Summarise your problem and the focus of your project. Give some details about your local context including; a) The type of organisation you work in, b) The size of your organisation, c) Details about the staff members who work there and d) Perhaps a little bit about your local patient population. Include here the SMART aim of your project (for example; the aim was to reduce medication errors from 15% to 5% across six elderly care wards in three months).
Background	This section gives the reader background information about the problem and provides up-to-date, research and knowledge from the literature. Summarize the literature you have found on the background to your problem here. a) What existing evidence is there that this problem exists? b) What existing evidence is there on the factors contributing to the problem? c) What evidence is there that other people have tried to solve this problem in the past? d) Is there any evidence for what works and what doesn't to solve your problem?

Measurement	Describe which measures you selected for studying processes and the outcomes of the intervention(s), including: a) Rationale for choosing them, b) Their operational definitions, c) Inclusion and exclusion criteria, d) The standard and how you determine it Describe how you planned to collect this data throughout your project and how frequently. Include here the results of your baseline measurement (verification study).
Initial assessment of the problem	Describe what processes are involved in your problem including the critical that will contribute to the achievement of your final goal. Describe on the perceived factors that could contribute to the problem and how you quantify them. Include here the results of the study that you conducted to identify the contributing factors to the problem.
Strategy	In this section you should explain your strategy for improvement to the reader and discuss how you implemented your improvement cycles. In most cases you will have tried a number of progressive improvement cycles, some of which will not have been successful. It is important that you also share these to help others avoid similar difficulties. Remember that data should be collected continuously throughout your project. This is a difficult section to document and will contain a lot of information. For each PDSA cycle you should describe your aim, your change hypothesis and strategy for change. a) Describe how you implemented the change and the data you collected. b) Describe your key learning from each cycle of change, and discuss how this learning impacted on your change process. c) How well did your predictions of what change was needed match your outcomes? d) What worked more effectively than anticipated and what had less effect than predicted?
Results	Provide a summary of what your results using appropriate chart or diagram. a) Describe the variation in your data. b) Were the interventions you made responsible for any improvements? c) Describe how contextual elements interacted with the intervention(s) and affected your results. d) Compare your results to your baseline measurement. Comment on how you assessed whether the data was complete and accurate- was there any missing data? Please comment on whether there were any unintended consequences such as unexpected benefits, problems, failures or costs associated with the intervention(s).

Lessons and Limitations	In this section, discuss the lessons you learnt from the project and its limitations. Comment on the strengths of the project. Describe any problems you faced and how you navigated these. If you were to undertake this project again, what would you do differently? Reflect on your project's limitations. For example, did you realise as the project was implemented that your results would be affected by unforeseen factors such as a small sample size or the turnaround of patients or staff? Comment on the limits of generalize ability. Describe whether chance, bias, or confounding have affected your results and whether there was any imprecision in the design or analysis of the project. Are more data points required? Were efforts made to minimize/adjust for any limitations? Although we accept publications using different improvement approaches, we would expect you to have modified your intervention as it was implemented and undergone a process of continuous improvement, measurement and learning. If your project does not fit with this approach then we would like to see reflections and learning here about how you could have incorporated continuous improvement and measurement approaches in your project.
Conclusion and the next steps	You should reflect on your background research, noting what is already known on this topic and what your project adds. You should refer back to your aims statement – did your project achieve its aims? Did you adjust your aims as you went along? Was it a useful project? Were your measures appropriate and did you use balancing measures? Think about what your senior sponsor would like to see as an output of your work and what can help others to make the case for undertaking a similar piece of work – or for doing something differently if your project was not successful. Please describe your cost analysis here, were there any financial savings that your project made? Being able to demonstrate that your intervention delivered savings really helps to add value. Give an assessment of whether you think your project is sustainable – do you have enough data? What have you done to try to ensure that your work continues? Comment on how you would spread your project and whether it could be replicated elsewhere. Discuss what your next steps will be and whether further study in the field is required. The point of the conclusion is not to rewrite the whole project, but to give an overview of how the whole project was conducted, what it achieved, and some personal reflections.
References	In this section you should record any references to published material that you refer to elsewhere in your project. This is particularly likely to include material from background reading or from your conclusions.

	Use the Vancouver style for referencing.
Acknowledgements	Please include here the names of anyone who is not on the author list but whose input you wish to acknowledge.
Conflict of Interest	Please declare any conflict of interest, if any.
Funding	Please declare any source of funding, if any.



INSTITUTE FOR HEALTH SYSTEMS RESEARCH

Institute for Health Systems Research
National Institutes of Health,
Ministry of Health Malaysia

Block B2, National Institutes of Health Complex,
No 1, Jalan Setia Murni U13/52, Seksyen U13,
Setia Alam, 40170 Shah Alam, Selangor.

03-33627500
ihsrqa@moh.gov.my
ihsr.nih.gov.my
www.facebook.com/MOHihsr

9 771985 013002