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EDITORIAL

Q Bulletin: Starting is Hard, Sustaining is Even Harder

Dear Readers,

It has been more than a year since our Q Bulletin went online through the MyJMS platform. Despite its minor flaws, the system aids us appreciably in the editorial process, as well as the managing and tracking of manuscripts' status.

The upgrading of the "old" Q Bulletin to the "new" easy access version has been immensely instrumental to us. We penned down the extensive journey, experiences and lessons learnt in a 4-page highlight entitled ESTABLISHMENT OF Q BULLETIN: FROM NEWSMAGAZINE TO ONLINE JOURNAL PLATFORM (https://ihsr.moh.gov.my/publication) as an institutional memory in the Q-Bulletin chronicles.

With the release of the latest volume, this marks the successful publishing of three "new" Q Bulletins' featuring a total of 16 quality improvement projects. For a new local journal, publishing an annual volume with a minimum of five manuscripts is HARD. Furthermore, getting a complete quality improvement project which is publishable is NOT EASY. Not to mention, getting a well written good quality improvement project is a whole DIFFERENT STORY altogether. This path, is without a doubt an EXTREMELY CHALLENGING PROCESS.

Despite the laborious and obstacle-filled path, we are determined to persevere and fully committed to continue publishing Q Bulletin as a dissemination platform for quality champions to share their success stories and best practices.

We will continue to find methods to SUSTAIN this journey we have embarked. Among the strategies we had adopted and will continue to implement and strengthen are:

1. Continue conducting a series of writing workshops and follow-up sessions to encourage authors commitment in completing the manuscripts.
2. Enhance collaboration with programmes, states and institutions in identifying potential authors and projects for manuscripts.
3. Enhance publicity to attract diverse potential authors (including regional and international) using innovative approaches via existing organisation networks and social media platforms.
4. Creating a pool of diverse reviewers from local, regional and international levels.

We envision for the Q Bulletin to be listed in MyCite, allowing for global visibility of the contents to stimulate its use, in addition to promoting potential collaborations and citations. This steers the Q-Bulletin in achieving its objective of serving as a focal point for the exchange and dissemination of knowledge on topics pertinent to QA/QI in healthcare.

Very much aware that this would be an uphill task, still, it is one of the goals that we hope to accomplish in the next 5 to 10 years.

Keep supporting us by submitting your articles!

Dr Samsiah Awang
Editor-in-Chief

REDUCTION OF FLARE-UP IN ROOT CANAL TREATMENT: AN IMPROVED TREATMENT

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Abstract

Flare-up in root canal treatment (RCT) is considered an alarming issue at the Kangar Dental Clinic. It causes patients to experience severe pain or swelling, leading to an impromptu visit to the clinic in distress. This quality improvement study aimed to reduce the flare-up during RCT in Kangar Dental Clinic to ≤ 10% in 12 months. The 6-month census from January 2016 to June 2016 showed an incidence rate as high as 70%. The contributing factors identified were the use of improper RCT technique (96%), inter-appointment duration of more than 30 days (88%), and poor awareness and knowledge among dental personnel on recent techniques (70%). These findings were collected from the patient's card, RCT assessment form, and appointment book. Remedial measures were implemented from July to December 2016, followed by a re-evaluation from January to June 2017. A flowchart of RCT was developed via the use of rubber dam for tooth isolation, 2.5% sodium hypochlorite (NaOCl) as irrigation solution, side-end needle irrigation tip, crown-down technique application, radiographic assessment, and 0.2% chlorhexidine (CHX) as intracanal medicament. A checklist was developed and monitored to ensure that all procedures were followed. The appointment scheduling system was also improved to ensure the patient's next visit is scheduled within 30 days. The post-intervention study showed a successful reduction of flare-up by 6%, which was further sustained at 4% and later to 5% incidence, as observed in the subsequent year. In conclusion, the intervention strategies were successful in reducing the flare-up incidence in Kangar Dental Clinic.

KEYWORDS: Root canal treatment, Flare-up, Quality improvement study

Problem

Root canal treatment (RCT) or endodontic treatment is a common procedure in every dental clinic. More than 25 million root canal treatments are performed annually by dentists worldwide (1). In Malaysia, more than 3,000 teeth were endodontically treated in 2016 (2). RCT is a process of cleaning, shaping, disinfection, and sealing of the canal from bacteria, which then promotes periradicular tissue healing. However, one of the disadvantages of performing RCT is that it carries the risks of a flare-up.

Flare-up is defined as pain or swelling of the facial soft tissues or oral mucosa in the root canal area of the treated tooth (1,3-4). It can happen immediately after the procedure or later. According to many researchers, flare-up incidence in RCT varies from 1.4% to 20% (5–7). In Malaysia, there was no study reported on the incidence of flare-up; however, Kangar Dental Clinic (KDC) has had flare-up cases as high as 28 out of 40 patients (70%) from January to June 2016. This triggers a red alarm when there is at least one patient a week who will turn up to the clinic due to pain and discomfort after RCT.

Pain and discomfort in RCT, if left untreated and disregarded, can lead to severe problems such as acute orofacial swelling, which is mainly caused by an infection that is improperly treated during RCT. Such incidents are considered as medical emergencies. The high incidence of flare-up has led to prolonged RCT, as well as increased workload and cost of health care. Although there is a range of severity of signs and symptoms, they are not life threatening. They tend to be localised and usually, they do not involve structures other than oral and perioral. However, occasionally, the flare-up may be complicated. It may spread to facial spaces and even has regional temporary paraesthesia, in which both patient and dentist would wish to avoid the mishap (8).

KDC is one of the dental clinics in the district of Kangar, Perlis, a state in the northern part of Peninsular Malaysia. It has 84 staff, where 20 of them are dental officers, 18 are dental assistants, and the remaining are dental therapists, technicians, and supporting staff. All dental officers in KDC have the privilege to perform the RCT procedure. New dental officers with less than one year of service must work under close supervision of the senior before they are credentialed to handle cases on their own.

KDC serves a population of approximately 300,000 people. It is equipped with five dental chairs, with four units for primary care and one unit for Periodontal Specialist Clinic. It is supported by a laboratory technician and one sterilisation room. This clinic has been appointed as an Endodontic Primary Care Clinic (EPCC) in Perlis, whereby it received RCT referrals from other primary dental clinics. The referral is indicated when the Restorative Dentistry Index of Treatment Need (RDITN) guideline score is 1 and 2. The RDITN has three scores: 1, 2, and 3. If the index is 1 or 2, the EPCC will take the case. If the index score is 3, the dental officer will refer the case to the Restorative Specialist. This guideline has been practiced in Kangar since 2015 for all restorative work, including RCT. KDC caters to approximately 10,000 patients per year, making it a primary dental clinic with the highest workload in Perlis.

Verification study showed 70% of which 28 out of 40 patients developed flare-ups. Most of the flare-ups occurred due to improper therapeutic procedures and incompetent dental personnel. The alarmingly high incidence of flare-up indicated an urgent need to find a solution for this issue, hence, consensus among the group members to formulate a study aimed to achieve the standard of ≤ 10%.

Background

Flare-up is a well-known risk of RCT. Unfortunately, its numerous preventive procedures are still being neglected. The prevention of this problem is crucial, as it causes unpleasant patient experience or worse, orofacial swelling, which is regarded as a medical emergency; this will create a misperception of clinician competency. To date, there is only one single tool established for the flare-up measurement, which is the Flare-up Index Questionnaire (FUI-Q) (3).

The global incidence of a flare-up in RCT ranges from 1.4% to 20% (5–7). The development of flare-up comprises significant pain and swelling, which can occur for a few hours to a few days after RCT. The intense pain will require the patient to make an impromptu visit for immediate treatment (5–7).

Iqbal et al. (9) reported that properly identified risk factors combined with clinician experience can improve patient management postoperatively. Causes of a flare-up are polyetiological and mostly influenced by mechanical factors (e.g., over-instrumentation, overfilled the root canal), chemical factors (e.g., irrigants, intracanal medicament, sealers) and microbiological factors (e.g., high bacteria bioburden such as that known in the case of poor dental hygiene), all of which contribute to its appearance (8).

A proper preoperative diagnosis of the tooth in concern is important, as a previous study had shown that preoperative pain is one of the major risk factors of a flare-up (8). The first visit of RCT is an important stage, where it can reduce the incidence of a flare-up when handled well (9). Many approaches and strategies have been attempted to reduce the incidence of a flare-up. Some involved strict aseptic technique and complete debridement using the crown-down technique. A study reported that the use of the crown-down technique is able to minimise extrusion of debris and necrotic pulp out of the root canal system (8). Based on the endodontology consensus report (10), this technique produces superior cleaning and shaping than the conventional one (i.e., step-back technique).

The use of a proper irrigation solution is crucial for achieving optimum cleaning of the root canal system. The use of copious and frequent irrigation using 2.5% sodium hypochlorite (NaOCl) is a must, as NaOCl is more potent in cleaning and disinfecting the root canal system (11). Placement of antimicrobial intracanal medications at inter-appointment is mandatory. Currently, 2% chlorhexidine solution is known as a potent intracanal medicament and is more effective compared to calcium hydroxide to combat many virulent bacteria in the canal system such as *Enterococcus faecalis* (12). Following placement of intracanal medicament, a proper corona seal is mandatory to prevent direct reinfection of the root canal system if left open (13).

Psychological management (13), which is a critical aspect of treatment, involves reassurance and a good local anaesthetic. The patient must be made comfortable by breaking the pain cycle prior to the start of RCT. Furthermore, explaining the RCT and the risk of undergoing RCT is a must to the patient. Among the key strategies to improve RCT is through continuous public education. Another study conducted in the United States of America cited that to increase awareness among patients, continuous dental education to the public via pamphlet, video, or talk on RCT is paramount (14).

Measurement

In view of the alarmingly high flare-up incidence (70%) during the verification study from January to June 2016 in our setting, the urgency for intervention was identified. A questionnaire was developed to evaluate the flare-up's clinical criteria, which allows the patient to precisely describe those manifestations (Table 1). The criteria of flare-up used in the study were based on Rimmer et al. (3). Assessment of flare-up was done by using the RCT assessment form. In this form, there is a section of the flare-up questionnaire (FUQ). The section will be filled in whenever a patient comes in for an unscheduled visit. Scoring of the flare-up was done by operators who had treated the patient. A flare-up is indicated if the score is equal to or more than four. Apart from that, a questionnaire was developed and administered to identify the knowledge among the dentists and dental assistants; the results of the study showed 70% of them had poor knowledge on the recent technique of performing RCT. In this knowledge assessment, the score of more than 80% signified them as knowledgeable operators.

Table 1: Flare-up Questionnaires (FUQ)

Criteria	Finding	Finding Up Score* (Range: 0–7)
Intense Pain	No	0
	Yes	1
Number of days pain	0 day	1
	1–2 days	2
	3 days and more	3
Analgesic	Not taken	0
	Taken	1
Unscheduled dental visit	No	0
	Yes	1
Emergency treatment rendered	No	0
	Yes	1

**A flare-up is indicated if the total score equals to or more than 4.*

The primary outcome of this study was the percentage of a flare-up in RCT. It was calculated as the number of patients who developed flare-ups over the total number of patients who underwent RCT. In this study, a flare-up incidence of less than 10% was selected as standard based on a study by Udoye et al. (2011), which matched the clinical setting, clinician experience, and target groups of this research.

Internationally, the lowest standard set for flare-up is 1% (8). However, based on the state service approval, the standard set is equal to or less than 10%, which is in accordance with some limitations such as basic dental facilities without advanced technology, inadequate clinical experience, and limited resources.

All patients that underwent RCT in KDC were enrolled during the study period. However, patients with special needs, limited mouth opening, and those with a known allergic reaction to materials used in RCT were excluded. A six-month verification study was conducted from January to June 2016. During this period, a total of 60 patients were enrolled for RCT cases in KDC, of which 40 patients were indicated for assessment due to their fulfilment of the inclusion criteria for the study. Out of 40 patients, 28 of them (70%) had experienced a flare-up. Twenty-four patients had flare-ups at the inter-appointment time and only four were at the post-operative stage, which is defined as pain that occurred after initiation or continuation of root canal treatment.

Initial Assessment of the Problem

According to the problem analysis chart, some factors contributing to the increased incidence of a flare-up are shown in Figure 1.

The RCT/RDITN assessment was performed via observation by the Quality Assurance (QA) team member using RCT/RDITN assessment form. Operators need to follow all required steps listed in the assessment form to be considered as total compliance with the procedure. Out of 21 dentists, 95% (n=20) of them practiced improper techniques and were not fully compliant with the required RDITN criteria. The majority of the operators did not use rubber dams, in which they performed step-back techniques for canal preparation, using normal saline as irrigation solution, using improper type of irrigation needle, and delayed placement of a permanent restoration.

During the verification study, 88% (n=35) of patients were documented to be given an inter-appointment time of more than 30 days and consequently, 69% (n=24) of these patients came back with a flare-up.

Based on verification data analysis, the risk factors contributing to flare-up were low adherence to RCT guidelines, long inter-appointment time, and poor knowledge among dental personnel. A pre-test was done on all 80 dental personnel to determine their knowledge of root canal treatment; the passing mark was 80% and above. Out of 80 staff, only 26 (32.5%) of them passed the pre-test; the remaining 54 (67.5%) had failed the pre-test. After reviewing the current process of root canal procedure in KDC, the refined flowchart (Figure 2) elaborated each step, emphasising on the critical steps (based on two broad areas) that can aid in reducing flare-ups.

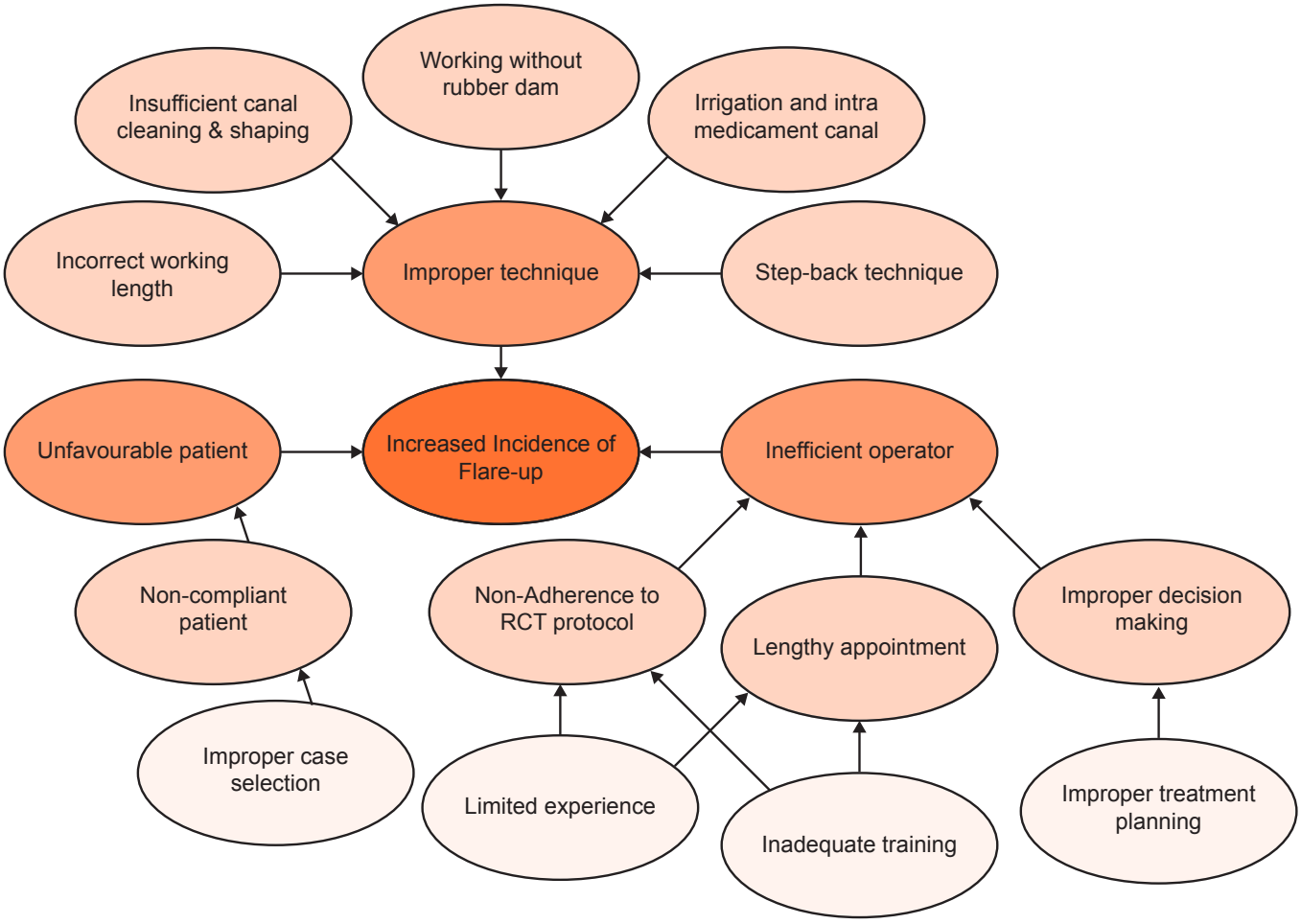

Figure 1: Cause effect analysis diagram

1. Examination and diagnosis stage, where the patient is examined and assessed for suitability to undergo RCT using RCT/RDITN assessment form. The form is divided into four sections: patient's detail, checklist of RCT procedural steps, flare-up questionnaire (FUQ), and RDITN. RDITN score is a tool to determine the complexity of the RCT case, which is divided into three scores (score 1 - low, score 2 - medium, score 3 - high). Cases with scores 1 and 2 will be managed in the primary care setting, whereas those with score 3 will be referred to Restorative Specialists. If the tooth is not indicated for RCT (e.g., poor prognosis: minimal tooth structure left, mobile tooth, and poor dental hygiene), thus, tooth extraction is indicated. In accordance with the existing practice, a preoperative radiograph was taken prior to the start of RCT to help determine the suitability of case selection regarding the complexity of the case. This is to determine whether the tooth can be treated by a dental officer or should be referred to a Restorative Specialist.

2. A prescheduled appointment that consists of several visit dates is given to the patient based on the complexity of the case (e.g., multi-rooted tooth, blockage canal). This is to ensure that the inter-appointment period was given at least within two weeks and to allow the intracanal medicament to work at full strength (15).

3. When RCT is indicated, local anaesthesia (LA) will be administered prior to the access within the cavity. The prolonged analgesic effect can help to calm the patient, as it breaks the pain cycle by blocking the sensory nerves.

4. Next, rubber dam placement for tooth isolation is mandatory, as this maintains the aseptic chain during the intracanal procedure. The microorganism is the major causative agent for flare-ups. Thus, clinicians should be aware of the need to perform RCT under strictly aseptic conditions.

5. Selection of instrumentation technique during the canal preparation that extrudes less amount of debris apically is paramount in preventing the flare-up. The crown-down technique must be implemented to remove the tissue remnants and bacteria from the canal space. While performing the canal preparation, it is essential to reach the endpoint of the root canal. One of the iatrogenic factors causing the flare-up is preparation exceeding the canal system due to the incorrectly measured working length of the canal system. Due to such an incident, prior to canal preparation, the working length of the canal is determined using a preoperative radiograph and apex locator.

6. Copious and frequent irrigation with correct solutions during canal preparation is a crucial procedure. A 2.5% sodium hypochlorite canal irrigation solution is used which is administered by using a syringe with a side end needle irrigation tip. This procedure significantly enhances the removal of necrotic pulp and debris in the canal system.

7. The antimicrobial intracanal medicament is essential in controlling flare-ups. The canals are then placed with 0.2% chlorhexidine gel/ solution as intracanal medicament.

8. A proper seal of the tooth access cavity with a temporary restoration in between appointments is important to prevent recontamination of the canal system. Thus, a good provisional restoration material is needed (e.g., Cavit, Kalzinol, IRM).

9. If there is no sign and symptom during the following appointment, the canal system is permanently sealed with a rubber-like material called gutta-percha. The RCT is now deemed complete.

10. A permanent restoration will be placed immediately after completion of RCT using available dental cement (e.g., composite and amalgam).

11. Management in the psychological aspect of the patients by reassurance is critical, perhaps the most important aspect of treatment. Reassurance, or counselling sessions, will be given by dental officers to patients prior to the start of RCT. Previously, this step was not properly addressed by operators. Thus, it was added as one of the interventions in this study. When the flare-up occurs, the patient is predictably and understandably upset and shaken by this episode. They may assume that the treatment was unsuccessful and that the extraction is needed. The dentist must explain that the situation is a risk of undergoing RCT and can sometimes occur but remain treatable.

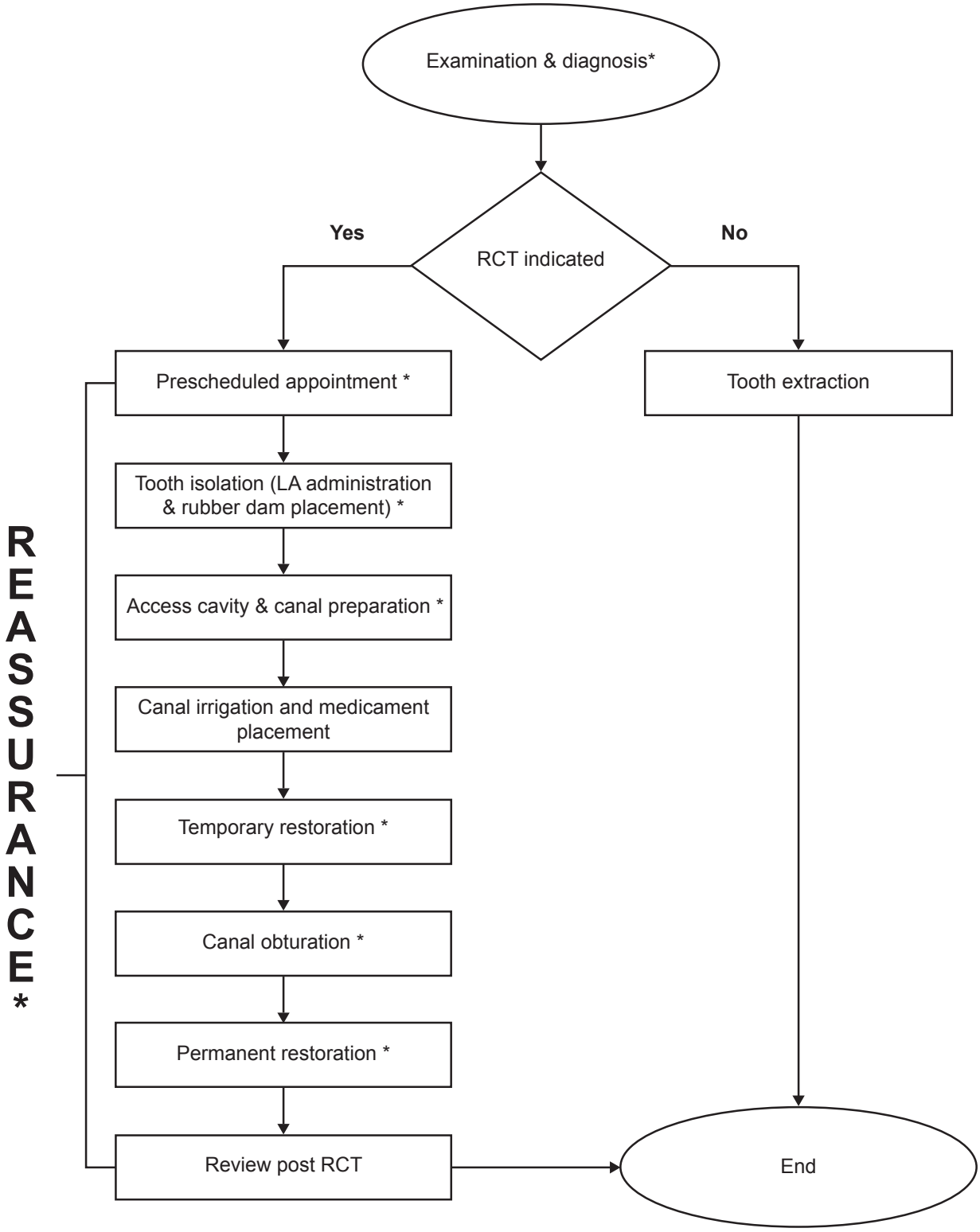

Figure 2: Flowchart of workflow on root canal treatment (* indicates critical step).

Strategy

A few strategies of change were implemented, aiming at improving the model of good care in the post-intervention period from July to December 2016.

A new RCT standard operating procedures to address the technical aspect was introduced based on Guidelines for Root Canal Treatment by European Society of Endodontology (16). All the operators must use a rubber dam during the procedure to ensure the practice of aseptic technique. Next, the irrigation solution was changed from normal saline (NaCl) to 2.5% sodium hypochlorite (NaOCl) (17). The NaOCl is the most effective, inexpensive readily available chemical. It is considered to be the most optimal irrigant to be used in root canal treatment as it has antibacterial and proteolytic activity. The proper effective concentration of NaOCl ranges from 2.5% to 5.25%. The negative properties of NaOCl are that it can cause soft tissue inflammation if passed outside the confined root canal. When it comes into contact with vital tissues, an acute inflammation followed by necrosis occurs. The severity of the complication depends on the concentration of the solution, its pH, and its duration of exposure. Sodium hypochlorite has a pH of 11–12.5 which causes injury by oxidation of proteins. Higher concentrations have some irritating effects on the periodontal ligament (18). Complications with the use of sodium hypochlorite can be avoided using specialised needles, avoiding excessive pressure, and not wedging the needle tip in the canal. Normal saline is ineffective in cleaning the root canal system, as it has no antimicrobial properties. In order to guarantee that the dental assistant is able to dilute the sodium hypochlorite at the correct concentration, a dilution form was constructed so that the operator can monitor it (Appendix 1). The irrigation needle was changed from an end-type needle to a side-end needle. This helped prevent the extrusion of irrigation solution out of the canal systems (11). In addition to the technical aspect, a combination of radiograph and apex locator was used to determine a correct working length accurately. The crown-down technique was adapted to improve the quality of preparation of the root canal system. The step-back technique, which was used conventionally to clean up and to shape the canal, was shifted to the crown-down technique in this study. The crown-down technique, which differs from the step-back technique in terms of the use of Ni-Ti files, has some benefits such as less canal transportation, less post-treatment pain, and less crack propagation in instruments. Prior to the conduction of this study, step-back technique was opted by the majority of operators in Perlis, as there were limited supplies of Ni-Ti files, a problem that is now considered to be resolved. Besides that, because of the weakness of calcium hydroxide as an intracanal medicament (4,16-18), 0.2% chlorhexidine gel/solution was substituted as a recent material used.

The next intervention was the introduction of patients' prescheduled appointments where the follow-up appointments were planned ahead to ensure that interval appointments are set within 30 days. The appointments were recorded manually in the appointment book, in which the dental assistant will then remind the patient by phone a week prior to the appointment date given. RCT pamphlet was developed, which comprises the procedure, advantages, and disadvantages of RCT. These approaches help patients to have a better understanding, hence, better compliance and tolerance towards the treatment.

Finally, continuous dental education (CDE) sessions for dental officers and dental assistants were carried out, which involved theoretical and practical lessons, followed by an assessment. All CDEs were given by the senior dental officer and restorative specialist, which focused on RCT procedure, new or updated technique and material, correct dilution of irrigation solution, RDITN guideline, and method of using the RCT assessment form.

Theoretical and practical assessments were performed on the personnel involved. A total of two assessment sessions were carried out with 40 personnel covered. Theoretical assessments were conducted where personnel involved were graded by a questionnaire given. The similar questionnaire was administered to all 80 staff to determine their understanding of how the root canal treatment was done with the passing mark set at 80%. The post-test result showed all dental personnel (n=80) had passed the post-test with an achievement of more than 80%. The sessions were later followed by a practical assessment on the topics delivered by a Restorative Specialist. Upon passing both theoretical and practical assessment with additional two RCT procedures performed under the supervision of senior dental officers and Restorative Specialist, dental officers were considered privileged to perform the RCT.

Results

The post-intervention analyses were conducted after the implementation of the remedial actions. All criteria in the model of good care (Table 2) showed an improvement after the intervention.

Table 2: Model of good care for reducing flare-up in root canal treatment

No	Procedure	Criteria	Standard	Pre-remedial	Post-remedial
1.	Examination and diagnosis	• RCT assessment form	100%	5%	100%
		• RDITN guideline	100%	5%	100%
		• Preoperative radiograph	100%	100%	100%
2.	Prescheduled appointment	• Appointments scheduled within 30 days	100%	5%	100%
3.	Tooth isolation	• Local anaesthesia (LA) administration	100%	5%	100%
		• Rubber dam placement	100%	5%	100%
4.	Cavity access and canal preparation	• Correct working length	100%	100%	100%
		• Using crown-down technique	100%	5%	100%
5.	Canal irrigation and medicament placement	• Using 2.5% sodium hypochlorite solution	100%	5%	100%
		• Irrigation using side end needle	100%	5%	100%
		• Placement of intracanal medicament, e.g., 2% chlorhexidine gel/solution	100%	5%	100%
6.	Temporary restoration	• Placement of provisional restoration using available temporary cement, e.g., Cavit, Kalzinol	100%	100%	100%

7.	Canal obturation	• Using gutta percha and sealer.	100%	100%	100%
8.	Permanent restoration	• Placement of permanent restoration immediately after RCT completion e.g., composite, amalgam	100%	85%	100%
9.	Reassurance	• Explanation on the risk of flare-up and other possible consequences to patients at every visit.	100%	5%	100%

From the table, the post-intervention result showed that 100% of the operators comply with all the RCT standard procedural steps except for the placement of permanent restoration following obturation (85%) due to unexpected mishap events such as broken instruments, time constraint due to multi-rooted tooth factor or equipment breakdown. Patient compliance is 100% when a prescheduled appointment was adopted. The accuracy of the data collection was ensured by having only one person collecting the data, which subsequently will be counter-checked by the restorative specialist to justify the data integrity.

Post-intervention study revealed a tremendous reduction of flare-up from 70% (January to June 2016) to 6% (January to June 2017). The first re-evaluation of six months from July to December 2017 showed that the flare-up percentage further dropped to 4% which was better than the standard set (≤ 10%). In the following year, the second re-evaluation marked only 5% of flare-up incidence reported. (Figure 2).

This result concluded that the remedial actions planned successfully brought down the incidence of a flare-up in RCT.

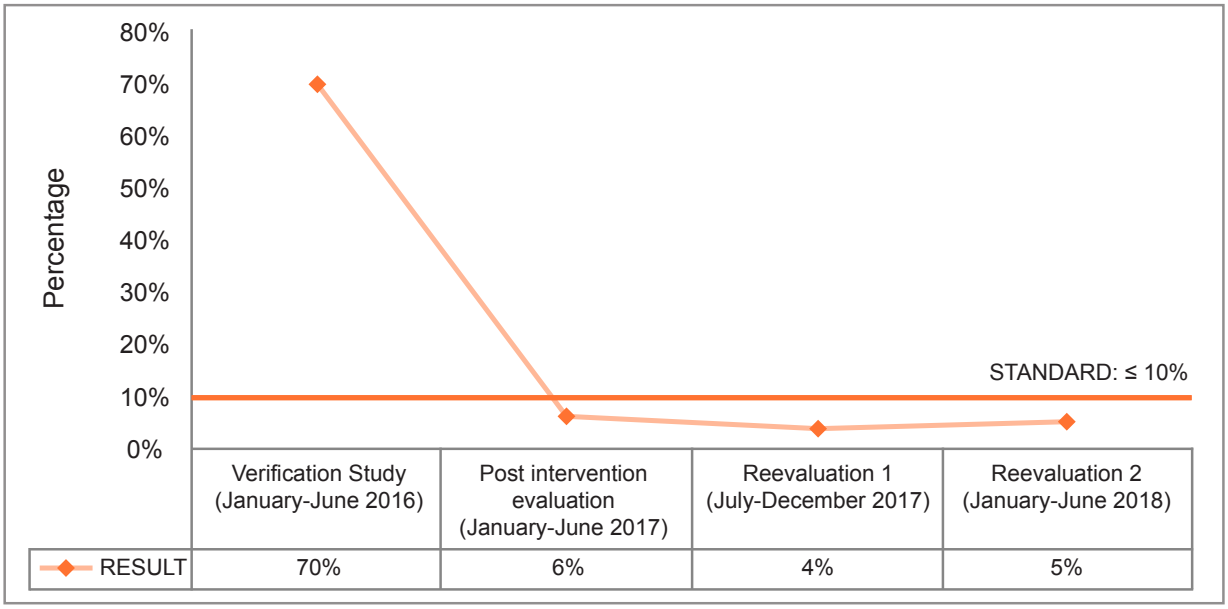

Figure 3: Percentage of flare-up case in Kangar Dental Clinic

Lessons and Limitations

Implementation of all study interventions has led to a remarkable reduction of flare-up incidence and yielded a sustainable result in subsequent re-evaluation. Additionally, the interventions were able to minimise the total cost needed for RCT. During the pre-intervention study, the total cost calculated to purchase the RCT materials (e.g., 0.2% chlorhexidine gel/solution, ProTaper files, apex locator, rubber dam set, and sodium hypochlorite solution) was RM 5,000.00 for a basic RCT set-up modality at Kangar Dental Clinic in the year of 2016. During post-intervention, the expenditure was also minimised to RM 2,000.00 yearly (rubber dam set and apex locator), thus amounting to RM 30,000.00 of cost saving in a 10-year projection.

The added values experienced by conducting this study included improvement in inter-and-intra-departmental communications, systematic arrangement of instruments and materials, organised documentation, and service delivery. Improved communication skills between healthcare providers and patients had led to the alleviation of anxiety symptoms related to unpleasant and painful experiences (19). In addition, this research also proved to be able to enhance rapport with patients, hence, increasing their compliance with the treatment. This also motivates patients to adhere to their appointments. It was learnt that every procedure must be in accordance with evidence-based dentistry (10).

Despite the researchers' enthusiasm, this study encountered several problems when the implementation was extended to other dental clinics. The most challenging part was that the other clinics have inadequate up-to-date instruments (e.g., apex locator, X-ray facility, hand ProTaper) to start a proper RCT. Hence, to meet the standard of RCT procedure, the cost was increased by one-fold. Moreover, it was also a challenge to convince the senior staff to embrace the new protocol of RCT in the clinic. The interventions implemented in this study were considered worthy enough to be practiced by primary clinics in Perlis and nationwide due to the comparable facilities as the Kangar Dental Clinic. Continuous update of RCT course to the Deputy State Health Director (Dental) of Perlis's management office in terms of cost-effectiveness and clinical outcomes will encourage the management to continue supplies of instrument and basic needs, as required in the interventions listed in this study.

This study would never have achieved its goal without the full support of the Deputy State Health Director (Dental) of Perlis, Perlis Restorative Specialist Unit, and the commitment from everyone involved directly or indirectly in this project. Since this study ensured the involvement of all related parties throughout the process, group discussion sessions, and considered the collective views of the team members in designing the implementation process, it has successfully resulted in a sustainable and user-friendly procedure, leading to improved delivery and patient care.

Conclusion and the Next Steps

Flare-up is a well-established and widely-studied issue in dental practice. It is common and has been reported to occur between 1.4% to 20% in other centres (5,8). In Kangar Dental Clinic, the flare-up incidence was found to be alarmingly high at 70%, thus presenting the need for interventions to be carried out. With specific interventions, the incidence of flare-up was able to be improved to 6%, which was comparable to the international standard mentioned above.

The study had revealed the contributing factors leading to a flare-up of RCT in this facility. Thus, specific interventions were identified and implemented to overcome the contributing factors. The flare-up incidence was able to be maintained below the standard set with full commitment at all departmental levels to comply with intervention strategies, continuous efforts, and great teamwork. Compliance with standard RCT procedure shall be continuously monitored to ensure the long-term sustainability of the achieved outcomes. Furthermore, this study allows

participation, contribution, and suggestions as a proactive approach in addressing issues promptly to give better outcomes in achieving long-term goals of zero flare-up target in all dental clinics in Perlis. In view of the success of this initiative, a guideline of root canal treatment has been endorsed by the Perlis Public Health Dental Specialist and distributed to all primary care dental clinics in Perlis, hence, the authors of this study would like to bring this initiative to the national level for replication in the near future.

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Conflict Of Interest

The authors declare that there is no conflict of interest.

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Appendix 1

Sodium Hypochlorite Dilution Form

UNIT KEPP (KLINIK ENDODONTIK PERGIGIAN PRIMER) KP KANGAR

Bil :	Tarikh :

Nama Persediaan	Larutan Sodium Hypochorite (2.5%)
Kekuatan	2.5%
Kuantiti	1 liter

Bahan-bahan	Kuantiti	Tandatangan Penyukat	Tandatangan Penyemak
Sodium Hypochlorite (2.5%)	25ml		
Distilled water	1000ml		

PROSEDUR PERCAMPURAN	DISAHKAN OLEH
1. Sukat sodium hypochlorite	
2. Selaraskan isipadu akhir	
3. Masukkan ke dalam bekas dan label	

Disediakan oleh		Disemak oleh	
Kod Persediaan		Tarikh luput	
Contoh Label			

IMPROVING THE PERCENTAGE OF INPATIENTS RECEIVING ENTERAL NUTRITION PRODUCT (ENP) WITHIN 24 HOURS OF DIETITIANS' PRESCRIPTION IN SERDANG HOSPITAL

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Abstract

Enteral nutrition product (ENP) is a product that contains dietary ingredients to further add nutritional value to one's diet. Dietitians prescribe ENP to ensure patients with malnutrition receive sufficient nutrients to improve their clinical status during the hospital stay. Delay in nutrition support may pose patients to a higher risk of disease complications, and increase mortality rate and length of hospital stay. This study aimed to achieve 90% of patients receiving ENP within 24 hours of dietitians' prescription. Verification study showed only 59.3% achievement against the current standard. A quality improvement study was conducted using universal sampling in three selected wards with 140 subjects in two consecutive phases by using an audit form. Pre-remedial study showed that 40.7% (n=57) patients did not receive ENP within 24 hours of dietitians' prescription. Products are not served to patients (67%, n=38), ENP not indented (23%, n=13), products not collected from dietetic department (5%, n=3), indent not processed (4%, n=2), and wrongly indented by staff (2%, n=1) were identified as contributing factors in delayed nutritional support. The improvement strategies included the establishment of a dietetic chart, provision of a formatted dietetic board, updating standards of work procedures, and conducting continuous nursing education. Additional strategies included updating the formatted nursing report, empowering hospital attendants to prepare ENP, conducting bedside teaching for nurses and providing bedside tagging. The percentage of patients receiving ENP within 24 hours of dietitians' prescription had improved from 59.3% to 85.4% in Cycle 1 and increased to 95.0% in Cycle 2. The interventions successfully reduced the duration of patients receiving the ENP from the time ENP was prescribed, from an average of 34 hours to 20 hours. This study has been expanded to all wards in the Serdang Hospital and replicated in all Ministry of Health (MOH) Hospitals in Selangor.

KEYWORDS: Enteral nutrition product, Dietitian, Quality improvement study

Problem

Nutritional support has emerged as an important component in the management of critically ill patients. For such hospitalised patients, Enteral Nutrition Product (ENP) will be prescribed when needed by dietitians to malnourished patients, especially undernourished patients and patients who have feeding difficulties through oral intake. ENP is intended to provide dietary, antioxidants, vitamins, and minerals that optimise recovery from illness. Patients must receive early nutrition support within 24 to 48 hours of hospitalisation to ensure good nutritional status while maintaining the healthy gut function, as well as avoid bacterial translocation and reduce infection. Serdang Hospital is a government-funded multispecialty hospital under the Ministry of Health located in the district of Sepang, Selangor, near Putrajaya, the Malaysian federal government administrative centre. Serdang Hospital started its operation in 2006 and is equipped with the Total Hospital Information System (THIS). The hospital has 19 clinical departments, nine clinical support and three non-clinical support departments and units, with a total of 694 beds and bed occupancy rate (BOR) between 89% and 100% from 2015 to 2019 and reduced to 78% in 2020. It is a reference for clinics and hospitals in the vicinity, especially for the population Serdang, Kajang, Putrajaya, Dengkil, and Puchong. Serdang Hospital serves as a reference centre for cardiology in the central region of the country, as well as a reference centre for cardiothoracic and pulmonology for the whole of Malaysia. Dietetic service is one of the clinical support services with a current manpower strength of ten dietitians. On average, 300 inpatients are referred to the dietitians monthly, half of whom require nutrition support. Dietitians will prescribe ENP to ensure patients receive adequate nutrient intake. From 2006 onwards, dietitians found out that ENP delivery was delayed and there were incidences of ENP that were not delivered to patients until they were discharged.

A preliminary study conducted in February 2016 in selected wards showed that only 56.4% of the patients received ENP within 24 hours of dietitians' prescription. The problem happened largely in three wards; Medical Ward (Ward 7C), Surgical Ward (Ward 6C), and Orthopaedic Ward (Ward 7E). The study involved a multidisciplinary approach consisted of dietitians, operational assistants (PO) and ward staff, including medical officers, nurses, and hospital attendants (PPK). Dietitians and ward sisters were the core team members of this study.

The aim of this study was to improve the percentage of patients receiving ENP within 24 hours of dietitians' prescription to be more than 90% in one year.

Background

Nutrition support therapy should be initiated within 24 to 48 hours following hospitalisation in patients who are unable to maintain oral nutritional intake (1,2). There are several mechanisms, whereby early Enteral Nutrition (EN) support may improve the patient outcome. Early EN has demonstrated to improve nitrogen balance, wound healing, and host immune function, as well as augment cellular antioxidant systems, decreased hypermetabolic response to tissue injury and preserving intestinal mucosal (3,4). Clinical studies showed that early EN helps maintain gut integrity, support the role of commensal bacteria, reduce the gut/lung axis of inflammation, sustain the mass of gut-associated and mucosal-associated lymphoid tissue, and attenuate systemic inflammatory responses (5). As such, the team aimed to commence ENP within 24 hours of dietitians' prescription to ensure that nutrition support is delivered as early as possible.

Malnutrition among inpatients is a prevalent problem worldwide. An international multicentre observational study concluded that increased intakes of energy and protein appear to be associated with improved clinical outcomes in critically ill patients, particularly when the body mass index is between 25 and 35 kg/m^2 (6). The length of hospital stay was

found to be longer for those patients with a poorer nutritional status (7). Based on a study in Korea, 20%–50% of hospitalised patients are malnourished. (8). In Ramathibodi Hospital, Thailand, the prevalence of malnutrition amongst inpatients between January and September 2016 was 15.3% (9). Another study in acute hospital settings in Australia, the prevalence of malnutrition ranged between 20%–50% depends on population, definition, and criteria used (10).

Multiple researches have shown a significant relationship between mortality and the average total calorie received in hospitalised patient (6). A meta-analysis on the effectiveness of oral nutritional supplements among malnourished patients suggested that clinical complications associated with malnutrition can be decreased by as much as 70%, while mortality can be reduced by around 40% (5).

In Malaysia, a study conducted in Tanah Merah Hospital in 2016 (n=32) reported that 87.5% of patients received ENP within 48 hours of prescription, with ENP not indented by ward as the main contributing factor.

Effective management of malnutrition requires a more holistic collaboration among multiple clinical disciplines (11). However, in many hospitals, malnutrition continues to be managed in silos, with knowledge and responsibility provided predominantly by the dietitian. Once the patient is identified as malnourished, appropriate nutrition intervention must be promptly ordered and fully implemented. Lack of nutrition-focused nursing procedure instructions leads to delays in the start of feeding. Policy surrounding ward supplies ordering, storage, stock rotation, and management needs to be developed at the local level, including those that undertake the overall responsibility (12).

Training for hospital staff not only raises awareness on the issue, but also helps them to identify their role and how it can be modified to improve nutrition care. Patients and families need to be aware of the importance of food for their recovery and how they can advocate for their needs while in hospital, as well as post-hospitalisation. A multi-level approach that promotes being "food aware" for all involved will help hospitals to achieve patient-centred care with respect to nutrition (13).

Measurement

The main indicator of this study was the percentage of inpatient who received ENP within 24 hours of the dietitian's prescription which assessed the timeliness domain. This was calculated as the total number of patients received ENP within the stipulated time over total number of patients who had been prescribed for ENP by a dietitian. After considering a few factors which are beyond control, the standard was set in the clinical department meeting as equal or more than 90%.

This was a quality improvement study conducted in three selected wards: medical (7C), surgical (6C), and orthopaedic (7E), as these wards showed the highest percentage of ENP delivery beyond the targeted timeline of within 24 hours. All patients with ENP prescriptions were included in this study. Patients who refused ENP, either died or were discharged from the ward before 24 hours prescription, were kept nil by mouth after prescription and already had the ENP on their own were excluded. A total of 140 subjects were needed based on sample size calculation in each verification and post-remedial study phase.

A pre-developed audit form was used for data collection by dedicated dietitians who were part of the study team. Content validation was made through feedback from the Head of Dietetic Department, senior dietitian, and senior staff nurse in the hospital, as well as expert practitioners in research. The audit form was improved and pre-tested in other wards, such as the medical ward (7B) and multidisciplinary ward (6A). The audit form contains information on patient registration number, admitted ward, date and time of ENP prescription issued as well as date and time of patient received ENP. The dietitian will identify the reasons for patients not receiving the ENP within the targeted timeline of 24 hours, whether due to ENP not indented, indented

but not processed, ENP not collected from the dietetic department, ENP not served to patients and others. A time-and-motion study was also conducted to measure the time taken for each step in the process of care.

This preliminary study to verify the magnitude of the ENP delivery problem was conducted in February 2016, followed by four-month data collection phase (March to June 2016) to complete 140 subjects. Remedial measures had been developed and implemented for two months (July to August 2016), followed by four months (September to December 2016) of post-remedial data collection. The authors completed the first cycle of data analysis in January 2017.

The second cycle of the study was carried out from February to April 2017 with more remedial measures implemented. This was followed by four months of post-remedial data collection from May to August 2017. Findings from this study were presented and shared at the Malaysian Dietitians Association Conference, Selangor Research Day, and Selangor Innovation Day throughout the year 2017.

In January 2018, this study was then expanded to all wards in Serdang Hospital. Data collection had been conducted for three months (February to April 2018) with a total sample size of 140. Subsequently, sharing sessions and meetings for study replication in Selangor were conducted in May and June 2018. Next, the verification study at the state level was conducted in July 2018. The one-month period was allocated to obtain data for the pre-remedial phase before three months (from September to November 2018) of implementing the remedial measures in 12 hospitals in Selangor. Results from this study were presented and discussed in Quality Assurance (QA) meetings in January 2019 at the state level. A few rectification sessions were held at the state level before the results were shared at the National QA Convention in October 2019.

The verification study results showed that only 59.3% (n=83) of patients received ENP within 24 hours of dietitians' prescription, whereas the remaining 40.7% (n=47) patients did not receive ENP within the stipulated time, in which needed to be intervened.

Initial Assessment of the Problem

Dietitians performed a nutritional assessment of patients once referred by medical officers or any medical practitioners including Houseman Officer. Following nutrition assessment, dietitians prescribed ENP for eligible patients and continued the indenting process through the e-Hospital Information System (e-HIS). Staff nurses in wards were responsible for indenting ENP upon receipt of prescriptions from dietitians. The system transferred data to Dietary Management System (called as DTrax), which is linked to another system known as e-Dietary system in staggered time. Due to this limitation, ENP could not be processed immediately after indention. Dietitians prepared ENP twice a day; before 10 am and 3 pm every working day. ENP will be provided on daily basis, and extra ENP will be supplied over the weekend and public holiday needs.

The dietetic department provides an extra service counter for ENP and dry rations to wards, apart from filing and dispatching task ENP distribution purposes, which is tasked by an operational assistant, a multitasking staff. The counter operates from 10.00 am to 12.00 pm and 3.00 pm to 4.00 pm during working days. Ward staff, usually health attendants (PPK) collected ENP within the specified time frame. Each ward was given a copy of the receipt slip which listed the ENP supplied for verification purposes, signed by both ward and dietetic staff. Due to miscommunication, lack of awareness, and a short number of staff in certain days, there were cases where ENPs were not collected within the specified period.

The ENP was brought by hospital attendants to respective wards and was placed at a different location in each ward before being served to patients; either in the pantry, counter cabinet, counter table, bedside table, trolley, and etc. depending on the preference of the respective ward. Generally, ENP were served by staff nurses, but some were

assisted by trained caregivers depending on their availability during the feeding times. Family members were taught by the nurses on the process of serving ENP. Due to time constraints and irregular, heavy workload, occasionally, the ENPs were not served to patients. Figure 1 shows the workflow of pre- and post-remedial phases.

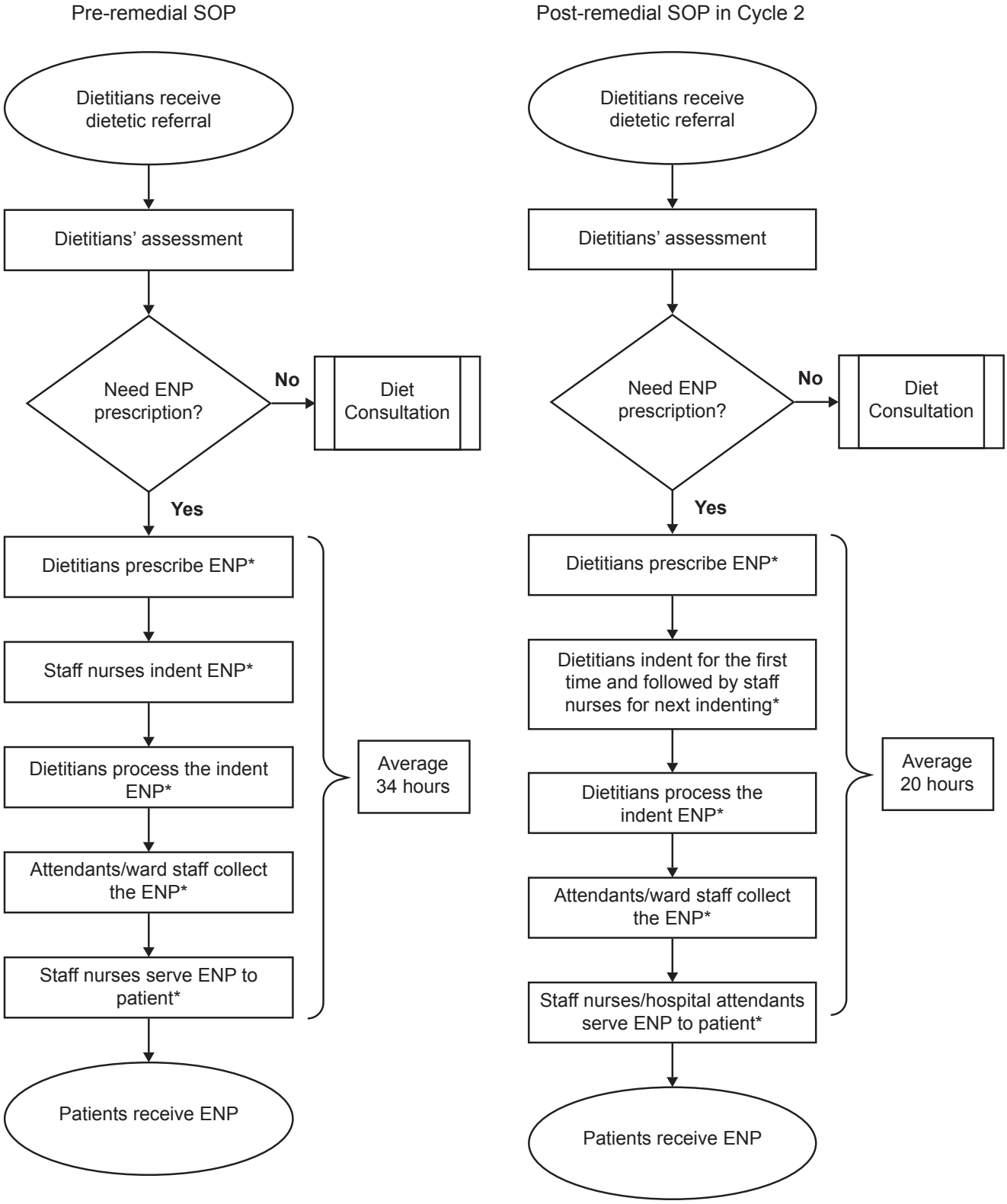

Figure 1: Process of care for ENP delivery in ward pre- and post-remedial measure in Cycle 2 (* indicates critical step)

Verification study conducted among the total sample (n=140) shown an average of 34 hours needed to complete the ENP delivery. Only 59.3% (n=83) of patients received ENP within 24 hours of dietitians' prescription. The identified contributing factors among those that had not achieved the standard (40.7%, n=57) were ENP not served to patients (67%, n=38), ENP not indented accordingly (23%, n=13), ENP not collected from dietetic department (5%, n=3), ENP indent not processed (4%, n=2), and wrongly indented by staff (2%, n=1). Two key contributing factors were focused on, which need to be resolved to overcome the problem (Figure 2), as illustrated in the Pareto chart.

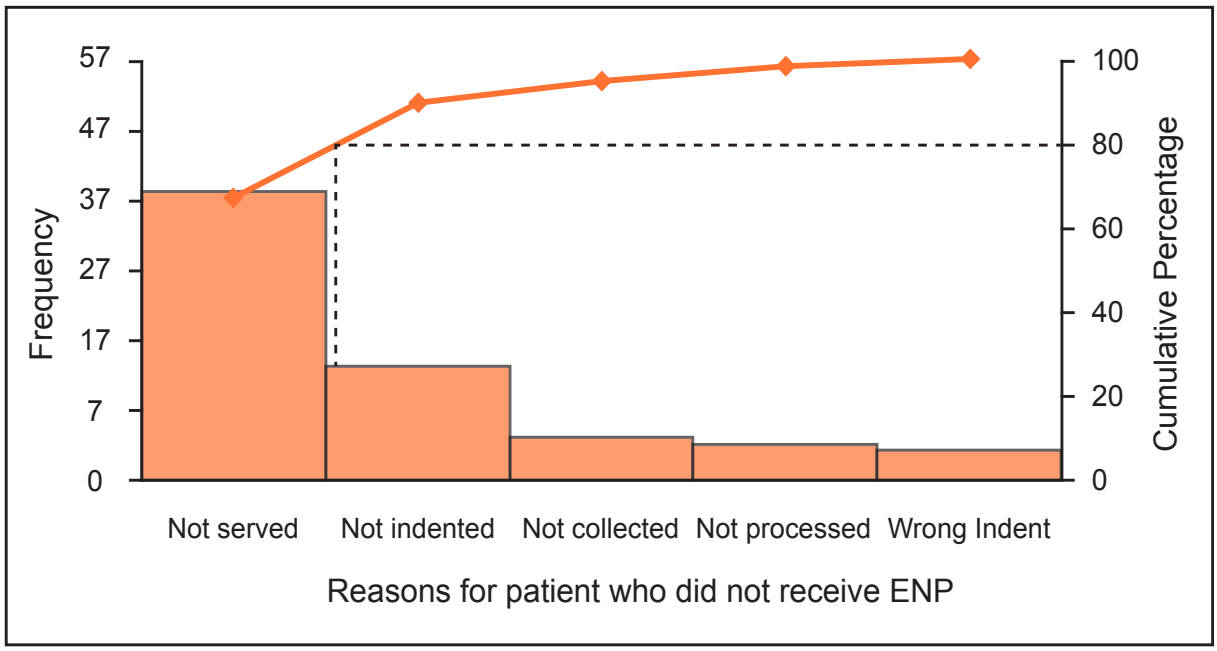

Figure 2: Reasons for patient not receiving ENP

Concurrently, a knowledge survey consisting of ten questions related to ENP management were conducted among the staff nurses who perform indenting and serving ENP. Their knowledge level was categorised under a good rating of 8 over 10 mean points. They were aware of the purpose of ENP prescription, able to differentiate the variety of ENP's categories, and can perform indenting and ordering process of ENP through THIS.

Strategy

The remedial actions were formulated based on the identified main contributing factors according to the Pareto chart. A few strategies had been developed involving a modified process of care in ENP administration at wards and the dietetic department level. The strategies were divided into two phases: four in Cycle 1 and another four in Cycle 2.

Firstly, a dietetic chart was introduced in the ward to ensure the product was served according to the feeding plan. The dietetic chart is a printed A4 paper with information of patient's details, feeding's regimen, date and time of prescription, and verification (stamp and signature) of the dietitian in charge. The individual dietetic chart should be available in the patient's file or bed head ticket (BHT) where nurses updated the date, time and signed their initial every time feeding had been provided for the patient. The same dietetic chart was also used to monitor the feeding progress of the patient.

Secondly, a diet board which is an A4 size paper clipped on the writing board was standardised and re-formatted. The diet board was placed at the nursing counter in each ward and used by ward staff as a reference for indenting diet or ENP through e-HIS. The previous diet board had the patient's name, bed number, and diet type only. After

modification, columns were added for ENP, order frequency and remarks for additional information, and instructions. Dietitians wrote their prescriptions for each referred patient in this diet board to avoid the ward staff from missing in ordering ENP.

Thirdly, the standard operating procedure (SOP) on ENP delivery was reviewed and updated. Previously, nurses indented the ENP in e-HIS following dietitians' prescription. In compliance with the new SOP, the dietitian who reviewed the case indented ENP for the first time to ensure a more efficient progress and appropriate ENP was indented right from the beginning. The new SOP was endorsed by the Hospital Director and subsequently distributed to all wards and clinical departments.

In addition, continuous nursing education (CNE) was conducted on ENP role and delivery to patients as a supplementary remedial measure. Each ward had its own CNE session conducted by the dietitian in charge. Half of the nursing staff in those three wards attended the CNEs. In view of good rating of knowledge among staff nurses, the aim of CNE is to create awareness of the study, and empower and enforce delivering of efficient ENP services.

More strategies were initiated in Cycle 2. The fifth strategy was to update the e-HIS nursing report format by adding the nutrition element from a free text report. The nursing unit practices ISBAR checklist as their pass-over report format to ensure that the complete information is communicated among nurses. ISBAR is a structured communication method consisting of Introduction/Identification, Situation, Background, Assessment, and Recommendation/Risk for each patient. Feeding prescription was made compulsory in nursing report format, thereby lowering the rate of missing in passing over report among the staff nurses.

In the sixth strategy, the job description of the health attendants (PPK) was reviewed. PPK's tasks on preparing and serving ENP to patients were reinforced by modifying the SOP to include this responsibility. This newly updated SOP was endorsed by the Hospital Director.

Only half of nursing staff were approached formally through three CNE sessions during Cycle 1. Therefore, in the seventh strategy, the knowledge of all nurses was re-enforced by providing bedside teaching. In this teaching session, the dietitian will explain to individual staff nurse the details about ENP delivery shortfalls and all remedial measures in the study, especially the dietetic chart and diet board usage which needed their involvement. Attendance was taken as proof of bedside teaching. Nurses in charge were approached directly after the dietitian's ward round. A total of 43 nurses were managed to be reached within two months.

Finally, dietitians prepared bedside tagging for all ENP patients, where it was placed on the patient's bed as a physical reminder. Bedside tagging is a laminating A4 size paper with a colourful picture that contains phrases reminding patients must be served with ENP accordingly. Patients and family members shall remind or request for ENP delivery from ward staff if they do not receive ENP at the scheduled time.

During brainstorming of remedial strategies, there was a suggestion for ENP to be kept in the ward as floor stock. However, this suggestion was turned down as there was limited space in the ward to keep ENP with irregular demand. Besides that, it burdens workload in the ward in terms of monitoring the ENP movement and misuse of ENP. Meanwhile, there had been an initial consideration of simplifying the indenting and ordering process in e-HIS but the changes are costly. Currently, the e-HIS is in the process of being upgraded to a newer version. Interim strategy in Cycle 3 adopted manual measures until a new version that can further enhance the patient's experience receiving ENP within 24 hours of dietitians' prescription.

Results

Results for post-remedial measure (n=144) in Cycle 1, showed increment to 85.4% (n=123). Higher improvement was observed in Cycle 2, where the outcome was 95.0% (n=133). The details of each study cycle by type of ENP administration and discipline were illustrated in the Table 1.

Table 1: Cycle 1 to Cycle 4 by type of ENP administration and discipline

QA Study cycle	ENP administration		Discipline								
	Ryles' tube	Oral nutrition supplement	Surgical	Medical	Ortho	Critical care	Pead	Nephro	O&G	Cardio	ORL/ Ophtal
Cycle 1 Total n=144	n=46 (31.9%)	n=98 (68.1%)	n=78 (54.2%)	n=55 (38.2%)	n=11 (7.6%)	-	-	-	-	-	-
Cycle 2 Total n=140	n=55 (39.3%)	n=85 (60.7%)	n=70 (50%)	n=58 (41%)	n=12 (9%)	-	-	-	-	-	-
Cycle 3 Total n=140	n=84 (60.0%)	n=56 (40.0%)	n=52 (37.1%)	n=37 (26.4%)	n=13 (9.3%)	n=12 (8.6%)	n=10 (7.1%)	n=2 (1.4%)	n=1 (0.7%)	n=1 (0.7%)	n=12 (8.6%)
Cycle 4 Total n=119	n=62 (52.1%)	n=57 (47.9%)	n=14 (11.8%)	n=36 (30.3%)	n=7 (5.9%)	n=4 (3.4%)	n=19 (16.0%)	n=27 (22.7%)	-	n=9 (7.6%)	n=3 (2.5%)

The time taken for delivering ENP was reduced from an average of 34 hours during the verification phase, to an average of 20 hours in the post-remedial phase of two months, with a reduction of 14 hours. This was mainly due to the new role of dietitians in initiating the ENP indenting instead of waiting for staff nurses to initiate the process.

Successful implementation of this study in those three wards has led to the expansion of the remedial measures to the whole hospital in Cycle 3. Meetings and discussions were arranged with the support and endorsement from the Hospital Director. Formal memo, briefing through hospital CNE session and training had been conducted to all 25 wards. Another data collection of total new 140 subjects in Cycle 3 showed that Serdang Hospital achieved an excellent result of 97.1% (n=136) of patients receiving the ENP within 24 hours of dietitians' prescription. The duration of ENP delivery to the patient was substantially reduced to an average of 12 hours. The time consumed in processing the indented ENP managed to be cut down. In order to overcome the limitation of the e-Dietary system, the dietitian processed ENP orders manually for cases that were referred during the period that was not captured by the e-HIS.

The ENP received among inpatients was continually monitored through yearly audits in Serdang Hospital. All dietitians will provide data collection in December every year. The results of the first audit in 2019 are demonstrated in Cycle 4, with an excellent achievement of 97.5% of patients who received ENP within 24 hours of dietitians' prescription. All results are shown in Model of Good Care in Table 2.

Improvement of the Achievable Benefit Not Achieved (ABNA) for Serdang Hospital could be seen in Figure 3. The ABNA was 30.7% in the verification phase (three wards) and reduced to 4.6% in post-remedial actions (three wards). ABNA has further reduced in Cycle 2 (three wards) and in Cycle 3 and Cycle 4, which involved all wards (25 wards) in the hospital. In these three cycles, the achievement had exceeded the target set.

Table 2: Model of Good Care (MOGC) achievements in Serdang Hospital from verification to Cycle 4.

Process	Criteria	Standard		Verification March–May 2016 3 wards		Cycle 1 Oct–Dec 2016 3 wards		Cycle 2 May–Aug 2017 3 wards		Cycle 3 Feb–Apr 2018 All wards		Cycle 4 Dec 2019 All wards	
		%	Average time	%	Average time	%	Average time	%	Average time	%	Average time	%	Average time
Dietitian prescribes the nutritional plan	• Dietitian must inform nurses either through verbal, notes or eHIS	100%	≤ 1 hour	100%	1 hour	100%	1 hour	100%	1 hour	100%	¾ hour	100%	½ hours
Dietitians/Staff nurses order/ indent diet/ ENP in eHIS	• Indent through eHIS or manual Ensure 2R:	100%	≤ 8 hours	90.7%	10 hours	99.3%	4 hours	100%	4 hours	100%	3 hours	100%	2 hours
	• Right patient	100%		100%		100%		100%		100%		100%	
	• Right ENP	100%		99.3%		100%		97.9%		100%		100%	
Dietitians process the ordered ENP	• Dietitians must process order through system or manual form.	100%	≤ 8 hours	98.6%	8 hours	99.3%	8 hours	100%	8 hours	100%	3 hours	100%	1 hour
	• Countercheck 2R and correct errors detected.	100%		100%		100%		100%		100%		100%	
Ward staff collect the ENP from Dietetic Department	• Ward staff should collect the ENP from JDS.	100%	≤ 4 hours	97.9%	7 hours	91.0%	5 hours	100%	5 hours	99.3%	4 hours	98.3%	4 hours
	• Reminder: Call/Whatsapps/ Telegram/SMS	100%		100%		100%		100%		100%		100%	
	• Receipt slip	100%		100%		100%		100%		100%		100%	
Staff nurses/ PPK serve the ENP as prescribed by dietitians	• Staff nurses/PPK serve the ENP to patients	90%	≤ 3 hours	72.9%	8 hours	95.8%	3 hours	97.1%	2 hours	97.9%	2 hours	99.2%	2 hours
	• Input-Output charting	100%		91.7%		100%		100%		100%		100%	
All entire process	• Patient receive the ENP	90%	≤ 24 hours	59.3%	34 hours	85.4%	21 hours	95.0%	20 hours	97.1%	12 ¾ hours	97.5%	9 ½ hours

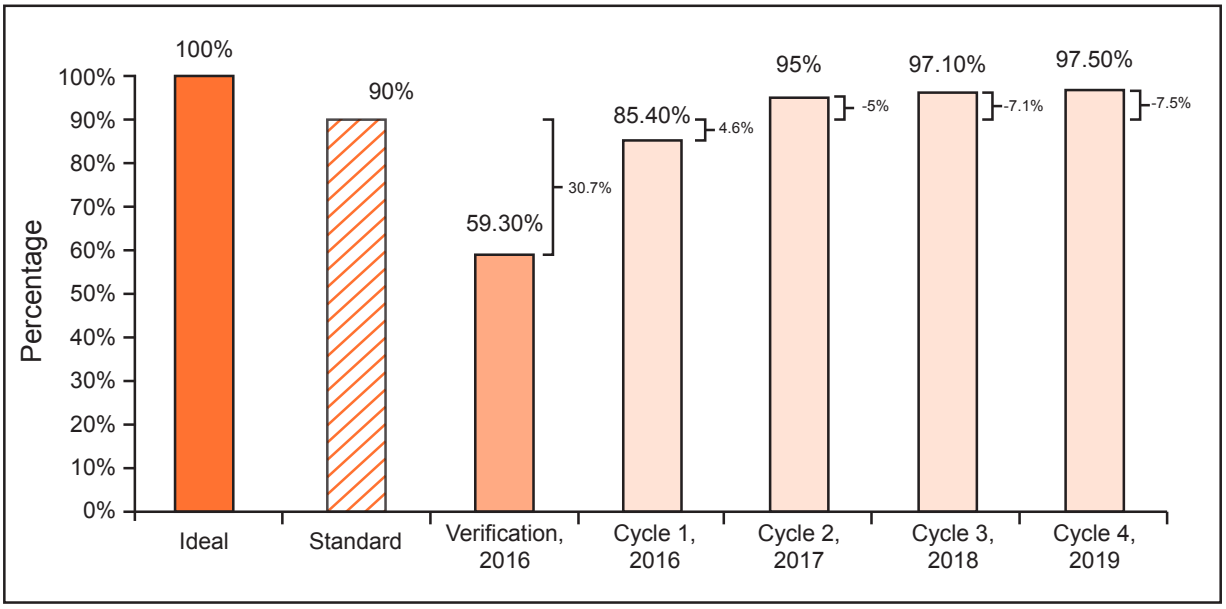

Figure 3: Percentage of patient received ENP within 24 hours of dietitian prescription from 2016–2019 in Serdang Hospital.

The study was presented at the state and national levels through conferences and carnivals. It had been replicated in all Selangor government hospitals with full support from the Selangor State Health Department (JKNS). The Quality Assurance (QA) secretariat in JKNS arranged and conducted series of meetings among dietitians in the state and collaborated with the nursing unit to run the study at each hospital in Selangor. Training, manual guidelines and circulars from the JKNS level were provided to all 12 hospitals in Selangor state and full cooperation and commitment were received from each hospital. At the state level, there were 133 subjects in pre-remedial data collection and 161 subjects in post-remedial data collection within one-month duration for each phase. Results showed an improvement from pre-intervention phase of 85.0% (n=113) to 91.9% (n=148) post-implementation of strategies at the state level, as shown in Appendix 1. The implemented strategies are now continued in all MOH hospitals in Selangor. The hospitals are allowed to choose and prioritise the remedial measures based on their shortfalls and the hospital settings.

Even though three hospitals (Sabak Bernam, Kuala Kubu Bharu, and Gombak) showed 100% achievement during the pre-remedial phase, the interventions were also introduced in these hospitals to test and prove that it can be practiced at multi-centre.

Shortfalls in other hospitals were contributed by ENP not indented (n=10, 50.0%), product not collected from dietetic department (n=5, 25.0%), ENP not served to patients (n=4, 20.0%), and indent not processed (n=1, 5.0%).

Sungai Buloh Hospital received more enteral nutrition support referrals from *Pusat Kawalan Kusta Negara* during post-remedial data collection. Distance factors affect the monitoring of ENP delivery. Kajang Hospital showed a decrease in patient receiving ENP within 24 hours of dietitians' prescription but remained above the current standard of 90%.

Lessons and Limitations

Teamwork is important in completing this study. Great commitment and cooperation among health care workers across multidisciplinary including top management in hospital and state level is absolutely needed

to make this study successful. Everyone acknowledges and plays their crucial roles in nurturing work culture in order to provide efficient services, thus improving the patient clinical outcomes.

Besides that, the awareness done has made an impact. During the implementation of the remedial measures, the Hawthorne effect might occur, which refers to the observer effect or people's tendency to work harder and perform better when they participate in an experiment (14). It describes a change of behaviour of an individual that results from their awareness of being observed. By understanding the importance and benefits of having this study, every health care worker involved and even patients or family members will ensure patients receive ENP accordingly and without missing any steps in the work process. Reminding and sharing tasks among dietitians, nurses, and hospital attendants in any step in the workflow had contributed to the successful outcomes of this study.

The authors managed to optimise the role of hospital attendants in addressing the shortage of human resources. As a result, dietitians, nurses, and hospital attendants have additional and privileged roles and responsibilities in the new work process. Through sharing the workload, the successful outcomes were able to be accomplished and sustained.

Quality is always about customer satisfaction. A simple satisfaction survey was conducted among patients and family members on ENP prescription and timing of delivery. Only family members were interviewed for the unconscious patient. The satisfaction survey showed that there was 100% of satisfaction among patients (n=46) and their caretakers (n=63) of receiving ENP within 24 hours of dietitians' prescription. An important lesson here is to ensure a patient-centred service in the healthcare system, which can be fostered through the development of trust between patients, family members and medical practitioners.

In this study, papers were printed for charting and tagging purposes. Even though paper usage was increased, it is still cost-effective compared with prolonged hospital stay costs and clinical management costs in patients with poor nutritional status.

In conducting this study, there were lots of limitations, weaknesses and also problems that occurred as this project was studied in different hospitals and wards with different process of care, working environment, culture and also personalities, of which they were looked at as an opportunity for learning and improvement. Experiences and practices were shared among hospitals in Selangor to overcome similar problems and therefore, contributing to the success of this study.

It is generally known that involvement in QA study is rather challenging among clinical practitioners. The team members greatly appreciate the protected time for clinical workers to run this quality study successfully.

Conclusion and the Next Steps

In conclusion, this study proved that percentage of patients receiving ENP within 24 hours of dietitians' prescription had improved successfully, not only at Serdang Hospital but also in Selangor state. In Serdang Hospital, the achievement of the indicator increased from 59.3% to 85.4% in Cycle 1, and to 95.0% in Cycle 2. Achievement improved to 97.1% in Cycle 3 and maintained at 97.5% in Cycle 4, where the study expanded to hospitals. Whereas the results for the replication study at the state level showed an increment from 85% to 91.9%. The contributing factors to the problem were identified, followed by formulating and implementing a few working strategies as remedial actions until the results showed the effectiveness of those measures.

Next, continuous monitoring of the work process will ensure that it is conducted efficiently through regular education, enforcement, and audits until it develops into a culture in hospitals. In addition, regular audits will be conducted at hospitals from time to time to ensure the sustainability of the practices and audit results will be presented in the departmental meeting to appreciate

staff who are committed to the tasks. A higher standard with a shorter time might be considered as a quality target in future study cycle.

In addition, there is a consideration to maintain a minimal ENP floor stock in wards as future remedial measures, even though different wards require different types of ENP. Hence, cooperation from all health care workers is needed to ensure ENP is kept in good condition and monitored closely to avoid misuse, wastage, and expiry. Further meetings and discussions will be conducted with nursing and ward staff for the purposes mentioned above.

Given the benefits of enteral nutrition support therapy, which had been proved, there is a plan to expand this study to the national level and share the remedial actions and experiences with hospital in other states for better achievement. Some ground levels preparations were initiated, where further discussions and promotions will be conducted. It is hoped that more studies will be undertaken on monitoring and evaluating nutrition support among patients in Malaysia.

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Conflict of Interest

None.

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Appendix 1

Pre- and Post-remedial Results among other Government Hospitals in Selangor

Hospital	Pre-remedial study, 1–31 July 2018		Post-remedial study, 1–31 December 2018	
	Numerator/ Denominator	Percentage (%)	Numerator/ Denominator	Percentage (%)
Klang Hospital	5/15	33.3	8/9	88.8
Sungai Buloh Hospital	25/27	92.6	36/44	81.8
Selayang Hospital	28/31	90.3	25/25	100
Shah Alam Hospital	15/17	88.2	20/20	100
Ampang Hospital	7/7	100	12/12	100
Kajang Hospital	18/19	94.7	28/30	93.3
Tanjung Karang Hospital	1/2	50.0	1/1	100
Banting Hospital	7/8	87.5	12/13	92.3
Sabak Bernam Hospital	4/4	100	3/3	100
Kuala Kubu Bharu Hospital	2/2	100	4/4	100
Gombak Hospital	1/1	100	0	-
TOTAL	**113/133**	**85.0**	**148/161**	**91.9**

IMPROVING THE APPROPRIATENESS OF INTRAVENOUS CEFTRIAXONE USE IN TUANKU AMPUAN NAJIHAH HOSPITAL

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Abstract

Appropriateness of antimicrobial therapy is defined as correct decision, correct choice, and correct use of antimicrobials. Overuse and inappropriate use of intravenous ceftriaxone, a third-generation cephalosporin, will increase the resistance towards it, hence the emergence of multidrug-resistant organisms. A verification study observed that the appropriateness of intravenous ceftriaxone usage in Tuanku Ampuan Najihah Hospital (HTAN) was 21.4% in the pre-intervention phase. This study aimed to improve the appropriate use of intravenous ceftriaxone in HTAN. A quality improvement study was conducted in medical, orthopaedic, and surgical wards from 2015 to 2018. All patients who were on intravenous ceftriaxone for pneumonia treatment were recruited during the antibiotic round, except for paediatric patients. Appropriate use of intravenous ceftriaxone was measured using the indicator of the percentage of appropriate intravenous ceftriaxone cases, with a standard of more than 50% based on consensus within the AMS team members. Contributing factors of low appropriateness were no indication of antibiotic (45.46%), no de-escalation or intravenous-to-oral switch (27.27%), and inappropriate choice or duration of antibiotic (27.27%). Three intervention cycles were conducted via Antimicrobial Stewardship Programme (AMS), with each cycle lasted for at least six months. Strategies implemented were the addition of intravenous ceftriaxone into the existing Antibiotic Request Form and fortnightly antibiotic rounds to assess the prescribing of intravenous ceftriaxone, renewal of Antibiotic Request Form to be more user friendly to aid the monitoring and feedback part, continuous teaching sessions, and dialogue with pharmacy staff and nurses to ensure strict adherence to new standard operating procedures. Appropriateness of intravenous ceftriaxone use was increased from 21.4% (verification study) to 54.55% (re-evaluation). The ABNA was reduced to –4.55 and ceftriaxone consumption was reduced from 90.67 DDD/1000 patient-days (January–June 2015) to 23.78 DDD/1000 patient-days (January–December 2018). Overall, multidisciplinary collaboration via AMS has successfully improved the appropriateness of intravenous ceftriaxone use in HTAN.

KEYWORDS: Ceftriaxone, Appropriate use, Quality improvement study

Problem

Inappropriate use of antibiotic is one of the factors leading to the development and spread of antibiotic resistance (1). Antibiotic resistance is a global threat to the human health because it can increase morbidity, mortality, and subsequently the economic burden (2). In Malaysia, the first National Antibiotic Guideline (NAG) published in 2008 recommended intravenous ceftriaxone as an example of third-generation cephalosporin to be used in moderate and severe community-acquired pneumonia (CAP) not requiring mechanical ventilation, and placed before the choice of other preferred antibiotics, which was the beta-lactam/beta-lactamase inhibitors, such as amoxicillin/clavulanate or ampicillin/sulbactam (3). However, starting from the second edition of NAG released in 2014, intravenous ceftriaxone was changed from the preferred choice to the alternative choice (4).

Ceftriaxone, a third-generation parenteral cephalosporin, is a commonly prescribed broad-spectrum antibiotic in the hospitals (4–10). Ceftriaxone was found to be easily overused and misused by the physicians (11,12). The extensive use of ceftriaxone empirically might be due to its beneficial properties of highly protein-bound and longer half-life, which allows for once-daily administration, and no renal and liver dose adjustment as a result of its elimination through the biliary tract, as compared with the narrower spectrum penicillin group of antibiotics, such as amoxicillin/clavulanate and ampicillin/sulbactam (13).

HTAN, a district hospital, is the second-largest government hospital in Negeri Sembilan. It consists of 314 beds to serve the Kuala Pilah population of approximately 83,000. It provides several inpatient and outpatient specialist services, which include Medical, Paediatric, Surgical, Orthopaedic, Anaesthetic, Obstetrics and Gynaecology, Ophthalmology, Psychiatry, Dental, Dermatology, Emergency and Trauma, and Ear, Nose, and Throat (ENT).

The annual surveillance of adult inpatient parenteral antibiotic usage is currently monitored in a total of 91 hospitals, including 44 Ministry of Health hospitals (14 state hospitals, 26 hospitals with major specialist and four hospitals with minor specialist), three Ministry of Education hospitals, three Ministry of Defence hospitals, and 41 private hospitals in Malaysia. An upper limit (without lower limit) will be calculated from the yearly antibiotic usage data submitted by all involved hospitals. A hospital will be labelled as an outlier if its antibiotic usage exceeds the upper limit of yearly national ceftriaxone usage.

According to the National Surveillance on Antibiotic Utilisation, Ministry of Health (14), the ceftriaxone usage in HTAN (in Defined Daily Dose per 1000 patient-days, DDD/1000PD) was initially noted to be 33.28 (2009) and 33.9 (2010). Subsequently, the figure increased to 54.72 (2011), 87.02 (2012), 92.38 (2013) and 93.29 (2014). The ceftriaxone usage is the highest among all Ministry of Health hospitals under national surveillance of antibiotic usage in Malaysia from 2012 to 2014, thus making HTAN as an outlier hospital. This triggered the alarm to inspect on this serious problem. A verification study conducted between January–June 2015 further confirmed this issue as ceftriaxone usage in HTAN was 90.67 DDD/1000PD and its appropriateness was only 21.4%. Therefore, this study aimed to improve the appropriateness of intravenous ceftriaxone usage to more than 50%.

Antimicrobial Stewardship (AMS) program aims to optimise prudent use of antimicrobials, and it can be led by either infectious disease (ID) physicians, clinical microbiologist experts or physicians with interest (15). As ID physician and clinical microbiologist were not available in HTAN, AMS team HTAN was led by a senior medical consultant with interest in ID. The team was established in December 2014, with AMS activities implemented in HTAN starting January 2015. After the introduction of AMS in 2015, the awareness of using antibiotic appropriately and judiciously had gradually improved.

Background

Inappropriateness of antimicrobial therapy is defined as incorrect decision (no antimicrobial is prescribed for the treatment or prophylaxis of infection, or antimicrobial is prescribed in the absence of infection), incorrect choice (divergence from guideline), and incorrect use (inappropriate dosage, timing, route of administration, and duration of therapy) (16). Numerous studies have been conducted in the past to reduce ceftriaxone consumption and to review the appropriateness of ceftriaxone use. The appropriateness of ceftriaxone use has been reported to be as low as 19.8% to as high as 93% in various studies (6,9,11,12,17,18).

Findings from an internal audit conducted in HTAN (January–June 2015) found that majority of the ceftriaxone cases in HTAN was prescribed for the treatment of pneumonia (58%), followed by leptospirosis (11%), and meningoencephalitis (7%), all of which were in line with other reported studies (9,11,12). Studies have shown that there was no difference in outcome between patients being treated with ceftriaxone or amoxicillin/clavulanate in CAP (19,20). Instead of ceftriaxone, antibiotics with narrower spectrum and similar effectiveness, such as β-lactam/β-lactamase inhibitor combinations, can be used to minimise the development of resistance towards ceftriaxone (17,21).

The common reported causes of inappropriate ceftriaxone use were inappropriate duration of therapy and incorrect decision (absence of infection or ceftriaxone is not indicated) (8,9,12,22). A study observed that 50.4% of the antibiotic prescriptions were found to be non-compliant with the hospital antibiotic policy, as antibiotics were prescribed based on doctors' experiences (7). Other factors contributing to inappropriate antibiotic prescribing were fear of missing an infection that would cause deterioration in patient's condition, diagnostic uncertainty, inadequate training, knowledge or awareness on updated guidelines, lack of time to review antibiotic choice, lack of outcome feedback, and lack of awareness on antimicrobial resistance (23-27). Studies also showed that increased ceftriaxone usage will lead to increased resistance towards ceftriaxone, and thus, an increased emergence of extended-spectrum beta-lactamase (ESBL) producing organisms (5,17,28). Reduced third-generation cephalosporins would reduce the acquisition of ESBL strains (29).

AMS strategies have been recommended to improve the justified use of antibiotics in the hospitals (30,31). Among the AMS interventions that have been evaluated to be effective in improving the appropriateness of antibiotic prescribing were persuasion through effective communication, such as recommendations by experts such as AMS leader or ID physician, audit and feedback to prescribers, and increasing compliance to guidelines or policy through educational events (32,33). One study had shown improvement in antibiotics appropriateness through the preparation of evidence-based guidelines, creation of new workflow, promotion, and education of staff on the guidelines and workflow (34).

In addition, few studies had successfully reduced ceftriaxone consumption through restriction of ceftriaxone prescription, for example restricting its prescription to be initiated by specialists only and ceftriaxone continuation after 72 hours must be approved by an ID physician, containment of antimicrobial policy in the induction program for all new doctors, continuous educational program for doctors on the use of narrower spectrum alternative antibiotic for empirical treatment of infection, and disallowing wards except the emergency department and intensive care unit to keep ceftriaxone (35,36). In general, periodic audit and monitoring on the prescribing pattern and rational use of antibiotics should be conducted to improve the appropriateness of prescribing practice (6,7).

Measurement

The general objective of this study was to improve the appropriateness of intravenous ceftriaxone use in HTAN. The appropriateness was measured using an indicator of the percentage of appropriate intravenous ceftriaxone injection cases using the following formula:

$$\text{Percentage of appropriate ceftriaxone injection cases} = \frac{\text{Number of appropriate uses of intravenous ceftriaxone cases}}{\text{Total intravenous ceftriaxone cases during antibiotic round}}$$

The appropriateness (choice, dose, frequency, duration, and indication) was determined by the AMS leader during the antibiotic round. Based on the literature search, there was no minimum percentage on the appropriate use of antibiotics set in any country. The appropriateness of ceftriaxone use has been reported to be as low as 19.8% to as high as 93% in various studies (6,9,11,12,17,18). Hence, the standard was set to be more than 50% based on consensus among the AMS team members.

This quality improvement study was conducted in medical, surgical and orthopaedic wards in HTAN, as these were the main users of intravenous ceftriaxone in the past few years. Study samples were recruited weekly or fortnightly during antibiotic rounds by the AMS team. Inclusion criterion was that all patients receiving intravenous ceftriaxone for the treatment of pneumonia, as it was mainly prescribed for pneumonia based on the result of internal audit (58%). Paediatric patients were excluded because the DDD methodology does not apply to them owing to the different doses based on age and body weight used in them (35). As all intravenous ceftriaxone cases encountered during the antibiotic rounds were recruited, a universal sampling method was applied.

Concurrently, intravenous ceftriaxone consumption was monitored to observe any reduction when the appropriateness increases. Ceftriaxone consumption was measured in DDD/1000PD based on the formula from National Surveillance on Antibiotic Utilisation (14), as shown below:

$$\text{No. of DDD per year} = \frac{\text{Total ceftriaxone injection usage (Grams) for adult inpatient in a year}}{\text{DDD (from World Health Organisation)}}$$

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

In order to calculate intravenous ceftriaxone consumption, intravenous ceftriaxone usage in vials was collected from the inpatient pharmacy and data of the number of patient-days for adult inpatients was obtained from the medical record unit. Intravenous ceftriaxone consumption was expressed in a 6-monthly DDD/1000PD data to allow for sufficient time to observe the effect of interventions. As HTAN is not a fully computerised hospital, it was not feasible to collect data for intravenous ceftriaxone usage for pneumonia only. Therefore, total intravenous ceftriaxone consumption instead of intravenous ceftriaxone consumption for pneumonia was used in this study.

In April 2015, a simple audit on 14 cases was conducted to identify the contributing factors of inappropriate use of intravenous ceftriaxone. It was conducted during the antibiotic rounds led by a medical consultant as the leader of the AMS team to determine the appropriateness of intravenous ceftriaxone prescribed in the ward and the reasons for inappropriate intravenous ceftriaxone cases. Simultaneously, a survey was also conducted, where a self-administered questionnaire (Appendix 1) was distributed to a total of 18 doctors from the medical department, 11 pharmacists from the inpatient pharmacy, and ten pharmacists from the ward pharmacy to further identify factors that contribute to prescribing of intravenous ceftriaxone in pneumonia. Such factors are their decision to select antibiotic for CAP, perceptions on superiority of intravenous

ceftriaxone in CAP, willingness to de-escalate intravenous ceftriaxone, and challenges faced by pharmacists in intervening intravenous ceftriaxone prescriptions.

Initial Assessment of the Problem

The initial process of a care of intravenous antibiotic prescribing and supply was reviewed, and critical steps were identified (Figure 1). It was observed that the inappropriate use of intravenous ceftriaxone could be controlled at the steps of prescribing by doctors in the ward and supply of antibiotics by the pharmacy. Inappropriate use of intravenous ceftriaxone could be reduced by advising doctors to use alternative antibiotics according to the NAG for treatment of CAP during the prescribing step and withholding the supply of intravenous ceftriaxone by the pharmacy in the event of inappropriateness.

From the simple audit conducted in April 2015, it was observed that among the inappropriate intravenous ceftriaxone cases (11 out of 14 cases, 78.6%) identified, there were five cases (45.46%) of no indication of antibiotic (e.g., fluid overload instead of

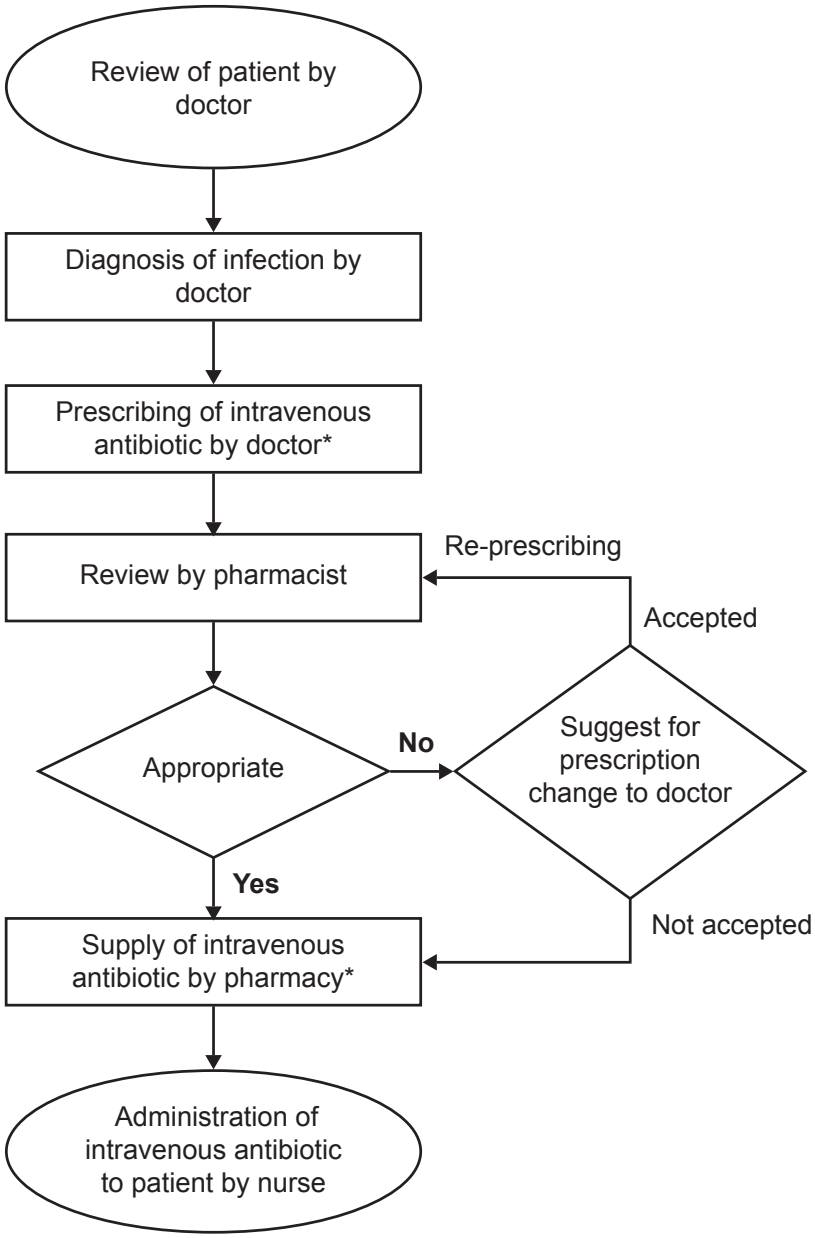

Figure 1: Initial process of care on prescribing, supplying, and administering intravenous antibiotic. (* indicates critical step)

pneumonia), three cases (27.27%) of no de-escalation (e.g., change of impression from covering for both leptospirosis and CAP to CAP only later on) or intravenous (IV)-to-oral switch as per guidelines and culture results (e.g., patients fulfilled the IV-to-oral switch criteria and could be discharged), and three cases (27.27%) of inappropriate choice (ceftriaxone is not the preferred choice for CAP) or duration of antibiotic (more than seven days in CAP treatment). Figure 2 illustrates the cause-effect analysis of the inappropriate use of intravenous ceftriaxone in HTAN.

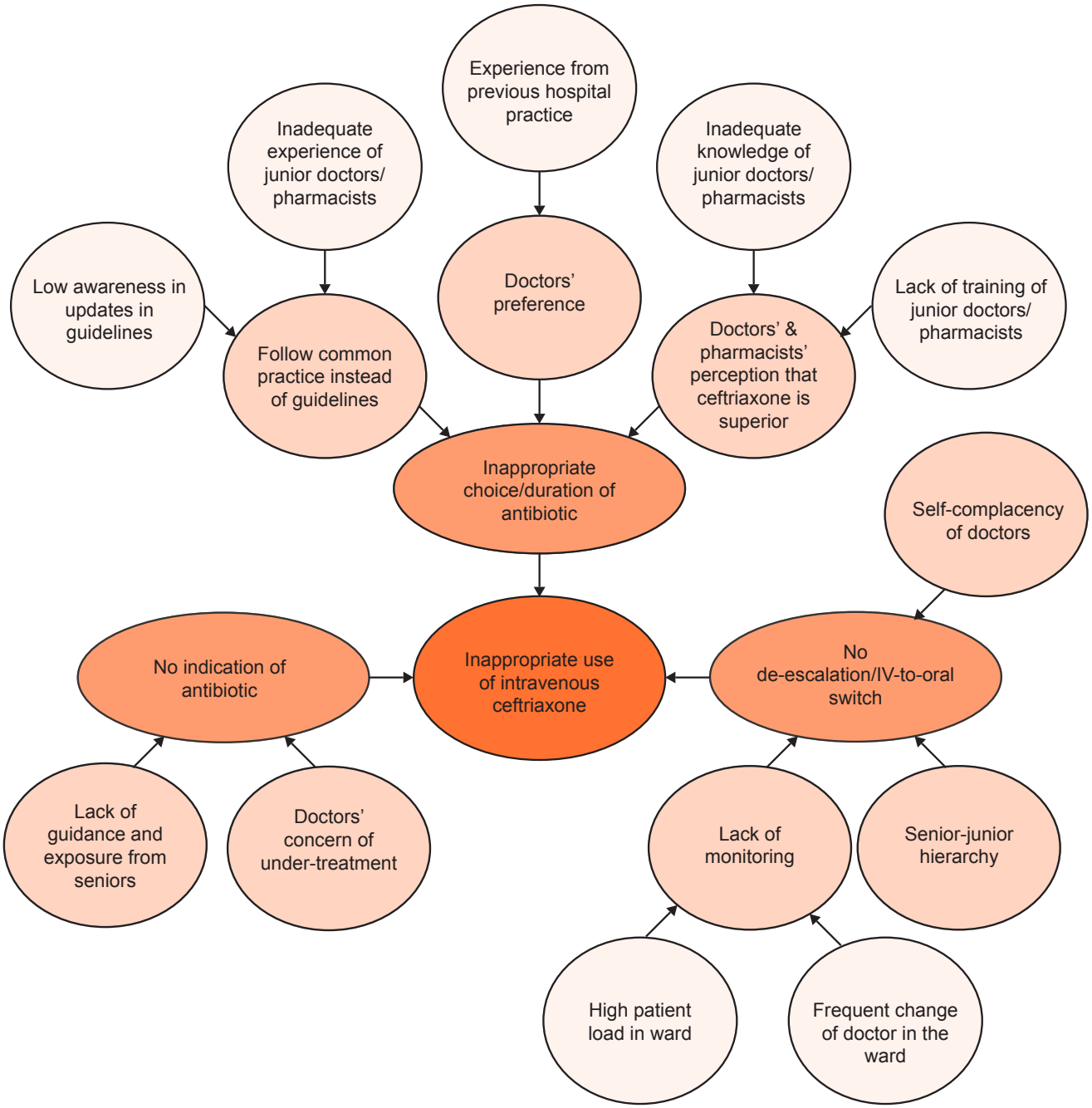

Figure 2: Cause-effect analysis chart of inappropriate use of intravenous ceftriaxone in HTAN.

The response rate for the survey conducted in April 2015 was 92.68%. The survey observed that 66.7% of the doctors would prescribe and 50% of the pharmacists would recommend antibiotic choice for CAP based on the common practice in the hospital rather than current guidelines even though they know that intravenous ceftriaxone is not superior than amoxicillin/clavulanate in treating CAP. The majority of the doctors would de-escalate intravenous ceftriaxone in clinically stable CAP patients (94.4%) and dare to de-escalate intravenous ceftriaxone started by their colleagues (61.1%). The majority of the pharmacists also answered that their suggestion to change intravenous ceftriaxone to alternative antibiotics was often accepted by doctors (70%). These highlighted that it was possible to change doctors' practice in prescribing intravenous ceftriaxone for CAP by implementing suitable strategies. Among the challenges mentioned by the pharmacists in intervening intravenous ceftriaxone prescriptions were lack of confidence in convincing doctors to de-escalate ceftriaxone and the preference of certain doctors to continue intravenous ceftriaxone despite the omission of cultural sensitivity (e.g., negative leptospirosis serology, penicillin-sensitive *Streptococcus spp*.), as doctors perceived no issue in continuing intravenous ceftriaxone or they were afraid that de-escalation would worsen patient's condition.

Strategy

Remedial measures were implemented in three 6-month cycles (Cycle 1: July–December 2015; Cycle 2: January–June 2016; Cycle 3: July–December 2016). Strategies in the previous cycles were continuously carried out in the following cycles throughout the study period. The success of remedial measures was evaluated between January–December 2017 and re-evaluated between January–December 2018 to ensure sustainability of interventions.

The Cycle 1 of intervention was conducted to tackle all the three contributing factors of antibiotic not indicated, inappropriate choice/duration of antibiotic and no de-escalation/IV-to-oral switch. Continuous teaching sessions for all specialists and medical officers, which focused on the medical discipline were conducted by the medical consultant, who was also the AMS team leader to inform and remind about the preferred antibiotic choice to treat CAP in the latest NAG, non-superiority of intravenous ceftriaxone in treating pneumonia and risk of increased resistance rate towards ceftriaxone. They were also advised to review patients from time-to-time to revise diagnosis and to de-escalate intravenous ceftriaxone to alternative or oral antibiotics. Similar continuous teaching sessions were also conducted by senior ward pharmacists to all wards and inpatient pharmacists.

A small increment in the appropriateness of intravenous ceftriaxone use was observed after Cycle 1 (from 21.4% between January–June 2015 to 33.33% between July–December 2015) and a small reduction in intravenous ceftriaxone consumption was also observed (from 93.29 between January–December 2014 to 79.44 between January–December 2015). Feedbacks received from the ward pharmacists and inpatient pharmacists where some doctors still prefer to prescribe intravenous ceftriaxone and were not keen to change their practice or not dare to de-escalate intravenous ceftriaxone started by colleagues or specialists. In addition, pharmacists were still facing challenges in intervening doctors for the intravenous ceftriaxone prescriptions, especially in the non-medical wards.

Hence, in Cycle 2 the intravenous ceftriaxone issue was listed as one of the focus of activities under the HTAN AMS team. First, the Antibiotic Request Form (Appendix 2) was required for all intravenous ceftriaxone prescriptions. Previously, this form was only applied to colistin, carbapenem, piperacillin/tazobactam and ceftazidime. This strategy was implemented to ensure that specialists play an important role in assessing and reviewing the need to prescribe or continue intravenous ceftriaxone, as the Antibiotic Request Form must be countersigned by the specialist said. The previous process of care was strengthened by adding a few important steps on Day 1 of antibiotic and 72 hours

after the initiation of antibiotic, as illustrated in Figure 3. Completion of Part A (for justification upon antibiotic initiation and countersign by a specialist) and Part B (to review patient after 72 hours of intravenous ceftriaxone initiation, trace pending cultures, writing reasons or justifications to continue, de-escalate or IV-to-oral-switch of ceftriaxone) in Antibiotic Request Form was emphasised. Intravenous ceftriaxone will not be supplied if the form is not countersigned by the specialist or incomplete after the time frame allowed (after 72 hours for Part B). These interventions also allowed the medical consultant to check the doctors' ceftriaxone prescribing practice from time-to-time through the Antibiotic Request Forms received in pharmacy and to remind the specialists during routine rounds to de-escalate or discontinue inappropriate use of intravenous ceftriaxone.

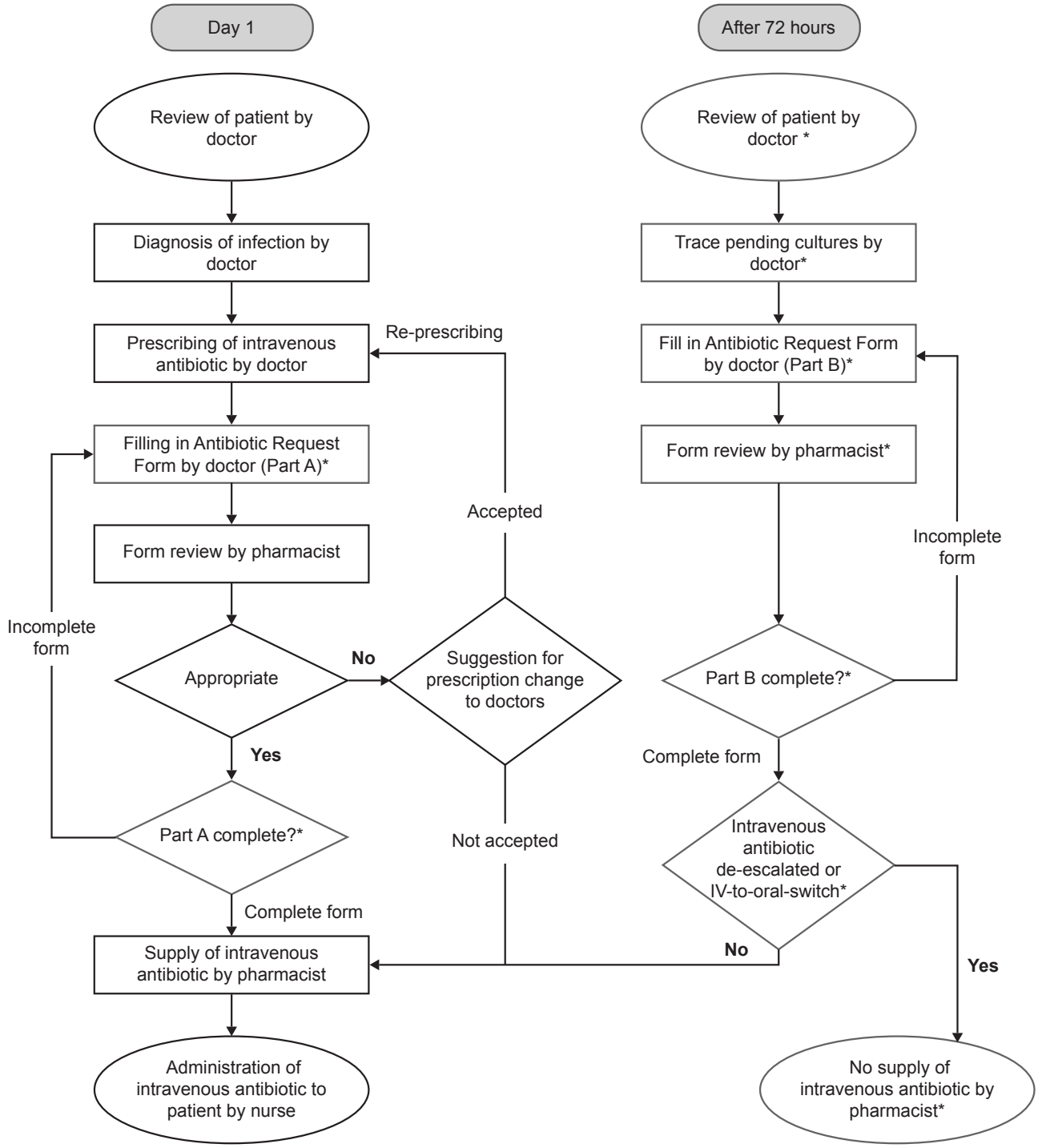

Figure 3: New process of care of prescribing, supplying and administering intravenous antibiotic. (* indicates critical step)

Secondly, all intravenous ceftriaxone cases in medical, orthopaedic and surgical wards were included into the fortnightly antibiotic round. Prior to this, only colistin, carbapenem, piperacillin/tazobactam and ceftazidime were included in the antibiotic round. The antibiotic rounds were led by a medical consultant who is the leader of the HTAN AMS team to assess the appropriateness of intravenous ceftriaxone, and to provide recommendations such as discontinue or de-escalate or IV-to-oral-switch of intravenous ceftriaxone.

Following the implementation of Cycle 2, intravenous ceftriaxone consumption was further reduced to 35.13 and the appropriateness was increased to 37.04% in January–June 2016. As it was understood that behavioural changes require time, the same strategies in both Cycle 1 and Cycle 2 were continued in Cycle 3. Further feedbacks regarding the Antibiotic Request Form were collected from multiple disciplines. One main issue was detected where some doctors, pharmacy staff and nurses were unaware of the requirement to complete Part B of the Antibiotic Request Form, or unsure of which part in the Part B to be filled in after 72 hours. This indicated that not all intravenous ceftriaxone prescribed was reviewed by doctors and pharmacy staff after 72 hours of initiation and it was still ongoing. Hence, Cycle 3 was implemented between July–December 2016, where strict adherence to the new process of care (filling in Antibiotic Request Forms) by doctors, nurses and pharmacy staff was enforced through continuous dialogues between the pharmacy and the nurses or doctors. In addition, the Antibiotic Request Form was revised and amended to be more user-friendly to all disciplines involved in order to ensure the form will be completed as required. In the revised form (Appendix 2), one column for empirical use and one column for definitive use of antibiotic were created to avoid confusion. After Cycle 3, the appropriateness of intravenous ceftriaxone was increased to 46.15%. As gradual behavioural changes were seen as time progress, implementation of existing strategies was improvised after Cycle 3 and carried out throughout the whole study period. Evaluation of intervention was done annually instead of 6-monthly in 2017 and 2018, as lesser intravenous ceftriaxone cases were encountered during antibiotic rounds due to reduced intravenous ceftriaxone consumption in the subsequent years.

Results

Following the implementation of remedial measures, the appropriateness of intravenous ceftriaxone use was observed to increase from 21.4% (three out of 14 cases in verification study) to 33.33% (two out of six cases), 37.04% (20 out of 54 cases), 46.15% (six out of thirteen cases), 50.00% (six out of twelves cases) and 54.55% (six out of eleven cases), with ABNA gap reduced to -4.55% (Figure 4). Intravenous ceftriaxone consumption was successfully reduced from 90.67 (verification study) to 23.78 (January–December 2018), as shown in Figure 5. HTAN is also no longer the high user of ceftriaxone since the year 2016 till 2019. To date, ceftriaxone consumption was maintained low throughout the years (10.91 in 2019 and 17.64 in 2020).

Lessons and Limitations

Strong teamwork between doctors, pharmacists, and nurses plays an essential role in ensuring the quality of antimicrobial management for patients of this study to reduce inappropriate antibiotic use. Multidisciplinary collaboration through AMS had successfully reduced ceftriaxone injection usage in HTAN. This is the strength of this study, where feedback from multiple disciplines was considered, especially during the implementation of the Antibiotic Request Form in Cycle 2 and Cycle 3. In addition, the Antibiotic Request Form together with the new process of care have been successfully introduced to cluster hospitals, Jempol Hospital and Tampin Hospital, since 2018 and 2019, respectively. The ceftriaxone consumption was reduced from 41.95 (2018) to 14.03 (2019) in Jempol Hospital and from 22.46 (2018) to 2.86 (2019) in Tampin

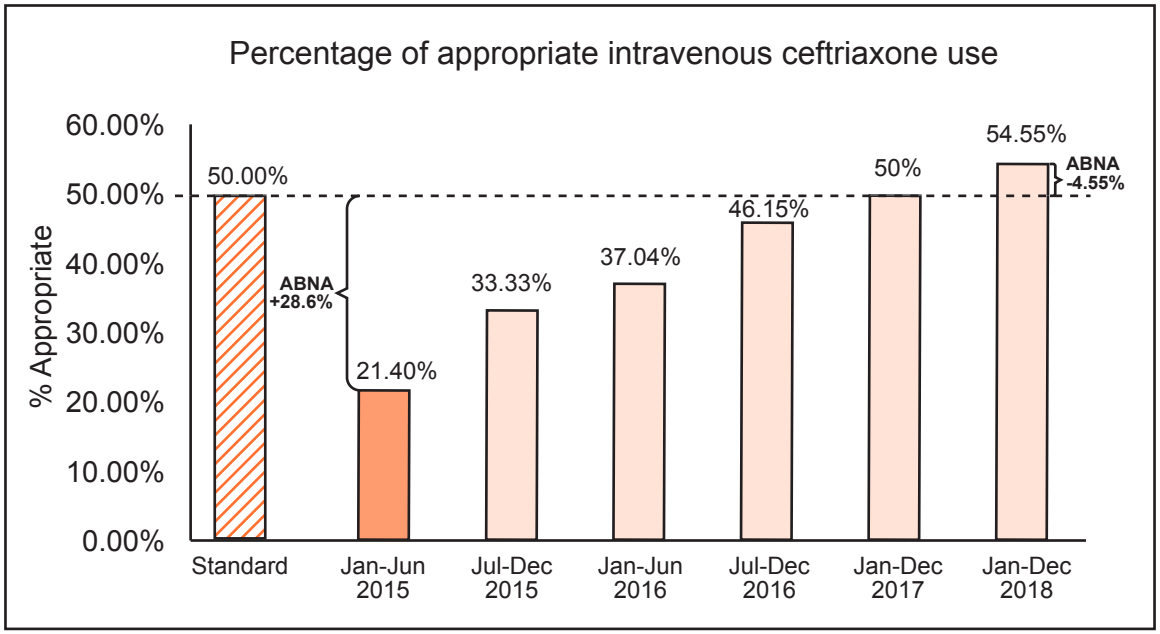

Figure 4: Trend of appropriate use of intravenous ceftriaxone in HTAN (ABNA analysis)

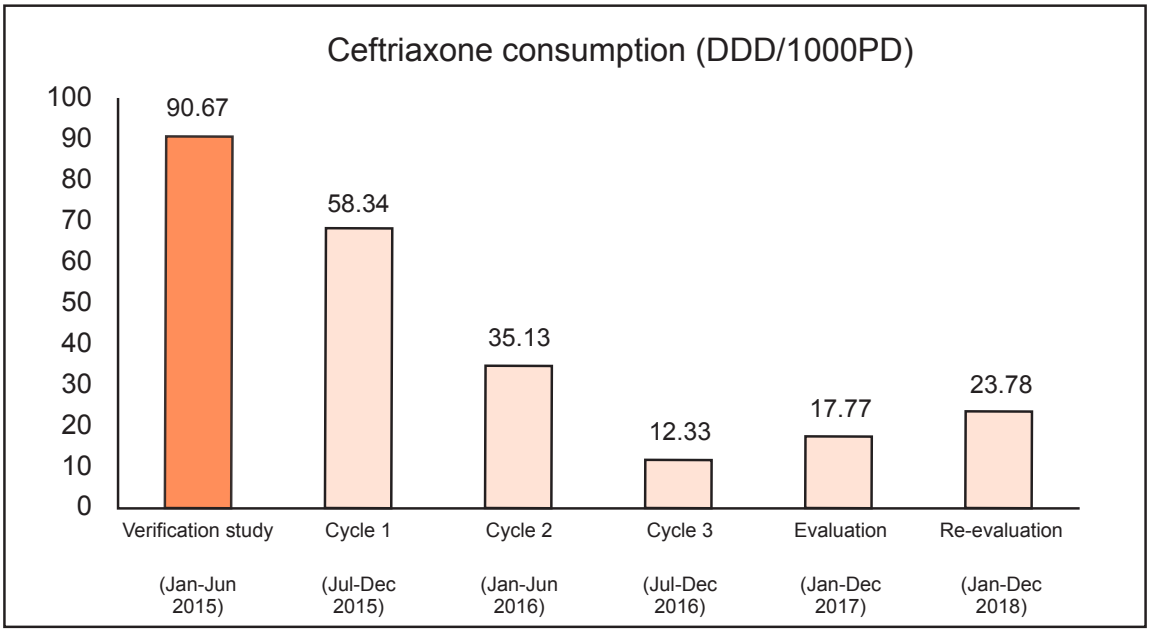

Figure 5: Trend of ceftriaxone consumption in HTAN

Hospital. These outcomes have further proven that the interventions to reduce intravenous ceftriaxone consumption are also effective in being adopted in hospitals without specialist. Appropriateness of ceftriaxone injection use could not be assessed in the cluster hospitals due to the unavailability of AMS rounds during the years mentioned.

There were few limitations in this study. First, the total intravenous ceftriaxone consumption instead of intravenous ceftriaxone consumption in pneumonia was used because of the difficulty to identify intravenous ceftriaxone consumption in pneumonia only in a non-computerised hospital such as HTAN. Secondly, the small up and down of the intravenous ceftriaxone usage during the evaluation phase and re-evaluation phases were likely due to the turnover of hospital staff, where doctors from other hospitals tend to prescribe ceftriaxone to patients with pneumonia. Although the influence on the results was minimal (as shown by ceftriaxone consumption observed to be sustainably low), but awareness should be created among the new staff regarding the use of ceftriaxone in CAP during the orientation before they start to work.

Conclusion and the Next Steps

Many studies had successfully improved the appropriateness of antibiotic use and reduce antibiotic consumption in order to slow down the development of antibiotic resistance. However, limited studies were available to describe in detail the efforts and processes to succeed. This study describes a feasible way to improve the appropriate ceftriaxone injection use and successfully and continuously reduce ceftriaxone injection consumption in hospitals without ID subspecialty through a multidisciplinary approach among essential role players (e.g., doctors, pharmacists, and nurses) in the process. In ensuring the sustainability of the outcome, the efforts of continuous teaching sessions, regular antibiotic rounds by the AMS team, continuous monitoring and enforcement of submission of Antibiotic Request Form are kept up-to-date. The strategies in this project have successfully been replicated to the other cluster hospitals to reduce ceftriaxone consumption. It is suggested that it is conducted in hospitals without ID subspecialty, preferably with a supportive AMS team.

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Conflict of Interest

None.

Funding

None.

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Appendix 1

Questionnaire on Factors Contributing to Intravenous Ceftriaxone Prescribing in Pneumonia

Survey questions for doctors

1. Is your decision of choosing antibiotics for CAP based on:
   (a) common practice at your hospital, or
   (b) based on current guideline?

2. Do you think that ceftriaxone (Rocephine) is superior than amoxicillin/clavulanate (Augmentin) in treating CAP? (Yes/No)

3. Will you de-escalate IV ceftriaxone for CAP if it is started by your colleagues? (Yes/No)

4. Will you de-escalate IV ceftriaxone in clinically stable CAP patients even though blood culture is not back yet? (Yes/No)

5. If yes (for Question 4), what antibiotics will you de-escalate to? (open-ended question)

Survey questions for pharmacists

1. Is your suggestion of antibiotics for CAP based on:
   (a) common practice at your hospital, or
   (b) based on current guideline?

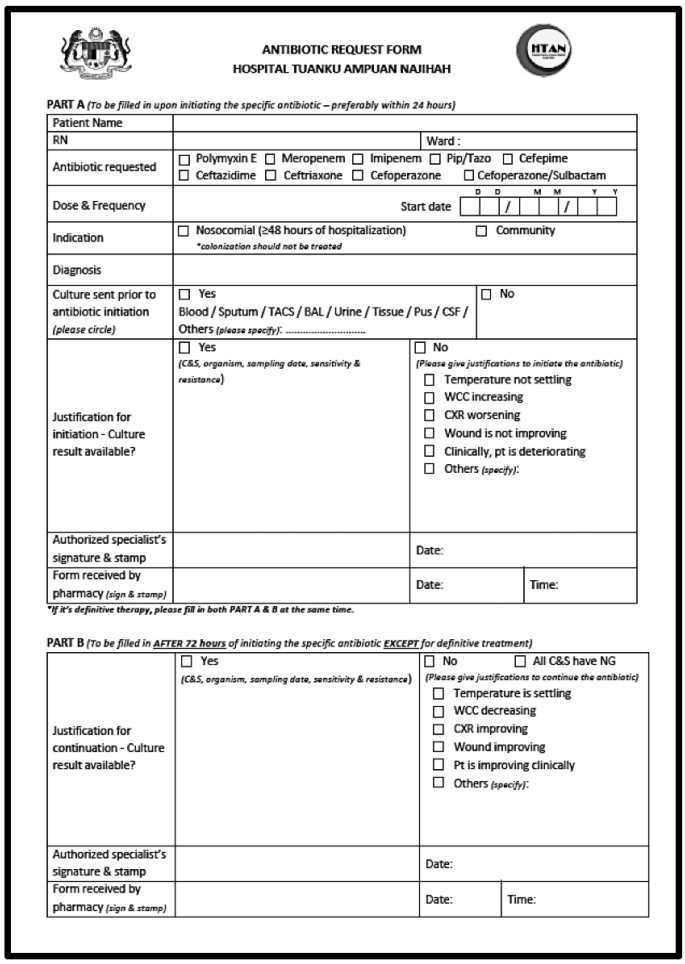
2. Do you think that ceftriaxone (Rocephine) is superior than amoxicillin/clavulanate (Augmentin) in treating CAP? (Yes/No)

3. If you suggest doctors to change ceftriaxone to other alternative antibiotics in patients with CAP, do they always accept your suggestion? (Yes/No)

4. If no (for Question 3), what are the challenges you always faced during intervening the doctors? (open-ended question)

Appendix 2

Revised Antibiotic Request Form



ANTIBIOTIC REQUEST FORM
HOSPITAL TUANKU AMPUAN NAJIHAH

PART A *(To be filled in upon initiating the specific antibiotic – preferably within 24 hours)*

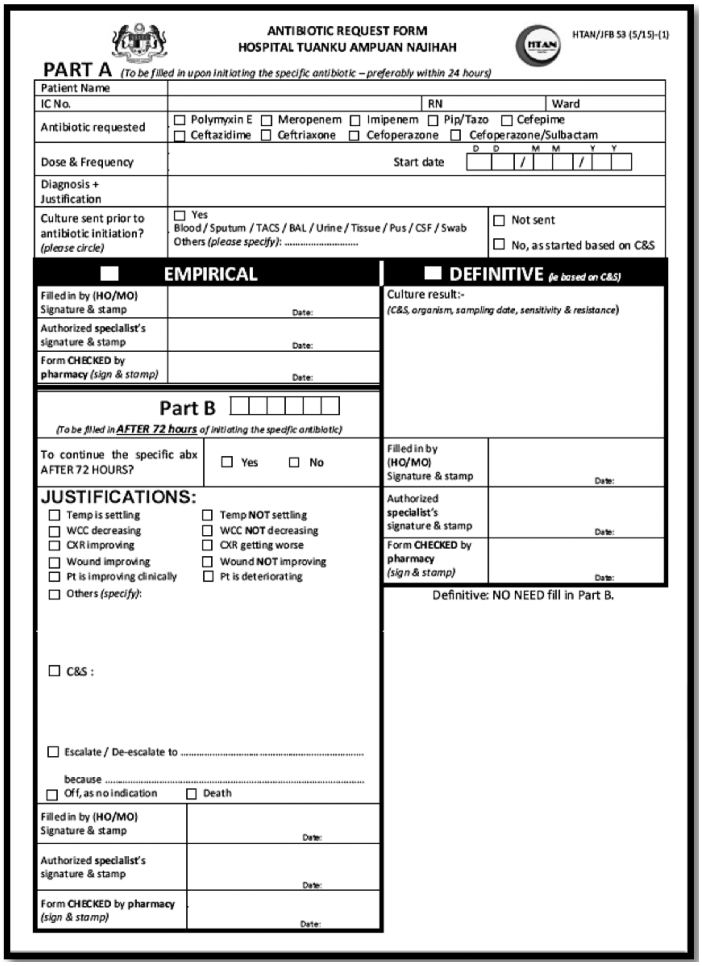
Patient Name			
RN		Ward :	
Antibiotic requested	☐ Polymyxin E ☐ Meropenem ☐ Imipenem ☐ Pip/Tazo ☐ Cefepime ☐ Ceftazidime ☐ Ceftriaxone ☐ Cefoperazone ☐ Cefoperazone/Sulbactam		
Dose & Frequency	Start date D D / M M / Y Y		
Indication	☐ Nosocomial (≥48 hours of hospitalization) **colonization should not be treated*	☐ Community	
Diagnosis			
Culture sent prior to antibiotic initiation *(please circle)*	☐ Yes Blood / Sputum / TACS / BAL / Urine / Tissue / Pus / CSF / Others *(please specify)*:	☐ No	
Justification for initiation - Culture result available?	☐ Yes *(C&S, organism, sampling date, sensitivity & resistance)*	☐ No *(Please give justifications to initiate the antibiotic)* ☐ Temperature not settling ☐ WCC increasing ☐ CXR worsening ☐ Wound is not improving ☐ Clinically, pt is deteriorating ☐ Others *(specify)*:	
Authorized specialist's signature & stamp		Date:	
Form received by pharmacy *(sign & stamp)*		Date:	Time:

**If it's definitive therapy, please fill in both PART A & B at the same time.*

PART B *(To be filled in AFTER 72 hours of initiating the specific antibiotic EXCEPT for definitive treatment)*

Justification for continuation - Culture result available?	☐ Yes *(C&S, organism, sampling date, sensitivity & resistance)*	☐ No ☐ All C&S have NG *(Please give justifications to continue the antibiotic)* ☐ Temperature is settling ☐ WCC decreasing ☐ CXR improving ☐ Wound improving ☐ Pt is improving clinically ☐ Others *(specify)*:	
Authorized specialist's signature & stamp		Date:	
Form received by pharmacy *(sign & stamp)*		Date:	Time:

Old version



ANTIBIOTIC REQUEST FORM
HOSPITAL TUANKU AMPUAN NAJIHAH
HTAN/JFB 53 (5/15)-(1)

PART A *(To be filled in upon initiating the specific antibiotic – preferably within 24 hours)*

Patient Name			
IC No.		RN	Ward
Antibiotic requested	☐ Polymyxin E ☐ Meropenem ☐ Imipenem ☐ Pip/Tazo ☐ Cefepime ☐ Ceftazidime ☐ Ceftriaxone ☐ Cefoperazone ☐ Cefoperazone/Sulbactam		
Dose & Frequency	Start date D D / M M / Y Y		
Diagnosis + Justification			
Culture sent prior to antibiotic initiation? *(please circle)*	☐ Yes Blood / Sputum / TACS / BAL / Urine / Tissue / Pus / CSF / Swab Others *(please specify)*:	☐ Not sent ☐ No, as started based on C&S	

■ EMPIRICAL		■ DEFINITIVE *(le based on C&S)*	
Filled in by (HO/MO) Signature & stamp	Date:	Culture result:- *(C&S, organism, sampling date, sensitivity & resistance)*	
Authorized specialist's signature & stamp	Date:		
Form CHECKED by pharmacy *(sign & stamp)*	Date:		

Part B ☐☐☐☐☐☐

(To be filled in AFTER 72 hours of initiating the specific antibiotic)

To continue the specific abx AFTER 72 HOURS?	☐ Yes ☐ No	Filled in by (HO/MO) Signature & stamp	Date:
		Authorized specialist's signature & stamp	Date:
		Form CHECKED by pharmacy *(sign & stamp)*	Date:

JUSTIFICATIONS:

☐ Temp is settling
☐ WCC decreasing
☐ CXR improving
☐ Wound improving
☐ Pt is improving clinically
☐ Others *(specify)*:

☐ Temp NOT settling
☐ WCC NOT decreasing
☐ CXR getting worse
☐ Wound NOT improving
☐ Pt is deteriorating

☐ C&S :

☐ Escalate / De-escalate to .....
because .....
☐ Off, as no indication ☐ Death

Filled in by (HO/MO) Signature & stamp	Date:
Authorized specialist's signature & stamp	Date:
Form CHECKED by pharmacy *(sign & stamp)*	Date:

Definitive: NO NEED fill in Part B.

Latest version

TOWARDS REDUCING ANTIMICROBIAL INJECTION PREPARATION ERRORS IN A PAEDIATRIC WARD, PENANG HOSPITAL

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Abstract

Antimicrobial injections are intended for the prevention and treatment of infections caused by microorganisms. Proper reconstitution and storage post reconstitution are crucial in maintaining the viability of multi-dose vials. Multi-dose vials are cost-effective and able to reduce medication wastage, especially in paediatrics dosage application that is according to their weight. However, incorrect reconstitution and multiple uses of single-use injections could potentially cause ineffective treatment, leading to antimicrobial resistance, thus making proper handling of these injections more essential. This study aimed to reduce antimicrobial injection preparation errors. A quality improvement project was carried out from September 2017 until May 2019 in a paediatric ward. Data on medication supply (by the pharmacy) and preparation processes (by ward) were collected. Questionnaires were distributed to assess the knowledge of persons involved in product stability. About 86.3% of all antimicrobial injection preparations contained at least one error. The contributing factors leading to the preparation errors were incomplete labelling (76.1%) as well as poor knowledge of injection stability among nurses (39.5%) and pharmacy staff (43.5%). Training and pocket guidelines were given as a reference for antimicrobial stability. Furthermore, flashcards were placed on the medication preparation trolleys to guide the reconstitution process. A reminder list on storage conditions was sticked on refrigerators in the ward. Mnemonic method and Antimicrobial Dilution Protocol (Paediatrics) were developed during the second cycle. From September 2017 to May 2019, antimicrobial injection preparation errors were successfully reduced from 86.3% (n=117) to 16.4% (n=122).

KEYWORDS: Antimicrobial injection, Preparation errors, Paediatrics

Problem

Penang Hospital (HPP) is the main public hospital in Penang, Malaysia. It also serves as a tertiary reference hospital for Northern Malaysia and consists of multidisciplinary wards, including eight paediatric wards with 156 beds. C1 is a paediatric medical ward with 40 beds, which is the highest number of beds (25.6%) among all paediatric wards, and the occupancy rate occasionally might increase up to 125%. Ward C1 has a total of 28 staff nurses who work in three shifts. There is also a clinical pharmacist in charge of the paediatric medical ward.

Paediatric dosage requirements are based on their body weight or size. Only a small dose of antimicrobial is needed for paediatric patients, therefore they tend to share the antimicrobial injection vial. The multiple-use vials are beneficial for cost management and cutting medication waste, especially for the paediatric patients. However, they are prone to preparation errors that can harm paediatric patients, as well as cause ineffective treatment and antimicrobial resistance (1).

A five-day verification study in August 2017 found out that a total of about 45% (27/60) of antimicrobial injection preparation errors occurred from all eight paediatric wards. The highest rate of preparation error of 58.1% (18/31) was detected in the paediatric medical ward (Ward C1). This showed an overwhelming amount of more than half of antimicrobial injections in Ward C1 were wrongly prepared and not complied with the recommended guidelines. These errors included multiple uses of single-use injections, inappropriate injection reconstitutions, inappropriate labelling of reconstituted injections, and inappropriate storage of reconstituted injections.

Following the verification study, a baseline (pre-remedial) study with a longer duration of one month was then carried out again in Ward C1 for a better investigation. The baseline study indicated an even higher error rate (86.3%) in the preparation of antimicrobial injection. Therefore, this project aimed to reduce the incidence of antimicrobial injection preparation errors in the paediatric medical ward (Ward C1) from 86.3 to 0% within two years.

Background

Paediatric is a vulnerable population with specific medical needs compared to adults (2). Most injections given to paediatrics are from vials with a pre-adjusted dose specifically for the adult population. Hence, paediatric medication preparation requires manual manipulation of the product to deliver the prescribed dose, which may vary from neonatal to adult dosing (3). This leads to the need for a specific weight-based drug-dose calculation and preparation such as mg/kg, mcg/kg, and mg/m^2 (per body surface area) for an individual patient (1, 2).

The process of reconstitution and storage would affect the stability of post-reconstituted medication. Drug stability refers to the extent to which a drug substance retains the same properties and characteristics that it possessed at its manufacturing time and throughout its period of storage and use (4). The types of stability are generally divided into chemical, physical, microbiological, therapeutic, and toxicological. Drug stability affects the safety and efficacy of the drug product, in which degradation impurities may cause a loss of effectiveness and generate possible adverse effects. Therefore, achieving drugs' chemical and physical stability is essential to ensure their quality and safety (4).

This error-prone process and the lower dosing error tolerance of paediatrics place them at a higher risk for life-threatening medication errors. A study had shown that paediatric patients possessed a higher mortality rate (10.4%) compared to adults (4-6%) when exposed to medication errors (5). Another study showed that the paediatric inpatients' preparation and the administration error rate was between 8.0 to 62.7%. However, a higher rate was seen in medication preparation errors involving intravenous drugs, which was as high as 48.4 to 97.7% (2).

In the Ministry of Health hospital setting, eight types of antimicrobial injections such as Ampicillin and Cloxacillin injections are single-use injections. Single-use injections should be administered immediately after reconstitution and the remaining should be discarded immediately. However, based on the results from the meeting with the Head of Paediatric Department, these single-use injections tend to be misused as multiple injections due to a lack of knowledge among the staff and their reluctance to prepare multiple reconstitutions. According to National Patient Safety Agency (NPSA) Signal by the United Kingdom National Health Service (NHS), there are risks of contamination if single-use injections are used multiple times (6). In addition, according to WHO guidelines, storing an open ampoule, vial, or syringe for reuse and improper storage of these preparations are most likely lead to contamination (7).

Centers for Disease Control and Prevention (CDC) revealed that at least 19 blood-borne or bacterial infection outbreaks had been reported since 2007, which were associated with the mishandling of single-use injections (8). These examples showed that the adverse impacts of mishandling a vial were underestimated as they were typically not seen immediately due to the difficulty of tracing the exploitation (8). Some providers compromised safe infection control practices to prevent waste. However, any cost savings achieved by preventing waste could be quickly offset by one or more adverse clinical outcomes. As a result, some patients died from these infections, and many others required prolonged, sometimes life-long treatment, and follow-up care (1).

Mcdowell et al. suggested that the reconstitution step contributed to the most errors among other processes in antimicrobial preparation (9). According to Armitage et al., four main variables affecting medication errors were knowledge, attitude, behavior, and training needs (10). Another study showed that task-related conditions such as inadequate or not following standard administration protocols might cause incorrect administration and preparation (11). Taxis and Barber reported a lack of knowledge on preparation and administration procedures contributed to the cause of medication errors (12). Latif et al. agreed with both studies by stating that the leading sources of errors that caused harm were deficits in knowledge and performance (57%) and procedures not being followed (26%) (13).

Interventions such as training junior nurses to assess the basic injection preparation skills, as well as having a specific satellite pharmacy, in which central preparation of drugs is done in the pharmacy to supply paediatric medications may reduce the error rates for preparing and administering intravenous drugs (14). De Giorgi et al. did a prospective risk analysis on the safety of paediatric patients in connection with the injectable medication process. They found that the involvement of clinical pharmacists during medication screening and counterchecking, as well as the introduction of ready-to-use syringes for selected drugs were the most cost-effective tools (15).

Based on questionnaire responses from Marco et al., hospital staff believed the above-mentioned remedial measures to be effective. The questionnaire results revealed that 90.8% of them believed that protocols and informative brochures helped in reducing errors while 90.2% believed that improving their knowledge on drug preparation and administration was vital. Furthermore, 87% believed that the awareness to prevent errors from occurring among the staff must be increased (16).

Measurement

The indicator used to measure this problem in Ward C1 HPP was the percentage of antimicrobial injection vials with preparation errors. It was calculated by dividing the total number of antimicrobial injection vials with preparation errors detected over the total number of antimicrobial injection vials prepared. Any vials observed with one or more errors were considered as one vial error. Our inclusion criteria were

all antimicrobial injections prepared and stored in Ward C1, excluding those done on the weekend and during public holidays, due to a lack of manpower to perform data collection. According to the Malaysian Patient Safety Goals Guideline, the target for actual medication errors is 0% and there is no specific target set for near misses for medication errors in the guideline (17). Errors in our study included both actual and near misses for medication errors; hence our proposed standard was to achieve 0% antimicrobial injection preparation errors. The indicator and standard were chosen based on the consensus among paediatric clinical pharmacists and the Head of Paediatric Department.

The antimicrobial injection preparation errors were defined as errors in selecting, calculating, mixing, labelling, and measuring all injection forms of antibacterial, antifungal, and antiviral (18). Labelling of reconstitution injection, in particular, requires complete reconstitution information written on the vials until administration to the patient is completed. Hence, in our study, preparation errors included errors in reconstitution, labelling, and storage (Table 1).

Table 1: Types of preparation error included in the study

Type of Error	Definition
Error in reconstitution	Wrong type or volume of reconstitution solution used according to leaflet
Error in labelling	One or more of the following was not labelled on multi-use vial: • Volume of reconstitution solution • Type of reconstitution solution • Date of reconstitution • Time of reconstitution
Error in storage	• Multiple uses/storage of reconstituted single-use vial. • Wrong storage temperature of reconstituted vial. • Storage of expired reconstituted vial.

This study was carried out from May 2017 to June 2019 in the paediatric medical ward (Ward C1). Around 20 types of paediatric antimicrobial injections were studied including acyclovir, cefepime, erythromycin, vancomycin, and many other injections.

Data were collected by the team members twice a day during working days from 11 am to 12 pm and 3 pm to 4 pm. During the first session, preparation processes of antimicrobial injections were observed directly by team members, and any reconstitution and labelling errors were recorded. During the second session, antimicrobial injection vials reconstituted earlier were inspected by the team members, and any labelling and storage errors were recorded. Every vial observed or inspected was marked with a specific number using a permanent marker to avoid sample repetition. Errors from both sessions were recorded in a specific data collection form (Appendix 1). Any vials with more than one error were counted as one overall error for the indicator calculation. The data collection form was also used to record the type of errors that occurred, whether it was a reconstitution error, labelling error, or storage error. Labelling errors were further classified into no reconstitution solution, no reconstitution volume, no date, and no time labelled. Storage errors were further classified into the wrong temperature, expired vials, and multiple uses of single-use vials.

Concurrently, knowledge on injection preparation and stability among nurses and pharmacists was assessed using a

questionnaire. The questionnaire contained ten questions that focused on the 20 most commonly used antimicrobials. It was created based on common mistakes and errors found among pharmacists and nurses, which intended to assess their knowledge on antimicrobial stability and antimicrobial reconstitution process, respectively. All nurses in Ward C1 and all pharmacists involved in handling paediatric medications were assessed. The same questionnaire was used before and after training to evaluate the effectiveness of the training given. The total of correct answers given in the questionnaire was calculated to grade the knowledge of the staff involved in the process. The passing mark was set at 80% as good knowledge was vital in handling paediatric medications to avoid fatal errors.

Initial Assessment of the Problem

According to the Standard Operating Procedure (SOP) of Penang Hospital in Figure 1, every prescription (Rx) from wards is sent to Inpatient Pharmacy to be screened. Subsequently, medication is supplied to the wards accordingly. Then, the staff nurses reconstitute the injections before administering to the patients.

A total of 117 vials of antimicrobial injection were included in this study. Data was collected throughout September 2017. Out of the total, only 58 vials were observed directly during the reconstitution process, as some reconstitution processes were done by nurses outside our observation time frame of 11 am to 12 pm. The other 59 vials were inspected during the afternoon visit to the ward.

There might be more than one error in each vial of antimicrobial injection preparation. In our study, vials with more than one error were counted as one overall error. Out of these 117 vials, 101 vials (86.3%) have at least one type of preparation error. Among the 101 vials that contained at least one error, labelling error was the type of antimicrobial injection preparation error with the highest percentage (76.7%), followed by storage error (19.8%), and reconstitution error (3.5%) (Figure 2). Among all types of labeling error, the highest labelling error found was no reconstitution solution labelled on the reconstituted vials, with a percentage of 98.8%.

Under the storage error, all vials with storage errors were found to be stored under the wrong temperature. Storage under the wrong temperature meant either the staff stored fridge items at room temperature or vice versa. We also noted that 60.1% of vials with storage errors were either stored over their stability period or used multiple times when they should only be used once and discarded immediately.

Based on the results of the questionnaires in the pre-remedial data collection, the knowledge of the antimicrobial injection stability among nurses in Ward C1 and pharmacists in Paediatric Pharmacy was only 39.5% (n=22) and 43.5% (n=17), respectively. The passing mark for the questionnaire was set to 80%. Thus, the results indicated that most nurses and pharmacists have poor knowledge of the antimicrobial injections stability.

Out of all antimicrobial injections supplied by Paediatric Pharmacy to the ward, 95.8% were supplied in sufficient quantity as two senior pharmacists usually performed counter-checking before the supply process. Oversupply or undersupply still happened in 4.2% of supplies due to inadequate knowledge of the pharmacists on antimicrobial injection stability. Undersupply of vials might affect the injection preparation process and thus contribute to the preparation error. It might cause a single-use injection to be used multiple times due to a shortage of supply.

Strategy

PDSA cycle 1: Our initial intervention was carried out from December 2017 until April 2018. We produced a quick reference pocket guide with the 10 most commonly used antimicrobial injections in the paediatric medical ward, which included information on reconstitution solution, injection stability post reconstitution, and a list of single-use injections. Due to space constraints in the

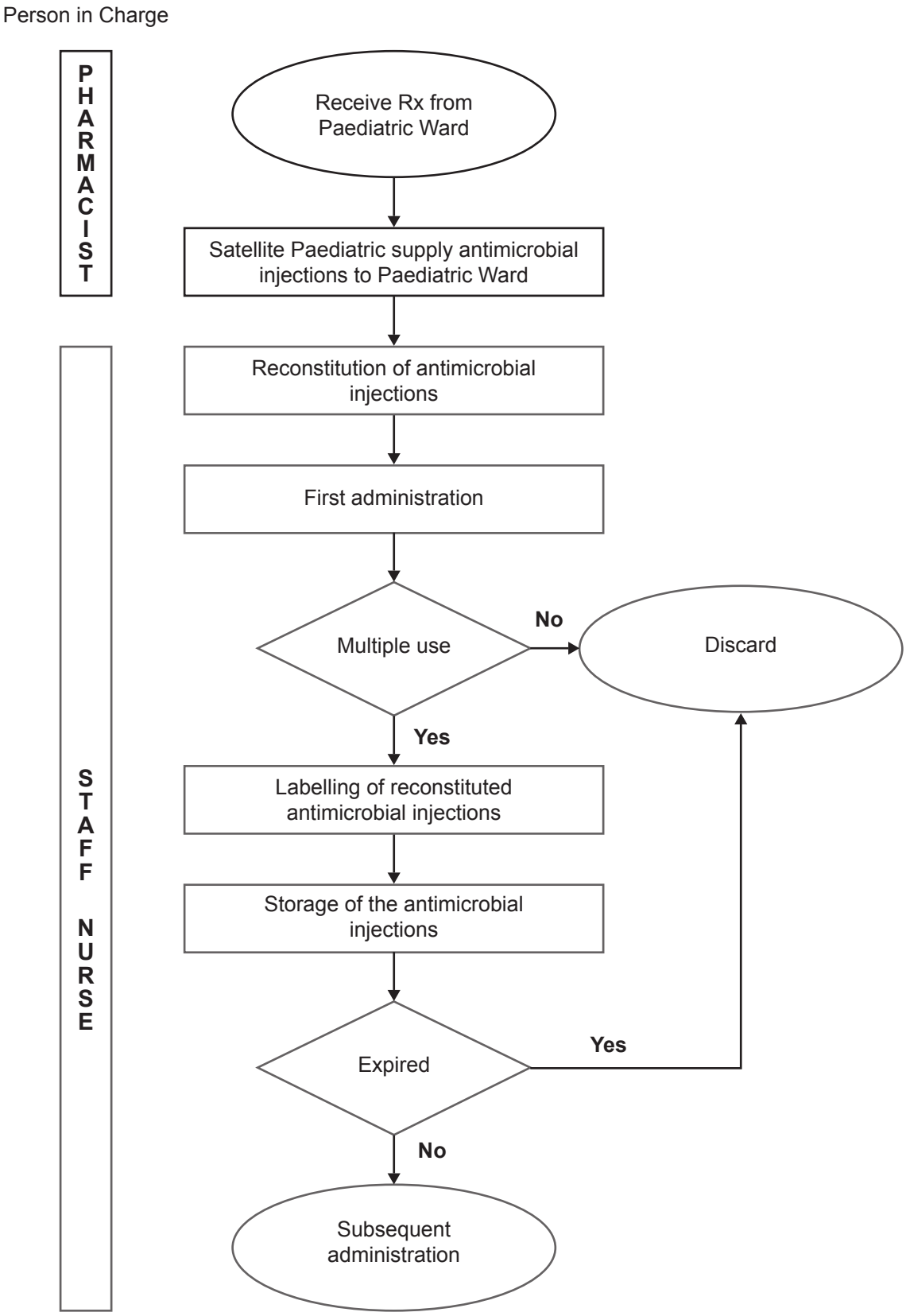

Figure 1: Standard Operating Procedure of supplying and preparation of injection medications for pediatric patients.

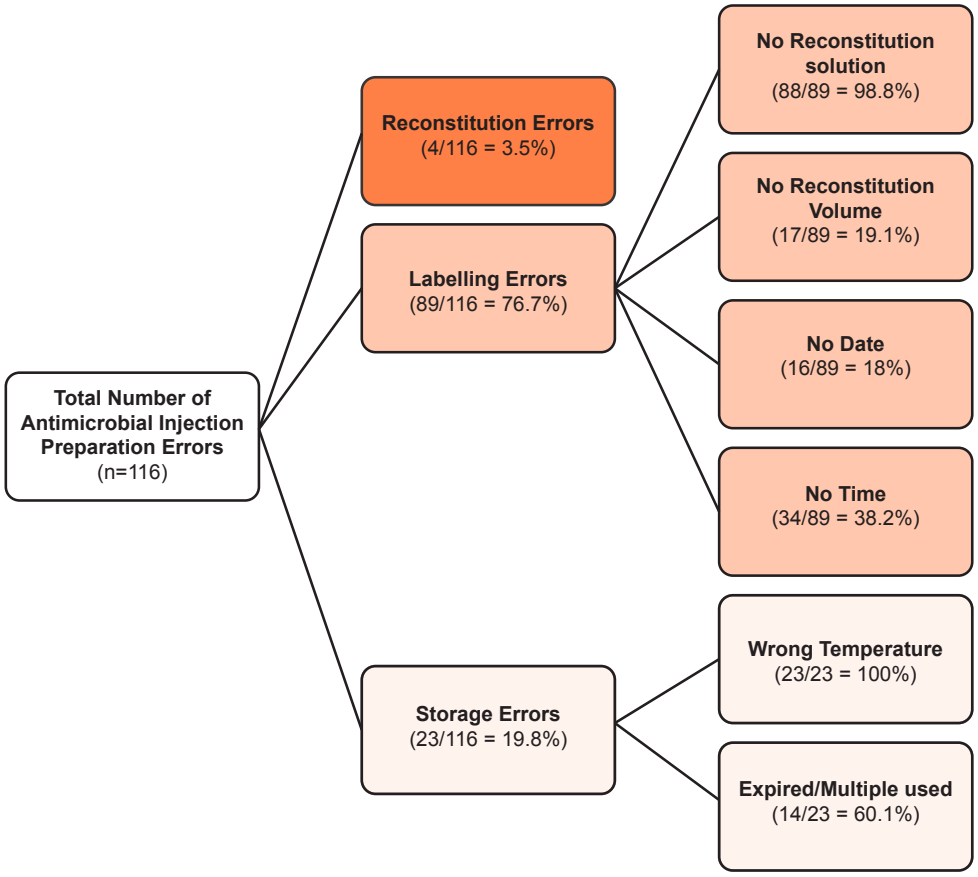

Figure 2: Number of preparation errors detected according to the types of error

pocket guide, flashcards of the antimicrobial injections commonly used in Ward C1 were then created and placed on individual product bins in the pharmacy and medication preparation trolleys in the ward for easy accessibility when supplying and preparing the medication.

In addition, training on injection stability was carried out for staff nurses to emphasise labelling adherence and improve their knowledge on antimicrobial injection reconstitution and stability. All attendees were given a small pocket guide. Some negative feedbacks was received regarding the pocket guide and flashcards, in which they did not include all antimicrobial injections and it was difficult for the staff nurses to memorise all the single-use antimicrobial injections.

A list of "NO ENTRY ITEMS" with images was placed on the fridge in Ward C1 to provide a reminder for nurses before storing the single-use injections or non-fridge injections into the refrigerator. Another training was also given to the pharmacists to increase their awareness on injection stability, which would directly affect the quantity of injections supplied by the pharmacy, especially a sufficient amount of single-use injections. Also, this training would equip pharmacists when they receive drug stability calls from nurses.

PDSA cycle 2: Our second intervention was implemented from December 2018 until April 2019. Antimicrobial Dilution Protocol (Paediatrics) 2019 was formulated to cover all the antimicrobial injections, including all the antimicrobial injections available in HPP, their stability data provided by the drug companies, and the dilution protocols permitted for paediatric used based on several references. In addition, a mnemonic method was introduced to empower the nurses' memory with the list of single-use antimicrobial injections. For example, ReLa4K stands for Reconstitution, Label 4 items and Keep, and MAU FACE stands for metronidazole,

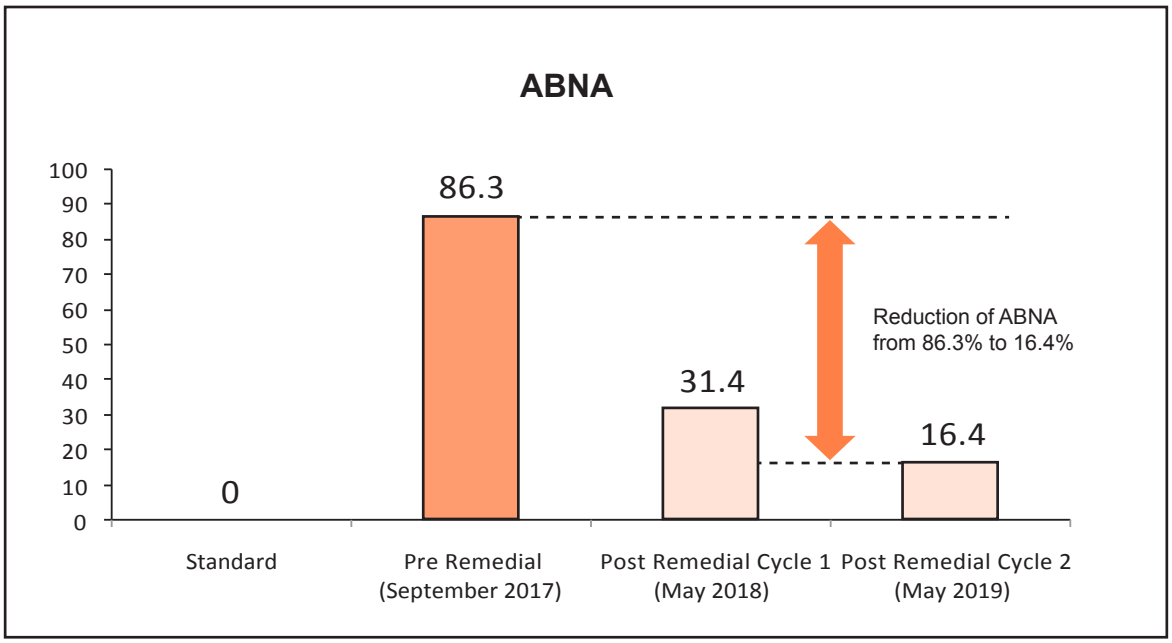

Figure 3: ABNA comparison pre-remedial and post remedial

Augmentin, Unasyn, fluconazole, ampicillin, cloxacillin, erythromycin, which are all single-use injections. After implementing our remedial measures for two cycles, a satisfaction survey on pocket guides, flashcards, and training was conducted among the nurses.

Results

Our main outcome measure on antimicrobial injection vials with preparation error was successfully reduced from 86.3% (September 2017) to 31.4% (first cycle, May 2018) and 16.4% (second cycle, May 2019). The achievable benefit not achieved (ABNA) result is shown in Figure 3.

Besides, the pharmacists' knowledge on the stability of antimicrobial injection improved from 43.5 to 92.9% and 89.3% in the first and second cycles, respectively. The slight drop in knowledge percentage in the second cycle might be due to a high staff turnover rate, which could be improved with continuous training. An improvement in the nurses' knowledge was observed from an average score of 39.5 to 81.4% in the first cycle and 90.9% in the second cycle.

The number of preparation errors detected during the post-remedial showed a reduction in reconstitution errors from 6.9% in the first cycle to 0% in the second cycle. All labelling errors were also reduced from 76.1 to 17.7% (first cycle) and 16.4% (second cycle). However, expired or multiple uses of single-use injections increased from 12% to 14.5% in the first cycle. This might be due to the unawareness of some nurses on the single-use injections. After the mnemonic method was introduced, the second cycle showed multiple uses of single-use injection errors reduced to 1.6% and overall storage errors were reduced from 19.7 to 16.9% (first cycle) to 4.1% (second cycle). Moreover, the average satisfaction score among nurses towards remedial measures implemented was found to be good with 76%.

Lessons and Limitations

The key learning point of this study was to get readily available and accessible information, which could be the success factor in reducing the antimicrobial injection preparation error at a marginal cost of innovation apart from the continuous training.

During the pre-remedial data collection period, 98.8% of labelling errors were due to the reconstitution solution type not being labelled. Without the label, it was hard to check if a correct reconstitution solution was used for each antimicrobial injection. There is a possibility that this might cause the

reconstitution errors to be underestimated.

We acknowledged the limitations of this study. We did not manage to capture all antibiotic reconstitutions conducted in the ward due to the inconsistent drug preparation schedule. The two observers were not available in the wards at all times and could not observe two preparations simultaneously. Therefore, some preparations were missed. The wards were also observed during periods when most medications were prepared and the highest workload for the nurses, which could increase the error rate (14).

One disadvantage of the observation technique was the influence of observer presence on the nurses' behavior (Hawthorne effect) (14). The error rate could increase as an observer's presence would likely cause extra pressure and anxiety among the nurses. The error rate might also decrease in the observer's presence due to the nurses being more cautious during the observation.

Other than that, remedial measures were also done in a short duration and thus, continuous monitoring on the implementation of these remedial measures is necessary to ensure their sustainability. It was also challenging to measure the clinical impact of these interventions on paediatric patients, as it was not seen immediately. A high turnover of staff in both ward and pharmacy departments requires the training on product stability to be done frequently.

Conclusion and the Next Steps

In conclusion, this study had successfully reduced the percentage of antimicrobial injection vials with preparation errors in the Paediatric Ward C1 from 86.3% to 16.4% through remedial actions. This study had also found out that factors such as incomplete labelling and lack of knowledge among staff had led to this error. The implementation of remedial measures such as training, pocket guide, flashcard, NO ENTRY ITEMS on the fridge, mnemonic method, and Antimicrobial Dilution Protocol (Paediatrics) enabled the preparation errors to be reduced. However, continuous work is required to achieve our standard of 0% antimicrobial injection preparation errors. Continuous training on antimicrobial injection preparation and product stability updates will be done frequently for staff nurses, especially for the new staff. Pocket guide, flashcard, and "NO ENTRY" items will be updated periodically and distributed to other paediatric wards as well. An audit will be carried out periodically to ensure that the reconstituted vials are labelled appropriately.

Expanding our study on to other types of injectables could also be done in the future. Another viable strategy of reducing preparation errors is supplying ready-to-use syringes to the ward, which could be included in the future study.

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Conflict of Interest

None.

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Appendix 1

Data Collection Form for Direct Observation and Inspection

No.	Antibiotic Name	Reconstitution		Labelling				Storage	
		Solution & volume		Solution	Volume	Date	Time	Temperature	Expired/ multiple used
1									
2									
3									
4									
5									
6									

TOWARDS A HIGHER PERCENTAGE OF RECREATIONAL DRUGS-FREE AMONG PATIENTS ON METHADONE MAINTENANCE TREATMENT IN LARKIN HEALTH CLINIC

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Abstract

Methadone Maintenance Treatment (MMT) Clinic in Larkin Health Clinic was established in 2007 as part of Malaysia's Harm Reduction Programme, mainly to prevent blood-borne viral infections, improve patients' mental and physical health, improve their socio-economics ability in society, and curb opiate addiction. A verification study in January 2017 found that only 34.9% of patients on MMT were recreational drugs-free after undergoing treatment. This study aimed to increase the percentage of recreational drugs-free among patients on MMT to 60% within one year. This quality improvement study was conducted among 63 patients and five healthcare providers. Face-to-face structured interviews with the respondents and brainstorming sessions with the healthcare providers were conducted to identify possible contributing factors. Four main contributing factors were identified; (i) healthcare workers were not formally trained for counselling techniques (100%), (ii) ineffective counselling (53%), (iii) unable to resist desire to take drugs (48%), and (iv) society's negative views (45%). In the post-intervention phase, all contributing factors had improved except for two factors that were beyond the group intervention, which were easy access for patients to drug supplies (38%) and peer influence (38%). Strategies implemented include Psychosocial Intervention Strengthening Courses, FRAMES counselling techniques (Feedback, Responsibility, Advice, Menu of Options, Empathy, Self of efficacy), Metha Club establishment, group counselling, and reward system in Phase 1. Inter-agencies involvement was held in Phase 2 and reinforcement of spiritual elements was implemented in Phase 3. The Sustainability Phase strengthened the process of defaulter tracing and introduced a drug abuse legal awareness. At post-intervention, the percentage of recreational drugs-free patients had increased from 34.9% (verification study) to 47.9% (Phase 1), 49.2% (Phase 2), 61.3% (Phase 3), followed by 65.1% (Sustainability Phase). ABNA reduced from 25.1% (Pre- Intervention) to -1.3% (Phase 3) and -5.1% (Sustainability Phase), thus the standard set in this study was successfully achieved.

KEYWORDS: Methadone Maintenance Treatment, Methadone, Recreational drugs, Illicit drugs use, Psychosocial intervention.

Problem

Drug addiction has been a big issue in Malaysia since 1983. According to National Anti-Drugs Agency (NADA), the number of drug addiction cases increased to 26,080 cases in 2019 compared to 21,777 cases in 2014. In Johor alone, there were 2,071 drug addicts reported compared to 1,999 in 2014 and heroine remains the main type of recreational drug used (1,2).

Methadone Maintenance Treatment (MMT) in Malaysia started in 2005 to provide treatment to opioid dependence patients, which is eligible to Malaysians who are 18 years and above. Methadone syrup is given as a treatment in MMT with an initial treatment dose of 20-30 mg per day, which can be titrated up accordingly. Generally, the optimum dose for methadone syrup is between 60-80 mg per day to achieve continuous abstinence. However, some patients may require a higher dose. In this MMT, the patient is monitored daily and methadone is administered by Daily Observational Therapy (DOT) (3). MMT in Malaysia is managed in the form of outpatient clinics and counselling in both government and private settings.

In 2018, there were a total of 484 government and private facilities that provided MMT service (4) and Larkin Health Clinic is one of the clinics under the Johor Bahru District Health Office. MMT in Larkin Health Clinic was established in 2007 and served by at least four healthcare workers from multidiscipline professions including Family Medicine Specialist, medical officer, pharmacist, and assistant medical officer. During the establishment in 2007, there were a total of 50 registered patients. This clinic was started as part of Harm Reduction Programs to treat opioid drug addiction and there were a total of 94 patients registered from 2007 until May 2016. Out of the total, only 63 patients are currently active. Based on the verification study, only 22 patients (34.9%) are recreational drugs-free based on their negative urine drug test results. Each patient is requested to do a urine test at least once a month. Recreational drugs are psychoactive drugs used for purposes other than medication that can be addictive and lead to pleasure effects such as opiate, cannabis, methamphetamine, and benzodiazepines (5). Negative urine is defined as negative urine drug test results for all drug groups analysed in Urine Drug Test (opiate, cannabis, methamphetamine, benzodiazepine). This study aimed to increase the percentage of recreational drugs-free patients from 34.9% to 60% (standard) or more within a year.

Background

Ever since drug addiction has been recognised by the World Health Organization (WHO) as one of the chronic diseases, many efforts have been made to identify a better and effective treatment (6) following the Malaysia's objective to be a drug-free country. MMT has been scientifically proven to be able to control and reduce addiction to opiate drugs and other related risks. Besides, MMT can also reduce the severity of withdrawal symptoms and gradually eliminate physical and psychological dependence (7,8). In 2012, there were 256,000 heroin and other opiate drug abusers in England alone with 155,000 under treatment (9). Opioid replacement therapy is believed to be cost-effective and recommended by the National Institute for Health and Care Excellence (NICE) as the most effective treatment to complement the psychological therapies to change behaviour (9). Opioid addiction is usually characterised as a chronic and relapsing condition (10). A study found that 60% of heroin addicts relapsed following inpatient treatment and others estimated that less than 25% of heroin addicts remained abstinent after MMT (10). Thus, psychosocial treatments may also be an important approach in improving relapse and treatment retention. In a study by Veilleux et al. (10), two psychosocial approaches such as reinforcement-based intensive outpatient treatment and enhanced outreach counselling were found to be beneficial compared to psychopharmacological treatment alone, but the small sample sizes do not support a robust conclusion. Another review that compared agonist treatment alone to agonist treatment with an adjunct psychosocial component

found that the benefit of adding psychosocial treatment was by increasing the number of people who remained abstinent during the follow-up.

MMT was introduced in Malaysia as a strategy to curb HIV/AIDS among drug addicts who share needles as well as to tackle the issue of opiate addiction especially heroin in Malaysia. This program aims to improve the quality of life and health of drug addicts by reducing the rate of addiction relapse especially among hardcore addicts and increasing their mental and physical fitness. Furthermore, it also aimed to increase psychosocial functions including acquiring and maintaining job quality and elevating their self-esteem to re-integrate into society (6,11). It was also reported that this treatment could reduce injection drug use, overdose mortality, and the risk of blood-borne pathogen transmission (11).

The use of any recreational drugs together with methadone may lead to serious adverse effects such as overdose, respiratory, and cardiovascular depression (12). Besides, the intake of recreational drugs is harmful and might increase the rate of morbidity and mortality.

However, the problem of drug addiction is something that cannot be solved easily as there are many relapse cases after being discharged from successful treatment in the rehabilitation centre. According to NADA, 3,095 out of 12,079 drug addicts were identified as repeat offenders or relapses from January to June 2010 (13). It was found that the number of repeat offenders increased from January to June 2009 as compared to only 1,136 people repeat offenders were detected.

According to a study by Alia et al. (13), among factors contributing to drug addiction relapse are low self-efficiency as they do not have the strength and self-confidence that they can continue living without drugs and bad influence from their friends. Additionally, lack of family and community support also contributes to a high relapse rate (13).

In order to tackle the relapse issue, a relapse prevention (RP) treatment was introduced based on the cognitive behavioral model (14). The model was primarily implemented in a study by Marlatt and Gordon et al. (14) towards heroin addicts in a Chinese rehabilitation center. This model incorporates both a conceptual model of relapse and a set of cognitive and behavioral strategies to prevent or limit relapse episodes (15). Treatment approaches based on the RP model begin with assessing the environmental and emotional characteristics of situations that are potentially associated with relapse such as high-risk situations. After identifying those characteristics, the therapist works forward by analysing the individual response to the situation before planning the strategies to target weaknesses in clients' cognitive and behavioral repertoire, thereby reducing the risk of relapse. RP has been widely used in many studies, providing theoretical and practical support for this model. A meta-analysis on RP was conducted based on 26 studies representing a sample of 9,504 participants (14). The overall treatment effects demonstrated that RP successfully reduced substance use and improved psychosocial adjustment.

A similar adjunct treatment to manage the relapse such as contingency management was also mentioned in a study among heroin addicts undergo opioid substitution treatment in the United Kingdom (9). Contingency management is a behavioural therapy that uses motivational incentives and tangible rewards to help a person become abstinent from drugs. It is proven that contingency management can significantly increase attendance as well as reduce illicit opiate use during treatment and follow-up when combined with methadone replacement treatment (9). In addition to MMT, other non-pharmacological approaches such as acupuncture, transcendental meditation, electrosleep, biofeedback, and hypnotism (16) can induce relaxation that appears to exert specific neurophysiological changes in the brain. This method is useful for some addicts and also helps to understand the addiction process.

Measurement

The objective of this study was to increase the percentage of recreational drugs-free patients. The standard set was 60% as NADA successfully achieved 60% rehabilitation retention (recreational drugs-free) in 2016 compared to its action plan target of 40% (17). The indicator used was the percentage of recreational drugs-free patients on MMT calculated based on the following formula:

$$\frac{\textit{Number of Drug-Free Patients}}{\textit{Total Patients on Methadone Maintenance Treatment}} \times 100$$

The verification study found that only 34.9% of patients on MMT in Larkin Health Clinic successfully achieved recreational drugs-free.

This study was a Quality Improvement Study conducted on 63 patients on MMT. Verification study to determine the magnitude of the problem and a study to identify the factors were conducted in January 2017. Remedial measures were implemented in three phases; (i) Phase 1 was conducted in February - April 2017, (ii) Phase 2 in May - June 2017, and (iii) Phase 3 continued in July - September 2017. Re-evaluation of the effectiveness of improved strategies took place in April 2017 (Phase 1), June 2017 (Phase 2), and September 2017 (Phase 3).

The inclusion criteria were all patients on MMT registered at Larkin Health Clinic. Patients registered for *Sistem Pendispensan Ubat Bersepadu* (SPUB), patients transferred in or out throughout the study period, and patients using Methadone Flexi (M-Flex) service were excluded.

Initial Assessment of the Problem

During the early stage of this study, the team had a session to brainstorm on possible contributing factors to the problem as illustrated in the Cause-Effect Analysis (Figure 1).

In order to identify the contributing factors from patients' perspectives, face-to-face structured interviews with all 63 patients were conducted by two pharmacists before the DOT. The interview questions included duration of addiction, causes of drug addiction, factors leading to relapse, and their view on existing intervention given. Each question has a list of possible answers for the interviewer to choose with an additional space for a new response that is not included in the list. On the other hand, a brainstorming session was conducted among the healthcare members to identify the factors from their perspectives.

These lead to the findings of the main opposing factors from the patients' perspective, which were counselling conducted did not affect patients (53%), patients were unable to resist their desires to take drugs (48%), society's negative views (45%), patients' easy access to free drug offers (40%), unconcerned health personnel (40%) as well as other factors. Based on the brainstorming session with the healthcare workers, they agreed that the unavailability of special formal training for counselling techniques was the main factor of the problem (100%).

Each step in the Process of Care outlined by MOH Methadone Maintenance Treatment Procedures (3) including treatment initial, dispensing, the patient undergoing treatment and counselling, and patients' assessment were reviewed to identify the gap that could be improved (Figure 2).

Based on the review, few steps were identified as critical and included in the MOGC (Table 1). Achievements for each step before intervention were 0% for health care providers attended Psychosocial Intervention Strengthening Course, 30% for individual counselling session, 0% for both group counselling, and 25% for the reward system. All criteria were set with 100% standards for comparison before and following remedial actions.

Verification study showed that only 34.9% of patients on MMT successfully achieved recreational drugs-free. ABNA was 25.1% (optimum standard = 60.0%).

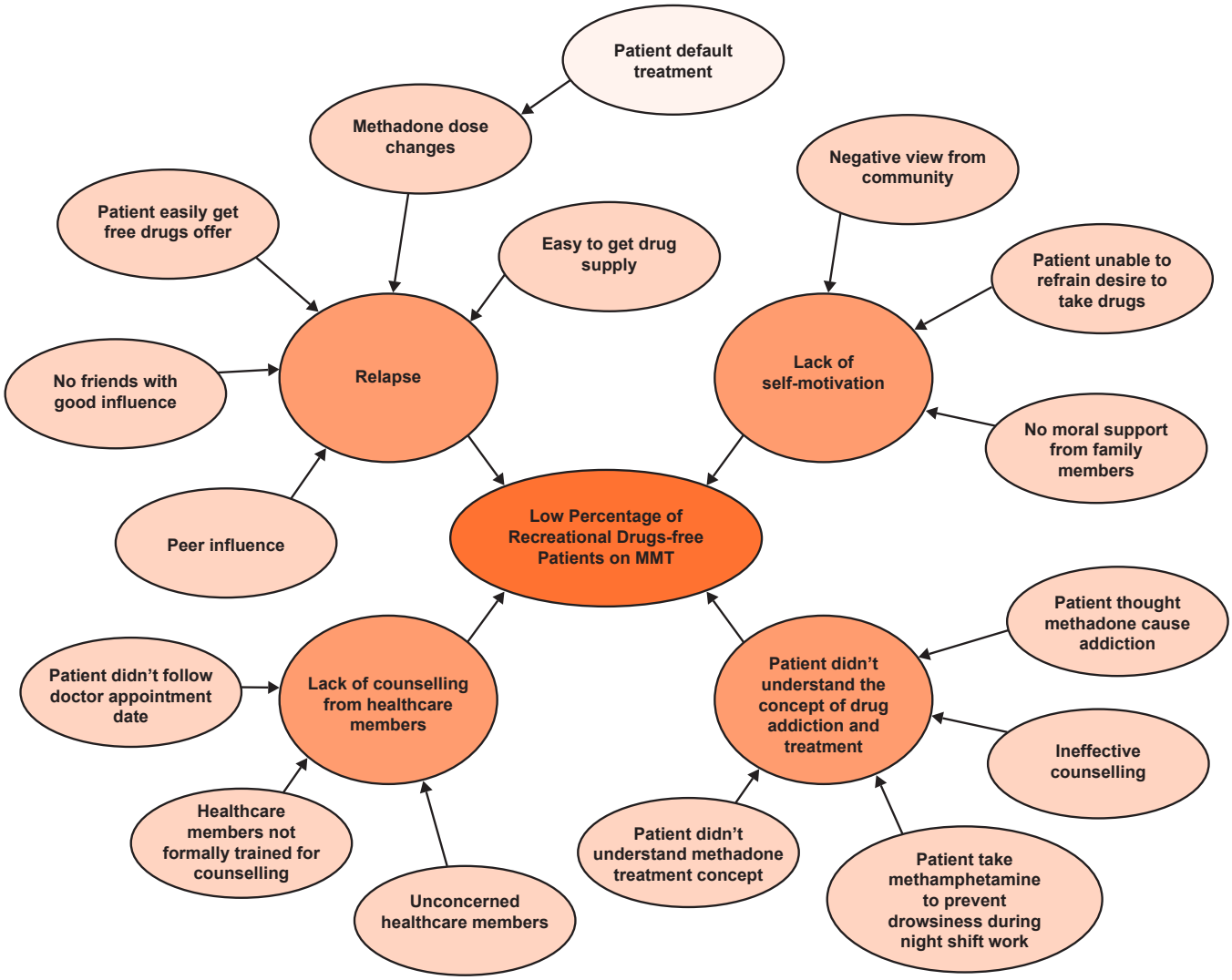

Figure 1: Cause-Effect Analysis

Strategy

Four phases were completed in implementing the strategies.

a) Phase 1:

In this phase, improvement strategies were formulated to strengthen health personnel's counselling skills and competency, particularly those in the Methadone Unit, as none of the health care members had received formal training on counselling techniques. Besides, this phase also emphasised strengthening health personnel-patient relationships as patients felt the healthcare members were unconcerned.

The first strategy was to enrol the Methadone Unit Members for a Psychosocial Intervention Strengthening Course organised by the Johor Bahru District Health Office (PKDJB) to provide training on simple techniques to handle patients on MMT. The training and experience sharing session was conducted by experts in counselling and managing drug addicts and also assisted by Intan Lifezone, a non-governmental organisation (NGO).

The second strategy was applying the of FRAMES counselling technique (Feedback, Responsibility, Advice, Menu of Options, Empathy, Self of Efficacy), which was introduced during the Psychological Intervention Strengthening Course. This

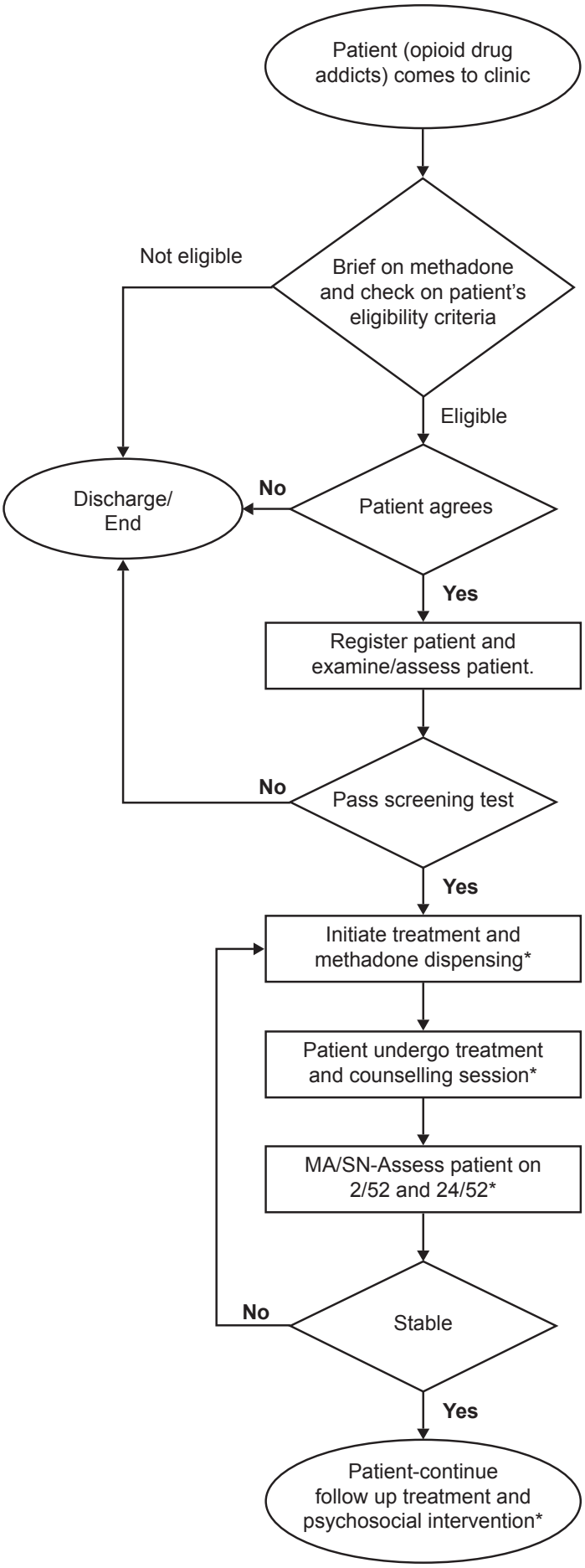

Figure 2: Process of Care for Methadone Treatment Clinic
(* indicates critical steps)

technique was applied in routine individual counselling. This technique is simpler and can be carried out in a shorter time as only one pharmacist will be scheduled to dispense methadone at one time. This counselling technique also allows for the improvement of personnel-patient relationships.

The third strategy was to set up a Metha Club, a peer support group consisting of all MMT patients in Larkin Health Clinic. This support group has its committee members and the highest committee members were appointed among methadone patients themselves. The support group aimed to improve the patient's identity as well as to train the patient to be more responsible.

The fourth strategy was to introduce group counselling on a regular basis. Group counselling was divided into two types: small counselling groups that consisted of ten patients or below and large counselling groups. Small counselling groups were chaired by a Psychologist from PKDJB and carried out at least once a month. A large counselling group was chaired by Medical Officer or Family Medicine Specialist conducted at least once or every two months.

In small group counselling, the session focused on problem sharing and motivational input from the psychologist. As for large group counselling, the input was initially provided by the Family Medicine Specialist or Medical officer on awareness of the MMT clinic and the importance of drug abstinence. At the end of the counselling program, a small birthday celebration for the patients was held to add on some joy and excitement for them to join such program again in the future. The attendance for the large group counselling was 59 patients.

The fifth strategy was introducing of a reward system, which was implemented using Take Away Dosage (TAD) coupons. One TAD coupon with TAD permission for two days was given if the patient managed to achieve recreational drugs-free for three consecutive months. Patients were also given Activity Coupons if they attended a large group counselling session with TAD permission for a day.

b) Phase 2:

Phase 2 improvement strategies were implemented to strengthen the existing strategies with involvement from inter-agency in managing of drug addicts in both individual and large group counselling sessions.

NADA, an expert agency that involves directly in handling drug addicts and rehabilitation was invited to provide individual counselling on a regular basis, which was once a month visit to the clinic. Priority was given to patients with positive urine test results (still taking drugs). NADA was also invited to participate in group counselling especially in the large counselling group.

c) Phase 3:

Phase 3 improvement strategies were improved by incorporating spiritual elements in the module, which involved *Majlis Agama Islam Johor* (MAIJ) in large group counselling. Emphasis was given in the aspect of patient spiritual strengthening to say no to drugs. The total of patients attended this session was 60 patients including both Muslim and non-Muslim.

d) Sustainability Phase

The sustainability phase focused on the implementation of strategies to tackle relapse issues among defaulter and missed dose patients. Defaulter patients are those who have missed methadone dose for more than 5 days while missed dose patients are those who missed methadone dose for 1 to 3 days (3). Defaulter tracing was done when the patient was absent after 2 days by contacting him through a phone call to avoid methadone dose adjustment. Patients who required dose adjustment (at least after 3 days of absence) would relapse to drug addiction as the original dose might be reduced into half or less (3).

Another factor contributing to the above problem was patients' non-adherence to appointments with medical officers or family medicine specialists. In order to overcome this, patients' appointments were rescheduled and set earlier to improve their adherence. The patients were informed of the date for

their appointment in advance to allow them to plan their daily or working scheduled ahead, which was not done before. For each patient, appointment with family medicine specialist was set at least once a year, appointment with medical officer was once in 6 months, while monthly appointment with assistant medical officer. These appointments are meant to review their medical and health condition and needs.

In order to tackle the issue of patients who were unable to restrain their desire to take drugs, an officer from the Narcotic Unit of South Johor Bahru District Police Office was invited to deliver a talk during a large group counselling session. The objective of this talk was to enforce and introduce drug abuse legal awareness to patients on MMT. This counselling session was attended by 51 patients.

All strategies in each phase are summarised in Figure 3.

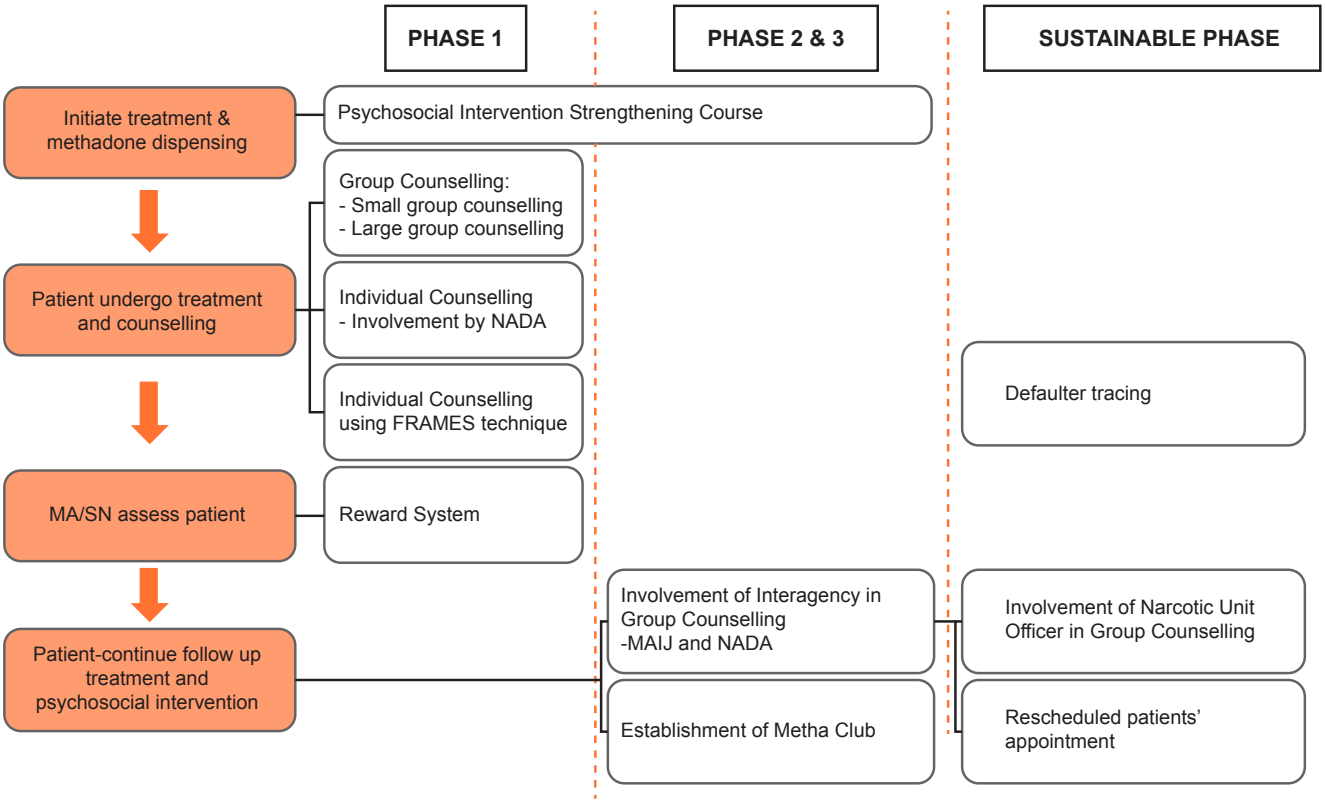

Figure 3: Strategies implemented by phases

Results

Phase 1 improvement strategies resulted in 47.9% of recreational drugs-free patients on MMT with an increase of 13.0% from the verification study. The percentage was further increased to 49.2% with an increase of 1.3% from Phase 1. The strategy implemented in Phase 3 achieved 61.3% of recreational drugs-free patients on MMT within one year, which was slightly higher than the 60% target standard set by NADA (17).

Contributing factors to the problem were re-assessed during the Sustainability Phase to further improve the outcome. It was found that 100% of defaulter patients and patients who missed doses (more than 3 days) would experience relapse after dose adjustment. It was also found that 15% of patients were unable to follow their appointments with the medical officer. The percentage of recreational drugs-free patients was further increased to 65.1% after the implementation of improvement strategies in the sustainability phase (Figure 4).

All standards set in the Model of Good Care also showed improvement (Table 1), in which referral for individual counselling sessions increased to 80% in Phase 3 then up to 100% in the Sustainability Phase, while 75% for small group counselling in Phase 3 and further increased to 100% in Sustainability Phase. Both large group counselling and reward system showed 100% improvement in Phase 3 and continued to Sustainability Phase. Last but not least, defaulter tracing improved to 50% following strategies in Sustainability Phase.

Achievement in Phase 3 and Sustainability Phase exceeded the optimum standard of 60% as illustrated in Figure 4.

Table 1: Model of Good Care

Process	Criteria	Standard (%)	Pre-Improvement Strategies (%)	Phase 3(%)	Post-Improvement Strategies (%)
1. Initiation of treatment	All healthcare workers to attend Psychosocial Intervention Strengthening Course	100	0	100	100
2. Patient undergo treatment and counselling:					
a) Patient referral for individual counselling	All patient is referred for individual counselling by pharmacist and AADK officer	100	30	80	100
b) Patient referral for small group counselling	All patients are referred for small group counselling.	100	0	75	100
c) Patient referral for large group counselling	All patients are referred for large group counselling.	100	0	100	100
3.MA/SN assess patients	Patient able to achieve negative urine test or join large group counselling will be given TAD coupons as a reward.	100	25	100	100
4. Patient-continue follow up treatment and psychosocial intervention	Defaulter will be traced when patient missed dose for 2 consecutive days to prevent methadone dose adjustment	100	0	0	50

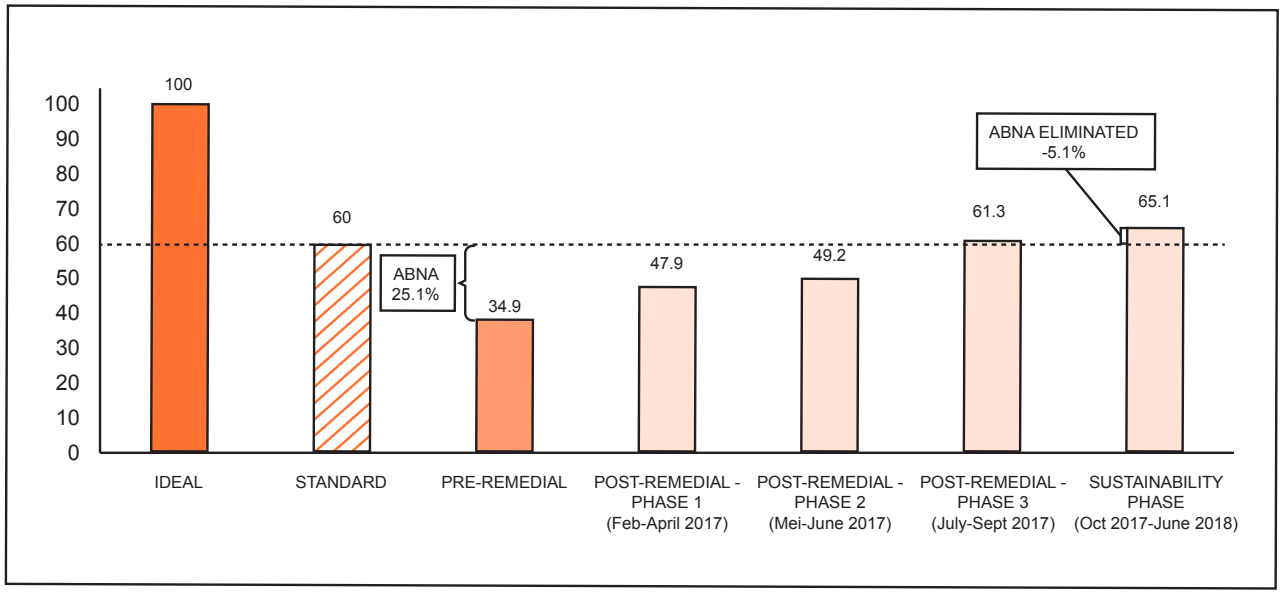

Figure 4: Percentage of Recreational Drugs-Free Patients on MMT

Lessons and Limitations

Based on this study, strengthening individual communication skills is critical to ensure the improvement of counselling method given. Apart from that, strengthening group and individual counselling session are deemed necessary to ensure the patients continue to be motivated and remain free from drug abuse as relapse cannot be solved by a medical approach alone. It is also proven that the involvement of inter-agencies during the counselling session gives better improvement and impact on the patients. The introduction of a reward system also helps to boost their motivation to continue to be drug-free and attract them to join any organised program.

However, there are limitations in this study in terms of financial and human resources, especially in organising workshop involving external agencies for the large group counselling. Besides, it is also time-consuming and requires a lot of commitments to plan and execute programs for the patients. It is a known fact that drug addiction and relapse cannot be solved in a blink of eye as the patients' awareness is not easily tackled. All the efforts done during the initial phase of the study seemed useless and impossible to make the patients drugs-free. But in the end, everything was worth it and showed positive effect with continuous intervention and supports from various parties and individuals. At the same time, the community has to believe that all drug addicts deserve to have their second chance to improve themselves to be better.

Therefore, we would highly encourage various related parties to come forward and involve in managing drug addiction and relapse especially for patients on MMT.

Conclusion and the Next Steps

In conclusion, collective strategies implemented such as strengthening individual counselling skills, group counselling, and inter-agencies involvement had successfully increased the percentage of drugs-free patients on MMT in Larkin Health Clinic from 34.9% to 65.1%. Involvement of family members in individual and group counselling sessions is highly needed to continually motivate patients to achieve recreational drugs-free status. Counselling on work management and communication skills can also help the patients in their self-management by improving the quality of interaction between them and their colleagues as well as the community. With the percentage increment of drugs-free patients on MMT, more than 90% of the patients can secure employment and live properly. At the same time, cases of patients on MMT being arrested for drug abused are also reduced.

As for the next steps, data collection and strategies for improvement will be continued to ensure continuous monitoring of the effectiveness of existing interventions not only for study purposes but more importantly for clinic-based monitoring. In addition, patients' feedback should be collected to provide new and innovative ideas in improving the target percentage towards the ideal standard of 100%.

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Conflict of interest

None

Funding

None

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

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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. Summarise 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 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 generalisability. 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.
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