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JOURNAL OF PATIENT SAFETY & HEALTHCARE QUALITY

Official Journal of the Healthcare Quality Society of Singapore
Affiliated with SingHealth Duke-NUS Institute for Patient Safety and Quality

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The Journal of Patient Safety and Healthcare Quality is published twice a year.
Firstly, a very warm welcome to this new journal! The Journal of Patient Safety & Healthcare Quality (JPSHQ) is a culmination of efforts by members in the healthcare community, who are keen in raising the academic standards for patient safety & healthcare quality in Asia and beyond.

Although there are many excellent projects, ideas and innovations in patient safety and healthcare quality improvement, very few of them had been distilled and translated into academic publications for better dissemination, education and sharing. This journal attempts to fill this void in Asia. We hope to encourage and nurture patient safety and quality improvement activists to share their project experiences and insights through academic publications in the JPSHQ.

As the saying goes - ‘it takes a village to raise a child’. Creating an academic journal in patient safety and healthcare quality requires multi-pronged support from the community. Besides a dedicated editorial board, a vibrant group of reviewers is needed to ensure the rigorousness of the peer-review system is maintained. Strong support from healthcare leaders as well as patient safety and quality improvement champions, is crucial. They help create a conducive environment for conducting rigorous projects in patient safety and healthcare quality improvement; and a system and culture for facilitating academic presentations and publications.

JPSHQ, a peer reviewed journal, is dedicated to presenting innovation advances, field applications & projects in every area of patient safety and healthcare quality. The journal accepts manuscripts for the following - original articles, commentaries, case studies, improvement projects, reviews and report articles in patient safety and healthcare quality.

If this journal faithfully mirrors our development and progress in patient safety & healthcare quality domain and improves its scientific and editorial standards in the years to come, the academic education and sharing of best practices will translate into better care for patients in Asia and beyond. JPSHQ will then realise the vision of its sponsors (Healthcare Quality Society of Singapore; and SingHealth Duke-NUS Institute for Patient Safety & Quality) and justify the efforts of the many who have helped to bring it into being.
INTRODUCTION

Learning, sharing and implementing are important organizational processes for a learning system in healthcare. A high functioning Learning Health System is capable of engendering a virtuous cycle of health improvement. (1) Sharing best practices is an excellent way to improve quality and patient safety in a healthcare organization. Sharing best practices can help healthcare organizations fill knowledge gaps, improve quality of care and make clinical practices better. In general terminology, when it is recommended that a practice should be followed, it is considered to be a best practice. When this practice becomes a part of the system or culture, it becomes a good practice of the organization.

Best practices can be in a variety of formats. It can be a set of guidelines, ideas, staff ethos, patient compact, clinical process or pathways, healthcare management practices or support tools and systems that represent the most efficient and prudent course of action or best quality practices in a given situation. Best practices in healthcare facilitate healthcare organization to deliver higher quality care. It can engender a strong patient safety culture as well as provide compassionate care, and good care access to ensure a positive patient experience.

How to share best practices optimally?

There are 2 elements to consider for sharing best practices optimally. They are responsive Learning Site Systems and an optimal Enabling Platform with effective engagement and sharing mechanism.

A. Learning Site System

These sites should have evidence-based mechanism in place for piloting practices based on evidence; as well as generating and validating evidences from established practices. Rapid improvement of healthcare occurs with effective adoption and scaling up of new evidence-based practices; and the use of contextualised practice-based evidence reviews to improve care. Practice-based evidence reviews are important to assess the quality of healthcare, ensure high standards and facilitate improvement.

It is important for a healthcare organization to have evidence-based practices at the forefront of science, as well as practice-based evidence reviews in advancing healthcare practices and ensuring high standards of care. This virtuous process, involving the proactive adoption of new evidence-based practices and constant instillation of practice-based evidence reviews to improve care, is beneficial for the progress of healthcare. (2) There should be a readiness by each learning centre to review, present and share best practices. Processes to be inculcated into the learning system, include good documentation of best practices and the creation of a responsive strategic plan to share and adapt best practices.

B. Enabling Platform

Sharing best practices requires an effective enabler. The enabler should be a catalyst for exchanges of ideas, practice-based evidence, evidence-based practices as well as for learning and implementation strategies and tactics between learning sites. This enabling platform can take the forms of a forum, conference, meeting place, network, virtual centre, ground visit, workspace, dialogue or a physical centre. Personnel in the platform and the tools used should actively encourage, promote and catalyse the assessment, identification and sharing of best practices.

The enabling platform serves as a catalyst centre for the sharing of best practices among the learning
sites. The catalytic steps of the enabling platform for the sharing of best practices are:

1. Engagement - The platform engages various learning sites and partners to come together for sharing.

2. Presentation - Each learning site presents their practices.

3. Assessment - Self and mutual assessments among sites are conducted of the various practices in each site.

4. Identification - Best practices are identified for sharing and documented. Sites may also seek to identify their practices with opportunities for improvement.

5. Transfer customisation - For good evidence-based practice, sharing for transfer would include on how practices can be adopted and adapted in another site. For practice-based evidence accumulated, the sharing should include contextualisation of evidence for the other learning site. (3,4)

The Framework for Sharing of Best Practices is shown in Figure 1.

EXAMPLE OF AN ENABLING PLATFORM

The Global Action for Leaders and Learning Organizations on Patient Safety (GALLOPS) is an Asia-Pacific programme for enhancing capability and competency of patient safety leadership in sharing and improving patient safety practices within the framework of WHO Global Patient Safety Action Plan (GPSAP) 2021-2030. (5) This global enabling platform for sharing best practices is initiated by the SingHealth Duke-NUS Institute for Patient Safety & Quality (IPSQ) and SingHealth International Collaboration Office (ICO). Speakers from World Health Organization and Asia Pacific healthcare partners shared on a wide spectrum of topics ranging from Policies to Eliminate Avoidable Harm, Patient Safety Training, Build High Reliability Health Systems, Patient and Family Engagement and many more.

Over 250 patient safety leaders from 16 countries engaged and participated in GALLOPS, where they attended the 4-day programme in October 2021, presented and completed a self-assessment tool in relation to the GPSAP’s 35 strategic areas in 7 strategic domains to identify good practices in their organizations and also practices with areas for improvement. The GALLOPS Ambassador Network was formed where leaders shared and adopt good practices and practices for improvement. The GALLOPS enabling platform provides the catalytic steps of engagement, presentation, assessment, identification and customised transfer of best practices for the sites participating in the forum, webinars, site visits and network.

CONCLUSION

A systematic plan and approach for sharing of best practices is vital for high functioning learning centres. The onus is for these learning centres to be ready to review, present, share and customised transfer best practices with each other. Collaboration in patient safety should entail the optimal use of an enabling platform to promote the sharing of best practices among learning sites and partners. The building of a strong best practice sharing constituent culture will strengthen the patient safety and quality ecosystem of the organization. (6)
Figure 1. Framework for Sharing of Best Practices in Learning Health System

Facilitating Virtuous Cycles of Sharing & Learning for Safe, Quality, Cost Effective and Patient Centric Care
REFERENCES


Improving the Quality and Efficiency of Mental Capacity Referrals in a General Hospital

Bixue Wen¹, Kai Wen Aaron Tang¹, Ahmad Fahmi Bin Ahmad Tarmizi¹, May Fong Low¹, Ian Matthias Ng², Leonard Eng¹, Alakananda Gudi¹

ABSTRACT

Objective: A Mental Capacity Assessment is a common reason for patients to be referred to the inpatient psychiatric liaison team. The information provided in mental capacity referrals however, is often inadequate. This leads to time wastage, redundant work, and delays in patient care. The aim of the project is to reduce the number of inpatient psychiatry mental capacity assessment that has inadequate information to zero over a period of 6 months.

Methods: Mental Capacity Assessment referrals were reviewed over 3 months, and a root cause analysis was performed to assess the underlying reasons for inadequate referrals. It was found that a lack of a standardized workflow was the root problem. In response, standardized mental capacity referral forms were created for various decisions. In PDSA 1, forms were introduced for decisions surrounding treatment and discharge destinations. In PDSA 2, an additional form regarding discharge against medical advice was added. Teams were required to fill up the appropriate form prior to the referral.

Results: 81 referrals were obtained over a period of 24 weeks. A significant decrease in inadequate referrals was noted, with the proportion of inadequate referrals dropping from 20/38 (52.6%) (pre-intervention) to 5/22 (22.7%) (PDSA 1) to 3/21 (14.3%) (PDSA 2). The inadequate referrals in PDSA 2 were largely due to referrals for financial capacity, for which mental capacity assessment forms were unavailable, and documentation of relevant information outside the referral letter.

Conclusion: An implementation of standardized referral forms can reduce the number of inadequate referrals for mental capacity assessments in an inpatient consultation liaison setting.

Keywords: Mental Capacity Assessment; Quality Improvement Project; Psychiatry Consultation-liaison; Mental Capacity Act; Singapore

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INTRODUCTION

Mental capacity assessments constitute a significant proportion of referrals in general hospitals. This is in line with a general shift in attitudes, notably in healthcare settings, toward the importance of autonomous decision making. [1] Many patients in general hospitals are noted to lack mental capacity to consent to treatments, with some studies suggesting numbers surpassing 30% of medical inpatients [2]. When questions regarding capacity to consent to healthcare decisions are raised in general hospitals, liaison psychiatry services are often involved [3]. This can account for as many as 10%-25% of all psychiatric consultations [4,5].

The assessment of mental capacity however, can be a challenging process [6]. While the assessment of mental capacity is supposedly a core skill for all doctors, doctors might find it difficult to conduct mental capacity assessments, and often lack knowledge on how to do so [7,8]. A previous review of the mental capacity assessments of the primary care physicians in our institution also revealed that many of the assessments were suboptimal [9].

As such, referrals for mental capacity assessments to psychiatric liaison services are commonly inadequate, leading to increased inefficiency in the form of redundant work, added costs, time wastage and delays and compromises in patient care. For example, when an inadequate referral is made, liaison teams would make incomplete assessments of the patient, and will sometimes need to review the patient again with the teams, or call back various parties to obtain more information, leading to time wastages. Hence, efforts need to be taken to reduce the number of inadequate referrals.

Definition of an adequate referral

The definition of an adequate referral is derived from the information required to conduct a mental capacity assessment, which involves the application of a two-stage test: (i) Taking a history and performing assessments to determine whether there is an underlying impairment or disturbances in the functioning of the mind or the brain, and (ii) Evaluation of its impact on the patient’s decisional capacity at the point of decision-making. An individual is only determined to be unable to make a decision for himself if he is unable to meet the following criteria: (a) Comprehend the information relevant to the decision (b) Remember that information (c) Reason with that information during the process of making the decision and (d) Communicate the decision [10].

As such, an adequate referral involves several criteria. Firstly, the formal decision to be made has to be stated. Secondly, teams must include reasons for concerns of impairments of mental functioning. Thirdly, a discussion with the patient must be made regarding: (I) Decision to be made (II) Indication of decision (III) Pros and cons of decision and (IV) Alternatives to decision. Lastly, the referral must include the reason for proceeding with the referral to psychiatry.

AIM

The primary objective of the quality improvement project is to reduce the number of inpatient psychiatry mental capacity assessments that have inadequate information to zero over a period of 6 months.

METHODOLOGY

Setting

A preliminary review of inpatient mental capacity referrals was done from February 2021 to May 2021 over a period of 12 weeks to establish the rate of inadequate capacity referrals in an inpatient psychiatric consultation-liaison service in a tertiary hospital in Singapore to confirm evidence of a clinical problem. The intervention was then conducted over a period of an additional 12 weeks in the same setting.

Patients

All patients with referrals made for mental capacity assessments in the period of study were included in this quality improvement project.

Method

The Quality Improvement (QI) methodology approach was used to address the problem of a high percentage of inadequate mental capacity referrals. This methodology helps in improving processes of care and service delivery. It primarily involves identifying a problem, measuring the scope and size of the problem, identifying a number of interventions that may reduce the problem, implementing the intervention, and re-measuring to ascertain whether the interventions have been made effective through cycles of Plan-Do-Study-Act (PDSA).

The Quality Improvement Project

The project was carried out by a team consisting of a core group of 7 doctors, with 6 doctors from the psychiatry department, and 1 doctor from the internal medicine department. No patients were part
of the team.

All mental capacity assessment referrals made to the department were reviewed by the team. The team also traced the entire workflow process of making a mental capacity assessment referral to the inpatient liaison service as seen in Figure 1.

Through the analysis of preliminary data, surveys and brainstorming sessions, key causes behind inadequate referrals were identified. A cause-and-effect diagram was done to organize the possible causes generated through a brainstorming session. As seen in Figure 2, the 5-Why’s technique was done to explore the cause-effect relationship underlying the potential root causes for the inadequate mental capacity referrals. A driver diagram (Figure 3) with a prioritization matrix (Figure 4) was used to determine the value of the specific solutions the team had generated.

**Intervention**

In view of the issues identified above, the PDSA continuous improvement spiral was used to guide and improve the workflow process to reduce the rate of inadequate referrals. After a discussion amongst the team, the intervention of choice was for referring teams to fill up a standardized mental capacity assessment form prior to referrals. The form guides the team to obtain the information necessary for an assessment of mental capacity.

Two variations of the form were created, to cater to the decisions involving (i) Discharge destinations and (ii) Procedures/Treatment. These decisions were chosen as they accounted for the bulk of the referrals (84.2%) in our pre-intervention data. The contents of the form were discussed with and approved by all consultants of the hospital’s Psychiatry Department. These forms were distributed by the on-call doctor receiving Psychiatry referrals to the respective inpatient teams. The forms were then included by referring teams in the subsequent formal referral to the Psychiatry team.

During the implementation, no major issues were encountered during the test implementation. Feedback was also obtained from referring team doctors, with mostly positive feedback received.

The intervention was applied over the following 6 weeks. Following intervention, the average percentage of inadequate referrals fell from 20/38 (52.6%) to 5/22 (22.7%) in PDSA 1. The bulk of the reasons for inadequate referrals stemmed from mental capacity assessments involving discharge against medical advice.

**2nd Intervention**

A second study was done based on information and lessons learnt from the first study over a period of a further 6 weeks. For PDSA 2, an additional form for discharge against medical advice was added, in addition to the previous two forms. The on-call doctor receiving the referrals was also tasked to remind teams to document information obtained in hospital records, with additional reminders included in referral forms as well.

Following the intervention, the percentage of inadequate referrals fell further to 3/21 (14.3%), with the remaining inadequate referrals resulting from (i) urgent referrals, where teams could not fill in the forms in time, (ii) referrals for financial capacity, for which mental capacity assessment forms were unavailable, and (iii) documentation of relevant information outside the referral letter.

**Statistics**

A chi-square test was performed to examine if the percentage of inadequate referrals was significantly different across the pre-intervention phase, PDSA 1, and PDSA 2. Statistical analyses were performed in SPSS, version 22. A p-value of <0.05 was accepted as significant.

**RESULTS**

The data of the mental capacity referrals obtained was analysed to see the breakdown of the various indications of referral, with the bulk of the referrals involving decisions regarding procedures, discharge destinations, and discharge against medical advice. This is summarized in Table 1.

A chi-square test was performed and showed that the difference in percentage of inadequate referrals across the pre-intervention phase, PDSA 1, and PDSA 2 was significant, X² (2, N=81) = 10.67, p <0.05. The proportion of inadequate referrals across the phases is summarized in Table 2. Figure 5 reflects the change of percentage of inadequate referrals over time.

Feedback was also obtained from the ground users, with mostly positive feedback received. Many commented that it helped the team to clarify the thought processes behind the referral, and provided a framework to help the team make their own assessments. Some however felt that the process could be cumbersome, but suggested that it would be easier to use if electronic versions of the forms were integrated into the hospital’s electronic records.
system. Efforts were hence made to engage the relevant departments of the hospital to discuss the integration of the forms as an accessible template in the hospital's electronic records system. A summary of the feedback can be seen in Table 3.

DISCUSSION

In this quality improvement project, we have shown how the use of referral templates can be used to improve the quality of mental capacity assessment referrals made to the psychiatry consultation-liaison service.

The improvement of quality of referrals with the systematization of referral processes is consistent with other research, where an increase in liaison psychiatrists’ satisfaction with the appropriateness of physicians’ referrals was noted following the introduction of the new processes [11]. The improvement of mental capacity assessments with the education of physicians (which the structured forms also provide) is also seen in other studies as well [12]. Further studies are required to further explore the reason behind these trends.

A key lesson that was learnt was that reducing the administrative burden of the user is important towards ensuring the receptiveness and sustainability of such initiatives. One source of administrative burdens is duplicate work. The form was hence designed in a manner such that its content could directly replace the content of the referral letter that the user would have had to write even before this initiative, hence preventing duplicate work.

To further improve the sustainability of the initiative, our team also approached the relevant departments of the hospital to integrate the form as a template document that can be directly accessed from the hospital electronic systems. This would reduce the administrative burden of having to transfer the contents of the form onto the hospital’s electronic systems. As an interim measure, the team has uploaded all the relevant documents onto the hospital’s intranet so that doctors can easily transfer the template form onto the hospital’s electronic records after downloading the documents. To further improve sustainability, information on the capacity assessment referral process has also been incorporated into the orientation programme for all new doctors in psychiatry in our institution.

The content of the forms was designed in such a way that the spreading of knowledge and processes could be achieved. The forms explicitly state the steps (along with examples) required for mental capacity assessments involving AOR discharge, procedures, and discharge dispositions. Referring doctors are hence educated through the process of making the referral. The project was also presented at the hospital’s Quality Improvement Project forums to further educate our colleagues. The project is also easily scalable, as the forms are not hospital-specific and can be easily used and edited to suit the needs of other hospitals.

Limitations of the project include a small sample size and a limited period of observation. Assessors of adequacy of referrals were also not blinded. Interventions were also limited to decisions regarding treatment, placement, and discharge against medical advice. Interventions involving capacity assessments for financial decisions or testamentary decisions were not done, though they accounted for a small proportion of referrals.

CONCLUSION

An implementation of standardized referral forms can reduce the number of inadequate referrals for mental capacity assessments in an inpatient consultation liaison setting.
Figure 1: Workflow Process Chart detailing workflow process of making a capacity assessment referral

Figure 2: Analysis and Understanding of the Problem (5-Whys Diagram)
Figure 3: Driver Diagram

Aim of project
- Eliminate inadequate and premature referrals
- Department triaging MO is familiar with the workflow

Concepts to address root cause
- Provide structural guidance to referring team
- Have structured capacity assessment forms for referring team to fill up prior to referral submission
- Department provides orientation/teaching to referring team
- Fields on inpatient referral form to be customized to include the required information

Specific solutions

Figure 4: Prioritization Matrix

<table>
<thead>
<tr>
<th></th>
<th>Feasibility</th>
<th>Acceptability</th>
<th>Low Cost</th>
<th>Effective</th>
<th>Sustainable</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have structured capacity assessment forms for referring team to fill up prior to referral submission</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Provide orientation/teaching to referring team</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Fields on inpatient referral form to be customized to include the required information</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Department provides doctor orientation to new doctors on mental capacity assessment form</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>19</td>
</tr>
</tbody>
</table>

1-Meets criteria poorly, 5 - Meets criteria very well

Improving the Quality and Efficiency of Mental Capacity Referrals in a General Hospital
Figure 5: Percentage of inadequate or premature referrals over time pre and post intervention

Table 1: Breakdown of Referrals Over Course of Time

<table>
<thead>
<tr>
<th>Types of referrals</th>
<th>Pre-Intervention (12 weeks)</th>
<th>PDSA 1 (6 weeks)</th>
<th>PDSA 2 (6 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure</td>
<td>25/38 (65.8%)</td>
<td>10/22 (45.5%)</td>
<td>8/21 (38.1%)</td>
</tr>
<tr>
<td></td>
<td>7/38 (18.4%)</td>
<td>8/22 (36.4%)</td>
<td>9/21 (42.9%)</td>
</tr>
<tr>
<td>Discharge Destinations</td>
<td>2/38 (5.3%)</td>
<td>3/22 (13.6%)</td>
<td>1/21 (4.8%)</td>
</tr>
<tr>
<td>Discharge against medical advice (AOR)</td>
<td>4/38 (10.5%)</td>
<td>1/22 (4.5%)</td>
<td>3/21 (14.3%)</td>
</tr>
<tr>
<td>Others</td>
<td>3.2</td>
<td>3.7</td>
<td>3.5</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Types of referrals</th>
<th>Pre-Intervention (12 weeks)</th>
<th>PDSA 1 (6 weeks)</th>
<th>PDSA 2 (6 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure</td>
<td>20 (52.6%)</td>
<td>5 (22.7%)</td>
<td>3 (14.3%)</td>
</tr>
<tr>
<td>Adequate Referrals</td>
<td>18 (47.4%)</td>
<td>17 (77.3%)</td>
<td>18 (85.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>22</td>
<td>21</td>
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</table>

Table 2: Proportion of Inadequate Referrals Over Course of Time

Abbreviations: PDSA, Planning Doing Studying Acting
### Table 3: Feedback from Users

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<th>No.</th>
<th>General Theme</th>
<th>Sample Responses</th>
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<tr>
<td>1.</td>
<td>The form guides decision making for the team.</td>
<td>“I think it is a good framework for us to do our own assessments, and a useful template to document for future reference.” “Thought it was quite helpful to guide our decisions.” “It was a good helpful guide for us.” “Very soul searching”</td>
</tr>
<tr>
<td></td>
<td>The form provides a framework for the team to assess the patient.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Easy to use and understand</td>
<td>“I think it was generally easy to use, and helped clarify the thought processes and reasoning behind the referral”</td>
</tr>
<tr>
<td>3.</td>
<td>Allows team to make their own decisions without having to refer to the psychiatry consultation liaison service</td>
<td>“I think it was generally easy to use, and helped clarify the thought processes and reasoning behind the referral”</td>
</tr>
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### Suggestion

<table>
<thead>
<tr>
<th>No.</th>
<th>Suggestion</th>
<th>Sample Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To integrate the form into the electronic referral system</td>
<td>“It’s a bit cumbersome. But it does guide you through the thought process. It would help if it can be integrated into the (electronic) blue letter” “Make it electronic rather than hard copy” “A soft copy version with a list to fill in might be easier for everyone to use”</td>
</tr>
<tr>
<td></td>
<td>To include an easy-to-access soft copy</td>
<td></td>
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<tr>
<td>2.</td>
<td>To include a template for the Mini Mental State Examination (MMSE)/ Abbreviated Mental Test (AMT) in the form.</td>
<td>“A drop-down menu with an attached MMSE and AMT template would be helpful if you want us to perform it and to standardise things.” “Perhaps something that would be helpful is to include the MMSE/AMT in the appendix for ease of access.”</td>
</tr>
</tbody>
</table>
REFERENCES


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Patients' and Caregivers' Attitudes Towards Video Consultation During the COVID-19 Pandemic

Eileen Lew¹, Jean Aan Mark Koh², Jing Chun Teo³, Delphine Ow³, Sally Oh⁴, Kee Chong Ng⁵

ABSTRACT

Introduction: In line with global trends, our institution experienced an expansion of telemedicine services during the COVID-19 pandemic. This study aims to evaluate patients’ and caregivers’ perception of video consultation at a women's and children's hospital. Results will guide efforts in integrating telemedicine into the mainstream health service.

Methods: Patients and caregivers who participated in video consultation during the study period completed an online questionnaire which explores their attitudes towards video consultation. In addition to demographic and academic data, patients or care-givers rated (on a five-point Likert scale) their agreement with items evaluating the dimensions of technical quality, perceived usefulness, effectiveness, effect on interaction and satisfaction. Free-text responses were also encouraged and coded by thematic analysis.

Results: Of 2672 unique video consultations conducted over 12 months, 392 surveys were returned, giving a response rate of 14.7%. Of these, 244 (62.2%) were conducted by a doctor or nurse and 148 (37.8%) by an allied health professional. Majority of responders were caregivers, female, of 36 to 45 years of age and had attained university qualification. Overall, responders perceived video consultation favourably, with 63.4% agreeing that it is equivalent to a physical attendance. Reduced travel time and improved access to medical care were quoted as major benefits while the lack of physical touch and inability to perform formal assessments were viewed as limitations.

Conclusion: Patients and caregivers regard video consultation as a viable substitute for care in a pandemic. A hybrid model of consultation for the appropriate patient-mix may be acceptable in the new norm.

Keywords: Telemedicine, telehealth, COVID-19, health care surveys

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INTRODUCTION

Telemedicine refers to the use of information and communication technologies for the delivery of health care services, where distance is a barrier [1]. It may be employed for the diagnosis of diseases and injuries, rehabilitation, research as well as continuing medical education of healthcare providers and patients. Despite reports of increased healthcare accessibility and cost savings related to the elimination of travel [2,3], global uptake of telemedicine has remained slow and variable until the present pandemic. Barriers to scaling-up are multi-dimensional and may be attributed to the piecemeal development of infrastructure, high start-up costs, lack of technical expertise, ethical and legal concerns and competing health system priorities [1,4,5]. The 2019 coronavirus pandemic (COVID-19) caused an unprecedented global disruption to healthcare services and facilitated the expansion of telemedicine by allowing medical care to be delivered remotely, thus reducing the risks of transmission of infections. Recent literature described the use of telemedicine in triaging care for COVID-19 patients and helping non-COVID patients navigate the health system to access routine care [6-8].

In line with global trends, our institution experienced a rapid ramp-up of telemedicine services in April 2020, driven by the hospital’s commitment to provide care to non-COVID patients, even as in-person clinic visits were curtailed. In addition to staff training, laptops, video conferencing accounts and a starter kit of instructions were allocated to all onboarding staff. Where feasible, scheduled outpatient visits for stable, repeat patients were converted to phone or video consults. To close the loop, medications were delivered at no additional charge to patients’ homes after each virtual consult. Prior to February 2020, only four clinical departments at our institution were offering teleconsultation. This number increased more than five-fold by June 2020. With limited time for deliberate planning and preparation, missteps could occur that could adversely impact service fidelity, patient experience and clinical outcomes. For telemedicine to be effective, it is important to identify and address the gaps and challenges faced by patients and their caregivers.

Surveys are a common method for evaluating patient-reported outcome measures. The value of a survey instrument lies in its ability to gather viewpoints efficiently from large samples to produce generalizable insights. Surveys have been extensively employed in telehealth research to evaluate the perception, attitudes and satisfaction of patients and healthcare providers [9]. Of note, the patient's perception constitutes an important domain of the Model for ASessment of Telemedicine applications (MAST) – a European framework for the evaluation of telemedicine [10].

The aim of this survey study is to evaluate patients’ and caregivers’ perception of video consultation at a tertiary women’s and children’s hospital during the COVID-19 pandemic. Results could provide insights to guide scale-up efforts and the integration of telemedicine into the mainstream health service as a "business as usual" (BAU) modality.

METHODS

This is a cross-sectional study conducted at the KK Women’s and Children’s Hospital, involving patients (or their caregivers) who had received video consultation for their follow-up care in the period 1 April 2020 to 31 March 2021.

Upon completion of video consultation with their healthcare provider, patients (or their caregivers) were invited to participate in an anonymous online survey seeking their feedback on their experience of virtual consultation. The feedback survey was mandated by the Ministry of Health as proof-of-concept evaluation in order for the telemedicine service to qualify for government subvention. Based on guidelines provided by the Ministry and the Integrated Health Information System (IHIS), the questionnaire was designed by an institutional workgroup consisting of clinicians, healthcare administrators and technical support staff using items adapted from validated telemedicine questionnaires that explore the perception of dimensions commonly reported in telehealth research [11]. The study questionnaire consists of newly developed questions and items derived from the validated Telemedicine Satisfaction Questionnaire [12] and Telemedicine Usability Questionnaire [13]. Given the urgency of telemedicine deployment at our institution, the study questionnaire focused primarily on utility and usability of video consultation to identify factors that could impede patient adoption.

Telemedicine participants completed the online questionnaire through a web link sent through email or Short Message Service (SMS). Besides demographic data and academic qualification, responders were asked to rate (on a five-point Likert
scale: strongly disagree, disagree, neutral, agree, strongly agree) their agreement with items exploring their perception of the dimensions under study. In addition, responders who had undergone a video consultation with an allied health professional were required to indicate the benefits and challenges of video consultation most relevant to them, by ranking a list of drop-down options. All responders were encouraged to provide free-text comments for each item. The study was exempted from ethics review by the Institutional Review Board as it was deemed a service evaluation.

**Statistical Analysis**
Data was auto-populated in Microsoft Excel 2016 (Microsoft Inc., USA) and analyzed by descriptive statistics. Responders were grouped under “medical” if they had virtual consultation with a doctor or nurse or “allied health” if they had interacted with an allied health professional in the video consultation. Categorical data were compared between groups using Pearson Chi-Square test, with level of significance set at 0.05. Free-text responses were coded by themes relevant to the research focus and context, utilizing the dualistic inductive and deductive thematic analysis to generate codes and derive insights [14].

**RESULTS**
Over 12 months, 2672 new video consultations were conducted by 21 clinical services and 392 patient surveys were returned, giving a response rate of 14.7%.

Of these, 244 responders (62.2%) had consulted with a doctor or nurse while 148 (37.8%) interacted with an allied health professional [Table I]. Majority of responders were caregivers of paediatric patients, female, of age range 36 to 45 years and had attained university qualification.

Table II shows the distribution of perception scores by service type. To allow differentiation between favourable (‘strongly agree’ and ‘agree’) and unfavourable (‘disagree’ and ‘strongly disagree’) perceptions, the five-point Likert responses were further classified into three categories: (1) a combination of ‘strongly agree’ and ‘agree’ (2) neutral and (3) a combination of ‘disagree’ and ‘strongly disagree’. At least 90% of both medical and allied health responders reported favourable perceptions of the dimensions of video consultation under study, except for items pertaining to cost and future adoption. Only 70.3% allied health responders found the video consultation charges reasonable and were willing to pay out-of-pocket, compared with 79.9% of medical responders, although the difference was not significant (p=0.120). In addition, only 76.4 % of allied health responders expressed willingness to adopt video consultation for future consultations, compared with 84.4% of medical responders (p=0.073). Similarly, only 76.9% of allied health responders would recommend video consultation to their friends and family compared with 86.1% of medical responders (p = 0.070).

About 63% of all responders reported their virtual experience to be equivalent to that of an in-person attendance, for consultation, assessment and treatment (Table III). Almost equal proportions of responders described their experience as better or worse, than an in-person attendance. Notably, a higher proportion of allied health responders had deemed their experience to be worse than that of a physical consult, compared with medical responders (16.0% vs 9.0%, p<0.01).

In the ranking of benefits specific to allied health responders, the reduction in travel time, convenience and access to healthcare during a pandemic emerged as major benefits associated with video consultation (Figure 1). Having their child undergo therapy in the comfort and familiarity of the home environment was also valued. Limitation in physical intervention, the inability to receive formal assessments and difficulty in building rapport with their healthcare provider were cited as major limitations (Figure 2).

Sixty-eight responders provided 106 free-text comments that were classified into 6 themes and 270 coding references. The 6 themes identified were experience, satisfaction, technical quality, perceived effectiveness, perceived usefulness and quality of interaction, generating 65, 63, 26, 32, 47 and 37 coding references, respectively. Almost equal proportions of favourable and unfavourable comments were obtained, with the majority relating to perceived usefulness, experience, satisfaction and future use. Among medical responders, positive comments related to “saving time and hassle of going to the hospital.” One responder commented that virtual consultation allowed her child to “have more time for his lunch and rest.” There were also open acknowledgements that “exposure risk” is drastically reduced with teleconsultation during the pandemic. One mother wrote that, with video consultation, she would “never miss future follow-up visits” for her child as she could “attend” the clinic while looking after her five children. Negative
comments relate to the lack of physical touch. One responder wrote, “Nothing beats face to face especially for a CP kid as more touch and feel is needed due to the tone of the muscles.” Another responder of the lactation service commented, “There are still some things that video consult is unable to achieve, such as helping to check blocked ducts and hands-on experience.” Allied health responders, in particular, expressed a preference for a hybrid model of care, comprising a combination of virtual and in-person therapy sessions.

**DISCUSSION**

Over 12 months from the onset of the pandemic, video consultations were successfully implemented for a myriad of paediatric and women’s medical and allied health services at our institution. The present study shows that follow-up patients have positive perceptions of video consultations, with more than half agreeing that it is at least equivalent to a face-to-face encounter. Although responders acknowledged the benefits of time-savings, convenience and accessibility to healthcare, the lack of physical touch consistently emerged as a limitation, particularly among allied health responders.

The response rate of the survey is 14.7%. Response rates to surveys have been declining over the last decades [15]. Explanations for non-response include survey fatigue arising from the increasing number of surveys, privacy concerns and greater time pressures. Our response rate, albeit low, is similar to that attained in a telemedicine survey conducted over the same period [16].

We observe that responders in the present study were mainly young females who had attained university qualification. Studies suggest that age, academic qualification and computer literacy can affect a patient’s perception and willingness to adopt mobile health technologies [4, 17]. In a study examining the utilization pattern of virtual health services, younger and predominantly female patients emerged as early adopters of virtual medical consultations [17]. With a low survey response rate, it may be preliminary to assume that our study sample is representative of the entire cohort of telemedicine patients. However, given the young age of patients or caregivers at our institution and the high internet penetration in the local population [18], we are optimistic that our patients and caregivers will have the open mindset and technology know-how to adopt a telehealth model of care in the new norm.

In the field of telemedicine research, it is common practice to evaluate user satisfaction and usability of telemedicine systems using validated questionnaires [19], while clinical outcomes are assessed by biometric measurements, quality of life and disease-specific questionnaire instruments [20]. In the present study, we have designed the study questionnaire using de-novo items and items derived from validated questionnaires [12,13], focusing on the dimensions of utility, usability and user satisfaction. The goal is to provide insights on acceptability and user compliance. It is indeed encouraging to note that survey responders have positive perceptions of video consultation and acknowledge it as an effective substitute for physical attendance in the current pandemic.

Responders’ perception of time-savings is supported by studies conducted prior to the pandemic. A study by the US Department of Veterans Affairs found that rural patients receiving care through telemedicine reported saving an average of 230 km and 142 minutes per visit, compared to physical attendance [2]. In another study, total cost savings of US$5.5 million were accrued over 5.5 years in 921 patients living in remote areas after the introduction of a tele-orthopedic service reduced patients’ travel time and cost [3]. Hence, reduction in patient costs is largely attributed to the reduction in travel costs and time off work. While participants of the present study acknowledge the convenience and time-savings associated with video consultation, a significant proportion expressed negative sentiments regarding its costs, even though telemedicine fees are currently priced lower than a physical consult to encourage patient uptake. We hypothesize that some patients may feel short-changed when paying for a service that falls short of their expectation of a traditional medical consult e.g. lacking in physical touch. We should educate patients on the value of telemedicine while assuring them that healthcare providers comply with current regulations in that video consultations are only conducted in cases where physical examination is not critical for clinical decision-making [21].

From the perspective of health care organizations, it may be harder to prove a return on investment, in the face of high start-up costs and competing healthcare priorities [4, 22, 23]. With perpetuation of traditional face-to-face consultations amidst slow adoption of telemedicine, healthcare institutions would be hard-pressed to demonstrate significant cost-savings, as facility overheads and manpower costs remain high. For cost-benefit analysis in the current context, one should take into consideration
hospital cost-savings gleaned from the prevention of COVID-19 transmission and treatment costs of infected patients.

Almost half of the study responders had participated in a tele-rehabilitation session. The World Confederation for Physical Therapy strongly advocates the use of tele-rehabilitation to improve accessibility to physiotherapy, speech therapy or occupational therapy [24]. Similar to previous studies [25-27], our survey responders had reported a satisfactory experience with their virtual sessions with allied health professionals, except for the “lack of physical touch”. This limitation had been highlighted in another local study evaluating the acceptance of tele-rehabilitation in post-stroke patients [28]. Physical intervention is an integral part of the therapist’s interaction with the patient. It is, therefore, not surprising that both patients and their therapists view the absence of physical touch as a limitation of tele-rehabilitation. Patients in the present study did not have the opportunity to use highly sophisticated tele-rehabilitation systems, based on virtual reality, which could potentially enhance patient experience by providing real-time feedback and positive reinforcements [29, 30]. Future virtual therapy sessions should seek to employ technology-based tele-rehabilitation systems capable of providing real-time sensory feedback. In the meantime, a hybrid care model, where virtual sessions are interspersed with in-person, hospital-based physical therapy might be more acceptable to patients in the new norm.

There are limitations in this study. The response rate was low (14.7%) and this could introduce selection bias, as only satisfied patients may have responded to the survey. Some demographic data were incomplete. As the study was conducted at a single institution, the results could not be extrapolated to another healthcare setting with different demographic profiles and case-mix of patients. The survey questionnaire, albeit derived from validated telemedicine questionnaires, has not been fully validated in its current form. Future research should seek to survey a larger cohort of patients, using a validated questionnaire for consistency and validity. The experience and attitudes of health care providers should also be elicited to provide a holistic approach to telemedicine service improvement.

**CONCLUSION**

Both medical and allied health responders have positive perceptions of video consultation and accept it as an effective substitute for care in a pandemic. Cost and the lack of physical touch are perceived limitations, particularly among tele-rehabilitation patients. A hybrid model, comprising physical and virtual consultation for the appropriate patient-mix, may be acceptable in the new norm for clinical consultation and therapy.
### TABLE I: Demographic data of survey responders

<table>
<thead>
<tr>
<th>By service type</th>
<th>n (%)</th>
<th>Missing data (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical services</td>
<td>244 (62.2%)</td>
<td>0</td>
</tr>
<tr>
<td>Allied health services</td>
<td>148 (37.8%)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Respondent Type (mandatory field)</th>
<th>n (%)</th>
<th>Missing data (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient</td>
<td>113 (28.8%)</td>
<td>0</td>
</tr>
<tr>
<td>Parent/Caregiver/Spouse</td>
<td>279 (71.1%)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender (optional)</th>
<th>n (%)</th>
<th>Missing data (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>262 (69.9%)</td>
<td>17</td>
</tr>
<tr>
<td>Male</td>
<td>113 (30.1%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>375</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age (optional)</th>
<th>n (%)</th>
<th>Missing data (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 18 years</td>
<td>24 (10.5%)</td>
<td>163</td>
</tr>
<tr>
<td>18-25</td>
<td>5 (2.2%)</td>
<td></td>
</tr>
<tr>
<td>26-35</td>
<td>70 (30.5%)</td>
<td></td>
</tr>
<tr>
<td>36-45</td>
<td>104 (45.4%)</td>
<td></td>
</tr>
<tr>
<td>46-55</td>
<td>2 (0.9%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>229</td>
<td>163</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education Level (optional)</th>
<th>n (%)</th>
<th>Missing data (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Secondary</td>
<td>56 (17.5%)</td>
<td></td>
</tr>
<tr>
<td>Post-Secondary, Diploma &amp; Professional Qualification</td>
<td>17 (5.3%)</td>
<td></td>
</tr>
<tr>
<td>University &amp; Above</td>
<td>247 (77.2%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>320</td>
<td>72</td>
</tr>
</tbody>
</table>
Table II: Distribution of perception scores among medical and allied health responders

<table>
<thead>
<tr>
<th>Statement</th>
<th>Medical (%)</th>
<th>*AHS (%)</th>
<th>P Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly agree and agree</td>
<td>Neutral</td>
<td>Disagree and strongly disagree</td>
</tr>
<tr>
<td>The process of setting up and using the VC zoom program was simple.</td>
<td>98.0</td>
<td>1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>The VC program’s sound, video and features are of good quality.</td>
<td>93.9</td>
<td>3.7</td>
<td>2.5</td>
</tr>
<tr>
<td>I feel that I received sufficient information and guidance before the VC</td>
<td>95.5</td>
<td>3.7</td>
<td>0.8</td>
</tr>
<tr>
<td>sessions.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The arrangement of the appointment for VC was convenient.</td>
<td>95.9</td>
<td>2.9</td>
<td>1.2</td>
</tr>
<tr>
<td>The healthcare staff was prompt in attending the VC session.</td>
<td>97.5</td>
<td>2.5</td>
<td>0</td>
</tr>
<tr>
<td>I felt at ease speaking to the healthcare staff over the VC.</td>
<td>96.7</td>
<td>2.9</td>
<td>0.4</td>
</tr>
<tr>
<td>I and/or my child understood what the healthcare staff was saying to me</td>
<td>97.5</td>
<td>2.0</td>
<td>0.4</td>
</tr>
<tr>
<td>VC.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The healthcare staff heard and understood me over the VC.</td>
<td>98.4</td>
<td>1.2</td>
<td>0.4</td>
</tr>
<tr>
<td>There was adequate opportunity for me to ask questions during the VC.</td>
<td>99.2</td>
<td>0.8</td>
<td>0</td>
</tr>
<tr>
<td>I felt that the healthcare staff was able to adequately assess my medical</td>
<td>91.8</td>
<td>6.6</td>
<td>1.6</td>
</tr>
<tr>
<td>condition over VC.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I felt my /my child’s privacy was respected.</td>
<td>97.5</td>
<td>2.5</td>
<td>0</td>
</tr>
<tr>
<td>The charges for the VC were reasonable and I did not mind the out-of-pocket</td>
<td>79.9</td>
<td>16.0</td>
<td>4.1</td>
</tr>
<tr>
<td>expenses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The consultation duration for the VC was adequate.</td>
<td>95.1</td>
<td>4.5</td>
<td>0.4</td>
</tr>
<tr>
<td>The process for collection of medications after VC was simple and</td>
<td>93.0</td>
<td>4.7</td>
<td>2.3</td>
</tr>
<tr>
<td>convenient.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># I and/or my child were taught all I needed to know on how to continue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with my/my child’s rehabilitation / therapy / intervention at home. I</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>feel supported by my allied health professional in the care of myself/my</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>child.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># The instructions during the Video Consultation were clear and easy to</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>follow.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I will continue to use VC for future consultation with my/my child’s</td>
<td>84.4</td>
<td>10.7</td>
<td>4.9</td>
</tr>
<tr>
<td>healthcare staff.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I will recommend VC to my friends and family.</td>
<td>86.1</td>
<td>9.3</td>
<td>4.6</td>
</tr>
</tbody>
</table>

*AHS: Allied Health Service
VC: video consultation
# Question applicable to AHS responders only.
Table III: Comparison of video consultation with in-person attendance for consultation, assessment and treatment

<table>
<thead>
<tr>
<th>“Compared to face-to-face, video consultation is...”</th>
<th>Medical n (%)</th>
<th>*AHS n (%)</th>
<th>p value</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better</td>
<td>111 (15.2%)</td>
<td>62 (14.0%)</td>
<td>0.573</td>
<td>173 (14.7%)</td>
</tr>
<tr>
<td>Similar</td>
<td>484 (66.1%)</td>
<td>262 (59.0%)</td>
<td>0.014</td>
<td>746 (63.4%)</td>
</tr>
<tr>
<td>Worse</td>
<td>66 (9.0%)</td>
<td>71 (16.0%)</td>
<td>0.0004</td>
<td>137 (11.6%)</td>
</tr>
<tr>
<td>Not applicable</td>
<td>71 (9.7%)</td>
<td>49 (11.0%)</td>
<td>0.417</td>
<td>120 (10.2%)</td>
</tr>
</tbody>
</table>

*AHS: Allied Health Service
Figure 1: Distribution of benefits of video consultation, as perceived by allied health responders

Figure 2: Distribution of limitations of video consultation, as perceived by allied health responders
REFERENCES


ABSTRACT

Introduction: Hand hygiene compliance (HHC) is the most effective way of preventing healthcare-associated infections, but is reported to be about 60% globally. Manual audit systems are labour-intensive and may introduce Hawthorne effects. Current technology for measuring HHC is limited and largely based on wireless tracking. We endeavour to design and validate a computer vision-based HHC tool for use in a paediatric outpatient setting.

Methods: A Kinect depth sensor was set up to capture depth data of real-world and simulated clinician-patient interactions via an angled view (set-up A) and frontal view (set-up B), respectively at a clinic over three months. For both configurations, depth data of clinician-patient pairs was continuously analyzed by a computer algorithm pre-trained to tag skeletal parameters at frontal view to identify potential HH opportunities (i.e. when distance between clinician and patient reaches a pre-specified threshold.) Accuracy of the system was validated by comparing the system’s output with manual observation of video streams by investigators.

Results: A total of 52 and 66 HH opportunities were identified by manual observation of video streams captured via set-up A and B, giving the system tagging accuracy of 19.2% and 74.2% respectively. Kinect detection errors occurred more frequently in the less obstructive but angled view in set-up A, and accounted for 54.8% of all its errors.

Conclusion: A computer vision-based HHC tool can be developed to track dynamic clinician-patient interactions and identify HH opportunities at a clinic. System accuracy is camera view dependent and can potentially be increased by incorporating multiple view-angles or ceiling-mounted wide-angle cameras with annotated datasets to enhance machine learning.

Keywords: Healthcare, image processing and computer, depth cues, design studies
INTRODUCTION

Hand hygiene (HH) is the single most effective intervention that reduces the transmission of healthcare-associated infections (HCAI’s). HCAI’s are reported to cause an annual 80,000 deaths in the United States and 5,000 deaths in United Kingdom [1], but hand hygiene compliance (HHC) is reported to be less than 60% globally [2-4]. Studies show a wide variation when observations are collected through manual covert audits [5] which are prone to Hawthorne observation bias [6] that artificially inflate HHC by 28%- 65% [7-9]. Manual audits are also laborious, requiring manpower resources to obtain appropriate sample sizes [10]. Most notably, monitoring HHC does not translate to an improvement in HHC, as manual audits are often retrospective and lacks the ability to provide immediate effective feedback [8]. Traditionally, health care providers have relied on visual reminders e.g. wall posters and slogans to reinforce education on HHC. The literature confirms the limited effectiveness of a sole focus on knowledge and has called for a more behaviour-driven approach, using practical and effective HHC detection tools to monitor and facilitate immediate feedback [11].

In recent years, technological applications for the detection of HHC have emerged [12-13]. They can be broadly divided into two categories: 1) technologies that monitor a specific aspect or moment of HH (e.g. HH at room exit and/or entry, number of hand rub dispenses) [14] and 2) compliance monitoring technologies that assess compliance of healthcare staff on a background of opportunities for HH e.g. via video monitoring [15-16]. Between the two, compliance monitoring systems have shown to be more effective in improving HHC, when combined with real-time notifications (e.g. vibrations in name tags) [17]. Compliance monitoring systems reported in studies are based on wireless tracking technologies, such as radiofrequency identity tagging (RFID), wireless local area networking (Wi-Fi) or Bluetooth Low Energy (BLE). However, these wireless systems require both clinicians and patients to wear a sensor or tag continuously and hence, are subject to human factors limiting their regular use. There are also concerns regarding electromagnetic interference (EMI), high costs and intensive maintenance [11,18]. Patient safety risks may result as EMI from radiofrequency identification could potentially induce incidents with existing medical equipment [11].

We have previously described a HH tool, based on infrared (IR) sensors and real-time notification, suitable for monitoring HHC in the outpatient setting [19]. The study showed that HHC increased from a baseline of 53.8% to 80.4% (p<0.001) with the 15 second-alarm and 100% (p<0.001) when the auditory notification was configured to be persistent until HH was performed. However, due to unintended crossing of static IR lines, a false-positive rate of 10.5% was attained. It was also observed that dynamic clinician-patient interactions could go undetected by static IR lines of the system.

We hypothesize that a HHC tool based on computer vision (CV) could provide more accurate tracking of the dynamic interactions between the clinician and patient, as it operates on a continuous video stream of depth images to locate objects in multidimensional space [20]. Specifically, CV technology allows motion to be captured at high resolution while maintaining patient and staff privacy as facial features are not captured. We sought to design a privacy-preserving, vision-based system for tracking HHC by replacing the IR line-of-sight-sensors with a combination of optical sensors and computer vision algorithms. This paper describes the development and validation of a CV-based HHC tool at an outpatient paediatric clinic via two configurations.

METHODS

Study Design and Setting
Cross-sectional study of HH moments during real and simulated clinician-patient encounters at a paediatric outpatient clinic

Outcome Measure
The study focused on Moment One of HH - defined as HH before patient contact. For the purpose of the study, HH opportunities are defined as first movement of a clinician into a zone around the patient, analogous to HH ‘prior to patient contact’. HH moments or opportunities logged by the computer vision algorithm for all clinician-patient interactions were compared with investigators’ manual observations of HH moments on video streams.

Technical Set-up
A CV-based HH tool was set up at a clinic consult room, as shown in Figure 1 and 2. A Kinect depth sensor was connected to a UP prototyping board equipped with Bluetooth capabilities. Data on clinician-patient interactions was continuously
streamed to the prototyping board that operates a scheduled Python™ program. Using an open-source library for body part recognition [21], skeletal recognition was achieved by ‘feeding’ images through a ‘trained’ deep randomised decision forest classifier. The workflow of the computer algorithm is shown in Figure 3. After background subtraction to filter out movable objects (e.g. chair, screen), the clinician was tagged with Kinect’s skeletal tracking function. This enabled the algorithm to register the clinician’s skeletal parameters (e.g. body joints, anatomy length) and store them for further reference. The patient was similarly tagged on entering the initialisation space at the door and the patient’s skeletal parameters stored and tracked. Distance between the clinician and patient was then continuously computed for each change of pose and if the distance was less than a pre-specified threshold indicating close contact, the HH opportunity was logged by the system. Point reference for distance calculation was taken from the tip of the clinician’s right or left middle finger to the mid-point of the patient’s spine. When the clinician pressed on the nozzle of hand sanitisers to perform HH, the HHC data was logged and the algorithm would be exited. To maintain patient and staff privacy, a depth video stream of 640x480 images at 30 frames per second was used, instead of Red Green Blue (RGB) stream.

Although the Kinect functions best with frontal views, we explored two configurations for the set-up. In set-up A (Figure 1), the camera was placed approximately 2 metres from the ground and positioned to capture the patient’s entry into the room as well as clinician’s workspace. In this position, the Kinect sensor would be mostly exposed to side views of the human body. In set-up B (Figure 2), the camera was positioned to capture full frontal views of people and objects.

Data Collection and Analysis
Depth video data was collected for each of the configurations. Set-up A was configured for real-world clinic consultation sessions of two of the study investigators (Cyc and Co) over three months. Video streams of 8 sets of patient-doctor encounters were stored, each spanning 4 hours and amounting to a total of 32 hours of depth video data. Set-up B was deemed unsuitable for practical operations, as it appeared intrusive and was at risk of being accidentally knocked over. Instead, clinician-patient encounters for set-up B were simulated through 23 mock-up interactions and stored for analysis, comprising interactions involving (1) 1 clinician and 1 patient, (2) 1 clinician, 1 patient and 1 caregiver, and (3) 1 clinician, 1 patient and 1 nurse. For each set-up, the ability of the system to capture events, such as movement, occlusion, position change and hand rub, were studied.

Two investigators (JCT and DK) manually reviewed all recorded video streams to identify potential HH opportunities. Data accuracy was validated by comparing HHC events logged by the system with the total available HH opportunities identified by manual observation. The system was deemed accurate when it correctly tagged the subjects and identified HH Moment One in each pair of clinician-patient encounter. When an error in tagging was encountered, logs were retraced to identify the source. Errors in tagging were also further analysed. The study was exempted from review by the SingHealth Centralized Institutional Review Board.

RESULTS
A total of 52 and 66 subject tags and HH opportunities (collectively known as ‘events’) were identified by manual observation of video streams captured via set-up A and B respectively (Table 1). Accuracy in tagging was 19.2% in set-up A, compared to 74.2% in set-up B. (Table 1)

Errors in tagging were further analysed and classified into 8 error types (Figure 4). Kinect detection failure occurred more frequently with set-up A and resulted in random floating skeletons being detected by the system when no subject was present. Both configurations also registered physical contact between clinician and patient when it did not actually occur. Wrong identification of the nurse, clinician or care-giver as the patient was another source of error.

DISCUSSION
Our study shows that the accuracy of a CV-based system in detecting HH events is 19.2% in set-up A, but increases to 74.2% when set-up B is used. The increase in accuracy is related to the camera position, which allowed full frontal views of subjects to be captured at eye-level. Kinect libraries are known to function best when tracking skeletal features at eye level (as in set-up B), but not from an angled position (as in set-up A). However, being at eye-level, the camera is subject to occlusion of bodies which could result in false-positive errors. As the camera in set-up B is perched intrusively in the clinician-patient sphere of interaction, it could also risk being accidentally knocked over and is not operationally feasible to implement in real-world settings.
There are ways to improve system accuracy in the prototype CV-based HH tool. Assuming that set-up is operationally more feasible, training the software for an angled detection in the outpatient setting could boost its accuracy. The current prototype may be underperforming, as ‘learning’ has not been achieved by the system and inferences were made, based on a pre-trained open source library. Open source libraries have limitations in that they could have been “trained” in a specific environment or context that is not relevant or applicable to the current clinical setting. Systems’ learning can also be enhanced by building annotated datasets, achieved by labelling datasets in the specific clinic environments.

Of the errors observed, Kinect detection errors accounted for 54.8% (23 out of 42) of total false positive results. This could be due to the angled position of the Kinect sensor. These errors could be potentially eliminated by the use of a wide-angle camera mounted to the ceiling which could capture skeletons drawn onto the human bodies more consistently.

Another class of errors relates to the wrong identification of subjects, wherein a nurse passing by a clinician could accidentally be labelled as the new “clinician”. While this problem can be remedied, to a small extent, by introducing movement momentum libraries, it highlights the limitations of using a single eye-level depth sensor and suggests the need for multiple depth sensors for better capture. The use of depth sensors and proximity algorithms in a computer vision HH tool for the tracking and re-identification of clinicians across wards has previously been described by Hague et al [22].

In conclusion, the present study shows that a CV-based HHC tool can be developed to track dynamic clinician-patient interactions and identify HH opportunities at an outpatient setting. Future innovation should focus on increasing system accuracy by incorporating multiple view-angles or ceiling-mounted wide-angle cameras with annotated datasets to enhance machine learning.

**ACKNOWLEDGMENTS**

The authors would like to thank the Children’s Surgery Centre and Infection Control Department at the KK Women’s and Children’s Hospital for their support of this project.
TABLES AND FIGURES

Figure 1: In set-up A, the camera is positioned to capture the side-view of patients and clinicians.

Figure 2: In set-up B, the camera is positioned to capture frontal views.
Figure 3: Algorithm workflow in Python™ 3.6.8

Table 1: Validation of CV-based HH algorithm against manual observation

<table>
<thead>
<tr>
<th>Kinect Position</th>
<th>No. of HH opportunities identified by manual review of video (n)</th>
<th>No. of events accurately identified by algorithm (n)</th>
<th>% accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>True interactions</td>
<td>52</td>
<td>10</td>
<td>19.2</td>
</tr>
<tr>
<td>via set-up A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulated interactions</td>
<td>66</td>
<td>49</td>
<td>74.2</td>
</tr>
<tr>
<td>via set-up B</td>
<td></td>
<td></td>
<td>[p&lt;0.001]</td>
</tr>
</tbody>
</table>
Figure 4: Comparison of systems errors between set-up A and B
REFERENCES


ABSTRACT

Introduction: Patients with musculoskeletal conditions have difficulty with mobility and travel. A pediatric hospital appointment can take up to a day, causing disruption in the child's and parents' schedule, especially for chronic conditions. Depending on the condition being consulted for, certain conditions if seen during the morning consultation may require a physical or occupational therapist's review later in the afternoon. Both can act as challenges towards attending physical consultations at the hospital. Hence, healthcare delivery can be re-designed to save time and cost and provide increased convenience for the patients and healthcare provider. The objective is to study the viability of a teleconsultation platform to optimize clinical consultation for patients.

Methods: A teleconsultation clinic was started for 30 chosen patients. Patients were evaluated for their suitability for the teleconsultation clinic. They were only included if they met these 3 criteria: patients with a known diagnosis, had a condition that can be assessed via pure clinical inspection, and have existing rapport with the clinician. Selection of patients were done so that those who transited to teleconsultation would be able to receive satisfactory service and better quality of care, as well as ensure that teleconsultation services could be appropriately evaluated. As quality improvement projects require a minimum of 15 per group (before and after intervention), these first 30 patients during the time period were chosen. Participants were given a survey at the end of the service to compare numerous components between telemedicine and face-to-face consultation. We measured time effectiveness of the service, as well as patients' satisfaction rate.

Results: 100% of the patients were at least satisfied with the teleconsultation clinic, with 96.7% being very likely to recommend the service to their peers. At least 94% of participants considered video conferencing to be as good as face-to-face consultation. An average of 74 minutes of travel time was saved when teleconsultation was compared to face-to-face consultation, and the median time needed for teleconsultation was 18 minutes less than the face-to-face consultation, not inclusive of travel time. There was an increase in attendance rate from 81% to 100% with the transition to teleconsultation.

Conclusion: Teleconsultation is a viable platform in the long run. It is time-efficient, helping to save significant time for patients and consultants, even freeing up physical consultation slots for patients who need them.

Keywords: Telemedicine, Teleconsultation, Paediatrics, Orthopaedics, Quality Improvement
INTRODUCTION

Patients with musculoskeletal conditions tend to face challenges with mobility and travel. These constitute challenges towards smooth accessibility when attending physical consultations at the hospital from having to navigate through registration, payment and the appointment counter. An appointment can take anywhere from a couple of hours up to a whole day inclusive of travelling and waiting time. Depending on the condition being consulted for, certain conditions if seen during the morning consultation may require a physical or occupational therapist's review later in the afternoon. Some conditions require plaster casting and orthotics services as well. This causes disruption to not only the child’s schedule, but also the parent’s schedule, as the parents are most likely caregiver to bring their child to the appointment. In cases of chronic conditions where multiple regular visits are required, the child’s education and the parent’s work performance may be affected. Hence, healthcare delivery can be redesigned to optimize clinical appointments for the patients.

Telemedicine has progressed over the past few years, together with advancements in technology. Evidence suggests that the use of communication technology works for both acute and chronic disease management [1] and can deliver the same quality of medical care as face-to-face consultation [2]. In addition, it is seen to be time and cost effective for both the healthcare provider and patients [2,3]. However, many are hesitant on transiting to teleconsultation services from standard consultations, due to threats on privacy [1] and the perception of teleconsultation being more impersonal. Technology literacy is another barrier that hinders the usage of teleconsultation [4].

Few studies have studied the viability and effect of telemedicine/teleconsultation in recent years, especially in cases of patients with musculoskeletal conditions [5-8]. This study aims to review the viability of a teleconsultation platform.

Under our initiative, a teleconsultation clinic was set up, working with various stakeholders to overcome challenges encountered. These include issues involving connection, data handling and operation of the software applications. We ensured that internet connection issues were minimal, data confidentiality was taken note of, and the possibility of data breach was eliminated. Other issues that we overcame while setting up the teleconsultation clinic included having a new charge code and description for billing issues. This is important as the charges for the teleconsults are lower than that of physical consults. It also allows proper documentation of resource usage, audit and insurance claims. To mitigate the problem of patients and their families not knowing how to use the software for teleconsultation, clinic assistants were trained and later helped to educate the families. The initial software application used was one provided by a local telecommunication service provider. A subsequent more widely used application has since then been adopted – Zoom. The recent Covid-19 pandemic had hastened the adoption of teleconferencing platforms be it for schools or work; and hence education for using the application is now rarely necessary.

We believe that a teleconsultation clinic as an alternative platform can help to save time and costs for both the healthcare provider and patient, as well as provide a better patient experience. Patients can have increased convenience by receiving the consultation from the comfort of their own home, while also reducing worries of possible exposure to communicable diseases especially in the setting of a pandemic in the hospital environment. Through the introduction of a telemedicine initiative, we hope to help our patients increase their access to healthcare, decreasing the number of appointments with no-shows.

MATERIALS AND METHODS

Local institution research board approval was obtained for this study. CIRB Ref: 2018/2766. A waiver of consent was obtained.

Teleconsultation Clinic Set Up

As a regulatory requirement, all hospital desktops and laptops have been disconnected from the internet to enhance overall cybersecurity and data confidentiality. This is to minimize the risk of cyberattacks on the electronic medical records. As such, a separate computer and dongle for internet connection had to be obtained. To ensure a more stable connection and prevent lagging of video and audio, we also subscribed to wireless internet connection, as well as searched for a room with good connection. A comprehensive cyber security plan was put forth after working closely with local enablers; Medical Innovation and Care Transformation (MICT) and Integrated Health Information Systems (IHIS), who are involved in the digitisation of healthcare. In addition, clinical notes were only keyed in after internet separation to eliminate the possibility of a data breach. For patients to have smoother transition to the teleconsultation initiative, clinic assistants were
trained and later went on to educate the patient and their family on the utilisation of the software for teleconsultation. In recent years, this has been unnecessary as more families are now familiar with the common teleconferencing platforms such as Zoom, Google Meet and Microsoft Teams. A system for short messaging service (sms) appointment reminders providing the teleconferencing platform link without a physical location was set in place. Once the appointment was set there would be two automatic sms, one instantly and one a day prior to the appointment. With the billing template being unable to differentiate face-to-face consultation from teleconsultation, a new charge code and description for teleconsultation was created to prevent difficulties in insurance claims.

Selection
Patients were evaluated for their suitability for the teleconsultation clinic. They were only included if they met these 3 criteria: patients with a known diagnosis, had a condition that can be assessed via pure clinical inspection, and have existing rapport with the clinician. Selection of patients were done so that those who transited to teleconsultation would be able to receive satisfactory service and better quality of care, as well as ensure that teleconsultation services could be appropriately evaluated. For example, we included stable digit fractures and volar plate injuries without ligamental involvement. These do not need follow up plain radiographs (not necessary even if attending face-to-face consultations). The range of motion can be assessed using screenshots or real-time goniometer measures on screen. The most important factor is to make sure that the digits are in a single file so as to minimize the parallax error. These fractures at first consult would have been given either a malleable metal splint or a Velcro-type buddy loop which are removable.

Prior to enrolling the child, we would check whether the child has a personal cellphone and their familiarity with using the software application (Zoom). The Covid pandemic has actually eased this step. When we started the clinic in 2019 which was prior to the pandemic, we had to train the child and family to use the application. Since the Covid pandemic, we have not met one who has not used it either for school or work

Evaluation Measures
Surveys were then carried out and data was collected from February 2019 to July 2020 to investigate the viability and benefits of teleconsultation. Data collected included the patients’ travelling time from their home to the hospital and back, as well as the average waiting and consultation time at the hospital. This data would be compared to the time taken for teleconsultation. In addition, patient's feedback on their experiences with teleconsultation such as their satisfaction of the service was gathered. The outpatient clinics generally have around 20 patients per session. As we have been very strict about the type of cases suitable for teleconsults, we only see an average of about 4 patients per session.

RESULTS

The study included 30 patients who were found suitable for the teleconsultation initiative. This was a consecutive series of patients which met our inclusion criteria and were keen on using this platform.

Face-to-face consultation includes travelling to and from the clinic, registration, and payment time (Figure 1). In comparison, teleconsultation removes the need for travelling, registration, waiting and payment time (Figure 1). Payment for the teleclinics is done via online banking.

From our survey, we found that the average total time spent on face-to-face consultation was 98 minutes. This consist of a median commute time of 37 minutes to the clinic, 24 minutes spent on consultation at the clinic, and another 37 minutes to travel back home. The interquartile range for consultation at the clinic was 38 minutes while that on commute time to the clinic was 45 minutes. On the other hand, only about 8 minutes is required for teleconsultation. Teleconsultation resulted in a 3-fold reduction of time spent in the consultation process. This was because registration and payment at the counter or kiosks were not necessary. (Figure 2). Through the elimination of commute, patients saved an average of 74 minutes on travelling time. Parking time was not included as it is very inconsistent.

We also took note of the attendance rate of the patients (Figure 3). Face-to-face consultation achieved only 81% of attendance. However, with teleconsultation, we saw an attendance rate of 100%. This rise in attendance rate for teleconsultation as compared to face-to-face consultation shows significant difference statistically (p<0.001). This was not affected by the change in the total patients seen for these conditions which have been on an increasing trend.
In our survey (Table 1), our patients were told to give a ranking of “bad”, “satisfied” and “great” to assess their satisfaction with the teleconsultation service (Figure 4). 100% of the patients were at least satisfied with the teleconsultation experience, with 100% of the patients in 2020 selecting the highest ranking of “great” in the survey. When asked whether video conferencing was as good as face-to-face consultations, at least 94% of the patients agreed that teleconsultation was on par with physical consultations. None of the patients had to return for a physical consult.

Finally, given the choice of “very likely”, “not sure” and “definitely not”, at least 94% of patients were very likely to recommend the teleconsultation tool to a colleague or friend (Fig 5). The other 6% were not sure of whether to recommend, while none of the patients were unwilling to recommend teleconsultation to their peers.

**DISCUSSION**

This study examined the viability and benefits of telemedicine in a paediatric orthopaedic clinic setting. In teleconsultation, time and cost is saved as commuting is eliminated. There is also increased convenience, especially for patients with musculoskeletal conditions, who may not be able to move around as easily.

From our results, about 80 minutes of time can be saved through consultation via video conferencing. This time saved can be beneficial for both the patients and the consultants. With less time being required for consultation, patients and their families can have decreased interruptions in their schedules, preventing their work performance from being affected. Furthermore, this can also help increase the productivity of consultants including the clinic staff maximising their time at the hospital. With teleconsultations being conducted in between clinicians’ clinic and operating days, more consultation slots can be created. This allows for more face-to-face consultation slots to be available for new patients, or for patients with conditions that require physical visits. Since teleconsultation clinics have also achieved a 100% attendance rate in our initiative, there will be lesser appointments with no-shows, allowing a more efficient use of consultation slots.

One of the barriers of transiting to teleconsultation includes the fear that teleconsultation may provide lower standard of care and be lower quality than face-to-face consultations [9,10]. However, most of our patients (96.7%) felt that consultation via video conference was on par with face-to-face consultations. This implies that for selected conditions, teleconsultation can be of same quality as face-to-face consultations.

Patient satisfaction can be defined as the service provided being able to fulfil the patients’ expectations [11-13]. While satisfaction is subjective, it is still an important evaluation criteria as they provide important insights into the patients’ views of teleconsultation and is an important quality indicator of the service [14]. In our initiative, 100% of patients were at least satisfied with teleconsultation. This can be supported by the high recommendation rate of teleconsultation, where 97% of patients were “very likely” to recommend teleconsultation to their peers. Our high satisfaction rate of teleconsultation is consistent with other studies on teleconsultation services [15,16], even if they may not be focused on orthopaedic surgery. However, we did not investigate the specific reasons behind the high overall satisfaction of teleconsultation, whether it was associated with a shorter waiting time [17] or the actual consultation itself. On the other hand, despite having clinic assistants educate patients on the utilisation of video conferencing applications, many patients (43.3%) still seek improvement in the ease of use.

Some limitations of our study include the teleconsultation initiative focusing on the musculoskeletal clinic, with only certain patients being included. Our sample size is also small. This is because of our strict inclusion criteria allowing a very select group of patients. Hence, our results cannot be expanded to other conditions, may not be generalised to a wider population and satisfaction rates may be slightly inflated. Nevertheless, it provides an alternative platform for a carefully selected group of conditions and patients, as elaborated upon in the selection criteria.

**CONCLUSION**

In conclusion, teleconsultation does show substantial benefits and potential to be a viable option in the long-term, providing relatively high satisfaction for the patients. It is cost and time effective, being advantageous for both patients and physicians. Future directions for the study could include utilising a questionnaire with more options and a larger scale to get more specific and accurate answers. In addition, the teleconsultation initiative could be expanded to include different conditions and clinics. Finally, future studies could also include
checking for the accuracy of teleconsultation examination, besides evaluating patient satisfaction, time and cost-effectiveness.

The manuscript’s guarantor affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned (and, if relevant, registered) have been explained.

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.
Figure 1: Flowchart showing the process of face-to-face consultation (above) and teleconsultation (below)

Face-to-face Consultation

- Leave home
- Arrived at clinic
- Register
- Consultation
- Pay
- Leave clinic
- Arrive home

Median for Total Time Spend on face-to-face consultation = 24 mins

Average commute time = 37 mins

Teleconsultation

- Prepare Environment for Teleconsultation
- Consultation
- End Consultation

Median for Total Time Spend on teleconsultation = 8 mins

Figure 2: Total time spent on face-to-face consultation versus teleconsultation
Figure 3: Comparison of Patient Attendance Rate before and after teleconsultation initiative
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**Table 1: Patients’ Evaluation of Teleconsultation**

<table>
<thead>
<tr>
<th></th>
<th>2019 (%)</th>
<th>2020 (%)</th>
<th>Total no. of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teleconsultation is as good as face to face consultation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>17 (94.4)</td>
<td>12 (100)</td>
<td>29 (96.7)</td>
</tr>
<tr>
<td>No</td>
<td>1 (5.6)</td>
<td>0 (0)</td>
<td>1 (3.3)</td>
</tr>
<tr>
<td><strong>Patient's overall satisfaction with teleconsultation experience</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great</td>
<td>10 (55.6)</td>
<td>12 (100)</td>
<td>22 (73.3)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>8 (44.4)</td>
<td>0 (0)</td>
<td>8 (26.7)</td>
</tr>
<tr>
<td>Bad</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>What can be improved</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of use</td>
<td>4 (22.2)</td>
<td>9 (75.0)</td>
<td>13 (43.3)</td>
</tr>
<tr>
<td>Video Quality</td>
<td>2 (11.1)</td>
<td>1 (8.3)</td>
<td>3 (10.0)</td>
</tr>
<tr>
<td>Product Features</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Others: Cannot hear voice clearly</td>
<td>1 (5.6)</td>
<td>0 (0)</td>
<td>1 (3.3)</td>
</tr>
<tr>
<td>Nil</td>
<td>11 (61.1)</td>
<td>2 (16.7)</td>
<td>13 (43.3)</td>
</tr>
<tr>
<td><strong>Will recommend to colleague/friends</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Likely</td>
<td>17 (94.4)</td>
<td>12 (100)</td>
<td>29 (96.7)</td>
</tr>
<tr>
<td>Not sure</td>
<td>1 (5.6)</td>
<td>0 (0)</td>
<td>1 (3.3)</td>
</tr>
<tr>
<td>Definitely Not</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>
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Table 1: Patients’ Evaluation of Teleconsultation

Patient Teleconsultation Satisfaction Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>Great</th>
<th>Satisfied</th>
<th>Bad</th>
</tr>
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<tbody>
<tr>
<td>2019</td>
<td>44%</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>2020</td>
<td>56%</td>
<td></td>
<td>100%</td>
</tr>
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</table>

Patient Recommendation Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>94%</td>
</tr>
<tr>
<td>2020</td>
<td>100%</td>
</tr>
</tbody>
</table>

Paediatric Orthopaedic Surgery Telemedicine Initiative
REFERENCES


Collaborative Audit Model for Monitoring Healthcare Hygiene

Shao Chu Teo¹, Anju Mary Samuel¹, Rachel Aik Hong Goh¹, Xin Yan Tang¹, Zann Foo¹, Swee Hia Lim², Kok Hian Tan¹

ABSTRACT

Background: The Cross Institution Infection Control (CIIC) collaborative audit model, was initiated in SingHealth, a healthcare cluster in Singapore, to monitor healthcare hygiene compliance for infection control and to build a safer system.

Objective: The aim is to describe the implementation, challenges & effectiveness of the CIIC collaborative audit model.

Methods: The CIIC collaborative audit model was implemented through a three-pronged approach, which comprised of the design of harmonised audit tools and standards, training and co-ordination of auditors and management of audit process, for Cross Institution Hand Hygiene (CIHH) and Cross Institution Environment Hygiene (CIEH) audits. A multidisciplinary team of auditors from eleven institutions within the cluster was recruited and trained to conduct Cross Institution Audits. The compliance rates and findings were reported to cluster and institutions' leadership, with trends for oversight of performance and improvement actions for follow up. The implementation of the model had since been reviewed by an independent group.

Results: This collaborative audit model met the needs of the cluster in ensuring a consistent way of monitoring the standards of hygiene across the cluster with no major disease outbreak. Collaboration within the institutions ensured a sustainable pool of multidisciplinary team of motivated auditors, through educational mutual sharing and professional recognition. CIHH and CIEH compliance rates, based on a consistent standardized audit format for a period of 6 years, were effectively tracked to facilitate timely leadership action. The model was successfully extended to other hygiene compliance areas such as Cross Institution Kitchen Hygiene (CIKH), Cross Institution Sterile Processing (CISP) and Cross Institution Endoscopy Reprocessing (CIER). The audits had facilitated cross-learning and sharing of best practices.

Conclusion: The CIIC collaborative audit model was an effective and sustainable setup for ensuring consistent monitoring of healthcare hygiene to enable high standards.

Keywords: Audit, Collaborative, Hygiene, Monitor, Healthcare, Team

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INTRODUCTION

The National Infection Prevention and Control (IPC) Guidelines for Acute Healthcare Facilities presented by the Ministry of Health (MOH), Singapore, has recommended for Healthcare institutions to ensure policies and processes for IPC are in place for safer healthcare system [1]. Audit is an important aspect of infection control to improve safety. Firth-Cozens pointed out that “because teamwork is the most effective means of bringing about innovation in organisations [2], we should look to teams in order to address the demands for change that the audit process entails” [3,4].

In the pursuit of a safer system, following Hepatitis C outbreak at a SingHealth Institution in 2015, Singapore healthcare cluster, Singapore Health Services (SingHealth) being the largest cluster with eleven institutions, comprising of more than 30,000 staff as at year 2021, through its Institute for Patient Safety and Quality (IPSO), developed the Cross Institution Infection Control (CIIC) collaborative audit model in 2016. The is a model comprising of an independent multidisciplinary team of auditors; comprising of IPC Nurses, Allied Health Professionals and Administrators from SingHealth Institutions, to conduct Cross Institution Hand (CIHH) and Environment (CIEH) Hygiene audits. It brings together appointed auditors from within SingHealth institutions, guided by a structured approach with harmonized audit tools and standards, centralised training of auditors, and cross-learning and sharing of best practices from the audits.

The audit model was scaled up to include Cross Institution Kitchen Hygiene (CIKH) in 2018 and Cross Institution Sterile Processing (CISP) and Cross Institution Endoscopy Reprocessing (CIER) in 2020. This paper elaborates the implementation, challenges & effectiveness of the CIIC collaborative audit model.

METHODS

The CIIC collaborative audit model was implemented through a three-pronged approach, (Figure 1) which comprised of the design of harmonised audit tools and standards, training and coordination of auditors and management of audit process. Professions came together to conduct independent audit through the CIIC audit collaborative model.

The implementation of the model was reviewed by an independent group. The adequacy of the governance framework was assessed, including the methodology, approach and reporting mechanism.

1. Design of Audit Tool and Standards

The two harmonized audit tools and standards mentioned below were adapted from appropriate references, tested and refined for practical applications. The use of observations & interviews techniques was adopted from JCI Standards [5].

(i) CIEH Audit Tool (Figure 2):

Learning from the lapses from the Hepatitis C incident, the main audit focus of the audit tool was on dirt and blood in environment, equipment and furniture. Examples of processes audited include glucometer maintenance to eliminate blood stains, cleaning of equipment between use, storage of sterile items, availability of alcohol-based wipes and hand washing facilities and knowledge of housekeeping staff concerning the use of different coloured cloths for cleaning.

The formula used to compute the CIEH compliance rate was derived after discussion with various stakeholders to give equal emphasis on blood and dirt; weightage of 50% compliance rate of blood and 50% on compliance rate of dirt for reasonable estimation on the cleanliness of the audit sites.

CIEH Index is computed as follows:

$$0.5 \left( \frac{\sum N_b - n_b}{\sum N_b} \times 100 \right) + 0.5 \left( \frac{\sum N_d - n_d}{\sum N_d} \times 100 \right)$$

Where –

- a) Blood and Dirt, accorded equal weightage for computing CIEH Index
- b) 10 or more locations were to be audited per institution
- c) 5 observations required per location each for Blood and Dirt
- d) $\sum N_b$ is Total observations for Blood; $\sum N_d$ is Total observations for Dirt
- e) $n_b$ is the Total number of blood / possible blood stains or other body fluids observed in each location
- f) $n_d$ is the Total number of dirt, dust, stains observed in each location
- g) $N_b = N_d = 5$; If $n_b > N_b$, $n_b = N_b$; If $n_d > N_d$, $n_d = N_d$

In 2018, the CIEH audit tool was mapped to the
check points of the MOH IPC Audit Tool, with certain degree of customization to suit the cluster’s cross institution audit requirements. Based on the MOH IPC Audit 2019/2020 report, the common findings in public healthcare institutions were also on lapses in environmental cleaning such as blood stains on equipment, walls; mould on ceiling board, faecal and urine stains seen on clean bedpan and underneath commode chair seat; and unsecured sharp boxes, which CIEH audit tool is aligned with.

(ii) CIHH Audit Tool:
This was developed with focus on WHO’s Five Moments for Hand Hygiene model [6,7,8], which to date is considered the gold standard method for establishing hand hygiene compliance rates [7,8,9]. The formula used to compute the CIHH compliance rate was thus based on the number of compliance observations from WHO’s Five Moments for Hand Hygiene from the total number of opportunities observed.

**CIHH compliance rate is computed as follows:**
(Number of compliance observations (n) / Total number of opportunities for Observation (N)) x 100.

2. Training and Coordination of Auditors
The Training and Coordination of auditors comprised of the following sub processes.

(i) Training of Auditors
The auditors were nominated by Institution Leadership and appointed by IPSQ. The names of auditors were listed in the website www.singhealthdukenus.com.sg/ipsq. Whenever there was a turnover, Institution Leadership would nominate new auditors timely to ensure audit can be continued smoothly. New auditors will undergo internal training courses co-developed by IPSQ and appointed Faculty who are adept in Infection Prevention and Control. Apart from this, the buddy system implemented for new auditor to be tagged to an experienced auditor provides the required on-the-job training and guidance for new auditor to get familiarized with their role and in the use of the tools and standards. During the COVID-19 outbreak, virtual training via tele-conference was conducted for the auditors, which was equally well-received. The training and sharing sessions fostered a culture of continuous cross-learning and helped in giving updates on new practices, regulatory guidelines, hence created parity in auditors’ knowledge.

(ii) Coordination of Auditors
An audit schedule would be prepared and auditors informed well ahead of the audit. The auditors were assigned to an audit site that was not their base institution. This was necessary for the independent cross institution audit to be credible, and for them to bring valuable cross-learning and sharing opportunities.

There are different roles in the multidisciplinary audit team; Cluster Lead, Team Leader and Team Member based on their experiences.

The Cluster Lead, Team Lead and Team members were divided into groups to conduct the CIIC audits. The Cluster Lead assisted in the development of the CIIC Audit Tool and Standards and in the development and implementation of the CIIC Audit Master Plan. The Cluster Lead guided the audit team leaders and was involved in providing inputs for the reporting of the results of the CIIC audits conducted to assure that the audit findings and observations were clear, concise and accurate.

The Team Lead worked with team members to generate reports and provide inputs for the Cluster Lead to share the key findings and observations during the audit debrief. The Team members worked with fellow CIIC auditors to carry out audits at individual Institutions. They assisted the Cluster Lead and Team Lead in identifying the audit findings and generated audit reports.

3. Audit Process
The audit process comprised of three phases; Pre-audit, On-site Audit, Post-audit, which ensured end-to-end follow through.

The audit was a primary fact-finding phase where a team of independent auditors were scheduled to assigned institutions to perform the audit using the harmonized audit tool and standards.

(i) Pre-audit
Essentially, the Pre-audit preparation work was facilitated by IPSQ, where the IPSQ Administrator would schedule and assign the auditors, coordinate and follow up on past audit outstanding findings with the Institutions to be audited.

(ii) Onsite Audit
Through the years of streamlining processes, Cross Institution audit could be effectively conducted within one day (8am to 5pm). IPSQ and Cluster Lead facilitated the Opening Brief and Closing Debrief sessions on the day of the audit. The audit sites list was distributed to the auditors on the audit day. During the audit, auditors noted both the findings...
and the good practices. Preparation of Preliminary Audit report was completed within the day to facilitate the closing Debrief. Since early 2020 with the launch of the SingHealth cluster HH Audit Mobile Application, CIHH result reporting had been instantaneous.

(iii) Post-audit
The compiled audit findings, known as the Preliminary Audit report was sent to the audited Institution counterparts after audit for corrective actions. After responses for the corrective actions were received, IPSQ would send the Final Report, which included the corrective actions received from the institution to the Senior Leadership of the audited institution. The consolidated results for SingHealth were shared periodically with the Group Senior Leadership.

RESULTS
The CIIC collaborative audit model was assessed in 2017 by Group Internal Audit (GIA) Division, MOH Holdings Pte Ltd. The governance of the model framework, including methodology, approach and reporting were found to be adequate.

The CIIC audit team was assessed to have taken methodological effort to implement the CIHH and CIEH audits to track the compliance rates across the Institutions and was effective in gaining buy-in from Institutions on the need for good CIHH and CIEH standards. CIIC Audit model had been effective and sustainable for SingHealth in monitoring CIHH and CIEH compliance. The Institutions were able to share and learn best practices through this audit. There was regular reporting of audit results to the audited Institution with follow up of the corrective actions and sharing of insights of trends over the years to the Senior Leadership Auditors from different institutions.

The GIA audit suggested the following areas for improvement for the CIIC Audit Team to work on:

1. Establish audit universe of all patient facing areas for CIHH and CIEH audits.
2. Establish list of action plan for more effective monitoring.
3. Enhance CIIC audit approach with relevant information from the institutions.

CIIC Team had since implemented first two items.

For the third item, SingHealth cluster HH Audit Mobile Application had been implemented in the cluster in 2020 and Institutions were using it for the internal audits. Relevant data could be obtained from this platform.

This model has enabled the cluster to build and sustain a pool of 151 CIHH and CIEH auditors (as at 31st Dec 2021), well represented from the eleven Institutions. The CIIC audit environment which enables cross-learning and sharing has attracted 121 auditors who have been with the team for more than 3 years. CIIC audits are conducted quarterly in all institutions according to the framework set up by SingHealth Infection Control Audit (SICA) task force to give timely independent assessment on hygiene compliance level. Since 4 CIHH and 3-4 CIEH audits have to be conducted for each Institution per year, 44 CIHH and 33-44 CIEH audits are conducted yearly which amounted to 350 CIHH and CIEH audits from FY16 to FY20. Due to COVID-19 heightened alert, only 6 CIHH and 6 CIEH audits were held in FY21. For Institutions which had achieved a high standard (e.g., an average of more than 90% in the first three audits), they would not be subjected to the fourth CIEH audit. To ensure the sustainability of this model, an optimum number of 151 CIHH and CIHH auditors is required to handle the audit load, with each taking on 3-4 audits per year. Whenever there was turnover of auditors, Senior Leadership was supportive and would nominate new auditors in a timely manner, with no lapse in manpower to date.

With strong leadership support and active closure of gaps by Institutions, CIHH and CIEH have achieved significant improvement in compliance over the past six years (P<0.01). Figure 3 shows the average result computed over 6 years. It can be noted that CIHH compliance has improved from 90.2% (FY16) to 96.9% (FY21) and CIEH compliance from 89.8% (FY16) to 98.0% (FY21).

A correlation study conducted between CIHH compliance rate and Catheter-Associated Urinary Tract Infection (CAUTI) rate had shown a significant negative correlation (r=-.44) for one of our institutions (Singapore General Hospital Medical Intensive Care Unit) i.e. Negative correlation indicates that as CIHH compliance rate increases, CAUTI rate decreases. This is consistent with many studies that had shown the association between improved adherence with hand-hygiene practice and reduction of healthcare-associated infection rates [10].
For CIEH audits, lesser blood and dirt non-compliances (substantiated by photographed images at sites) had been observed over the years. For CIHH audits, improvements were seen generally across all the different professions over the years. From these successes, this audit model has been scaled up and implemented for CIKH, CIER and CISP audits since 2018.

This model also facilitated the independent monitoring and reporting needs of our institutions, where the audit data were submitted periodically to the SingHealth Board of Directors, SingHealth Risk Oversight Committee, SingHealth Cluster Leadership and Institution Senior Leadership. In recognition of the excellent work performed by auditors, appreciation events were held annually and were well attended by SingHealth Cluster and Institution Senior Leadership. To date, 4 annual appreciation events had been held.

DISCUSSION

The governance framework of the model, including the methodology, approach and reporting mechanism of the CIIC audits were assessed by MOH GIA Division to be sound and adequate. There were several good practices from the model:

1. Cross institution audits serve as a platform to foster knowledge-sharing and exchange experiences around prevention of healthcare-associated infection across the different institutions in SingHealth;

2. Consistent and high standard cluster training of staff from different institutions, backgrounds and experience as auditors to advocate infection control practices.

3. Ignition and promotion of a culture for patient safety and quality of care to prevent healthcare associated infection across all the institution within SingHealth;

4. Beneficial cross-sharing of audit findings between institutions are used as a platform for further development, implementation and continuous improvement in infection prevention and control;

5. Consistent use of standardised measurement tools to assess the compliance rate for CIHH and CIEH across institutions; and

6. Immediate concurrent feedback to staff on CIHH and CIEH lapses to address deficiencies for timely rectification.

There were challenges faced with this model. As in the GIA's recommendations, CIIC could adopt a more effective and proactive approach by obtaining Institute-hand hygiene audit results and available disease outbreak surveillance results from Institutions. Institute-hand hygiene audit results could enable CIIC to identify gaps in audit approaches or other anomalies while CIIC could use the surveillance to prioritise audit resources. Institute-hand hygiene audit results were obtainable through the SingHealth cluster HH Audit Mobile Application which was launched in early 2020. Institute-EH audit results had to be obtained from Institution.

Auditors’ replacement due to turnover was another challenge encountered. To ensure that the model was sustainable, there had to be an adequate number of auditors appointed and trained to support the cross institutional audits. Strong leadership support and recognition of the importance of the audit, had ensured that auditor’s replacement was timely without causing any issues on the Cross Institution Audits. To enhance professional recognition, auditors were all appointed. Annual events, well attended by Senior Leadership, were conducted to appreciate their commitment and efforts.

Auditors frequently required administrative support especially for CIEH Audit reporting during the audit. They were unfamiliar with completing the report template as they only conduct the audits 3 to 4 times a year. This has since been overcome with the assigning of IPSQ Administrators to provide the administrative support on the day of the audit.

The CIIC collaborative audit model had demonstrated its effectiveness to facilitate high standards of healthcare hygiene level and meet the needs of the cluster in ensuring a safer healthcare system. The model ensured that the healthcare hygiene compliance levels were tracked regularly and sustainably in a consistent manner and to facilitate regular reporting of audit results to the audited institutions for follow up of the corrective actions. This Cross Institution model together with committed and supportive institution leaders, routine internal audits, awareness campaign and quality improvement projects, had kept the standards of healthcare hygiene in SingHealth high.
CONCLUSIONS

For large organizations like SingHealth with more than 30,000 staff as at year 2021, the CIIC collaborative audit model has shown to be effective in meeting the cluster’s needs to maintain a high level of hygiene. This is achieved through a structured audit methodology and approach, establishing a reporting protocol and a robust system of training and follow-up. The model was a good platform for staff to cross-learn and share practices in improving infection control and healthcare hygiene.

Declaration of Interests:
The Authors declare that there is no conflict of interest.

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AUTHORS’ CONTRIBUTIONS

Shao Chu Teo, Anju Mary Samuel and Zann Foo researched literature and conceived the study. Xin Yan Tang from IPSQ performed data analysis for this study. Kok Hian Tan, Swee Hia Lim and Rachel Goh Aik Hong provided guidance in writing and thorough reviewing of this manuscript. All authors reviewed, edited the manuscript and approved the final version of the manuscript.
### Figure 1: Three-Pronged Approach

<table>
<thead>
<tr>
<th>Product</th>
<th>People</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit Tools and Standards</td>
<td>Training and Coordination of Auditors</td>
<td>Audit Steps</td>
</tr>
<tr>
<td>Referencing Internal, National and International standards and Guidelines</td>
<td>Onboarding programme for auditors to ensure consistency in auditing standards</td>
<td>Pre-audit</td>
</tr>
<tr>
<td>Harmonised Audit Tool and Standards</td>
<td>Coordination includes scheduling of auditors to different institutions</td>
<td>Audit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-audit</td>
</tr>
</tbody>
</table>

### Figure 2: SingHealth Cross Institution Environment Hygiene (CIEH) Audit Tool Items (Updated as on 10th Mar 2020)

<table>
<thead>
<tr>
<th>S/N</th>
<th>ENVIRONMENT</th>
<th>S/N</th>
<th>EQUIPMENT</th>
<th>S/N</th>
<th>FURNITURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Walls</td>
<td>1</td>
<td>Hypocount machine / Glucometer</td>
<td>1</td>
<td>Bed (rails, head board, foot board)</td>
</tr>
<tr>
<td>2</td>
<td>Doors</td>
<td>2</td>
<td>Infusion pumps</td>
<td>2</td>
<td>Commode chair</td>
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<tr>
<td>3</td>
<td>Curtains</td>
<td>3</td>
<td>Blood pressure machine</td>
<td>3</td>
<td>Cardiac table</td>
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<tr>
<td>4</td>
<td>Floors</td>
<td>4</td>
<td>Arterial Gas Machine</td>
<td>4</td>
<td>Bedside cabinet</td>
</tr>
<tr>
<td>5</td>
<td>Ceiling</td>
<td>5</td>
<td>Diathermy Machine (ESU)</td>
<td>5</td>
<td>Baby cot</td>
</tr>
<tr>
<td>6</td>
<td>Windows</td>
<td>6</td>
<td>Anaesthetic Machines &amp; Monitors</td>
<td>6</td>
<td>Baby bassinets</td>
</tr>
<tr>
<td>7</td>
<td>Airconditioner / Fan</td>
<td>7</td>
<td>Baby resuscitator</td>
<td>7</td>
<td>Incubator</td>
</tr>
<tr>
<td>8</td>
<td>Suction machines</td>
<td>8</td>
<td></td>
<td>8</td>
<td>Patient examination couch or equivalent for clinical setting</td>
</tr>
<tr>
<td>9</td>
<td>Computer on Wheels (COW) / Medical COW</td>
<td>9</td>
<td></td>
<td>9</td>
<td>Ophthalmic chairs</td>
</tr>
<tr>
<td>10</td>
<td>Computer</td>
<td>10</td>
<td></td>
<td>10</td>
<td>Dental Chairs</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Operating theatre lights</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Operating theatre tables</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Procedure Trolley</td>
</tr>
</tbody>
</table>

### S/N PROCESS

1. Equipment cleaned / wiped down in between patient use
2. Maintenance of glucometer - Test Strip port of glucometer cleaned in between patient use
3. Each COW / med COW / procedure trolley with sharp box, gloves, hand rub, medi-wipes & general waste holder
4. Storage of sterile goods & items - facilities clean and aseptic technique used for opening, dispensing and transferring of the sterile consumable, supplies and instruments
5. Sterile supplies and sterile instrument packs inspected and validated for integrity - expiration date and chemical indicator tape
6. Alcohol-based Handrub / hand washing facilities accessible
7. Mikrozid wipes are available in the Disposal Rooms (Outside)
8. Housekeeping staff know and use the different colour cloths used for cleaning various areas
9. Nurses know the use of the different coloured cloths for cleaning various areas
Figure 3: SingHealth Overall Compliance Rate from FY16 to FY21

Note:
- CIEH Index is expressed as percentage to align with CIHH audit results.
- Financial Year (FY) starts from 1st April to 31st March of the following year.
- For FY21, only 6 Institutions were audited due to COVID-19 heightened alert.
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Reducing Outpatient Pharmacy Interventions with Physicians - A Pilot Quality Improvement Project

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ABSTRACT

Introduction: Pharmacists are integral members of the healthcare team and work with physicians to optimise patient care by identifying and resolving drug-related problems, usually via phone interventions. These calls interrupt physicians’ other consultations, compromising patient safety and reducing efficiency for both physicians and pharmacy staff. The initial aims of the project were hence to determine the number and types of interventions made, and to implement solutions that could reduce the number of interventions.

Methods: A structured quality improvement approach was used to execute the project. Baseline analysis showed an average of 942 interventions made monthly at the Outpatient Pharmacy, of which 59% were considered to be less clinically significant and potentially avoidable. The project was piloted with the Department of Renal Medicine as further analysis showed that it accounted for 40.5% of all interventions. For this pilot, the specific objective was to reduce avoidable intervention phone calls to the Department of Renal Medicine by 30% in 12 months. Possible root causes were identified, and solutions were developed and implemented using Plan-Do-Study-Act cycles. The solutions were staff and patient education, Pharmacy “Order-on-behalf” protocols, and sharing about “Good Prescribing Habits” with physicians.

Results: The median number of avoidable intervention phone calls per month decreased by 60.4%, from 77 to 30.5, saving an estimated $4000 in annual manpower costs.

Conclusion: The initiatives reduced potentially avoidable intervention phone calls, thereby improving efficiency in prescription processing, and have been incorporated into daily operations.

Keywords: Quality Improvement; Pharmacist intervention; Outpatient pharmacy.
INTRODUCTION

Pharmacists are integral members of the healthcare team and work with physicians to optimise patient care. They review prescriptions for patients and advise both healthcare professionals and patients about safe, efficacious, evidence-based, and cost-effective use of medicines. The Joint Commission International (JCI) recommends that all prescriptions must be reviewed by pharmacists for drug-related problems (DRPs) before dispensing [1]. A DRP is defined as an event or circumstance involving medication therapy that actually or potentially interferes with an optimum outcome for a specific patient [2]. Hepler and Strand classified DRPs in the following categories: untreated indication, improper drug selection, subtherapeutic dosage, failure to receive drug, over dosage, adverse drug reaction, drug interactions, and drug use without indication [2]. As in any human process, it is possible for DRPs or errors to occur, especially with heavy clinic workloads [3]. When DRPs are identified, pharmacists perform interventions with physicians to make recommendations to optimise patient management or therapy.

Locally, prescription error rates at polyclinics are estimated to range from 0.35% to 0.97% of all prescription lines [3]. At the Singapore General Hospital (SGH), Singapore’s largest tertiary acute care hospital and national referral centre, more than 2,000 prescriptions are processed at the hospital’s outpatient pharmacies each day [4]. Assuming similar error rates, this could translate to approximately ten errors per day, which may adversely affect patient outcomes and lead to increased healthcare costs.

Even though interventions are necessary, they are not without their problems. When interventions are performed, they often interrupt the physicians’ other consultations, and may compromise patient safety and reduce efficiency for both physicians and pharmacy staff. This can lead to adverse outcomes, and even cause additional medical errors due to the interruption of physicians’ clinical tasks and thinking processes [5]. Patients whose consultations are interrupted may also have a poorer perceived experience [6].

In addition, when phone calls are made, the physicians may not pick up the call, and this subjects the patients and pharmacists to a further wait for a return call, adding to the overall time spent performing the intervention.

This project was initiated when physicians provided feedback to the Outpatient Pharmacy at SGH about receiving a significant number of phone calls which had caused disruption to their consultation sessions. The aims of the project were hence to determine the number and types of interventions made, and to implement solutions that could reduce the number of intervention phone calls made.

METHODS

A structured quality improvement (QI) approach was used for the project, with various QI tools employed.

Problem Analysis

A baseline analysis conducted using electronic data from April to June 2016 showed that monthly, pharmacy staff made an average of 942 interventions with physicians. However, apart from the usual DRP categories as defined by Hepler and Strand, the team found that 53.6% of interventions were classified under ‘Others’. After analysing these other interventions, the team identified a few categories of interventions as less clinically significant and potentially avoidable. The following types of interventions were defined as avoidable intervention phone calls: 1) interventions made for patients’ requests for medications used on a “when necessary” basis; 2) substitution of medications with similar medications due to financial coverage or other administrative issues; 3) clarification of orders that were ambiguous; and 4) interventions for short-term top-up of chronic medications to last till an upcoming appointment. Examples of such interventions are described in Table 1. A further analysis of the interventions under “Others” showed that 59% of them belonged to these four sub-categories.

Further, the team found that out of 30 clinical specialties, the Department of Renal Medicine accounted for nearly 40.5% of all interventions made at the Outpatient Pharmacy. This was not surprising as patients with renal disease, especially those on hemodialysis, are at higher risk of DRPs, because of multiple comorbidities, polypharmacy and need for frequent medication changes [7]. This in turn makes it difficult to address all patient issues during consultations, and hence the department also accounted for 30% of avoidable intervention phone calls. The team therefore opted to pilot this project to reduce avoidable intervention phone calls with the Department of Renal Medicine. Apart from pharmacists from the Outpatient Pharmacy, physicians from the Department of Renal Medicine were included in the project team.
**Specific aims and outcome measures**
With the objective of reducing avoidable intervention phone calls in mind, the team set a target based on the SMART (specific, measurable, achievable, realistic, and time-bound) goal criteria. The project goal was to reduce the number of avoidable intervention phone calls with the Department of Renal Medicine by 30% within 12 months. This was specific in its scope of reducing avoidable intervention phone calls with the Department of Renal Medicine only, measurable by the number of such interventions, and time-bound by the project duration of 12 months. The target of 30% was deemed to be realistic and achievable by the team.

**Root Cause Analysis**
The team brainstormed for possible causes to the high number of interventions using the Cause-and-Effect diagram (Figure 1) to identify root causes, which were categorised into People, Plant/Environment, and Process. Recognising the important roles that the various stakeholders played in the entire process, the 'People' category was further divided into Patients, Physicians, and Pharmacy Staff. To verify the findings and find contributory causes, the team also interviewed other Pharmacy staff to seek their opinions. Some root causes were related and were grouped together for discussion. Details of the team's analysis of the information to verify the root causes are presented in Table 2.

A Pareto Chart (Figure 2) was then constructed to identify vital root causes to focus on. Multi-voting was used to rank each of these root causes. To achieve a prioritisation effect, a 1/2 rule was applied, with each of the seven members of the core team given four votes for the ten root causes identified. Weighting of votes were allowed but limited to two votes per cause to avoid over-focus at the beginning. Based on the 80/20 rule i.e. 80% of effects come from 20% of causes, the team identified four main root causes. However, in view of the difference of only one vote, the team decided to address the next two root causes identified as well. Hence, the final root causes identified for addressing were: 1) Lack of patient education regarding prescription durations and medication balances; 2) Medication ordering system not user-friendly for some medication orders; 3) Medications may have similar spellings and multiple ways of dosing; 4) Pharmacy restrictions on supplying medications - extending durations, prescribing, and/or switching medications; 5) Lack of training for pharmacy staff in handling patient requests; 6) Patients' unawareness of pharmacy restrictions on supplying medications without prescription.

**SOLUTIONS**
Based on the vital root causes identified, the team used a Driver Diagram (Figure 3) to propose key drivers for achieving the project aims. From the key drivers, the team brainstormed for possible solutions. A prioritisation matrix (Figure 4) was then used to select the best solutions using a scoring system. The criteria for the scoring system that the team agreed on was: 1) ease of implementation; 2) minimal time and resources required; 3) effectiveness; and 4) sustainability.

Three solutions were selected for implementation: 1) Staff and patient education; 2) Pharmacy "Order-on-behalf" Protocols; and 3) Sharing about "Good Prescribing Habits" with physicians. The Plan-Do-Study-Act (PDSA) cycle, a four-stage problem-solving model, was used to implement the solutions. A Gantt Chart was used to guide the preparation, implementation, and data collection for the solutions.

**Solution 1 – Staff and patient education**
This solution involved educating both pharmacy staff and patients on the appropriate procedure when patients request for additional medications which are not on the prescription. Pharmacy staff was educated to remind patients to raise requests during their consultation instead of at the pharmacy, which will likely result in shorter waiting times for their medications as they do not need to wait for pharmacy staff to call the physician and repack the medications. Moreover, this also ensures that the physician can directly assess whether the requested medications are appropriate for the patient.

Subsequently, after the implementation of solution 2, in situations where solution 2 were not applicable, the team educated pharmacy staff to direct patients who presented to pharmacy requesting for additional medications back to the clinic to obtain a prescription from the physician. Physicians may then see them in between, and not during, consultations with other patients, thereby reducing disruptions to their consultations.

**Solution 2 - Pharmacy “Order-on-behalf” Protocols**
The team analysed the common types of patients’ requests and the commonly requested medications. Based on this data, the team proposed a Patient Request Protocol and an Auto-Switch Protocol, which were lists of medications that could be added on or substituted with alternative medications without having to call the physician. Examples of such medications include medications for minor ailments, pain medications, moisturisers, and
supplements. The lists consist mainly of medications that are classified as General Sales List (GSL) or Pharmacy-only, which pharmacists are trained to review and dispense without a prescription. The proposed medications were also reviewed and approved by the Department of Renal Medicine.

Another common issue was patients having insufficient medications, for reasons such as miscounting of their medication balances, or mismatch between the duration of their prescription and their appointment date. To tackle this, the team also proposed a Duration Extension Protocol which allowed pharmacists to extend the duration of prescription for a maximum of 30 days without having to call the physician.

Various steps were taken to ensure that patient safety and medical care were not compromised. Firstly, all cases must be assessed by a pharmacist to ensure that the medicines supplied are appropriate for the treatment of the persons for whom it is intended to be used. Apart from medication review, appropriate counselling has to be provided to the patient. For the Duration Extension Protocol, the patients must be deemed to be stable. Any tests done since the previous appointment must be reviewed, if relevant, and issues that contraindicate the continuation of certain medications or warrants the attending physician’s attention would be brought up to the physician for review. All medications ordered on behalf then had to be reviewed and signed electronically by the physician by the end of the next working day. Lastly, for cases deemed to be more complex, pharmacists would still contact the physician for discussion.

Solution 3 - Sharing about “Good Prescribing Habits” with physicians
The team developed materials on “Good Prescribing Habits” which were specifically tailored for physicians from the Department of Renal Medicine. In particular, the materials developed by the team highlighted common ambiguous orders requiring clarification and educated the physicians on the appropriate settings to select in the IT system to ensure these orders were clear. This would in turn minimise the number of interventions from pharmacy staff to clarify ambiguous orders. Other aspects covered included prescribing sufficient medications and common medications not covered by third-party payers.

DATA COLLECTION AND ANALYSIS
The primary outcome measure was the number of avoidable intervention phone calls made with the Department of Renal Medicine. A run chart was used to plot the primary outcome measure over time. Data was collected from when the first solution was implemented, for eight months, from August 2017 to March 2018. These data points were compared to the data for the baseline analysis period, designated as months 1 to 3.

RESULTS
After the implementation of the solutions, the median number of avoidable intervention phone calls per month decreased by 60.4%, from 77 during the baseline period to 30.5 (Figure 5). This surpassed the project target of a 30% decrease within 12 months. The lowest number of avoidable intervention phone calls was 19, achieved in month 9 (Jan 2018). Usage of the pharmacist order-on-behalf protocols was also measured. A total of 58 interventions during the study period were avoided when pharmacists utilised these protocols.

Based on the difference from baseline of 46.5 avoidable intervention phone calls per month, and an estimated processing time of 10 minutes per intervention, there was a time-savings of 7.75 man-hours per month. This translates to an annual manpower cost savings of $4,001.04.

In terms of safety, there were no orders placed on behalf of the physicians that were rejected, while there were also no reports of DRPs that arose due to the initiatives.

DISCUSSION
The project, through its three solutions of Staff and Patient Education, Pharmacy “Order-on-behalf” Protocols, and Sharing about “Good Prescribing Habits” with Physicians, achieved a median reduction of 60.4% in the number of avoidable intervention phone calls with physicians. This further translated to estimated time-savings of close to eight man-hours per month, which in turn saves an estimated $4000 in manpower costs annually. With the time saved, pharmacy staff were able to provide more efficient service to patients. With the order-on-behalf protocols, pharmacists also felt more empowered as they were able to assess patients and directly supply additional medications where appropriate. Physicians experienced less
stress and frustration due to interventions. With lower risk of medication errors occurring due to such interruptions, patients would in turn receive safer care.

Some of the solutions may also result in benefits that extend beyond the Department of Renal Medicine. For instance, by providing staff and patient education, there could be potential reductions in interventions for other medical disciplines as well.

Challenges Faced
The team faced several challenges during the project. The initial uptake of the initiatives was slow. In addition, staff from both the Pharmacy Department and Department of Renal Medicine may rotate to different practice areas and have new staff joining over time. To overcome this, training slides were developed to train new pharmacy staff, and made readily available to all staff via the department's shared drive. Routine roll calls were done to remind staff of the initiatives. Similarly, the Department of Renal Medicine gave regular reminders to their physicians, via platforms such as department meetings. Regular feedback was obtained from the Renal physicians and pharmacy staff to continually improve the workflows. For instance, the list of items in the Patient Request Protocol, as well as the maximum quantities that could be supplied, were updated based on staff feedback.

Limitations
There were a few limitations to the project. There was no qualitative measure of the patient's perspective of how their quality of care has been affected by the project. Despite the definitions proposed by the team, there could still be some subjectivity in classifying an intervention as an avoidable intervention phone call, although this was mitigated by having two pharmacists independently assess and adjudicate each intervention, with any discordance decided via team discussion.

Future Directions
With the success of the order-on-behalf protocols, a similar concept has been applied to other medical disciplines whenever a trend in a certain type of intervention was noticed. Some examples of new protocols developed for other disciplines include Patient Request Protocols and Extension of Duration / Quantity Protocols for the Department of Orthopaedic Surgery and Department of Dermatology, as well as Auto-Switch protocols whenever a medication was discontinued, and a replacement product brought in by the hospital.

CONCLUSION
The implementation of various initiatives developed through a structured Quality Improvement approach has brought about a reduction in potentially avoidable interventions by pharmacists with physicians, resulting in time saved and fewer interruptions to physicians. There is potential to expand these beyond the pilot with the Department of Renal Medicine to benefit other medical disciplines.

DECLARATION OF INTEREST
The authors declare no affiliations with or involvement in any organization or entity with any financial or non-financial interest related to this manuscript.

ACKNOWLEDGEMENTS
The authors would like to thank all staff from the Department of Pharmacy and the Department of Renal Medicine who have contributed to the project.

AUTHORS’ CONTRIBUTIONS
KYO, XYT, AXYG, CSH and GYK contributed to the initial study concept and design. PLT, LHLC and MWYF served as physician champions for the project. All authors were involved in the implementation of the project. CSH, YZT, PYS and SSL were responsible for data collection and analysis. Preparation of the manuscript was done by KYO and JAW.


Table 1: Examples of avoidable phone interventions

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interventions made for patients’ requests for medications used on a</td>
<td>Antihistamines (e.g. Loratadine), analgesics (both oral e.g. Paracetamol, and topical e.g. Ketoprofen plaster/gel), medications for gastric conditions (e.g. antacids, Lactulose, Sennosides), eye drops for dry eyes (e.g. Hypromellose eye drops), and topical creams (e.g. moisturisers).</td>
</tr>
<tr>
<td>“when necessary” basis</td>
<td></td>
</tr>
<tr>
<td>Substitution of medications with similar medications due to financial</td>
<td>Retail topical analgesics to Ketoprofen plaster/gel. Branded moisturisers to generic emollients such as Aqueous Cream and urea creams. Branded products to generic substitutes (e.g. combination Vitamin B tablets). All of which are necessary as the original prescribed products are not covered by many common financial schemes, such as via common Medical Social Service schemes (including Medifund), other public assistance schemes, as well as Civil Service Medical Claims.</td>
</tr>
<tr>
<td>coverage or other administrative issues</td>
<td></td>
</tr>
<tr>
<td>Clarification of orders that were ambiguous</td>
<td>Variable dosing items (e.g. Calcium Acetate 667mg, one tablet with breakfast, two with lunch, one with dinner, prescribed as use as directed without dosing frequency). Less common dosing frequencies being prescribed with instructions added as free text remarks, with incorrect doses selected as the main order (e.g. Erythropoietin prescribed as once weekly, but with remarks of every 5 days, when it was intended to be every 5 days).</td>
</tr>
<tr>
<td>Interventions for short-term top-up of chronic medications to last till</td>
<td>Insufficient medication duration discovered coincidentally at point of dispensing. Insufficient prescription balance supply discovered only at subsequent refill. Insufficient medication supply due to patients misplacing their medications.</td>
</tr>
<tr>
<td>an upcoming appointment.</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2: Analysis of data to verify root causes

<table>
<thead>
<tr>
<th>Root causes</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians’ unawareness of pharmacy restrictions on supplying medications without prescription</td>
<td>While many of the medications requested by patients were available as General-Sales List (GSL) and Pharmacy-only (P) medications, as the Outpatient Pharmacy did not operate under a Retail Licence, the Pharmacy is not legally allowed to supply the medications unless they were ordered under a patient's prescription. Some of the physicians were unaware of this limitation, and therefore did not include these medications in patients' prescriptions. Most patients were also not willing to purchase the medications from external pharmacies, as it would incur greater costs and inconvenience to them, therefore they end up requesting for pharmacy staff to contact the physicians for adding these medications to their prescriptions.</td>
</tr>
<tr>
<td>Physicians’ unfamiliarity with financial schemes</td>
<td>Certain medications are not claimable under various third-party financial schemes (e.g. social welfare schemes or Civil Service Card benefits) that patients are covered by. Hence, patients often request for pharmacy staff to contact the physicians to substitute these medications to alternatives that can be claimed under their financial schemes. As the main role of a physician is to diagnose and treat the patient, physicians from the Department of Renal Medicine are often unaware of the limitations in coverage of these financial schemes, and therefore prescribe medications which may not be claimable.</td>
</tr>
<tr>
<td>High patient loads / clinic slots full / insufficient time for full medication reconciliation</td>
<td>The team felt that this was a factor that was mainly beyond our control. Patients with renal disease are inherently difficult to manage, and the high prevalence of renal disease in Singapore means that clinic loads are unlikely to decrease.</td>
</tr>
<tr>
<td>Medication ordering system was not user-friendly for some medication orders (e.g. medications may have similar spellings and multiple ways of dosing)</td>
<td>Patients with renal disease may require special dosing regimens which cannot be found under the pre-set dosing templates in the medication ordering system. These included medications with variable dosing, such as phosphate binders and erythropoiesis-stimulating agents, as well as medications which differed in dosing regimens between dialysis and non-dialysis days. This often led to ambiguous orders that needed to be clarified.</td>
</tr>
<tr>
<td>Lack of appropriate alerts and prompts for medications commonly ordered wrongly</td>
<td>Current medication ordering system may not prompt physicians when duplicate orders are prescribed, or when there are discrepancies in the orders.</td>
</tr>
<tr>
<td>Pharmacy restrictions on supplying medications - extending durations, prescribing, and/or switching medications</td>
<td>As above, even though many medications requested by patients were available as General-Sales List (GSL) and Pharmacy-only (P) medications, as the Outpatient Pharmacy did not operate under a Retail Licence, the Pharmacy is not legally allowed to supply the medications unless they were ordered under a patient's prescription. In addition, in cases where the duration of the prescription is not enough to supply enough medication until the patient's next appointment date, pharmacy is not allowed to extend the duration of medication to supply without first calling the physician.</td>
</tr>
<tr>
<td>Lack of standardised training of pharmacy staff in handling patient requests</td>
<td>Patients often present to the pharmacy with requests regarding their prescriptions at two stages: reception – where a pharmacy technician (PT) takes the patient’s medication order and at dispensing – where patients may suddenly tell the PT or pharmacist serving them that they would like to request for certain medications. Under the current pharmacy workflow, there is no standardised way of handling such requests.</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>Lack of patient education regarding prescription durations and medication balances</td>
<td>Patients often assume that the duration of medications prescribed to them will be sufficient until their next appointment with the physician. Physicians prescribe medications for a certain duration with an intention to see the patient within that time. The clinic assistant then proceeds to book the appointment for the patient. However, due to high patient load in the clinics, the patient’s next appointment date may exceed that pre-specified duration, resulting in patients not being prescribed enough medications. Patients often do not check that the duration of medications prescribed on the prescription will last them until their next appointment with the physician. Patients may sometimes also inform the physician that they have balance medications at home, resulting in shorter durations or entire line items not being prescribed, only to realise subsequently that they in fact require additional supply to last till their appointments. Occasionally, it may also be due misplaced medications.</td>
</tr>
<tr>
<td>Patients’ unawareness of pharmacy restrictions on supplying medications without prescription</td>
<td>Patients are often unaware that the Outpatient Pharmacy cannot supply medications without a prescription. As they are used to getting OTC/P medications without a doctor’s prescription in external pharmacies, they have the misconception that they can do the same in the SGH Outpatient Pharmacy.</td>
</tr>
</tbody>
</table>
Figure 1: Cause-and-Effect diagram for root cause identification

Reducing Outpatient Pharmacy Interventions
Figure 2: Pareto Chart to identify vital root causes to focus on

Root causes (in chronological order, from left to right): (1) Lack of patient education regarding prescription durations and medication balances; (2) Medication ordering system was not user-friendly for some medication orders; (3) Medications may have similar spellings and multiple ways of dosing; (4) Pharmacy restrictions on supplying medications - extending durations, prescribing, and/or switching medications; (5) Lack of standardised training of pharmacy staff in handling patient requests; (6) Patients' unawareness of pharmacy restrictions on supplying medications without prescription; (7) Doctors' unfamiliarity with financial schemes; (8) Lack of appropriate alerts and prompts for medications commonly ordered wrongly; (9) Doctors' unawareness of pharmacy restrictions on supplying medications without prescription; (10) High patient loads / clinic slots full / insufficient time for full medication reconciliation.
Figure 3: Driver Diagram of key drivers for achieving project objectives, and proposed solutions

- **Project objective**
  - Lack of patient education
  - Patients unaware of pharmacy restrictions on medication supply without prescription
  - Lack of staff training on handling patients’ requests
  - Pharmacy restrictions on supplying medications without prescription
  - Medication ordering system not user-friendly
  - Multiple dosing regimens/similar sounding names for medication

- **Drivers**
  - Patient education
  - Develop standardised procedure on handling patients’ requests
  - Staff education
  - Allow supply of retail items at Outpatient Pharmacy
  - Physician education

- **Options**
  - Educate patient to inform doctors about add-on items during consultation instead of at pharmacy
  - Educate patients that Outpatient Pharmacy cannot supply medications which are not on the prescription
  - Disallow phone interventions for OTC/P items → send patients to Clinic
  - Disallow phone interventions for OTC/P items → send patients to Retail Pharmacy
  - SingHealth Pushcart selling retail items in Outpatient Pharmacy
  - Apply for retail licence to allow Outpatient Pharmacy to function as a retail pharmacy
  - Sharing about “Good Prescribing Habits” with Renal Physicians
  - Training slides on how to order medications in a non-ambiguous way

Figure 4: Prioritisation Matrix for solution selection

<table>
<thead>
<tr>
<th>Solution</th>
<th>Root Cause(s) Addressed</th>
<th>Ease of implementation</th>
<th>Time/resources required</th>
<th>Effectiveness</th>
<th>Sustainability</th>
<th>Total Score</th>
<th>Solution chosen?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disallow all phone interventions for OTC/P items and clarification of orders – patient only allowed to collect items printed on prescription</td>
<td>Lack of staff training on handling patients’ requests</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>N</td>
</tr>
<tr>
<td>Disallow phone interventions for OTC/P items → send patient to Retail Pharmacy</td>
<td>Lack of staff training on handling patients’ requests</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>N</td>
</tr>
<tr>
<td>Pharmacist “Order-on-behalf” protocols with restrictions</td>
<td>- Pharmacy restrictions on supplying medications without prescription</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>Y</td>
</tr>
<tr>
<td>Apply for P licence for Outpatient Pharmacy to function like a retail pharmacy</td>
<td>Pharmacy restrictions on supplying medications without prescription</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>N</td>
</tr>
<tr>
<td>SingHealth Pushcart selling retail items in Outpatient Pharmacy</td>
<td>Pharmacy restrictions on supplying medications without prescription</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>N</td>
</tr>
<tr>
<td>Physician education on “Recommended Prescribing Habits”</td>
<td>- Medication ordering system not user-friendly</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>Y</td>
</tr>
<tr>
<td>Staff and patient education on handling patients’ requests</td>
<td>- Lack of staff training on handling patients’ requests</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>- Lack of patient education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Score 1 = Meet criteria least; Score 2 = Meet criteria moderately; Score 3 = Meet criteria most

Reducing Outpatient Pharmacy Interventions
**Figure 5: Run chart showing number of avoidable intervention phone calls against time**

Months 1 to 3 represent three months of baseline data from Apr to Jun 2016. Data collected after solution implementation started from Aug 2017.
REFERENCES


Asia-Pacific Patient Advocacy Consensus for Patient Safety

Asia-Pacific Patient Advocacy Consensus for Patient Safety Workgroup

ABSTRACT

A total of 52 participants and 16 facilitators were involved in the Global Patient Safety Action Plan (GPSAP) on Patient and Family Engagement Co-Creation Consensus Workshop held at the 3rd Asia-Pacific Patients Congress (APPC) on 17 November 2021. The consensus workshop was jointly organized by the SingHealth Duke-NUS Institute for Patient Safety & Quality (IPSQ), International Alliance of Patients’ Organizations (IAPO), Philippine Alliance of Patient Organizations (PAPO) and Patient Academy for Innovation & Research (PAIR). Five Asia-Pacific Patient Advocacy Consensus Statements for Patient Safety were reached in the consensus workshop held at APPC, with suggested actions. This consensus can serve as a guide for patient advocates, patient organizations and healthcare organizations in Asia Pacific region to strengthen patient and family engagement in eliminating avoidable harm in healthcare.

BACKGROUND

The 72nd World Health Assembly (WHA) adopted resolution WHA 72.6 ‘Global action on patient safety’ on 25 May 2019 [1&2]. The resolution recognized patient safety as global health priority and call for global solidarity and concerted action by all countries and international partners.

The World Health Organization (WHO) formulated a global patient safety action plan in consultation with Member States and all relevant stakeholders and released “Global Patient Safety Action Plan 2021-2030” (GPSAP). The global action plan provides a framework for action through seven strategic objectives and is further elucidated through 35 strategies, five under each of the strategic objectives, to create a seven by five matrix [3].

OBJECTIVES

As the co-organizers of the 3rd Asia-Pacific Congress (APPC), SingHealth Duke-NUS Institute for Patient Safety & Quality (IPSQ), International Alliance of Patients’ Organizations (IAPO), Philippine Alliance of Patient Organizations (PAPO) and Patient Academy for Innovation & Research (PAIR) took this opportunity to work together with various stakeholders to explore action plans and opportunities of co-production, fundraising, collaborative partnerships.

The workshop aimed to achieve the following objectives:

1. Create awareness of strategic direction and recommendations from the 5 strategies in the WHO Global Patient Safety Action Plan on Strategic Objective 4: Patient and Family Engagement (Engage and empower patients and families to help and support the journey to safer health care)

2. Facilitate consensus building by Patient Advocate Leads in Asia Pacific. The session should lead to agreement and support for an Asia-Pacific Patient Advocacy Consensus for Patient Safety as guided by the 5 strategies in Strategic Objective 4: Patient and Family Engagement, namely:

   a. Engage patients, families and civil society organizations in co-development of policies, plans, strategies, programmes and guidelines to make health care safer (Strategy 4.1)

   b. Learn from the experience of patients and families exposed to unsafe care to improve understanding of the nature of harm and foster the development of more effective solutions (Strategy 4.2)

   c. Build the capacity of patient advocates and champions in patient safety (Strategy 4.3)
METHODS
The Global Patient Safety Action Plan (GPSAP) on Patient and Family Engagement Co-creation Consensus Workshop held at the 3rd Asia-Pacific Patients Congress (APPC) on 17 November 2021 was jointly organized by the SingHealth Duke-NUS Institute for Patient Safety & Quality (IPSO), International Alliance of Patients’ Organizations (IAPO), Philippine Alliance of Patient Organization (PAPO) and Patient Academy for Innovation & Research (PAIR).

From attendees of the 3rd APPC, a total of 52 participants from over 6 countries were invited to attend the virtual workshop. They joined the workshop in their roles as a patient, patient advocate, caregiver, healthcare professional and industry representative. The workshop was led by the organizers virtually and supported by 16 facilitators from Asia-Pacific region. For the list of participants and facilitators, please refer to Annex A - Asia-Pacific Patient Advocacy Consensus for Patient Safety Workgroup.

The workshop was crafted to support GPSAP Strategic Objective 4 which advocates for engaging and empowering patients and families to help and support the journey to safer health care. The workshop brought together various stakeholders, particularly patients and patient advocates to discuss how they can share views and suggest action plans to contribute in accelerating GPSAP Strategic Objective 4. Voices from patients offers a different perspective in the care process and it is important to integrate their opinions into designing a safer healthcare system. For patients to be empowered, all stakeholders in the health system need to recognize the importance of shared decision.

A pre-workshop briefing session was organized for the facilitators to align the objectives, expected deliverable outcomes and roles and responsibilities. Participant information slides and the WHO GPSAP document were also disseminated to participants for their reading and preparation prior to the workshop.

The participants were grouped into 5 groups. Each group was assigned a strategy from the GPSAP Strategic Objective 4 Patient and Family Engagement, supported by 2 facilitators. Each group had a good representation mix of patients, patient advocates, caregivers, healthcare professionals and industry representatives.

In their respective breakout rooms, the groups reflected and discussed on the strategy for proposed consensus statement and to refine the statement if need to, before finally attaining agreement on the consensus statements with supporting statements and proposed actions.

RESULTS
In the past, patients and families played a passive role in their course of treatment and understanding of medicines and devices, technology used are limited. Healthcare professionals welcome the active role of patients and families as it promotes self-care management and improves the clinical and patient safety outcomes. It is clear from the consensus workshop meeting that we should embrace and enhance this partnership with patients and families to create a safe and holistic healthcare system. Involvement from patients and families come in various forms - being more engage in their own care as a partner, sharing and speaking up from past experiences, participating in the review and co-production of policies, services and co-design of healthcare infrastructure and patient safety systems when necessary. Partnership with patients and families provides an excellent platform for exchanges of information, knowledge and experiences while maintaining transparency and openness in the care process.

With the partnership and empowerment of patients and families, it becomes important to educate, train and build their knowledge and capability, so to contribute and play the functional role in the whole care process and journey. The training should encompass different aspects and domains of patient safety discipline such as patient safety, healthcare quality improvement, root cause analysis, safe culture, design thinking, human factors and self-care mindfulness.

Below were the discussions on the 5 consensus statements and actions put together by patients and families, patient organizations and healthcare professionals from the workshop.
1. **GPSAP Strategy 4.1 - Engage patients, families and civil society organizations in co-development of policies, plans, strategies, programmes and guidelines to make health care safer**

The first consensus statement is [Engage] Partner and Engage patients, families and civil society organizations in co-development of polices, plans, strategies, programmes and guidelines to make health care safer.

The word “Partner” was suggested to be included in the consensus statement, to highlight patients and families as partner and stakeholder working alongside in the care design and improvement journey. An effective partnership is where all parties involved get to share and listen to constructive opinions and working together to achieve the best outcome. Healthcare strategies, policies and services must be patient and family centric focus rather than just focusing on organization’s needs.

A. The following supporting statements were made to help elaborate on the focus areas and how they can be translated into proposed actions to work on:

   i. Any patient safety strategy or policy, to be effective, must be patient and family centric, and inclusive. The focus should be the needs of the patients, and their values, and not just staff or organization needs.

   ii. A common language platform for effective co-production by having policies, strategies, and services in both medical and plain language, which patients and families can easily understand.

   iii. Partners are empowered for true co-production of solutions, strategies and policies. We should, listen to and respect their opinions, share information and the rights to make decisions and trust their decisions.

B. To transform the consensus statement into actionable plan, the group had also suggested actions which will help to build the patient and families’ competency and involve them in the co-production of strategies, policies and services:

   i. Promote active recruitment of Patient and Family Advisory Council (PFAC) members within institutions, and provide support for Patient Organizations, and equip them with the necessary knowledge and skills.

   ii. Hardwire patient engagement/involvement in the wording and presentation of policies and strategies that directly or indirectly impact patients, before roll-out and implementation so that the purpose and outcomes of these can be easily understood and measured.

   iii. Appoint a PFAC Representative to planning committees to determine stage and extent of patient engagement for projects.

2. **GPSAP Strategy 4.2 - Learn from the experience of patients and families exposed to unsafe care to improve understanding of the nature of harm and foster the development of more effective solutions**

The second consensus statement is [Learn] Learn from the experience of patients and families exposed to unsafe care to improve understanding of the nature of harm and foster the development of more effective solutions.

The group agreed to the consensus statement, and agreed that there is a gap of available pathways on reporting of patient and family experience, and depository to contain the records. The experiences are invaluable learning resources to enhance the current healthcare system and future design. It is necessary to provide pathway to specify the ownership, storage and control of such information and how the information is disseminated for learning purposes.

A. In support of the consensus statement, the group provided few supporting statements to emphasize the importance of having a legitimized framework to govern the procedures on reporting and disclosure to patients on unsafe care and how these incidents can be documented into case studies for learning and improvement:

   i. Adopt openness and transparency approach to patients and families especially in patient harm incidents. Accountability should be clear.

   ii. Use an engagement framework for patients to share patient harm stories. The framework to govern the platform and mode disclosure and sharing of patient harm stories, including the people involved. This creates a safe environment for sharing and promote effective solutions and learning.

   iii. Co-design patient safety reporting mechanisms with a charter to facilitate the reporting of avoidable harm and unsafe care.
B. The group believed it is important to first build and strengthen the patient advocacy network at national level, to promote a safe platform for sharing and learning to take place. Proposed actions from the group were:

i. Develop relevant programme at national level, to build capacity, foster sharing and learning of health care experiences from patients and families. These include reporting of patient safety problems and sharing of solutions for improvement.

ii. Create national charters or laws for patient engagement in reporting of patient harm incidents.

iii. Create awareness through various media channels to share learnings of avoidable harm and unsafe care stories and emphasize on safe care.

3. GPSAP Strategy 4.3 – Build the capacity of patient advocates and champions in patient safety

The third consensus statement is [Capacity Building] Build the capacity of patient advocates and champions in patient safety.

The group agreed with the consensus statement. For patient advocates and champions to participate and contribute to the system, they need to be competent and familiar in their roles. This creates the needs to build the skills and knowledge of the patient advocates and champions to support the delivery of their roles.

A. The consensus statement was supported with the following statements to highlight the requirements needed to build the capacity of patient advocates and champions in patient safety:

i. Patient advocates and champions should be competent to execute their roles and be the voices of patients and families. Establishment of a comprehensive development framework to build capability, promote continuous learning, sustain skillsets relevancy of patient advocates and champions through community sharing and engagement.

ii. Introduction of patient safety council/board in hospitals and healthcare facilities to integrate the roles and representation of patients and families in the healthcare system.

iii. Training curriculum with accreditation from established patient or healthcare organizations.

B. The group suggested the following proposed actions which provided an oversight on the capacity building plan from nomination to training and assessment of competency of the patient advocates and champions:

i. Develop a training roadmap to build patient advocates and champions with funding support from government.

ii. Identify and nominate potential patient speaker/s in respective therapy area to be trained as patient advocates and champions.

iii. Develop training programmes including refresher training.

4. GPSAP Strategy 4.4 – Establish the principle and practice of openness and transparency throughout health care, including through patient safety incident disclosure to patients and families

The fourth consensus statement is [Transparency] Establish the principle and practice of openness and transparency throughout health care, including through patient safety incident disclosure to patients (and families when permitted).

It was recommended to include “(and families when permitted)” to the consensus statement to emphasize that while patient safety incident disclosure to patients was expected and deemed important, disclosure to families should be only permitted after and upon patient's authorization.

A. The supporting statements echoed the importance of holding up the principle and practice of openness and transparency of the risk impact of the care process to the patients, in particular. Patients have the rights to know what are the care treatment they are receiving and what are the risks involved. This in turn will build trust and foster shared decision making. Two important tenets are:

i. Regardless of the level of risk to the patient, transparency and disclosure is necessary. The increased openness and honesty following adverse events can improve provider-patient relationships, thus facilitating better health outcomes and quality of life.
ii. Autonomy of patients and families on informed decision and information throughout their care journey.

B. The group had listed several actions to suggest ways to create an open and safe environment and promote trusting relationships between patient and provider and towards a safer health system:

i. Help patients better understand their diagnosis, and to formulate relevant questions for their health care providers, so that they are clear about treatment options, possible side effects and the way forward.

   • Indicator: Number of patient feedback on the support they received from patient advocates or patient organizations against number of support requested.

ii. Raise awareness about the rights to correct and complete information, and their entitlements.

   • Indicator: Number of activities conducted by the patient advocates/patient organizations

iii. Raise awareness on the rights to seek full open patient safety incident disclosure related to adverse events and ongoing treatments to take informed decisions.

   • Indicator: Number of Root Cause Analyses done on adverse events and ongoing treatments

iv. Patient organizations/advocates should be the voice of patients and families in seeking the following aspects of disclosure:

   a. the disclosure is relevant, credible and accurate;

   b. easily accessible, comprehensible and timely communication of disclosure;

   c. disclosure that includes strategies for prevention of recurrence to ensure safety of patients;

   d. privacy and confidentiality of the shared disclosure.

   • Indicator: Campaigns made by patient organizations to help patients understand the importance of seeking quality information about their healthcare.

v. Patient advocates and patient organizations should encourage the government to create an enabling environment for all members of society to be open and transparent.

   • Indicator: Number of policies being reviewed or lobbied by patient organizations

5. GPSAP Strategy 4.5 – Provide information and education to patients and families for their involvement in self-care and empower them for shared decision-making

The fifth consensus statement is [Education & Empowerment] Provide information and education to patients and families for their involvement in self-care and empower them for shared decision-making in relation to patient safety.

The group recommended to add “patient safety” to the consensus statement as they felt the original statement is too broad and did not explicitly emphasize on the element of patient safety. The discussion also touched on the lack of information and access to information and policies, which can impact patients and families in their care journey. Hence, this brought up the importance of the communication skills and channels between patients, families and healthcare providers, on how shared experiences can be integrated with professional knowledge to create collective wisdom and build health literacy and finally adopting empowerment and shared decision-making model to enhance the care process.

A. It is equally important to engage patients and families as partner-in-care, and in providing adequate and relevant education to them, to build their knowledge and competency. The supporting statements illustrated the key areas of focus:

i. Tailor education to meet varying needs and literacy levels of patients and families and autonomize self-care management and patient safety beyond healthcare facilities.

ii. Build communication skills among patients, families as well as healthcare providers and other stakeholders to promote patient safety.

iii. Co-create through Patient and Family Partnership programmes and platforms, and transform valuable insights and case studies from patients and families into collective resources for learning and improving patient safety.
iv. Leverage on digital innovations to promote self-care management and reporting patient safety data.

B. The group agreed that healthcare organizations should be proactive and take the lead to drive the initiatives in promoting patient advocacy and patient empowerment. There is no easy or fast route to attain that. Proper planning, collaboration and support from various stakeholders are very much needed to realize the goal. The list of proposed actions from the group was as follows:

i. Healthcare organizations should provide the lead in understanding the patient journey and consolidating the insights into a patient journey framework with potential patient safety issues highlighted at each stage.

a. Collection of patients' and families' experiences and case studies to build repository and co-create education resources for learning and enhancing of healthcare system.

b. Provision of segmented education to patients and families, addressing varying levels of needs and knowledge gaps.

c. Promotion of the use of plain language and communication skill training to healthcare providers.

d. Leveraging on digital innovations e.g. social media and apps to educate and empower patients and families to report on adverse events or near misses using digital technologies to co-create patient safety data.

ii. Healthcare organizations should lead dynamic and active peer support groups that give opportunities beyond formal channels to patient and family members to raise concerns through dialogue on safety aspects of care.

a. Design and promote patient advocacy programmes in patient organizations and healthcare facilities.

b. Explore opportunities for collaborations or invites for patients and families to participate in support groups, advocacy groups, etc. to represent and contribute in their perspectives.

iii. Healthcare organizations should advocate for creation of formalized platforms where patient advocates can dialogue with regulators and other health authorities to raise their concerns and promote accountability.

a. Formulate a framework to establish the pathway of engagement and communication between patient advocates, regulators and other health authorities, providing a legitimatized platform to manage the information and accountability.

CONSENSUS STATEMENTS

The Asia-Pacific Patient Advocacy Consensus Statements for Patient Safety reached in the consensus workshop were as follows:

i. [Engage] Partner and Engage patients, families and civil society organizations in co-development of policies, plans, strategies, programmes and guidelines to make health care safer.

ii. [Learn] Learn from the experience of patients and families exposed to unsafe care to improve understanding of the nature of harm and foster the development of more effective solutions.

iii. [Capacity Building] Build the capacity of patient advocates and champions in patient safety.

iv. [Transparency] Establish the principle and practice of openness and transparency throughout health care, including through patient safety incident disclosure to patients (and families when permitted).

v. [Education & Empowerment] Provide information and education to patients and families for their involvement in self-care and empower them for shared decision-making in relation to patient safety.

CONCLUSION

Through the consensus workshop, participants from Asia Pacific region had come together to discuss, share insights and contribute ideas in their represented roles as patients, patient advocates, healthcare professionals and other health system stakeholders. The groups agreed on 5 consensus statements which are aligned to WHO GPSAP 2021-2030 Strategic Objective 4 Patient and Family Engagement. This consensus can serve as a guide for all, especially patient advocates, patient organizations and healthcare organizations in Asia.
Pacific region to reference and explore the strategies in strengthening patient and family engagement in eliminating avoidable harm in healthcare.

ACKNOWLEDGEMENTS

We would like to thank the participants in the consensus workgroup for their participation, and sharing their invaluable insights and suggestions, bringing a step closer to actualize WHO Global Patient Safety Action Plan (GPSAP) Strategic Objective 4 - Patient and Family Engagement.

We would like to express our gratitude to the facilitators whom have done a fantastic job in facilitating the session and guiding the participants to achieve consensus of the statements and proposing the actions. Lastly, we would like to thank all our partners for guidance and strong support to make this workshop a success.

The consensus report was endorsed by: Professor Tan Kok Hian, Group Director and Senior Associate Dean SingHealth Duke-NUS Institute for Patient Safety & Quality (IPSQ), Singapore; Mr Kawaldip Sehmi, Chief Executive Officer, International Alliance of Patients’ Organizations (IAPO); and Dr Ratna Devi, Board Chair, International Alliance of Patients’ Organizations (IAPO).
### Facilitators

1. Professor Tan Kok Hian, Group Director and Senior Associate Dean, SingHealth Duke-NUS Institute for Patient Safety & Quality (IPSQ), Singapore
2. Mr. Kawaldip Sehmi, Chief Executive Officer, International Alliance of Patients' Organizations (IAPO)
3. Dr. Ratna Devi, Board Chair, International Alliance of Patients' Organizations (IAPO)
4. Ms. Zann Foo, Deputy Director (Admin), SingHealth Duke-NUS Institute for Patient Safety & Quality (IPSQ), Singapore
5. Ms. Mabel Sim, Senior Executive, SingHealth Duke-NUS Institute for Patient Safety & Quality (IPSQ), Singapore
6. Ms. Dani Mothci, Manager, Member Engagement, International Alliance of Patients' Organizations (IAPO)
7. Ms. Rachel Githinji, Communications Lead, International Alliance of Patients' Organizations (IAPO)
8. Mr. Ankit Dabra, Project Officer, Patient Academy for Innovation & Research (PAIR)

### Breakout Room Group 1

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<td>Ana Ma, Veronica A. Solano</td>
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## Breakout Room Group 3
### Consensus Statement 3 - [Capacity Building] Build the capacity of patient advocates and champions in patient safety.

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## Breakout Room Group 4
### Consensus Statement 4 - [Transparency] Establish the principle and practice of openness and transparency throughout health care, including through patient safety incident disclosure to patients (and families when permitted).

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### Consensus Statement 5 - [Education & Empowerment] Provide information & education to patients & families for their involvement in self-care and patient safety and empower them for shared decision-making in relation to patient safety.

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REFERENCES


Highlights of the HQSS Quality Forum 2022 - Day 1
Highlights of the HQSS Quality Forum 2022 - Day 2
HQSS QUALITY FORUM 2022
Transforming Healthcare in the New Normal
Hilton Singapore Orchard 29-30 July 2022

Event Photos

Plenary and Symposium Speakers

FACULTY
All speakers are from Singapore unless otherwise stated

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Chief Executive Officer
Council of Presidents of Medical Colleges Australia

Prof Chua Hong Choon
Chief Executive Officer
Khoo Teck Puat Hospital & Yuhana Health

Ms Cynthia Loo
Chief Human Resource Officer
Khoo Teck Puat Hospital & Yuhana Health

Dr Tan Sook Bee
Deputy Director, Nursing (HPN)
Singapore General Hospital

Adj. Asst. Prof Mohd. Nazri Salleh
Chief Wellness Officer
President, BDWO - Women in Science and Healthcare
National University Health System

Dr Lim Eng Kok
Senior Advisor, Office of ValueDriven Care
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Clinical Director & Senior Consultant
Department of Orthopaedic Surgery
National University Hospital Group Chief Value Officer
National University Health System

Ms Karen Zhang
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Ms Chua Keen Tong
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Deputy Director, Peri-operative Services
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National Healthcare Group

Dr Yeo Yik Chuan
Head of Medical Innovation
National Healthcare Group

Poster

Visit www.hqss.org for more information.

secretariat@hqss.org
# HQSS Healthcare Quality Course

**10th - 14th October, 2022**

## Programme

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<td>Problem Solving Tools</td>
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## CME and CNE Accreditation

CME and CNE points will be awarded for participation at the Healthcare Quality Course.