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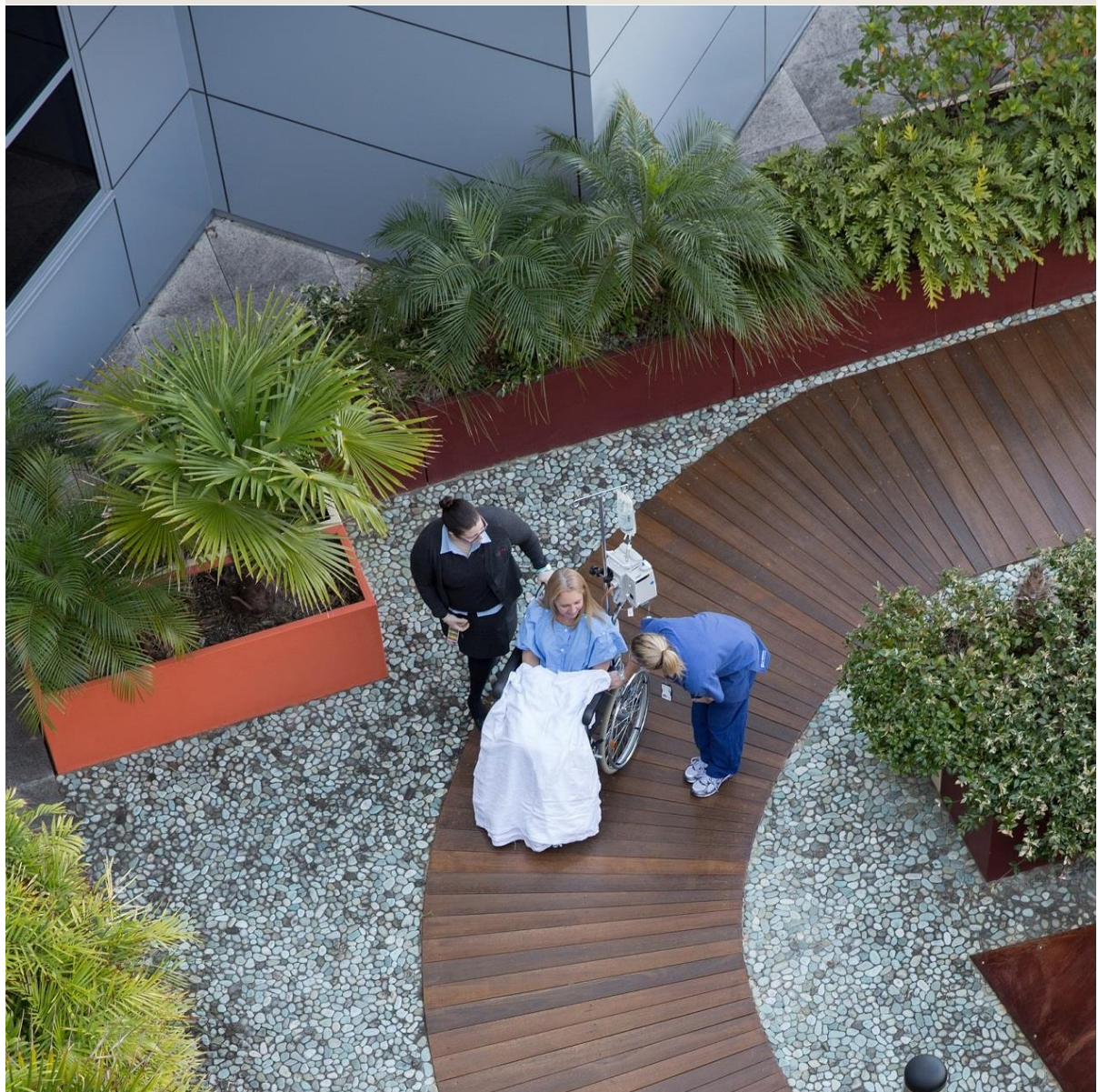
*Faculty of Medicine, Health
and Human Sciences*



MACQUARIE
University

Centre for Health Systems and Safety Research

EVALUATION OF 24/7 EICU MODEL OF CARE



Report

Centre for Health Systems and Safety Research May 2022

1. INTRODUCTION

VIRTUAL MODELS OF CARE

Virtual models of healthcare delivery have accelerated during the COVID-19 pandemic. Virtual health care involves delivery of care using telecommunication and information technology. Modalities of virtual care can include a telephone/ video consult, clinical data monitoring via a wearable device, patient monitoring via video and mobile health providing authentic, health care information to the patient or the wider community (1, 2). Prior to the pandemic, virtual care was becoming an important topic in relation to the future of health care delivery (3). Virtual models such as remote digital monitoring using a smart phone device or smart watches were gaining public interest (4). The field of cardiac electrophysiology was recognized to be an early adopter of remote, digital monitoring technologies such as the wearable electrocardiography (ECG) monitors, smartphone-enabled ECG device, implantable loop recorder, pacemaker, and implantable cardioverter defibrillator (ICD) technologies used in healthcare. Despite momentum pre-pandemic, few opportunities to adopt novel entirely virtual care models were documented (5). Professional Attendances – about 255,000 out of a total of 200 million in Australia in 2019(6). This arose to 54 million telehealth services completed Australia-wide between 13 March 2020 and 31 March 2021 (7). Rapid transition towards virtual models across all sectors of healthcare delivery during the pandemic have created opportunities to now evaluate the impacts of such approaches on processes and outcomes of care (8-10).

VALUE IN VIRTUAL CARE MODELS

Virtual care models offer a multitude of potential benefits in the delivery and coordination of clinical care (11, 12). Advantages of virtual modalities of care include improved convenience and accessibility to care with reduced travel time and cost, especially for management of chronic conditions (13) rehabilitation services and follow up appointments (14). Improved accessibility to care via virtual models has been identified as critical to redress inequities in access for under-served and rural patients(15, 16). This also includes provision of enhanced critical care to rural sites (16). The NSW Bureau of Health Information (BHI) developed the Virtual Care Survey 2020 to collect information about adult patients' experiences of virtual care outpatient appointments with New South Wales (NSW) public hospitals (17). Patient experiences captured through this state-wide survey are predominantly positive, and these corroborated with the main benefits of virtual health care delivery identified in the literature (14) in terms of convenience, cost and time saving and easy accessibility(17). A propensity to prefer traditional, face to face health care delivery was noted among patients new to or unfamiliar with virtual care (17).

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VIRTUAL INTENSIVE CARE UNITS

The Intensive Care Unit (ICU) is a highly resourced, specially staffed health care service provided to manage complex, complicated, and critical patients in a self-contained area in a hospital (18, 19). eICU describes technology-enabled care delivered from a remote command centre to deliver effective and safe care for complex and critical patients in offsite locations. Generally, ICUs are categorised as open or closed models. In an open ICU, patients are admitted under the care of multiple generalists with or without the assistance of intensivists/ intensive care specialist, whereas patients are admitted under the complete care of a trained intensivist in the closed ICU format (19, 20). Research has shown more favourable outcomes of closed units and/or mandatory intensivist consultation not only in terms of a reduction in ICU and hospital mortality (21) but also a reduction in the length of stay for critically ill patients in an ICU (20). The eICU models address some of the longstanding challenges of critical care delivery related to staffing ICUs and addressing inequities in remote and rural care. The insufficient supply of intensivist in rural and regional intensive care units is identified as a critical challenge in the delivery of optimal ICU care (18). Moreover, during the pandemic, critical care delivered virtually was considered to aid the provision of up-to-date protocols of management for COVID positive patients and for them to be effectively managed in rural and regional ICUs (18, 22).

Prior to the pandemic, there was a paucity of functioning, eICUs, despite discussion about the possible positive outcomes of this model of health care delivery (18, 23, 24). During the pandemic, virtual delivery of health care promulgated including rapid implementation of eICUs (18, 22). Virtual care in general and eICU in particular have the potential to be harbingers of a more comprehensive, effective, efficient health care delivery model (11, 18, 25); however, there is a need for in depth evaluation of the impacts and outcomes achieved through the implementation of these models. NSW Health acknowledge the rising and rapid adoption of virtual modalities of health care delivery and therefore prioritise a system-wide objective to optimise the patient experience (17). A preliminary analysis of an eICU implementation in Victoria has identified a reduction in transfers to a higher centre, cost savings and care comparable to tertiary centres when 24/7 ICU support was received by a regional ICU (16). However, there is a lack of evaluative data of the use of eICU in New South Wales (NSW)health.

2. PRESENT PROJECT

ICUs in NSW are classified as Level 4, 5 and 6. Level 4 ICUs are located in smaller hospitals, Level 5 in metropolitan hospitals and Level 6 ICUs in tertiary hospitals. Patients requiring complex, long- term therapies are transferred from Level 4 ICUs to Level 5 or Level 6 ICUs. Some Level 4 ICUs in NSW function as open collaborative models (OCM) where patient care is under the admitting specialist, with limited or no intensive care specialist availability. Level 4 ICUs can also function as closed collaborative models, where an intensive care specialist is responsible for patient management. A report from the Agency of Clinical Innovation NSW indicated that failure to recruit intensive care specialists resulted in

uncoordinated, fragmented and unsupported care with limited access to senior critical care advice and management, particularly for deteriorating patients in OCM Level 4 ICUs (19).

The present project sought to support three, regional OCM Level 4 ICUs during the COVID 19 pandemic. The Campbelltown Level 5 ICU provided specialist virtual care ward rounds supervision at Level 4 ICUs in Goulburn, Bowral and Bega hospitals. The ward rounds provide a single daily virtual care specialist review with telephone on call as required at other times. Therefore, this project proposed a virtual care enhanced 24/7 eICU model of care by providing supervision and care to patients 24/7 in these ICUs. The proposed eICU model is also designed with the objective to provide better safety and quality to the existing care of their patients, and enhanced ability to manage patients locally during COVID-19 while avoiding risks during retrieval and isolation from families.

3. PROJECT OBJECTIVES

This Project, commissioned by the South Western Sydney Local Health District, sought to address the following objectives:

- To determine the clinician experience of providing care in an eICU model of care
- To determine the patient experience of receiving care in an eICU model of care.

The clinicians experience of providing eICU care is reported in this report, with the patient experience to be reported subsequently.

4. METHODS

Qualitative data was collected via semi-structured interviews. staff members from Campbelltown ICU, Bowral ICU, Goulburn ICU and Bega ICU, were invited to participate in a brief interview exploring their experiences, views and preferences of how the telehealth/virtual care was being delivered and/or received across the different sites of the eICU implementation, the main gains of the eICU model and aspects which would benefit from improvement.

SAMPLE AND RECRUITMENT

All clinicians and executive managers involved in the eICU model of care were eligible to participate. The principal investigator sent an invitation to participate email to total n= 54 clinicians (medicine, nursing and allied health) and executive managers. Three email reminders were sent.

DATA COLLECTION

Each interview was conducted online via Zoom (Zoom Video Communications, Inc). The interviews were audio recorded. The average duration of each interview was 20-25 minutes. At the start of the interview, the member of the research team conducting the interview (MPI) introduced herself and the project. The discussion in the interview progressed via the questions outlined on the interview schedule. The interview schedule explored: the individual role and experience with eICU model of care, clinicians experience in terms of the relative gains of using the eICU model and aspects which would benefit from improvement.

DATA ANALYSIS

Thematic analysis was undertaken following Hesse-Biber and Leavy's (26) four steps in data analysis. In the 'data preparation' phase the audio data was transcribed. Transcription is a valuable activity because listening to the data facilitates and starts the process of analysis and interpretation (26). The two subsequent steps occurred simultaneously: data exploration and data reduction (26). The transcripts were read, important phrases were highlighted, and concepts were subsequently coded. The coding was undertaken on the program NVivo, a qualitative data analysis computer software package. The member of the research team (a clinician with health services research background) read the transcripts and conducted the initial round of coding the data; the research team reviewed the transcripts and the coding process. Any discrepancies were discussed and resolved by the team. The coding process was performed keeping in view the questions that were asked during the interviews. The emerging codes were further analysed and organised under common themes. In the final step of the analysis codes were further refined, organised into categories and emerging themes, and exemplar quotes identified.

5. RESULTS

PARTICIPANT CHARACTERISTICS

As shown in Table: 1, participants were predominantly clinicians (which includes doctors, nurses and pharmacists) (n=19) and for some participants the role of clinician and manager overlapped i.e. clinician managers (n=5). The latter role was seen in Goulburn and Bega sites where the clinician managers were also doctors/nurses, who had an oversight of the eICU model of care and participated in eICU delivery of care. Clinicians who were doctors were equally represented across the different sites (total n= 10), this was followed by nursing staff (n=6) and least representation was from the allied health that participated from Goulburn and Bega hospitals (n=2).

Table 1 Participant characteristics

Characteristic	Total N=21
Goulburn Hospital	n=7
Doctors	2
Clinician managers	2
Nurses	2
Allied health professional (e.g. Pharmacist)	1
Bowral Hospital	n=4
Doctors	1
Clinician managers	1
Nurses	2
Allied health professional (e.g. Pharmacist)	--
Bega Hospital	n=4
Doctors	1
Clinician managers	1
Nurses	1
Allied health professional (e.g. Pharmacist)	1
Campbelltown Hospital	n=6
Doctors	3
Clinician managers	1
Nurses	2
Allied health professional (e.g. Pharmacist)	--

PARTICIPANTS EXPERIENCES WITH THE EICU MODEL OF CARE

The themes were developed from the interviews exploring the participants working in an eICU both in terms of providing virtual care service (i.e. Campbelltown hospital (CH)) as well receiving virtual care services (Goulburn (GB), Bowral (BO) and Bega Hospitals (BH)). Our analysis of the interviews identified six themes and 11 sub-themes- see Table: 2. The interviews also provided an opportunity to discuss aspects which would benefit from improvement in terms of optimal ICU care. As presented below, participant quotes across the four sites are labelled with their site abbreviation (i.e. Campbelltown (CH); Goulburn (GB), Bowral (BO) and Bega Hospitals (BH)) and a unique participant code number.

Table 2 EICU evaluation interview: Themes and sub-themes

Themes	Sub- themes
1. Collaboration and building a community of care	1.1 Facilitation of collaboration via the multidisciplinary team meetings 1.2 Collaboration between metropolitan and rural sites 1.3 Practical suggestions for teambuilding
2. Power dynamics in intergroup communication	2.1 Disjointed management plans 2.2 Clinician conflict and tensions 2.3 Enhanced access to support
3. Service efficiency and equity	3.1 Facilitation of patient transfer 3.2 Requirements for service integration 3.3 eICU model funding
4. Implementation of the technology	---
5. Functional aspects of eICU model	5.1 Space for eICU- monitoring site 5.2 Staffing issues
6. Patient experiences and care quality	---

1. Theme: Collaboration and building a community of care

Each interviewee highlighted the relevance of eICU model of care in promoting collaboration and building a community of care between metropolitan and rural sites. This model of care fostered communication and offered a safety net for making care decisions in the interest of the patients. Doctors, nurses, and allied health care staff discussed their involvement in daily, virtual, multidisciplinary team meetings which provided the context for them to communicate with the team. This model of care enabled the provision of expert advice to rural sites where a senior ICU clinician (doctor or nurse) was not present. In sites with a senior ICU doctor the role entailed a peer review of patient management plans. Here are some participant quotes:

“... [the eICU model of care] supports enhanced communication and collaboration between clinicians...” (Interviewee_BO1) and “...it also builds a community, which I think it's quite helpful.” (Interviewee_GB5)

“... [the eICU model of care] it offers the greatest safety net as I was saying before it gives those ICU doctors a chance to talk to other ICU doctors about situations and problems which is great...” (Interviewee_GB5)

1.1 Facilitation of collaboration via the multidisciplinary team meetings

One important aspect of the eICU involved the daily, multidisciplinary, virtual team meetings that were generally conducted around midday of every weekday. The involvement of the entire care team in the multidisciplinary team meetings (MDT) and format of the meeting implementation impacted the team members' satisfaction with participation and contribution in the discussions. Many participants discussed the importance, inclusivity, feasible time to attend and the provision of a safe platform to discuss patient concerns during these MDTs. They highlighted that the MDTs encouraged contribution from all members, and everyone was given a chance to speak and provide their insight. Here are some quotes:

“...yeah well everybody's here [at the MDT] and ...usually it takes about half an hour we go through all patients, so it doesn't intrude upon our day too much...” (interviewee_GB3)

“...I think the meetings [MDT meetings] are very inclusive and multidisciplinary and everybody is given a chance to speak, which I think is fantastic...really great collaborative model I think it's very inclusive and as I've already said I'm sure it gives better patient care...” (Interviewee_GB 7)

Some participants discussed challenges with the MDTs that were related to the practical aspects like the communication software. Here is an exemplar quote:

“...where some meetings I think we had to cut short because technology wasn't very good and we couldn't have this sort of medium of meeting where it just became like a phone discussion...” (Interviewee_CH 4)

As evidenced in the below quotes, participants discussed how the eICU model enabled a cohesive care team which communicated daily and worked together to achieve positive and safe patient outcomes. Prior to the eICU model of care, allied health care staff members such as pharmacists were working in silos and did not participate in discussions with the formal team, in relation to patient management and care plans. However, in this model they were locked into the care team and attended the daily meetings and contributed towards the discussion of patient management.

“Cohesive and good working team...working towards good outcomes and not just medication safety but optimizing patients care...” (Interviewee_GB 7)

“... [In the eICU model of care, there is] daily review of the patient and the care that they receiving...and the fact that the allied health are involved, the nurses are involved and everybody's on the same page discussing same issues and everybody knows what's going on....” (Interviewee_GB1)

1.2 Collaboration between metropolitan and rural sites

Participants described that in addition to promoting collaboration between team members, it also promoted collaboration between metropolitan and rural hospitals by providing insight to clinicians in metropolitan areas to gain deep understanding of how intensive care is provided in rural hospitals. A few of the participants, particularly who are in executive managerial roles, discussed that health care staff may be unaware of the challenges of health care provision in rural hospitals. The eICU model served to address rural intensive care provision in a rural site to some extent, by clinicians from other sites being involved in providing care and, through this, gaining understanding of the challenges involved. This unintended benefit was described as a *“Fortuitous partnership for rural sites”* (interviewee_BO1), with further evidence in the below quotes.

“...there's a lack of for people who have never worked in the rural regions, so there's a distinct lack of understanding about the limitations [in terms of health care delivery in rural sites] like they kind of don't understand why we can't manage it ourselves...So I think that's really helpful....” (Interviewee_BH1)

“...From the advice giver [in an eICU Model of Care] ... quite helpful to see what's going on and experience the dilemmas of rural and regional, small units with only one practitioner. And it does give a better sense of what they have to deal with on a day-to-day basis in their small units.” (Interviewee_BH2)

1.3 Practical suggestions for teambuilding

Many participants across all the sites were supportive of promoting team building. Some discussed strategies like arranging site visits and face to face events for the wider teams, which includes the virtual team at the command centre and ICU team at the rural and regional hospitals. These meet and greet opportunities would aid in developing collegiality between the wider teams:

“You know we should go out to these intensive care units, introduce ourselves and have a name put to a face...” (Interviewee_CH1)

“...One of the best ways we can improve it [i.e. Collaboration between the team members across the sites] is occasionally allowing people to go out and visit each other's units and spend that quality time physically together ... I think does help significantly.” (Interviewee_GB5)

2. Theme: Power dynamics in intergroup communication

While the eICU model of care was a collaborative model which involved communication and cohesive partnership between clinical care teams on-site and another virtually, the power dynamics, imbalances and the intergroup communication challenges were also highlighted. Participants discussed a number of circumstances in which the context of clinicians' interactions could have implications for the safety and quality of care provision via the eICU.

2.1 Disjointed management plans

Differential approaches of clinicians' management plans sometimes created power imbalances and tensions experienced by the participants. Examples of this include the management plans being changed back and forth after the multidisciplinary team meetings, which created confusion for the nursing staff and was considered detrimental for patient safety. Also, there were some instances in which the eICU clinicians providing advice virtually without physical presence was sometimes being ignored.

“So it was fairly obvious when there is a disagreement between the two trading teams [clinical team at the rural site and the team members at Campbelltown hospital] ... Sometimes I see orders being changed and then changed back. Yeah! and that's really quite detrimental to a patient and it adds that extra layer of risk. Also, for poor nursing staff, you know, trying to keep up with what is going on....” (Interviewee_GB7)

“...Because they don't see us they sometimes think they can ignore you and keep doing what they're doing. Whereas if you're physically there they can't ignore you...” (Interviewee_CH5)

2.2 Clinician conflict and tensions

The power imbalances of this model of care also played out in conflicts between clinicians involved in delivering patient care. There were several examples of clinicians feeling that they were questioned about their care provision and the feeling of being “spied on.” Participants highlighted the tensions created in relation to power dynamics, due to hierarchy and expertise, between two or more teams which were difficult to overcome:

“...some consultants-they don't feel the need to explain their management actions to another consultant or to discuss with consultants...” (Interviewee_GB2).

“...the people [clinicians] taking the advice is variable... some of them really appreciate it and, again...others think it's unnecessary because they will say I'm an intensivist- so I'm trained and, on the ground, why do I need to talk to another intensivist somewhere else- so it's not uniform or universal...” (Interviewee_BH2)

Alteration of patient care responsibility and management between the onsite clinician and the virtual clinician has led to unintended negative impacts in relation to power imbalance. One person commented on the tensions which were created and the impact of this on the trust relationship between the clinicians located in the eICU provider site and those located in the receiving sites. Here is the exemplar quote:

“... the primary carers [i.e.ICU Clinicians located in the receiving sites] feel that there is someone watching all the time because they may not be as vigilant...they're the primary responsible people that have the ownership of the patient and the care, so there needs a careful balance...of retaining the patient ownership but providing I guess timely warning if there is any problem...” (Interviewee_GB1)

Limitations of the eICU in terms of visual access to the patient, inability to examine the patient and not being able to physically act for a deteriorating patient were described as the barriers in providing effective care. Frustrations, in relation to power imbalance, were also expressed from both ends of the spectrum that is the receiving site in relation to accepting advice from a clinician without them being able to examine the patient and the provider site in terms of their inability to physically act when a patient is deteriorating. Here are some quotes:

“I didn't think you'd really be able to do it [provide eICU advice] very well without being able to examine the patient...how reliable is the doctor giving advice over the phone without having direct examination.... because you can examine the patient, you might miss something and therefore misguide treatment...” (Interviewee_GB3)

“...that [observing the patient virtually] was a really challenging experience, because all these years I've been face to face contact with the patient.... And when they deteriorate, I can really work it on...” (Interviewee_CH2)

One participant also expressed that there have been a few instances when some senior consultants asked them to avoid reporting and discussion in the MDTs to circumvent any discussion about the problems of ICU care in the rural hospital when they were in charge of the patient:

“I've had mixed involvement, depending on who the consultant is...some welcome me to bring up things in the MDTs some prefer not to...” (Interviewee_BH3)

2.3 Enhanced access to support

The prospect of being able to access professional and senior ICU staff was a central argument for sustaining the eICU model of care. Therefore, antithesis to the negative power imbalances, many participants explained that the eICU model provided them with the support and expertise which they lacked, and this was expressed as: *“[eICU Model of care was] Another set of eyes, looking at a problem, a different way.” (Interviewee_BH1).*

Enhanced accessibility of receiving patient care advice and the additional advantage of being able to manage the patient on site was described as the key strength of the eICU model of care.

“Firstly, it [the eICU model] allows patients to stay in their home...and their families are close by....so if we can keep this patient safely into the home...I think, would be a huge advantage of it, you know, looking at it from a social perspective...” (Interviewee_CH1)

Using the eICU to provide an up-to-date care protocol for patient management during the COVID- 19 pandemic gave rise to improved care delivery in regional sites. Also, COVID positive patients being managed in the rural ICUs had reduced transfer to metropolitan hospitals. This resulted in better isolation for patients and health care staff who would be involved in the ICU transfer:

“In the covid centres, with a lot of COVID patients, we were providing up to date with the latest info on the management and we could provide them with that advise with the latest in covid management protocols... so the patient's benefited so that they can receive treatment closer to home, and they didn't have to go in an ambulance to a bigger centre...it also saved the ambulance service from and they stopped from being infected or being exposed to code, so these patients are receiving the top care in their own ICU...” (Interviewee_CH5)

The expertise and support which was received via the eICU provided an additional avenue for education and had a wider, positive impact in promoting education for rotating medical students especially in rural sites.

“I think education wise, [the eICU] it's quite helpful, especially where now, here at Goulburn we are getting our MED [medical] students and things like that, so I think it's going to be helpful to help improve those kinds of things...” (Interviewee_GB5)

All the participants from Campbelltown hospital (i.e., eICU provider site), were keen to be viewed as a source of support only rather than an interference in work in this eICU model of care:

“I would love it if ...they saw us purely a support. We are not there to make life difficult ...we are just there to make it better. You know we're just there to make it better for the staff and for the patients, you know, and how can we help.” (Interviewee_CH1)

“Since we've had consultants, I think it's just having that extra person to speak to and like we've been in many meetings where XXX [senior ICU consultant at Campbelltown hospital] suggested, something that our team hadn't considered. And the other benefit which I've seen is that Deepak helping us find beds for patients that need to go into a metropolitan ICU.” (Interviewee_BH3)

3. Theme: Service efficiency and equity

With access to virtual eICU care from tertiary hospital, rural ICUs were able to effectively manage more critical and complex medical cases onsite. Participants identified that with having an eICU support they now had additional competency in managing patients in their hospitals. Therefore, the eICU model of care had an important role of promoting equitable care provision in rural hospitals. There was a discussion about the discrepancy between the access to care in rural sites as opposed to metropolitan sites. However, this model provided

an avenue of delivering equitable care across rural and metropolitan hospitals. Here is an exemplar quote:

“...[The eICU model of care] programs like this will help more equalize the care that regional patients receive...” (Interviewee_GB5)

“...so the main gain is that people [patients] in level-4 ICUs which are the rural and regional areas get the same access to specialist support and review, as people in the metropolitan areas...” (Interviewee_CH5)

The eICU model of care offered a regular, 24/7 monitoring of patients and daily MDTs which the onsite care team and the virtual team attended. In some sites, especially if they had an intensivist on site felt that eICU was like a “*duplication of services...*” (Interviewee_GB4).

3.1 Facilitation of patient transfer

In the process of optimal care provision, it was notable that eICU forged collaborative relationships which aided in overcoming a huge practical challenge of arranging the transfer of very sick patients to tertiary ICUs. Prior to the eICU, transferring patients from rural ICUs to tertiary ICUs involved coordination and communication for transfer arrangements and patient management. However, the eICU expedited this process and made the patient transfer a seamless course of action:

“...To review patients and we say well this patient needs to move out of there so we were able to organize quickly for them to move and seamlessly for them to move out of those ICUs. When normally, if you want to move patients from one to the other end, it involves four to five phone calls and a lot of complex procedures. Whereas with this it's a one phone call...so it becomes easier and already because we know the patient, we can handover the patient to the specialist who is on for icu and give them a comprehensive senior level handover...” (Interviewee_CH5)

3.2 Requirements for service integration

Several reasons were discussed in relation to the requirements of the service integration of the eICU model of care across the different sites. In order for the eICU model to be successful the role of a project lead was highlighted, and this involved a person not only in the eICU provider site but also in each receiving, rural ICU as well:

“...[For an efficient eICU model] you have a local champion and driver who's going to make it happen...” (Interviewee_BO1)

Some participants also addressed issues related to the equity in care provision by having some additional sites involved and organising a rotation of eICU provider site to involve other sites in this role, in order to have a more representative model of care.

“I'd like the model [eICU model], perhaps in the future to be more integrated, not just within one LHD [Local Health District] but perhaps amongst the LHDs.” (Interviewee_GB1)

“...it's not just a team of nurses at Campbeltown that link to the device but it's also maybe one day a week, a team from Goulburn and other sites taking over the monitoring... this creates this sort of more egalitarian service.” (Interviewee_GB1)

With access to eICU from a tertiary site, there were discrepancies in identifying the eICU purpose and objectives. Many participants discussed that the context of the model was not properly introduced, across the sites and often people were brought into it and had to figure the model functioning on a trial basis. Implications for a lack of eICU model introduction and promoting the eICU model in relation to the clinicians' motivation to be involved in the eICU model of care. Few participants suggested putting up posters to introduce and make everyone aware of the eICU model of care. Also, the important role of a local leader for the model was stressed, who could constantly communicate and aid in the model introduction and maintenance across the sites. Here are some exemplar quotes:

"I think I guess I didn't really know how it [the eICU Model of care] works, so when I was introduced to the process, I was kind of told just have a conversation with these guys [the team at Campbelltown hospital]" (Interviewee_BO4)

"... [for the eICU model to work] in particular it has to be introduced well and the aim of it has to be explained well...." (Interviewee_GB1)

"[In order to start and keep the momentum of the eICU model of care going] ...it's a no brainer, it comes from the medical directors of each of these places, so I think [they] are all key players to keep this going..." (Interviewee_CH4)

During the discussions, the role of the project lead and a champion at each site was stressed. It was discussed that a project lead would be important in managing the model's efficiency and sustainability. Here are some participants quotes:

"Initially, what we're supposed to have but we haven't got it is a project manager and I think that's made things a bit a bit more challenging..." (Interviewee_CH1)

"I found, what has been the hardest thing, is that you have to constantly have people driving it and pushing it...if I put my guard down, then I will have some of the doctors here who don't want to do it, saying, 'oh we're not going to do it today! it's Okay! The patients are fine, etc!' and I have to constantly keep saying to them no we're doing it! come on let's go! So, I find without the person driving it, it loses momentum really quickly." (Interviewee_GB5)

Another key aspect which was a necessity in sustaining the model was a formal protocol/ a memorandum of understanding, which needed to be designed and communicated across the sites with all staff members involved in intensive care delivery. The need for communicating the eICU objectives and understanding the importance of the model of care was discussed in most interviews:

"... [the eICU model] It can't all rely on Deepak [a senior ICU Clinician and

project lead at Campbelltown hospital] and someone on the other end of a WhatsApp message. It needs to be formalized...It needs to identify that a senior eICU consultant in a tertiary facility and that it's their responsibility to accept the inquiry, from whichever facilities... You know the connections that we may need have to be fairly bulletproof they can't be haphazard..." (Interviewee_BH1)

3.3 eICU model funding

The importance of funding to sustain the model of eICU was recognised. As senior clinicians and executives navigated the eICU model of care, they were mindful to ensure this model was designed to enhance care delivery in rural and regional hospitals, rather than a cost saving model to reduce future funding to rural ICUs.

“...we don't want as administrators to use this [the eICU model of care] to get care cheaply, or to reduce funding that they give to the sites or to stop other models of care- we want this [eICU model] to be an enhancement rather than a cost saving exercise...” (Interviewee_CH 5)

Challenges have been identified due to the lack of funding to involve wider allied health care staff in the MDTs in rural hospitals and which can have implications for optimal patient care:

“...but the issue for us is lack of funding...So that's probably why we don't get that engagement [from allied health care like physiotherapist and speech pathologists, etc]...I think having physio like, for example, would be great when it's applicable having speech pathology but they just don't have the capacity, because they're not funded...I just think if there was funding for true MDT involvement that that would definitely improve.” (Interviewee_BH3)

The funding of the eICU model of care was also discussed in relation to incentivising the senior intensivists to be involved in the eICU and was important especially in sustaining and making eICU as a standard care model:

“...If we want to have this model, and if we wanted to make it a standard of care, then there needs to be...the intensivist who will be you know be spending the day speaking to the smaller ICU there needs to be more incentives for them to do more...” (Interviewee_CH 7)

4. Theme: Implementation of the technology

Technology was critical in the eICU model of care, and several challenges were identified. Frustrations were expressed due to the lack of synchronous patient data available to the Campbelltown hospital staff monitoring the ICU patient at the remote site. The participants reported that there was often a lag in receiving patient data and this was especially common during the night shifts. Here is an exemplar quote:

“A lag [in receiving patient observation data] or even longer sometime, that time we don't know what's happening so we're sitting there waiting for numbers [i.e. Vitals] and patient details to come up because we're concerned...because we might be able to flag it sooner or you know alleviate our stress a little bit because I tell you one thing my I've never been so anxious in my life, as I have been in this project!” (Interviewee_CH1)

There was a suggestion to have two monitors set up to have a synchronous patient observation data: *“... if we had access to two monitors, so we could see numbers [patient vitals and details] and we would be able to see that live and things like that would make it so much more efficient for us...” (Interviewee_CH1)*

One person also identified the challenge related to the electronic medical record system- ERIC which was implemented specifically for the ICU. The roll out of ERIC was described as a *“huge change”* and the system was *“clunky”* and *“difficult to manage.”*

Challenges were identified in relation to the audio and video, when participating in the MDTs, which was disruptive. The MDTs, which were discussed previously were an important format of the model which promoted the communication and collaboration between the

teams and therefore technological disruption impacted the participants motivation with the eICU model of care:

“...where some meetings [MDTs] I think we had to cut short because technology wasn't very good and we couldn't have this sort of medium of meeting where it just became like a phone discussion...” (Interviewee_CH4)

“...We could have better hardware, in terms of camera and stuff and we're planning a few in terms of the software...slightly better software for good interaction may be better if it is kind of integrated into the electronic method, a medical record...” (Interviewee_CH5)

5. Theme: Functional aspects of eICU model

The eICU model of care encompasses virtual monitoring of the patients in rural hospitals. Participants discussed certain functional and practical challenges in relation to the context and synchronicity of virtual patient monitoring which may have implications for safety and quality of care provision and the additional requirements to ensure a high quality eICU service.

5.1 Space for eICU- monitoring site

Clinicians identified that an important and practical functioning of the eICU model of care involved a proper office space for the nursing staff of Campbelltown hospital, who were involved in virtual patient monitoring. The discussion centred around inadequate desks, computer screens and a proper office for them to sit and conduct the remote patient monitoring.

“Proper office room for the {eICU monitoring team} issue, because at the moment I'm doing night shift I don't have much problem, but the day staff are really facing that challenge [because] they don't have proper place to sit....” (Interviewee_CH2)

5.2 Staffing issues

A small number of participants from the rural and remote hospitals indicated concerns due to the lack of staff members on the site to manage work and the need for them to be attending the MDTs for the eICU: *“It can be because of the way we're being staffed at the moment, it can work fine while I'm doing it, but if I'm not here that it's almost impossible for someone to spend the 10 or 15 minutes {to attend the MDT} away from that clinical area...” (Interviewee_BH1)*

6. Theme: Patient experiences and care quality

Patients are often not directly involved in the eICU model of care communications, but they are important recipients of the wider collaborative care which is provided across the different sites. An important advantage of the eICU model was ability to manage patient in the local sites with insight from tertiary care facility. Many participants discussed that patients and carers preferred to be managed in ICU facilities near their residence and eICU provided an added layer of support to manage patient remotely. Here is an exemplar quote:

“Firstly, it allows patients to stay in their home...and their families are close by, I know how you know, when you say to a patient's relatives, that has been transferred to another

hospital the anxiety that comes with it first because it's further away from home it they don't know the area well and with Bowral and Goulburn there's a lot of elderly patients and for them to go somewhere else to go to another tertiary hospital, it does become a challenge, so if we can keep this patient safely into the home, it is, I think, would be a huge advantage of it, you know, looking at it from a social perspective..” (Interviewee_CH1)

In the more practical aspects of impacts, since this model has commenced, a reduction in the patient referrals from the rural sites has been experienced: “...before these five months ago [i.e. prior to eICU model started] we used to get plenty of patient at least twice or thrice week...” (Interviewee_CH2)

The care quality and confidence factor of clinicians has improved in this virtual model of intensive care provision because they feel that an added layer of support is available round the clock and a team of professionals at the tertiary hospital are also monitoring the patients:

“I think it's just the confidence factor, the fact that they [the clinicians at the rural ICUs] know that they're not on their own...” (Interviewee_CH4)

“.... it's just wonderful to have a backup and a support and as a nurse, I will tell you they've been numerous times in my career that I'm trying to figure out something and I'll talk to another nurse, and she'll suggest something o and it'll just be like a light bulb goes off and I'll say why didn't I think of that...” (Interviewee_GB5)

“...We can give the team the confidence that somebody senior has reviewed the patient and can make a plan for the goals of care for that patient...” (Interviewee_CH5)

Many participants expressed that it was difficult to gauge the patients experience with this model because often patients were not aware that they were being monitored or were receiving advice from a tertiary care facility. However, some said that although patients did not know about eICU, they would value the virtual care they were receiving and that they were receiving optimal care service as a patient. Meanwhile, this model had an added advantage of providing coordinated and effective care. There were several examples of this in terms of seamless and easy coordination and transfer of very sick patients to appropriate ICU beds and into the tertiary hospital. Here is an exemplar quote:

“Well, as an example, as recently as last week, it gave us another exit point for a patient....we needed to move [the patient] him to Canberra to an ICU bed and they didn't have one...And the conversation in part of the handover with Deepak (Campbelltown Hospital)...they advised yeah we've got a bed and so then it was an easy transfer to their care...which is out of scope of our normal care protocol...” (Interviewee_BH1)

The quality and effectiveness of care delivery via the eICU was also discussed with anecdotes of positive patient outcomes. Here is an exemplar quote:

“I can tell you, we saw a very young lady, and the moment we saw her we realized that she was extremely short on oxygen saturation. And within a minute we said that patient needs to come to our center so that made a big change to that patient...So although we didn't have a direct interaction with the patient or talk to the patient just the visualization of the patient and the information that we got from a senior doctor, we were able to immediately just move them within minutes and that really saved this patient's life...” (Interviewee_CH5)

Quality of patient care outcomes of the eICU model of care was also measured with stable and slightly improved morbidity and mortality ratios in quality assurance hospital meetings.

7. KEY RECOMMENDATIONS

Experiences reported by clinicians across the participating sites revealed that the eICU model was broadly supported, but contingent on several service and team activities. Major benefits of the model were the increased collaborative approach to care, increased awareness of the regional and rural context among metropolitan teams, and ready access to the necessary expertise for safer patient care. A full scale evaluation of the eICU model is necessary to assess the impacts of eICU on safety and quality of care outcomes, along with clinician and patient experiences quantitatively.

Several recommendations for service and system actions are made based on the findings resulting from this evaluative study. These are:

1. (a) eICU models may operate optimally when a project leader or project champion is appointed at local sites and supported by a coordinator across all sites to facilitate sharing understanding of the purpose and process of the model of care.
2. (b) The eICU model of care must be supported by protocols that are shared across the involved sites and within the wider health system to guide practice in order to ensure shared understanding of the model and how it should be used.
3. (c) Potential for power imbalances and tensions to occur when a command centre model is utilised was noted and may be mitigated by a rotation of eICU provider role to involve other sites. This also has the potential to build capacity in a range of specialist centres.
4. (d) Strategies to improve the opportunities for patient and/ or carers to contribute to virtual team meetings and care processes are needed to support a person-centric eICU approach.
5. (e) Gaps in the availability or effectiveness of the technology available and the capabilities of staff who utilise the technology must be tackled to ensure that the model can operate effectively, with effective multidisciplinary team meetings and the recording of clinical observations.
6. (f) The integration of video equipment to support visual access to patients in the ICU maybe advantageous but must be considered with reference to patient and families perspectives on managing their privacy.
7. (g) Whilst the findings indicate that some duplication may occur in the eICU model, this may be mitigated by a review of the overall processes of care to more seamlessly integrate eICU as a complimentary and additional model that supports but does not duplicate existing care.
8. (h) Approaches such as clinical redesign may be value to progressively ensure that ICU care models are designed with virtual care integration in mind. Design features that would be valuable include dedicated office space to provide eICU services from the specialist sites.

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MACQUARIE
University

AUSTRALIAN INSTITUTE OF HEALTH INNOVATION

Faculty of Medicine, Health and Human Sciences

L6, 75 Talavera Road North Ryde, NSW 2113 T: (02) 9850 2400 mq.edu.au

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