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Cover Page Footnote
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Research

An organisational study into the impact of mobile devices on clinician and patient experience in Auckland, New Zealand

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Abstract
Mobile technology has potential to improve workflow, patient safety and quality of care, and has been identified as an important enabler of community services. However, little is known about the impact of mobile device use on clinician and patient experiences. Eleven community allied health clinicians were provided with live access to electronic health records, their email and electronic calendar, peer reviewed education and therapy mobile applications via a mobile device. Three data measures were collected over 19-weeks. First, quantitative time and motion data was gathered at baseline and follow-up to enable longitudinal analysis of clinician workflow. Second, a questionnaire consisting of rateable statements, multi-choice and open questions was completed at baseline and follow-up to enable analysis of clinician experience. Third, a short questionnaire was completed with a convenience sample of 101 patients who experienced mobile device use in their home. Clinicians and patients reported positive experiences associated with access to electronic health information at the point of care and the use of pictures, diagrams and videos to support clinical interactions. There was a significant reduction in time spent on patient related administration ($p<0.0001$) and a significant increase in direct patient contact time ($p<0.0001$) following 15 weeks of mobile device use. This study indicates that mobile device use has potential to improve clinician and patient experiences of community allied health through improvements in workflow and efficiency, improved clinician-patient interactions and improvements in health information flow.

Keywords
Mobile technology, patient experience, clinician experience, health literacy, information flow

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Introduction

Technology in health has been associated with improvements in workflow, quality of care[1,2], and patient safety[3]. Furthermore, clinicians and patients are increasingly expecting devices to be incorporated into their healthcare experiences[4]. Mobile devices such as tablets and smartphones have potential to become invaluable tools for community clinicians. These devices can provide connectivity to hospital systems including health information, therapy tools and decision making systems at the point of care. In a recent survey three quarters of clinical leaders described mobile devices as an important enabler of community care now and in the future[5].

Health organisations have described challenges integrating technology [6]. One reason for this is that technology integration has focused on capability and cost-benefit, with little understanding of impact on working practices and experiences[7]. Additionally, technology solutions are often developed without the involvement of the people who will be using them[8]. If patients, clinicians and health care organisations are to optimise benefits from the reported workflow, quality and safety improvements associated with successful technology use, we must first understand the impact of mobile devices on the people who will use them.

This paper describes a study at Waitemata District Health Board (DHB), in Auckland, New Zealand (NZ), which explored the impact of mobile devices on community clinicians and patients. Waitemata DHB is one of three health boards in the Auckland region. It provides

secondary hospital and community services from two hospitals and 30 community sites. The organisation serves a population of 580,000 people, and has approximately 6,800 employees[9]. The two Board priorities are to enhance patient experience and achieve better health outcomes.

Waitemata's community allied health clinicians complete approximately 155,000 home visits each year. Traditionally Waitemata's community clinicians kept paper records. Since the introduction of electronic health records in 2005 clinicians have completed both paper notes in the community and electronic documentation at the hospital base. This process presents a risk to efficiency, security and accessibility of health information and impacts clinician and patient experiences. Mobile devices were identified as a potential solution to streamline the documentation process. This study set out to explore the impact of mobile devices on clinician and patient experiences of community allied health.

Methodology

Design

The mixed method organisational study was carried out over 19 weeks between Nov 2014 and Feb 2015. Quantitative and qualitative data was gathered to explore the impact of mobile device use on the experiences of clinicians and patients. Quantitative data was gathered to understand the impact of mobile device use on workflow. Organisational ethics approval was not required as the study formed part of a service evaluation intended to inform decision making about mobile device use in the community.

Participants

Eleven community allied health clinicians were recruited from a selection of volunteers who worked a minimum of 0.60 full time equivalent. The sample size was limited by the number of mobile devices available to the project team. Clinicians were chosen to represent the five therapy professions working in the multi-disciplinary team. Clinicians worked across adult and paediatric services in four geographical locations (Table 1).

Patients were selected at random. Patient feedback was anonymous. Given the sample size, patients are presumed to reflect the demographics of the community adult and paediatric services (Table 2).

Measures

We investigated three independent variables: 1. clinician quantitative and qualitative data obtained from a purpose designed questionnaire, 2. patient quantitative and qualitative data obtained from a purpose designed questionnaire and, 3. quantitative workflow data obtained from a time and motion tool.

The project team devised two clinician questionnaires: one at baseline and one at follow-up. The questionnaires sought to investigate clinician's attitudes towards mobile devices, competence with technology and perceived potential for technology to improve the quality and

Table 1. Summary of clinician participant demographic information

	Discipline	Service	Full-Time Equivalent	Personal smartphone?	Personal tablet?
1	Speech-language therapist	Adults	1.00	Y	Y
2	Speech-language therapist	Adults	1.00	Y	N
3	Speech-language therapist	Adults	0.90	Y	N
4	Occupational therapist	Adults	1.00	Y	N
5	Occupational therapist	Adults	0.80	Y	N
6	Occupational therapist	Paediatrics	1.00	N	N
7	Dietitian	Adults	0.70	Y	N
8	Dietitian	Paediatrics	0.80	Y	N
9	Physiotherapist	Adults	1.00	Y	N
10	Physiotherapist	Adults	1.00	Y	Y
11	Social worker	Adults	0.60	N	N

Table 2. Summary of community adult and paediatric patient demographics at Waitemata District Health Board

Community adult patient demographics	Community paediatric patient demographics
54% aged 64 years and over. Mean age 64 Diagnoses include stroke, progressive neurological conditions (e.g. Parkinson's disease, motor neurone disease) and age-related changes in health	72% aged 0-4 years Diagnoses include autism spectrum disorder, neurological conditions (e.g. cerebral palsy), developmental delay, swallowing disorders and intellectual disability

efficiency of their care. The baseline questionnaire comprised fourteen items: six demographic questions and eight statements accompanied by a seven point rating scale. Clinicians completed the baseline questionnaire before the introduction of the mobile device. The follow-up questionnaire comprised three demographic questions, seven statements accompanied by a seven point scale repeated from the baseline questionnaire and seven open questions to encourage qualitative responses. Clinicians completed the follow-up questionnaire after 15 weeks of mobile device use.

The project team developed a single page patient questionnaire. The questionnaire sought to investigate patient comfort with mobile device use in their homes, how the mobile device was used and impact of the device on their experience. The questionnaire comprised one statement accompanied by a seven point rating scale, three multi-choice questions and an open comments box to encourage qualitative responses.

A Waitemata DHB time and motion tool was used to gather quantitative workflow data. Clinicians recorded daily activities in five minute increments, rounded to the nearest five minutes. All clinicians were provided with a template, coding definitions, and examples to guide completion (Table 3).

Procedure

All clinicians completed two weeks of time and motion data and a baseline questionnaire before they were provided with a cellular/Wi-Fi mobile device on an IOS platform. The devices provided remote access to 1. the hospital's computer network, including electronic health record, via a virtual private network (VPN), 2. email account and electronic calendar, and 3. a repository of pre-approved mobile applications for therapeutic education and instruction. Baseline measures were completed at different times due to staggered mobile device provision. All clinicians attended a 2.5 hour structured teaching session and four one hour forums between weeks four and seventeen. The forums focused on strategies to incorporate the device into the clinical day. The project team also provided written tips and tricks via email at six points during the study.

Table 3. Summary of time and motion tool coding definitions and examples

Code	Definition	Examples
A1	Direct face-to-face patient contact time	All face-to-face contact with patients/families
A2	Indirect patient contact time	All patient/family contact via telephone or email
B	Patient liaison	All patient related liaison including equipment applications, contacting third parties, completing patient related documentation, discussion with colleagues regarding patient interventions
C	Travel	To and from base and between patients' homes. Includes filling up with petrol
D	Professional development	Time spent in clinical supervision, reading journal articles/text books, attending courses
E1	Administration	Time spent clearing phone messages, scheduling cars, loading equipment into cars, filing and responding to emails
E2	Waiting list/caseload management	Time spent managing referral and allocation processes, waiting list letters and telephone calls
F	Leave	Time spent on annual, sick, special leave or time-in-lieu
G	Role specific tasks	Working on specific projects, team meetings, discipline specific meetings, senior clinical tasks

Patients and/or caregivers exposed to mobile device use during the fifteen week period were invited by their clinician to complete a paper based questionnaire about their experience at the end of their home visit.

All clinicians completed two weeks of time and motion data and a follow-up questionnaire after fifteen weeks of device use.

Data Analysis

Clinician baseline and follow-up quantitative questionnaire responses were compared as a group. Means, medians, modes and ranges were calculated for quantitative responses. Thematic analysis was used to code and analyse qualitative responses[10]. Patient responses were collated and presented as percentages or a number. Braun and Clarke's thematic analysis method was used to code and analyse qualitative responses[10]. Time and motion baseline and final data was collated. Proportion of time spent on each activity, means, medians, ranges, t-tests and p scores were calculated to enable comparison.

Results

Clinician experiences - Quantitative data

All clinicians reported using the mobile device. Eight clinicians (72.7%) reported daily mobile device use. Two clinicians (18.2%) reported device use every 2-3 days, and one clinician (9.1%) less than every 2-3 days. All clinicians used the mobile devices to access health information at the point of care and to support therapeutic education and instruction (n=11) during the 15 week project. All clinicians used the mobile device for more than one function.

Baseline mean confidence with technology rating was 5.72 out of 7 and mean confidence with the electronic health record 5.5 out of 7. At follow-up both confidence ratings were 6.8 out of 7. Baseline mean rating for potential improvements in efficiency and quality were 6.3 out of 7. At follow-up mean for both measures was 6.8 out of 7 (Table 4). These changes were not significant.

Clinician experiences - Qualitative data

In the final questionnaire, clinicians provided qualitative data about the advantages and disadvantages of mobile device use. We identified three themes; 1. efficiency and effectiveness, 2. health information flow, and 3. device connectivity and responsiveness.

Theme 1: Efficiency and effectiveness

This theme includes clinician responses about their ability to complete activities in their work day. Clinicians reported improved efficiency associated with direct documentation into the electronic health record throughout the day, rather than having to wait until the end of the day. For example a dietitian commented that access to the health record:
"increased my efficiency by not needing to write all my clinical notes at the end of the day".

They also reported to be more efficient as they could complete administrative tasks in the community for example:
"checking emails between visits saves time at the end of the day" and *"I can do my documentation or equipment ordering or phone calls between patient visits".*

Clinicians attributed improved efficiency to a reduction in re-working for example:
"it's more efficient as I don't have to double handle my notes".

Table 4. Comparison of clinician perceptual ratings from baseline and 15-week follow-up questionnaires

	Baseline	Follow-up	t-test	Two tailed p test
Confidence with technology	5.72 mean (median 6, mode 5, range 3)	6.8 mean (median 6, mode 7, range 3)	0.54	P = 0.6000
Confidence with electronic health record	5.5 mean (median 6, mode 6, range 3)	6.8 mean (median 6, mode 7, range 3)	0.72	P = 0.4865
Potential to improve efficiency	6.3 mean (median 7, mode 7, range 2)	6.8 mean (median 7, mode 7, range 2)	0.54	P = 0.6000
Potential to improve quality	6.3 mean (median 7, mode 7, range 2)	6.8 mean (median 7, mode 7, range 2)	0.63	P = 0.5146

Clinicians utilised time saved to complete other work tasks for example:
"one advantage is the ability to have notes completed when arriving back to the office to free up time in the afternoon to complete other tasks".

Another clinician reported to feel more prepared for other tasks on returning to base for example:
"I am more ready and feel I have more allocated time to deal with other tasks including emails, phone calls and case discussions with colleagues".

Clinicians identified improved efficiency as being advantageous for themselves and their patients for example:
"It has impacted my time management positively and as a result I have been able to perform my job more efficiently which in turn benefits the patients".

They also described how improved workflow had a positive impact on their well-being as clinicians for example:
"I feel less stressed knowing I do not have to complete many sets of notes at the end of the day", *"it helps me to pace myself as I can have a break between visits to write my clinical notes and I feel less rushed"* and, *"now I can complete my notes and have time for a lunch break and don't leave work feeling burnt out and resentful".*

Theme 2: Health information flow
This theme encompasses feedback about accessibility to health information at the point of care. Clinicians described how access to health information enabled them to complete tasks together with the patient in their home for example:
"I am able to provide families with information about equipment, housing and eligibility criteria, and complete application forms with them in their own home".

Clinicians described how access to health information at the point of care enabled them to be more responsive for example:
"patients are able to have their questions answered immediately", *"you have access to information then and there rather than calling back later in the afternoon"* and *"if wanting to check normative data or outcome measures or range of motion this can be done instantly without having to return to the office".*

Clinicians perceived they could provide better education for their patients for example:
"Clearer patient understanding of equipment, surgeries, exercises etc. from being able to show them videos, pictures etc…I feel I am providing a better service as a health professional" and *"I have enjoyed seeing patient's understanding improve with easier access to education through the iPad".*

In some instances clinicians associated access to education and health information with improved clinician-patient engagement for example:
"children who are reluctant to engage in traditional therapy tasks are easily engaged in the iPad".

Theme 3: Device connectivity & responsiveness
This theme includes reports about device connectivity and responsiveness when working in the community. Some clinicians expressed concerns about reliability of their internet connection for example:
"there's not always signal" and *"I often get locked out in rural areas".*

These concerns were associated with fear that work would be lost for example:
"if I lose connectivity I lose everything".

Patient experience - Quantitative responses
One hundred and one patient surveys were completed. There were no reports of patients declining to complete the survey. We received 83 responses from adult patients and 18 from paediatric patients. Mobile devices were mostly used to access health information (n= 58) and support education and instruction (n=53). Ten respondents reported experience of more than one mobile device function.

Ninety-four percent (n = 95) of patients reported maximum levels of acceptance when a mobile device was used in their home. The remaining six percent (n = 6) rated acceptance as six out of seven. Ninety- three percent of patients (n = 94) reported mobile device use improved their community allied health intervention. Seven percent reported the device made no difference to their appointment.

Patient experience - Qualitative responses
Fifty-nine patients (58.4%) provided qualitative data about their mobile device experience. We identified three themes; 1. enhanced therapeutic instruction and education, 2. health information flow, and 3. technology use.

Theme 1: Enhanced therapeutic instruction and education
This theme describes patient reports about the use of pictures, diagrams and videos as part of their interventions. Devices were loaded with pre-approved mobile applications for education and instruction, for example speech-language

therapists were provided with videos and diagrams of swallowing difficulties, and occupational therapists were provided with access to electronic equipment catalogues. Patients described how visual resources positively impacted their learning for example: *"I find videos and pictures very helpful to learn", "being a visual person it was good to see all the equipment"* and *"very helpful in explaining more clearly by using pictures of the spine"*.

They described how 'seeing' aided understanding of their health condition and therapy activities for example: *"seeing a picture of my hip operation I understand the importance of doing the exercises"*, and *"for my first knee joint replacement I did not understand the importance of doing the exercises. Now with my second knee joint replacement seeing the muscles on the device really helped me understand the importance of each exercise"*.

Patients described pictures and diagrams as particularly useful when working on abstract concepts for example when used to provide visual feedback about vocal volume: *"using the decibel/sound level meter app made it easier to understand the purpose of the speech therapy activities"*.

Patients also described how seeing health equipment on the mobile device helped them to conceptualise the options available and make informed choices for example: *"I was able to look at the different equipment to see if it would fit"* and *"people can see what they are getting and the different options"*.

Theme 2: Health information flow

This theme captures reports about access, accuracy and security of the health record. Patients described their interventions as more responsive when the device was used to access the health record at the point of care for example: *"instead of checking and getting back to me you get answers right now"* and *"I think if you can access information straight away, that's great"*.

They also described mobile device use as efficient for example: *"it's great as it saves time and you can get information quickly", it's faster and saves double handling"* and *"it's better for quick access to the hospital database"*.

As well as improvements in access, patients whose electronic health record was updated during their session perceived documentation to be more accurate for example: *"with the note taking I found it great because it was all down and would not be forgotten"*, *"immediate timely notes reduces errors as it's hard for people to remember what happened in visits"* and *"I did not have to worry by therapist would forget what we discussed"*.

Patients also recognised that contemporaneous documentation into the electronic health record could contribute to improved care co-ordination: *"immediate timely notes helps to increase access for other staff"*.

One patient reported to feel more listened to when the electronic health record was updated during their home visit: *"knowing my notes were being written then and there I felt my issues were acknowledged"*.

Several patients acknowledged how electronic documentation eliminated some of the risks associated with paper documentation, such as duplication and papers being lost or misplaced for example: *"I like the way you go into the system and don't need papers*", *"it's great there's not bits of paper flying around"* and "*iPads are better than all the paperwork"*.

Theme 3: Technology use

This theme includes general feedback about technology use in society and some of the risks associated with reliance on technology. One patient expressed concerns about difficulties accessing the device during the session due to poor internet connectivity for example: *"it's great but can be frustrating if it doesn't connect…I think you still must have the paper file"*.

Another commented on the hospital using technology: *"it's great to see the hospital embracing modern technology"*.

There were also comments about device ownership for example: *"It's good for you but I don't have an iPad"* and *"lots of people have them but I don't have a computer"*.

Table 5. Number of direct patient contacts recorded in baseline and 15-week follow-up time and motion data by discipline

	Adults	Paediatrics	Total
Speech-language therapy	113	0	113
Occupational therapy	71	38	109
Physiotherapy	74	0	74
Dietetics	17	22	39
Social work	19	0	19
Totals	294	60	354

Table 6. Comparison of direct and indirect patient contact hours at baseline and 15-week follow-up

	Baseline	**Follow-up**	**Percentage change**	**t test**	**Two-tailed P test**
Total number of patient visits	168	186	22.5%	1.64	1.000
Total patient visits (hours)	141.8	158.3	11.6%	17.5	<0.0001
Total patient related admin (hours)	263.0	215.4	18.1%	-26.0	<0.0001
Total indirect patient contact (hours)	26.6	20.8	21.7%	-27.9	<0.0001

Workflow

We collected a combined total of 179 days of data (1,593.1 hours) from baseline and follow-up time and motion studies. The 11 clinicians completed a total of 354 patient visits during this period (Table 5). Before the introduction of mobile devices, the clinicians completed 168 visits totalling 141.8 hours. Following 15 weeks of mobile device use the clinicians completed 186 visits totalling 158.3 hours (Table 6). The mean time spent visiting patients at baseline was 95.1 minutes (Table 7) or 19.7% of the day (Table 8) compared to 112.5 minutes or 24.2% of the day at follow-up ($p = <0.000$).

At baseline clinicians completed 263 hours of patient related administration compared to 215.41 following 15 weeks of mobile device use. The mean time spent on patient related documentation tasks was 177.5 minutes or 36.77% of the day at baseline and 153.6 minutes or 30.30% of the day at follow-up.

Discussion

The aim of this study was to explore the impact of mobile device use on allied health clinicians and patients in the community. Clinicians and patients adopted mobile devices into their interactions. Clinicians reported regular device use and patients reported high levels of acceptance with the devices in their homes.

Clinicians reported high levels of confidence with technology and the hospital computer systems prior to the introduction of the devices. There were small changes in their ratings following 15 weeks of mobile device use, but these were not statistically significant. This is not surprising as our clinician group were volunteer participants and early adopters of technology. All had previous personal experience with mobile devices. Clinicians represented above average ownership of mobile phones and below average ownership of tablets: 81% of clinicians owned a mobile device (NZ average is 70%); 18% a tablet (NZ average is 51%) [11].

Table 7. Comparison of time spent on tasks as reported in time and motion data at baseline and 15-week follow-up

	Baseline (minutes)			Follow-up (minutes)		
	Mean	Median	Range	Mean	Median	Range
Direct face-to-face patient contact	95.1	92.5	92.5 – 124.5	112.5	117	75 - 152.5
Indirect patient contact	18.6	17	2 – 38	15.8	12.5	0 – 40
Patient liaison	177.5	182	127 – 231	153.6	146.4	95.5 – 224.2
Travel	65.0	63	35.5 – 95	69.7	65	38.5 – 102
Professional development	17.0	7.8	0 – 73.8	15.5	15	0 – 48.6
Administration	40.5	46.8	8.8 – 63.6	36.3	37.5	0 – 60
Waiting list / caseload management	18.8	10	0 – 98	20.2	14	0 – 72
Leave	2.2	0	0 – 16.8	11.2	0	0 – 123.1
Role specific tasks	48.0	29	3.2 – 99.5	48.2	34.2	2.8 – 130.5

Table 8. Comparison of percentage of time spent on activities during clinical day at baseline and 15-week follow-up

	Baseline	Final
Direct face-to-face patient contact	19.7%	24.2%
Indirect patient contact	3.8%	2.6%
Patient liaison	36.8%	30.3%
Travel	13.5%	13.4%
Professional development	3.5%	4.5%
Administration	8.3%	8.8%
Waiting list/caseload management	3.9%	3.9%
Leave	0.5%	2.3%
Role specific tasks	9.9%	9.9%

Patients reported high levels of acceptance when the mobile device was used in their home. This is likely due to widespread computer use in other health contexts such as GP consultations[12] and the increasing levels of mobile device use in New Zealand society. In the last three years there has been a reported 43% increase in smartphone access and 46% increase in tablet and iPad access[11]. In 2015 51% of all adult New Zealanders reported to have access to a tablet or iPad and 70% to a smartphone[11].

Qualitative and quantitative data showed mobile devices had a positive impact on clinician and patient experiences and workflow. Thematic analysis of clinician and patient feedback identified improved health information flow and enhanced therapeutic education and instruction as key benefits of mobile device use.

Mobile devices were most frequently used to access the health record. Clinicians reported reduced need for follow up appointments when the electronic health record was accessed at the point of care, as clinicians could be more responsive during the home visit. For example clinicians could complete tasks such as equipment applications with patients in their homes rather than having to return to the hospital base. Patients also described a reduction in follow up contact as an improvement. They preferred having their questions answered immediately during the visit and valued the time this saved them and their clinician.

Patients also described electronic documentation as more accurate, secure and accessible than paper documentation. They recognised how contemporaneous electronic documentation reduced the risk of clinicians forgetting key information or misplacing paper notes and how electronic records were more available and accessible to other members of the care team. These findings are consistent with other reports that have described electronic health records as more legible and accessible[13,14]. A more accurate and accessible health record can improve clinician and patient experiences by facilitating communication between members of the care team and reducing errors and delays in care[13,14].

The second most frequent use of the device was to access education materials. Patients described how use of pictures, diagrams and videos on the mobile device aided understanding of their health and interventions, and increased their participation in their care. Pictures, diagrams and videos are proven tools to facilitate understanding of technical and abstract concepts [15] and are recommended to support different learning styles, health literacy, patient engagement and better health outcomes[2,16]. In NZ 56.2% of adults have poor health literacy skills[17]. Clinicians also acknowledged benefits of pictures, diagrams and videos in their interventions. They reported to feel better resourced and more engaged with their patients. Pineros- Leano et al.[18] published similar findings following the introduction of an interactive perinatal depression scale on a mobile device.

In addition to improved patient engagement, clinicians reported emotional and physical benefits of mobile device use. Clinicians talked about feeling less stressed as a result of improved workflow. The positive reports from clinicians are important as staff well-being and engagement is central to the delivery of quality care, patient experience and health outcomes[19].

Quantitative workflow data validated clinician reports about improved workflow. Clinicians demonstrated they could reduce time spent on administration and increase patient contact when using mobile devices. There was a statistically significant reduction in time spent on administration and a statistically significant increase in time spent visiting patients. These findings not only support UK reports about the economic benefits of mobile technology implementation[20,21] but also demonstrate the potential for mobile technology to improve clinician and patient experiences by reducing administration time and increasing opportunities for clinician-patient interaction.

Some studies have reported changes in clinician-patient interactions when technology is used[12]. Changes have occurred when attention is diverted from face-to-face communication and towards the mobile device[22] and have included altered eye contact and body posture, and changes in the content of conversations such as the amount of information provided or the number of questions asked[12]. We did not gather specific communication measures during this study, nor did any of our participants express any concerns about changes to their interactions.

In this study access to the electronic health record and education resources appeared to enhance interactions for our clinician and patient participants. Our clinicians reported to feel better resourced and patients described better understanding of their health conditions and interventions. These findings are consistent with Noordman et al's[12] observations of general practitioner-patient interactions. Noordman et al acknowledged that whilst computers interfere with face-to-face communication, they also provide access to a wealth of information that can enhance the interaction. These reports are echoed by Shachak and Reis[23] who believe electronic health records can help to educate and empower patients and improve the effectiveness of health interventions.

While clinicians and patients described positive benefits of mobile device use, both recognised how technical issues with mobile devices negatively impacted their experience. Clinicians reported concerns about internet connectivity and the potential for them to lose their documentation. Patients reported feelings of frustration when connectivity was poor and the device could not be used.

The experiences described in this study align with international patient perspectives that technology in health should improve efficiency and result in better access and integration of health information[25]. In addition, thematic analysis has highlighted the important role mobile technology could play in improving clinician-patient interactions and clinical effectiveness through access to education and therapy tools. Furthermore the combination of access to health information, education and therapy tools and improved workflow enabled clinicians to be more responsive to patient needs. Effective clinician-patient interactions and clinician responsiveness are key to positive patient experience[13]. In addition clinicians indicate improvements in their own well-being which is positively correlated to patient experience[19].

The findings of this study can inform future mobile technology design by acknowledging the importance of user experience. However, the results of this study should be viewed with caution as there are limitations in

sampling and measures. Firstly, the clinician sample size is small. Future investigations should include larger samples and analysis of experiences of different allied health professions over a longer period. Secondly, there is potential positive bias in the results as the clinicians and patients were recruited from a convenience sample. It is, therefore, unlikely that the participants are representative of the broader clinical team and patient populations. Thirdly, this was the first pilot study of mobile device use at Waitemata DHB. Clinicians and patients advocated strongly for the use of mobile devices to continue which represents potential positive bias in the data. Finally the measures used were not validated and so their reliability and validity are unknown.

Conclusion

In conclusion this study indicates that mobile technology could benefit clinician and patient experiences of community allied health. Mobile devices can improve clinical responsiveness through access to health information at the point of care and can improve clinical interactions and health outcomes when used as a tool to support education and instruction. Mobile technology can also reduce time spent on administration tasks which can lead to increased patient contact time. At a time when demand on clinical resources is high, mobile technology could be a low cost tool to enhance clinician and patient experiences of community allied health.

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