# The Feasibility and Capacity for Home Video Consultations in Canterbury

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# Executive summary

**Background**

The delivery of health or medical care from a distance via information and communication technology, a practice known as telemedicine, is becoming increasingly common. A specific mode of telemedicine, Home Video Consultation (HVC), refers to a consultation between a patient and their clinician, conducted in real time using videoconferencing technology, where the patient is in their own home or place of residence. HVC can offer patients flexibility with regard to the time and location of their consultation, reduce the cost and inconvenience of travelling to hospital, without limiting their access to specialist care. Telemedicine, and HVC in particular, has received scant research attention in New Zealand. Given the importance of how health care is delivered, it is imperative to understand patients' willingness and capacity to use such technology. The aim of this study was to explore the feasibility of offering patients HVC within the CDHB. We specifically explored the willingness of patients to use HVC, their capacity to participate in a test HVC with the technology available to them at home, and the conditions under which a HVC could be offered.

**Methods**

This study employed a three phase sequential mixed methods design. Phase One used a survey to determine participants' degree of willingness to use HVC. Phase Two consisted of live testing of participants' technical capacity for HVC. In Phase Three, participants took part in semi-structured interviews that explored their perceptions regarding the conditions under which they would be willing to use HVC. Participants were patients, or the parents/guardians of paediatric patients, attending either the cardiology or paediatric outpatient clinics at Christchurch Hospital over a two week period in July 2018.

**Results**

In Phase One, a total 204 participants completed the survey (112 from paediatrics and 92 from cardiology). Overall, most of participants 139 (69.2%) were willing to use HVC if their clinician deemed it appropriate, 28 (13.9%) were unsure, and 34 (16.9%) were unwilling. Willingness to use HVC was high irrespective of gender, age group, ethnicity, or travel time to hospital. A subset of the survey participants (n=20) took part in Phase Two, 13 of whom managed a successful HVC connection, while seven people experienced an unsuccessful connection due to HVC software problems or challenges following the software download instructions. In Phase Three, 10 participants who had completed Phase Two were interviewed, with their responses suggesting a major factor contributing to a high degree of willingness was the potential for HVC to reduce the considerable time and energy currently spend attending comparatively short, and for certain health conditions frequent, specialist consultations.

**Conclusion**

Overall, participants rated the use of HVC positively, with high rates of willingness and perceived capacity to successfully use HVC. However, participants identified that HVC should be an option for health care delivery, rather than completely replacing current outpatient services. There are a number of prerequisites to establishing a HVC service. Appropriate guidelines need to be developed on a technical level, with adequate testing of HVC software platforms required to ensure user-friendliness and high reliability. Support for staff and patients is required, including training for staff on the delivering of health care using a HVC platform.

# Background

**The use of home video consultations in healthcare**

Telemedicine can be defined as the use of electronic information and communication technology to facilitate the provision of health care between healthcare professionals and patients[1]. The use of information or communication technology to deliver healthcare over a distance has many different applications including (but not limited to) telesurgery (e.g. surgical equipment controlled by a distant operator), telementoring (e.g. a health professional teaching another individual), telemonitoring (e.g. when physiological or biological data are transferred from the patient's location to the health professionals location via telecommunication equipment), and teleconsultation (e.g. a consultation conducted via telecommunication equipment between a patient and their health professional)[1]. Throughout this report the term Home Video Consultation (HVC) refers to a consultation between a patient and their clinician, conducted in real time using videoconferencing, so that the patient and their clinician can see and hear each other, where the patient is in their own home or place of residence.

A key reason for offering a HVC is to provide patients with the opportunity to be seen in a location of their choice, such as their own home or place of residence, which is often where they feel most comfortable. They may get a degree of flexibility with regard to the time and location of their consultation, avoid the cost and inconvenience of traveling to hospital, and continue to receive the care they require, when remaining in their home[2-4]. A number of factors have made it feasible offering HVC. These include a greater proportion of the population having access to broadband internet and a device with a camera and microphone, and familiarity with videoconferencing in other contexts such as keeping in touch with friends and family[5]. In addition, videoconference solutions have become cheaper and easier to access as they are software based, available across a broad platform of devices and operating systems, and of a suitable standard to allow clinicians to provide high quality, safe care.

Telemedicine, and HVC in particular, has received scant research attention in New Zealand. A patient feedback survey conducted at Waikato District Health Board (WDHB) in March 2016 (N=1032) found that 48% of patients attending an outpatient visit would be willing to try virtual health care, and 60% had access to the internet and a device[6]. No attempt was made in this study to test the connection with patients at home. There has been no other published New Zealand based research examining factors involved in the successful uptake of HVC.

**Telehealth at the Canterbury District Health Board (CDHB)**

As one of the largest District Health Boards in New Zealand, Canterbury provides care for patients from across the country. The relationship with the West Coast DHB is particularly important, as the Coast has a small and geographically dispersed population, and the CDHB is the provider of many specialist services to this community.

Telehealth is proposed as one way the CDHB can improve equity of access to healthcare. Telehealth has been a component of service delivery in CDHB for at least the last 10 years, although use remains limited. Initially based around hardware videoconference units located in CDHB facilities, the use of telehealth has expanded from education sessions and meetings to planned patient consultations, and now also includes unplanned consultations, such as those carried out by the adult and neonatal retrieval services. Complex multidiscliplinary meetings to plan oncology care are provided by the Southern Cancer Network, and store and forward telehealth has become possible with the adoption of the image sharing app Celo[7].

Over time, the number of patients receiving some of their care by telehealth has steadily increased, concomitant with an increase in the number of specialities offering telehealth consultations. Because of the reliance on hardware based videoconferencing, most patients need to attend a hospital or primary care facility to be seen, rather than staying in their own home or place of residence. However, requests for patients to be seen at home have been coming from clinicians, and from patients themselves. The factors that would make doing so acceptable, successful, and clinically safe are not well understood, particularly in the context of the local population.

The aim of this study was to explore the feasibility of offering patients HVC within the CDHB. We specifically explored the willingness of patients to use HVC, their capacity to participate in a HVC with the technology available to them at home, and the conditions under which a HVC could be offered.

# Study Design

**Methodology**

A three phase sequential mixed methods study was used:

Phase One:     A survey of patients to determine their willingness to use HVC.

Phase Two:     Testing of patients' technical capacity for HVC.

Phase Three:   Interviews with patients to explore their perceptions of a HVC and the conditions in which they would be willing to use HVC.

Ethical approval was given by the Northern A Health and Disability Ethics Committee, reference number 17/NTA/270.

**Participants**

The target population were patients, or the parents/guardians of paediatric patients, attending either the cardiology or paediatric outpatient clinics at Christchurch Public Hospital over a two week period in July 2018. Participants in Phase Two and Three are subsets of the Phase One sample.

Inclusion criteria

    a. Patients or the parents/guardians of paediatric patients, attending either the cardiology or paediatric outpatient clinics at Christchurch Hospital over a two week period in July and August 2018.

    b. 18 years of age or older.

    c. Able to communicate in English.

**Recruitment**

Patients who met the inclusion criteria and who were scheduled to attend the participating clinics over the study period were sent a covering letter and study information sheet, with their standard clinic appointment letter. Upon arrival at the outpatient clinic reception potential participants were approached by a research assistant, reminded about the study, asked if they had any further questions, and then asked if they would like to participate in the study. Willing participants were invited to consent before beginning.

**Videoconference software technology**

As there was not currently a videoconference solution available in CDHB that could be used for HVC, a specific solution had to be sought for this study. The platform used was a software based solution being run over a managed network. Features of the solution

relevant to this study included the ability to be used on a broad range of devices and operating systems, adequate security and privacy specifications, the ability to send meeting invites, a low bandwidth requirement, and use in other healthcare settings internationally. It is also a solution used in other healthcare organisations in New Zealand. One of these organisations provided access to an endpoint on their network for use in this study. Neither this organisation, nor the software vendor, had any involvement in the design, conduct, or analysis of this study.

# Phase One: Outpatient Clinic Survey

Phase One of this study involved a survey administered to consenting participants from the paediatric and cardiology outpatient clinics at Christchurch Public Hospital. The aim of the survey was to determine participants' willingness to engage in HVC.

### Survey design
A purpose designed survey was developed (Appendix 1). The content of the survey was informed by the study aims and telemedicine literature. The survey was piloted with a small sample prior to use.

### Data collection and analysis
Data was collected over a two week period in 2018: the 9th to the 13th of July in paediatric outpatients and the 23rd to the 27th of July in cardiology outpatients. Participants completed the survey while they waited for their scheduled outpatient appointment. A research assistant was available to assist participants to complete the survey, administered on a tablet. Study data were collected and managed using REDCap (Research Electronic Data Capture) tools hosted at the University of Otago[8].

Data were managed by downloading the raw REDCap file into a Microsoft Excel spreadsheet. Participants from the paediatric and cardiology clinics were compared to determine whether there were consistent or inconsistent views between these different patient groups. Similar comparisons were made between the major demographic variables. Specialist statistical software (Stata SE version 14.2) was employed for all analyses, and α=0.05 was used to define significance. Reporting of analyses were informed by the STROBE guidelines for observational studies[9].

### Findings
The survey was completed by a total of 204 participants from 326 eligible people who attended either a paediatric (149) or cardiology (177) outpatient clinic during the study period, giving an overall response rate of 62.6% (75.2% for paediatric and 52.0% for cardiology outpatients). Of those who completed the survey, 112 (54.9%) were parents/caregivers from paediatric outpatients and 92 (45.1%) were from the cardiology outpatients. Overall, 118 (59.6%) were female, and the average age of participants was 50 years (range: 15 to 85 years); while the average age of children attending paediatric outpatient appointments was 6.8 years (range: 1 to 17 years). Table 1 presents the demographic characteristics of the sample.

Table 1. Demographic distribution of participants (n=204) overall, and partitioned by paediatric (n=112) and cardiology (n=92) outpatient recruitment sites.

| | Total | | Paediatric | | Cardiology | | |
|---|---|---|---|---|---|---|---|
| | n | (%) | n | (%) | n | (%) | p-value |
| *Sex*[a] | | | | | | | <0.001 |
|     Male | 80 | (40.4) | 26 | (24.3) | 54 | (59.3) | |
|     Female | 118 | (59.6) | 81 | (75.7) | 37 | (40.7) | |
| *Age group (years)*[b] | | | | | | | <0.001 |
|     ≤30 | 30 | (15.3) | 24 | (22.9) | 6 | (6.6) | |
|     31-60 | 110 | (56.1) | 79 | (75.2) | 31 | (34.1) | |
|     >60 | 56 | (28.6) | 2 | (1.9) | 54 | (59.3) | |
| *Ethnicity*[c] | | | | | | | |
|     New Zealand European | 151 | (74.0) | 81 | (72.3) | 70 | (76.1) | 0.63 |
|     Māori | 20 | (9.8) | 7 | (6.3) | 13 | (14.1) | 0.10 |
|     Pacific | 5 | (2.5) | 3 | (2.7) | 2 | (2.2) | 0.99 |
|     Asian | 10 | (4.9) | 6 | (5.4) | 4 | (4.3) | 0.99 |
|     Indian | 5 | (2.5) | 5 | (4.5) | 0 | (0.0) | 0.07 |
|     Other | 19 | (9.3) | 10 | (8.9) | 9 | (9.8) | 0.99 |

Note: [a]6 (2.9%) values missing; [b]8 (3.9%) values missing: [c]multiple ethnic identities are permitted, and so percentages can sum beyond 100%, and p-values determined by comparing presence vs. absence of each ethnic identifications.

While there was no difference in the ethnic identification profile between participants attending the paediatric and cardiology outpatient clinics, substantial and significant differences were observed in the sex (p<0.001) and age group (p<0.001) composition (Table 1). In particular, relatively more female participants attended the paediatric clinic, and those who attended the cardiology clinic were generally older. Should sex or age have important differential effects in telehealth participation willingness, then this would limit the external validity of the results herein.

HVC participation willingness

Overall, the majority of participants 139 (69.2%) were positively predisposed to HVC, 28 (13.9%) were unsure, and 34 (16.9%) were negatively predisposed. Despite the sex and age differences between paediatric and cardiology outpatient clinics, this willingness was not different between clinic participants (p=0.30); with 72 (65.6%) paediatric and 67 (73.6%) cardiology participants positive to these consultation types. Table 2 presents the HVC willingness distributions by the elicited demographics variables for the combined sample. No significant differences were noted between the distribution of HVC willingness by sex (p=0.36), age group (p=0.14), or Māori ethnic identification (p=0.87).

Table 2. Willingness to participate in a HVC by participants' demographics and appointment travel time groupings (n=204).

| | Total | Willing | | Unsure | | Unwilling | | |
|---|---|---|---|---|---|---|---|---|
| | n | n | (%) | n | (%) | n | (%) | p-value |
| *Sex[a]* | | | | | | | | 0.36 |
| Male | 80 | 54 | (67.5) | 9 | (11.3) | 17 | (21.3) | |
| Female | 118 | 82 | (69.5) | 19 | (16.1) | 17 | (14.4) | |
| *Age group (years)[b]* | | | | | | | | 0.14 |
| ≤30 | 30 | 19 | (63.3) | 5 | (16.7) | 6 | (20.0) | |
| 31-60 | 110 | 75 | (68.2) | 20 | (18.2) | 15 | (13.6) | |
| >60 | 56 | 41 | (73.2) | 3 | (5.4) | 12 | (21.4) | |
| *Ethnicity[c]* | | | | | | | | 0.87 |
| Non-Māori[d] | 181 | 125 | (69.1) | 26 | (14.4) | 30 | (16.6) | |
| Māori[e] | 20 | 14 | (70.0) | 2 | (10.0) | 4 | (20.0) | |
| *Travel time to appointment (minutes)[f]* | | | | | | | | 0.43 |
| 0-30 | 69 | 43 | (62.3) | 11 | (15.9) | 15 | (21.7) | |
| 31-60 | 90 | 68 | (75.6) | 11 | (12.2) | 11 | (12.2) | |
| >60 | 42 | 28 | (66.7) | 6 | (14.3) | 8 | (19.0) | |

Note: [a]6 (2.9%) values missing; [b]8 (3.9%) values missing: [c]3(1.7%) values missing; [d]non-Māori includes participants who identified exclusively as New Zealand European, Asian, Pacific, Indian, or other; [e]Māori includes any participant who included the category Māori in their ethnic identification; [f]3(1.7%) values missing.

Also contained in Table 2 is the HVC willingness distributions by appointment travel time group. Overall, 69 (34.3%) participants self-reported travel time between 0-30 minutes, 90 (44.8%) were between 31-60 minutes, and 42 (20.9%) participants travelled more than an hour. Perhaps surprisingly, travel time to their appointment was also not significantly associated with participant's willingness to engage with a HVC (p=0.43) (Table 2).

Perceived benefits and disadvantages of a HVC

The majority of participants regarded reduced travel time, reduced disruption to their daily routine, and reduced costs as being the primary benefit of HVC (Table 3). Only 11 (5.4%) participants perceived there to be no benefit. Unsurprisingly, these participants were more likely to be unwilling to have an HVC (p<0.001). There was no difference between outpatient clinics in the distribution of those participants who perceived there to be no benefit (p=0.35).

Table 3. Distribution of perceived benefits and disadvantages of a HVC, ordered from most to least frequent reasons cited.

| Perceptions of HVC | N | (%) |
|---|---|---|
| *Perceived benefits* | | |
|     Reduced travel time | 167 | (81.9) |
|     Reduced disruption to daily routine | 130 | (63.7) |
|     Reduced cost | 128 | (62.7) |
|     Reduced time off work | 100 | (49.0) |
|     Other | 10 | (4.9) |
|     No benefit | 11 | (5.4) |
| *Perceived disadvantages* | | |
|     My doctor wouldn't be able to examine me | 145 | (71.1) |
|     I wouldn't be able to see my doctor in person | 69 | (33.8) |
|     Concerns about the quality of the consultation | 51 | (25.0) |
|     I don't have the technology required at home | 28 | (13.7) |
|     Concerns about information privacy | 18 | (8.8) |
|     Other | 10 | (4.9) |
|     No disadvantages | 38 | (18.6) |

In terms of perceived disadvantages, the majority of participants considered having the doctor unable to examine them as being the primary issue. Not having in person contact, and the quality of the consultation were also important but relatively minor issues reported. Some 38 (18.6%) participants, nearly one in five of the sample, reported no perceived disadvantage. Again, there was a significant relationship between willingness and those reporting no perceived disadvantages (p=0.02), with 35 (92.1%) of these 38 participants willing to participant in such a consultation (compared to 63.8% of others), 1 (2.6%) unsure (compared to 16.6% of others), and 2 (5.3%) participants unwilling (compared to 19.6% of others). Despite the wording of the question around technology (which was based on hypothetical rather than actual availability), of the 28 declaring a perceived disadvantage of not having the technology required at home, a relatively higher number were unwilling to have a HVC compared to their counterparts without this concern (50.0% vs. 11.6%, p<0.001). Finally, when investigating those who perceived no disadvantage to a HVC against the outpatient type, a significant difference emerged (p=0.001). Overall, 11 (9.8%) paediatric outpatient clinic participants reported that there was no disadvantage whereas 27 (29.3%) cardiology outpatients felt similarly.

# Phase two: Home Video Consultation Test

The purpose of the second phase was to if identify whether participants had the technical capacity to conduct a HVC from their own home (or chosen location), and the quality of the HVC.

**Data collection and analysis**

A sub group of participants (n=20) was selected from Phase One participants who indicated they were willing to participate in Phase Two of the study. Selection was guided to best ensure a range of participant characteristics. Participants were contacted by phone to arrange a convenient date and time for the test consultation.

Participants were then sent an email confirming their appointment. Participants were required to download and install the videoconference application. To help participants with this process, the appointment email outlined six steps to initiate the connection, alongside screenshots of each step in the process. The instructions to download and install the videoconference application were designed by the research team. Data were collected using a purpose designed short questionnaire (Appendix 2). The questionnaire content was informed by the aims of Phase Two, that is, to assess the equipment used for the HVC, and the capability and quality of the HVC.

Descriptive statistics were used to categorise the results. The capability of the HVC equipment was determined through dichotomous categories (did it work: yes/no). Quality of sound and video, and ease of connection, was assessed using a Likert scale.

**Findings**

Demographics

Table 4 presents the demographic characteristics of the sample, partitioned by participants who experienced a successful connection and those who didn't. Overall, 11 (55%) were female, and the average age of participants was 41.8 years (range: 22 to 68 years); while the average age of paediatric patients was 4.1 years (range: 1 to 13 years). From the 20 participants who attempted to connect with researchers for a test HVC, a successful connection was only established for 13 participants; 9 (69%) from paediatric outpatients and 4 (31%) from cardiology outpatients. Seven participants experienced an unsuccessful connection; 3 (43%) from paediatric outpatients and 4 (57%) from cardiology outpatients.

Table 4. Demographic distribution of Phase Two participants (n=20)

| | | Total (n=20) | | Successful (n=13) | | Unsuccessful (n=7) | |
|---|---|---|---|---|---|---|---|
| | | N | (%) | n | (%) | n | (%) |
| *Sex* | | | | | | | |
| | Male | 9 | (45) | 6 | (30) | 3 | (15) |
| | Female | 11 | (55) | 7 | (35) | 4 | (20) |
| *Age group (years)* | | | | | | | |
| | ≤30 | 4 | (20) | 3 | (15) | 1 | (5) |
| | 31-60 | 11 | (55) | 8 | (40) | 3 | (15) |
| | >60 | 5 | (25) | 2 | (10) | 3 | (15) |
| *Ethnicity* | | | | | | | |
| | New Zealand European | 15 | (75) | 9 | (45) | 6 | (30) |
| | Māori or non-New Zealand European[a] | 5 | (25) | 4 | (20) | 1 | (5) |
| Clinic | | | | | | | |
| | Paediatrics | 12 | (60) | 9 | (45) | 3 | (15) |
| | Cardiology | 8 | (40) | 4 | (20) | 4 | (20) |

Note: [a]pooled to maintain anonymity; Māori includes any participant who included the category Māori in their ethnic identification and non-New Zealand European includes participants who identified exclusively as Asian, Pacific, Indian, or other.

<u>Feasibility of software</u>

From 20 participants who agreed to attempt a test HVC, a successful connection was only able to be established for 13 participants: an overall success rate of 65%. Of the 13 successful connections, 11 (85%) connected on the first attempt without any technical issues, whereas two test calls (15%) had to be re-scheduled due to technical issues with the HVC platform and were only successful on the second attempt. The reasons a connection could not be established included:

1. The participant's inability to follow instructions or problem-solve any technology response that occurred outside of the instructions provided.
2. Technical issues with the HVC solution. Specifically, a network setting that allowed the use of WebRTC was inadvertently switched off during the study, which prevented some connections being established.
3. Difficulty operating externally provided videoconference software over the CDHB network.

Such observations reinforce the conclusion that software and vendor choice, network integration, rigorous testing including user testing and acceptability, and good education would all be crucially important parts of setting up a HVC service.

The following findings are reported for those 13 participants who experienced a successful test HVC connection.

## Equipment

For the test HVC a majority of participants used either a laptop computer (5, 39%) or tablet (5, 39%), followed by a smart phone (3, 23%). Interestingly, no participants reported using a desktop computer. All 13 participants used the camera which was built into the device. Eleven participants (85%) used the microphone and speakers built into the device, with two participants (15%) using a headset.

## Internet connection

Eleven participants (85%) reported using their home internet connection, followed by one (8%) who used their workplace connection and one (8%) who reported other (unspecified). With regard to Internet connection type a majority of participants (5, 39%) used fibre broadband connection with 2 (15%) using ADSL, VDSL, or Mobile data 3G respectively. Two participants did not report a connection type. Vodafone was the most commonly used Internet provider, used by four participants (31%) followed by 2degrees (3, 23%) and Spark (2, 15%). Three participants reported using other (unspecified).

## Sound

A majority of participants (7, 54%) rated sound quality of their HVC as very good, with three participants (23%) rating the sound quality as average, and 2 (15%) rating excellent. One participant rated their sound quality as poor. No participants rated their sound quality as very poor.
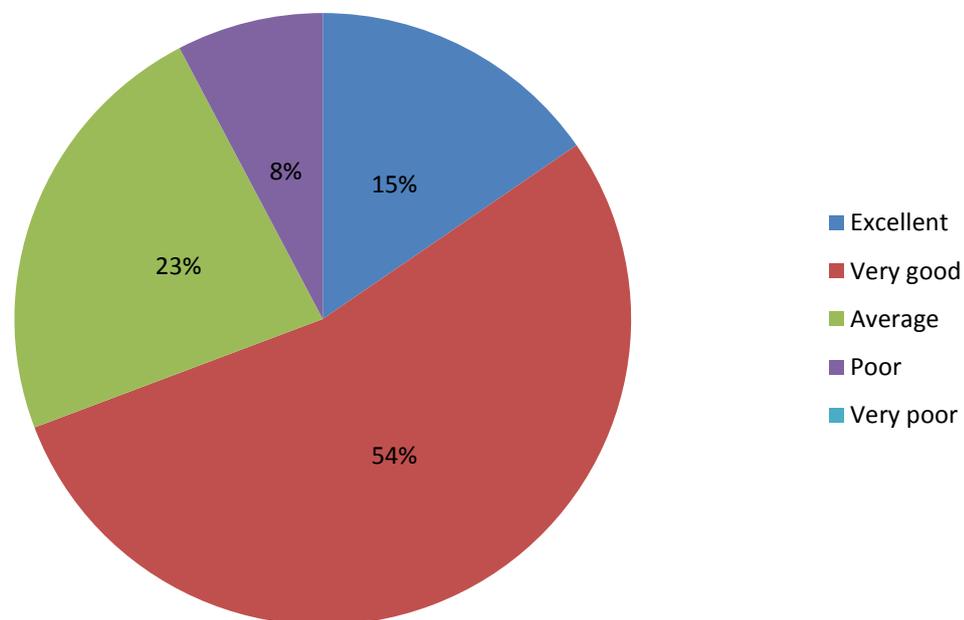


***Figure 1. Participant ratings of sound quality of the test HVC.***

Video

Four participants (31%) rated the video quality of their HVC as excellent, with a majority of participants (6, 46%) rating the video quality as very good, three participants (23%) rating video quality as average, and no participants rated their video quality as poor or very poor.
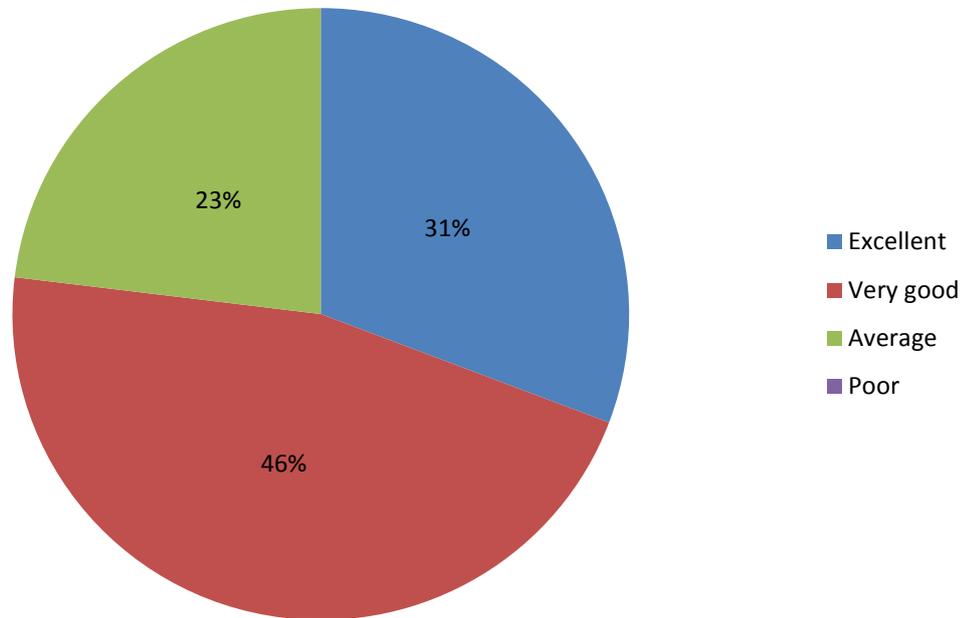


*Figure 2. Participant ratings of video quality of the test HVC.*

HVC setup and usability

During Phase Two participants were asked how easy was it to set up and use the HVC platform. Two participants (15%) rated the HVC platform as extremely easy to set up and use, six participants (46%) rated the platform as very easy, and five participants (39%) rated it as being of average difficulty to set up and use. No participants rated the platform as being difficult or very difficult to set up and use.
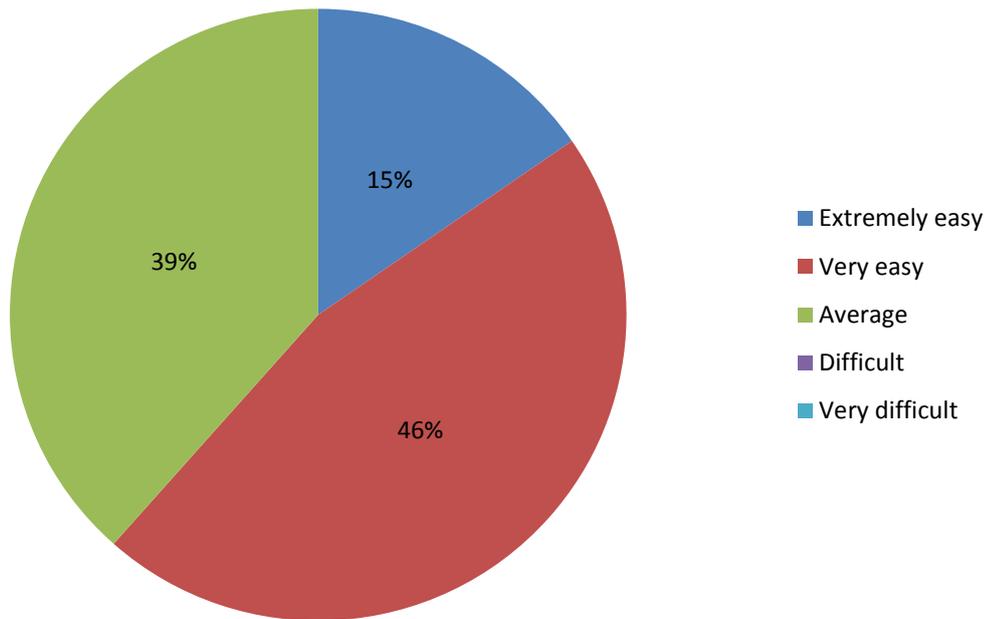
*Figure 3. Participant ratings of difficulty to set and use the test HVC.*

Confidence

During Phase Two participants were also asked how confident they would be to use HVC with their doctor. Five participants (39%) felt extremely confident, seven (54%) felt very confident, and one (8%) rated themselves as having average confidence. No participants rated themselves as not very confident or not at all confident.



**Figure 4. Participant ratings of the confidence to use HVC.**

# Phase Three: Interviews

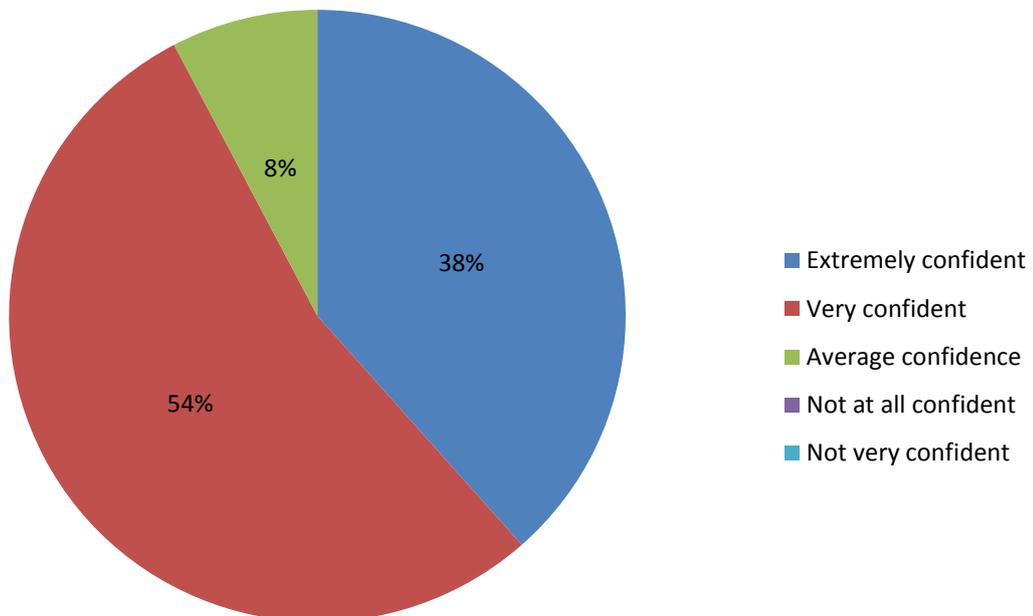The purpose of this phase was to explore and understand participants' perceptions and experiences of HVC, and the conditions where they would be willing to use HVC.

## Data collection and analysis

Interview data were collected from 10 participants who participated in Phase Two and indicated they were willing to participate in Phase Three of the study. Semi structured interviews explored participant perceptions of their willingness to receive outpatient care via HVC, their technical capacity to use the HVC software from their home (own device), and any conditions on the use of HVC for health appointments (Appendix 3). Interviews took place over the videoconference software where possible (during the test HVC). In some cases this had to be supplemented by phone call. Interviews duration ranged between 9 and 26 minutes. Interview data were recorded and transcribed verbatim. An inductive thematic analysis[10] was used in relation to each of the three research questions of willingness, capacity, and conditions of HVC use.

## Findings

A total of six themes were interpreted in relation to the three research questions regarding participants willingness to use HVC, participants capacity to use HVC, and the conditions in which participants would (and would not) feel comfortable using HVC. The themes are presented below illustrated by participant quotes. As these participants were a subset of the survey group their original participant number has been kept.

Table 5. Summary of themes in participants willingness, capacity and conditions of HVC use.

| Area | Themes |
|---|---|
| **Willingness** | 1. Everybody wins |
| | 2. Saving time and energy are health priorities |
| | 3. HVC from home feels safer |
| **Capacity** | 4. Yes! Despite glitches |
| **Conditions for use** | 5. An excellent option with some exceptions |
| | 6. Communication, uncertainty and indifference |

Willingness:

Two major and one minor theme in participants' willingness to use HVC for specialist appointments were observed. (1) Everybody wins; (2) Saving time and energy are health priorities; (3-Minor) video conference from home feels safer.

***Theme one: Everybody wins***

Participants were unanimously and emphatically willing to have their consultations via video-conference if at all possible and felt it would benefit patients and health professionals:

> *I really can't see how the disadvantages even come close to the possible advantages of this kind of system* (participant 112).

> *Obviously there's the convenience factor* (participant 29).

Several expressed disbelief that HVC was not already routinely used for talking or interview based consultations and that it was only a matter of time before it was routine practice:

> *I think it's the way forward. If it saves time, it saves money for everybody* (participant 189).

> *I think it's* [HVC] *great. I want these things to go ahead. I can't understand why they* [CDHB] *don't* (participant 112).

Participants described practical scenarios such as being able to keep appointments if out of town that day. Many also expressed an expectation that HVC access would save doctors' time as well as their own, and that access to specialists would improve e.g. through more direct access to specialists, such as for patients on the West Coast and for those who simply could not get in to appointments:

> *My first thoughts are that it is an excellent tool for people that cannot get into a GP, hospital or doctor, and really need some straight-up quick advice and for those that just physically cannot get in a car and travel to facilities and of course people that live a vast distance from the nearest available medical centre or doctor, GP or hospital* (participant 8).

***Theme two: Saving time and energy are health priorities***

Convenience of HVC and the saving of participants time was raised by all participants. Several participants gave the example of pre-op appointments and discussion of results which were solely didactic as an ideal candidate for HVC. Several participants also described the use of HVC as a first step or triage to determine if an in-person appointment was needed. For some it would be worth it to avoid coming in if possible. Others described that this would be a bothersome additional step in care and waiting:

> *it's easy, you know, you don't have to go to the doctor so it saves time, it saves everybody time and cost and you know, just convenient, and this technology seems*

*to work really well and we know it works well in lots of ways, not just in relation to medical stuff, general communication, so yeah, great idea* (participant 112).

Often statements regarding the time benefit were made in relation to the time taken to get to an appointment in comparison to the length of time of the appointment which then only involved a conversation. One participant described missing a whole day's work for a 10 minute discussion:

*it's the time more than anything, especially you know, I had to have a day off work for a ten-minute interview* (participant 189).

Many participants described complex changes to schedules and the need for a full or half-day's absence from work to take themselves or their family member to an appointment. The physical and psychological effort of this journey was clearly substantial for many participants, many of whom had monthly or 3 monthly appointments. For many participants the strong motivation to avoid travel to the hospital was combined with a need to conserve energy and minimise disruption in order to better manage their health condition. As participant 122 explained, fatigue management is one of her biggest issues, and her ability to do this is substantially impacted by specialists' appointments:

*On most consultations with my doctor, this would be infinitely easier than going there… It saves on transport, for a start. But because, I think mainly transport and the energy it takes me to actually go to the doctor. I need to conserve energy, that's my main issue in terms of health… if I can afford to expend energy then all the better* (participant 122).

Several participants described flexible employers that accommodated their days off work but all expressed doing so as being disruptive. One participant, paid hourly, reported a substantial loss of income on the weeks that she had outpatient appointments, and although her employer was supportive, she felt she compromised her employment relationship each time she asked for leave:

*But yeah, there was a little bit of anxiety… when it comes to taking time off work, I always get a bit anxious about having to ask* (participant 101).

For most the time and effort were vastly more of an issue that the financial cost (in lost income, petrol, parking) of attending appointments. Several participants described driving around for some time in order to find a close car park, and the need to allow time to do this.

### Theme three: HVC from home feels safer

A less common but reoccurring theme related to feeling unsafe when attending specialist appointments. This related to their personal safety walking to and from their car, particularly in the evenings; concern that their car might be broken into during their visit, and a desire to avoid the ordeal 'trauma' of disruption to routine for unwell children.

> *like there's no way I would accept any appointments in the dark, because of the parking around that area and … But I mean, during the daytime, I don't really have much concern about the safety of me and my child, it's more about my car* [getting broken in to] (participant 101).

> *I think it's quite traumatising for children to be out of their own environment when they're all bundled up and shuffled in* (participant eight).

Data safety was mentioned by a few participants but it was not considered a barrier to use of HVC either because it was assumed to be secure, or complete and total security was accepted as impossible:

> *I would be comfortable doing it, like I wouldn't mind doing it, just be on the list and then as long as everything is all safe and secure type stuff* (participant 85).

One participant who worked in IT commented that the system feature requesting patients to disable a firewall to allow the system to work was not good practice, and that the system worked anyway when he did not enable this feature. Notably, the IT specialist described that any online system was able to be breached therefore she worked from an assumption that this could happen. Essentially the convenience of the HVC appointment outweighed any concern over data safety:

> *'Cos I work in IT, I understand that secure systems get compromised all the time so I've just, I just assume that any data that is stored on any system, could be compromised at any time [OK] so because I'm prepared for that, I don't, I just don't allow anything to be recorded that I wouldn't want to be compromised* (Participant 82).

Capacity for video conference

### Theme four: Yes! Despite glitches.

Unanimously participants felt they had the technical capacity to undertake consultations by HVC, despite for several participants, glitches occurring during the video interview, or occurring during the trialling of the equipment. Minor technical hiccups (e.g. temporary loss of sound or video) seemed to be considered normal and this disruption was overlooked (not mentioned).

Participants suggested improvements such as wide angle lenses for whole body views, capacity to upload high spec photos if a particular body part needed very close, detailed scrutiny (e.g., off smartphones).  Essentially participants felt it was easy to use:

> *If I can do it, anyone can* (participant eight).

<u>Conditions for use of video conference</u>

***Theme five: An excellent option***
In the context of overwhelming positive support for the use of HVC consultations, most participants alluded to the importance of choice and flexibility about when consultations occurred via HVC and its appropriateness for some types of situations but not for others. When questioned, participants stated that HVC was only desired if it did not result in a compromise to the quality of care:

> *I want them to not only sit down and talk to me, but I want them to examine… this whole video idea's great and saves time… but my concern is that you can't… look in an ear… really, over the phone* (participant 101).

> *I think that it'd be really hard for a doctor to see exactly what was going on in* [Child's] *mouth… If any part of the consultation needed the clinician to see the patient closely, then I think you'd find some shortcomings* (participant 29).

Repeated exceptions to the use of HVC were for physical examination, acute care events or when a person was worried, or feeling emotional at the time of the consultation.  In these instances, in-person support was preferred over HVC.  The emotionality was described as not necessarily relating to the specific health concern, but may reflect other issues going on for the person, or their personal response to their health issue. Of significance was that only the patient could judge this. In addition, a couple of participants raised the need for privacy in their own environment for a HVC, which could be difficult for some patients.

***Theme six: communication, uncertainty and indifference***
Several participants referred to the impact of HVC on specialist's use of communication skills. Some participants felt that HVC would require doctors most advanced communication skills as they would be relying on their listening skills, and would be challenging with some patients; others felt communication could be compromised as doctors may have more difficulty reading between the lines, or picking up on unspoken issues:

> *I think really you would have to have some pretty good doctors, not just in their medical knowledge, but to be able to read a lot of that, what is not said; body language… concentrating on every little cue that they can pick up, that would be*

*helpful for diagnostic purposes.  I think people that are very articulate, not afraid to say what hurts, what's happened, you know, what it's all about, they are the key ones that will just be the easiest of the bunch, but you know, I guess not everyone's gonna be that easy* (participant eight).

Several participants described that HVC would make no difference to their own communication, namely their level of disclosure. HVC was considered to be no barrier to their speaking the truth to doctors. Several participants responded with indifference when specifically asked what the impact of HVC appointments might have on their communication. As one participant responded when asked about impacts on communication specifically:

*What do you want out of a doctor's appointment?  To get a conclusion and there's no reason why that can't happen* [by HVC] (participant 112).

# Discussion

The aim of this study was to explore the feasibility of offering patients in CDHB an outpatient appointment by HVC. We specifically explored the willingness of patients to use HVC, their capacity to use HVC with the technology available to them at home, and the conditions under which they would be willing to use HVC. A mixed method approach was used to develop a broad contextualised understanding of the feasibility and capacity for HVC for CDHB patients. The integrated results of all three parts of this study are presented below and discussed in relation to existing literature.

**Willingness**

Overall, results indicated a great degree of willingness to use HVC to engage with clinicians. Seventy percent of all participants surveyed were positively disposed to using HVC. This is a higher proportion than identified in the Waikato DHB[6], and also higher than a similar study conducted in the UK where the rate was 50%[11]. This positive disposition towards HVC was irrespective of clinic type, gender, age group, or ethnicity. Supporting this, only 11 (5.4%) participants perceived there to be no benefit (with difference between outpatient clinics types) and 38 (18.6%) participants, nearly one in five of the sample, reported no perceived disadvantage to HVC use. While our high rate of willingness to have a HVC is encouraging, it is important to remember that 30% of participants felt it would not be suitable for them or their child.

The qualitative findings highlight some reasons for the high rate of willingness. For example, participants identified using HVC would not only save time, but more importantly, a great deal of energy and disruption to numerous aspects of their lives. For example, many participants described complex changes to schedules, with the need for a full or half-day absence from work to take themselves or their family member to what was often only a 10-15 minute appointment. Another important consideration for participants in their enthusiasm for HVC was the fatigue experienced by participants through the process required to attend appointments. Some participants felt that the effect this had on their health condition could be considerably reduced by the option of HVC. Additional factors contributing to participants' willingness to use HVC also included concerns about their safety walking from their car to and from the hospital, or their fear of their car being broken into.

The high degree of willingness reported by participants in our study reflects trends reported in similar research surrounding the willingness and feasibility of telemedicine approaches. The reasons reported in our study for motivating people's willingness to use telemedicine are also reported elsewhere and include a reduction in travel, extraneous out-of-pocket costs, missed work, and attitudes towards technological communication[1,12,13]. For example, a Canadian survey of family members attending paediatric surgical outpatient clinics reported that outpatient visits were associated with significant burden and a majority of

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families were in favour of using telemedicine and comfortable or extremely comfortable communicating via videoconferencing[12].

**Capacity**

Participants' capacity to use HVC was mixed. In the survey 13% of participants indicated they would not have the technology required at home to use HVC. To some degree this influenced willingness, as those who said they didn't have the technology were less willing to have a HVC. It may be there are a subgroup of patients who would need to be provided with suitable technology so that they could have their care provided by HVC.

We also found that in the testing participants who were asked to try a test HVC connected successfully on a range of devices including laptops, tablets, and smartphones. Interestingly no participants used a desktop computer for the HVC test, and there was a high rate of smart phone use. These devices used by participants reflect the most common devices used to access the internet in the 2015 New Zealand internet report, which were laptops and smartphones respectively[5]. Findings from HVC test phase showed the majority of participants who successfully connected found the HVC platform extremely easy or very easy to set up and use, and also felt extremely confident or very confident to use the HVC platform. For the thirteen participants who were able to connect to the system, a majority were happy with the quality of the connection: nine rated sound as excellent or very good, and ten rated video quality as excellent or very good.

However, the overall successful connection rate was only 65% in the test (including two participants who required two attempts to connect), and an improved connection rate would be required for clinical use. We would argue this value would need to be close to 100% to ensure that both clinicians and patients maintain confidence in the value of HVC[14]. There are a number of reasons we believe our successful connection rate was low. The connection instructions we provided were not optimised for a Mac or iOS users, and there were some difficulties establishing a connection from the research assistant end of the HVC. At times this seemed to be due to trying to operate from within the CDHB network, and at one point the vendor identified an incorrect network setting that was resulting in a call connection failure.

With respect to capacity, this is often considered from the point of view of technological capacity of software, and the technological ability and equipment of the patient or potential user. In a study which explored the factors influencing the adoption of assistive telehealth, Cook[15] reported that the usability and usefulness of equipment played a large role in whether participants would like to engage in a telehealth service. In an overview of telemedicine in paediatric surgery, Harting[1] reported that a key consideration is to select a reliable and secure technology to facilitate telemedicine. The provision of technological support is also important, not only for patients but also to ensure health professionals have the support necessary to mitigate any technological risk when conducting teleconsultations[13]. The experience from our study is consistent with these assertions, and

we believe our successful connection rate would have been higher if we had used an integrated, established, fully supported videoconference solution from within the CDHB network.

## Specific conditions relating to the use of HVC

Despite a high rate of willingness and perceived capacity to use HVC, the findings of this study indicate that there are specific conditions where HVC would be more appropriate than others. Participants in both the survey and interviews expressed a willingness to use HVC as long as it did not compromise the quality of clinical care they received. Of most concern to participants was the knowledge that HVC would not allow a physical examination to take place if their clinician felt it was needed. The qualitative interviews identified concerns around communication differences (positive and negative) between in person consultations and HVC.  Of note, no participants in Phase Three felt that HVC would reduce their own level of disclosure to their clinician, or their ability to relate to their clinician around their specific health issue. However, several described a perception that HVC would require their clinician to have particularly good communication skills, due to a potential loss of unspoken subtleties (e.g. expression, eye contact) that are more obvious during an in person consultation. Participants suggested that when emotional support was sought the option of in person consultations would be preferable. A message interwoven through participants' perceptions of HVCs was that the final decision of whether or not to use this approach would need to be voluntary and a decision agreed to by both the patient and the health professional, as opposed to it being a requirement or decided singularly by a health professional.

## Strengths and Limitations of the study

This research has a number of strengths worth noting. Firstly, this study is, to the best of our knowledge, the only New Zealand research to test HVC connection quality with patients in their own home all residence, while also exploring participants perspectives regarding the specific conditions where HVC would be appropriate. Secondly, while only two outpatient groups are included in this research, the two groups we included were different, (for example health condition, age, and one group spoke for themselves and the other expressed an opinion on what they wanted for their children), and yet these two groups had very similar ideas about the use of HVC. The finding that survey participants displayed similar levels of enthusiasm, and the high rates of willingness have been found in the literature, supports the case that the similar levels of willingness for HVCs would be likely from other patient groups within the CDHB.

There are some limitations of this evaluation. There were no existing instructions on how to download the software connection so the research team devised their own. These were not specific to individual operation systems and may have contributed to participant difficulty to connect. The qualitative data was only collected from people who had successfully connected to the HVC, and future research could seek to understand perceptions of people

who might experience difficulties connecting to an HVC. Also, while this study has given us valuable insights into how patients feel about having a HVC, we did not seek the views of their treating clinicians. There are at least three aspects of the consultation where the view or experience of the clinician is important[14]. The first is in deciding whether the patient would be suitable for a HVC (for example the clinician has to be sure a physical examination is not required) and the second is in determining whether the HVC is of a suitable quality to allow the clinician to make treatment decisions with the patient. The majority of our participants were happy with the quality of the audio and video they experienced, and it is likely but not certain that the clinician would feel the same. Lastly, it would be important to understand what clinicians would require in terms of technology and support to be able to conduct their end of a HVC.

## Conclusion

The findings of this study suggest that willingness to use HVC is high irrespective of gender, age group, ethnicity, or travel time to hospital. A major factor contributing to this willingness was the potential of HVC to reduce the considerable time and energy currently spent attending comparatively short, and for certain health conditions frequent, specialist consultations. Participants also perceived their capacity to successfully use HVC as high, however more work is required to improve the reliability of the HVC platform and ensure the connection process is as user-friendly as possible. Software and vendor choice, network integration, rigorous testing including user testing and acceptability, and good education would all be important parts of setting up a HVC service.

# Recommendations

- That the findings of this study be circulated to clinical staff and service managers in the CDHB, with particular emphasis on the findings that the majority of patient would consider having a clinic appointment by HVC, and that they perceived significant advantages in doing so.
- That the CDHB prepare for some patients being offered a clinic appointment by HVC by procuring, establishing, and supporting a suitable VC solution.
- That the CDHB make user acceptance and reliability key considerations in the choice of VC solution.
- The CDHB consider HVC software which can be provided with the least number of technical steps required by the patient as possible. Ideally a single link that can be used by patients. If the HVC software requires patients to download and install an application, easy to follow instructions need to be provided and individualised to suit a variety of operating systems.
- That technical support services are available for patients using HVC (e.g. a phone helpline).
- That a CDHB wide protocol on HVC use be developed, and that HVC clinical guidelines are put into place for each speciality.
- That further work be done to understand the clinician perspective in relation to seeing patients by HVC.
- That comprehensive training on the technical aspects of telemedicine consultations, as well as adaptations required to communication style, be provided for clinical staff who will be working in this way.
- That there be an active evaluation of HVC services as they are established.

# Appendix 1: Phase One Survey

| | Question | Response Options |
|---|---|---|
| 1 | What type of clinic will you (or your child) attend today? | 1. Paediatric outpatient<br>2. Cardiology outpatient |
| 1 | What type of appointment will you (or your child) attend today? | 1. First appointment<br>2. Follow up |
| 2 | How long did it take you to get from your home to your appointment (in minutes)? | 1. Less than 30 mins<br>2. Between 30 and 60 mins<br>3. Between 1 and 1 ½ hours<br>4. Between 1 ½ and 2 hours<br>5. More than 2 hours |
| 3 | What transport did you use to get your appointment? | Private transport<br>Public transport<br>Other |
| 4 | If your clinician thought it was appropriate, would you be willing to have your (or your child's) next appointment with them by video consultation from your own home? | Yes<br>No<br>Unsure |
| 5 | What do you think the benefits of a video consultation would be? | Select any that apply:<br>• Reduce travel time<br>• Reduced cost<br>• Reduced time off work<br>• Reduced disruption to daily routine<br>• Other: |
| 6 | What do you think the disadvantages of a video consultation would be? | Select any that apply:<br>• I prefer to be seen in person/face to face.<br>• I would be concerned about the quality of the consultation<br>• I would be concerned about the privacy of my information.<br>• I don't have the technology required at my home (internet access; computer etc).<br>• Other: |
| 7 | Would you be willing to have a test video call with a researcher? | No<br>Yes (please provide contact details) |
| 8 | Would you be willing to be interviewed at a later date about your willingness to have (or not have) a video consultation from home? | No<br>Yes (please provide contact details) |
| 9 | Your date of birth | dd/mm/yyyy |

| 10 | Your gender | Male |  |
|---|---|---|---|
|  |  | Female |  |
|  |  | Gender neutral |  |
| 11 | Your ethnicity | NZ European |  |
|  |  | Maori |  |
|  |  | Pacifica |  |
|  |  | Asian |  |
|  |  | Indian |  |
|  |  | Other |  |
| 12 | Do you have any addition thoughts about HVC that we haven't covered? |  |  |

# Appendix 2: Phase Two Questionnaire

| Question | Response options |
|---|---|
| **What type of device are you using?** | 1. Desktop computer<br>2. Laptop computer<br>3. Tablet<br>4. Smart phone<br>5. other |
| **What internet connection are you using?** | 1. My home connection (i.e. at your house)<br>2. Friends/family connection (i.e. not at your home)<br>3. Public connection (e.g. public library)<br>4. Workplace connection<br>5. Other |
| **What type of camera do you have?** | 1. The one built into my device<br>2. An external fixed camera<br>3. An external pan tilt zoom camera<br>4. Other |
| **What type of microphone and speakers do you have?** | 1. The ones built into my device<br>2. External microphone and speakers<br>3. A headset<br>4. Other |
| **What type of internet connection do you have?** | 1. Dial up<br>2. ADSL<br>3. VDSL<br>4. Ultra fast broadband (fibre)<br>5. Mobile data 3G<br>6. Mobile data 4G<br>7. Satellite broadband<br>8. Other |
| **Who is your Internet provider?** | 1. Spark<br>2. Vodaphone<br>3. Slingshot<br>4. Flip<br>5. 2 degrees<br>6. Orcon<br>7. Trustpower<br>8. Skinny<br>9. Stuff fibre<br>10. Other |
| **Sound**<br>   1. **Does it work?** | Yes/No<br>If yes, how would rate the quality of sound?<br>1. Excellent<br>2. Very good<br>3. Average<br>4. Poor<br>5. Very poor |

| **Video** | Yes/No |
| 1. **Does it work?** | If yes, how would rate the quality of video? |
| | 1. Excellent |
| | 2. Very good |
| | 3. Average |
| | 4. Poor |
| | 5. Very poor |
| **Ease** | 1. Extremely easy |
| 1. **How easy was it to set up and use this HVC platform?** | 2. Very easy |
| | 3. Average |
| | 4. Difficult |
| | 5. Very difficult |
| **Confidence** | |
| 1. **How confident would you be to use this type of communication with your doctor?** | 1. Extremely confident |
| | 2. Very confident |
| | 3. Average confidence |
| | 4. Not very confident |
| | 5. Not at all confident |

# Appendix 3: Phase Three Interview Guide

Potential questions

1. What did you think about the HVC platform test today?
2. How would you feel about communicating with your (or your child's) doctor using HVC?
3. Can you think of situations when this would be a good way to communicate with you (or your child's) doctor?
4. Can you think of situations when this might not be a good way to communicate with you (or your child's) doctor?
5. What are the factors that are important to you when you're communicating to your doctor?
   a. Do you think these could be achieved through HVC?
6. Do you have any other comments or thoughts about the use of HVC as a way to communicate with doctors?

Possible prompts for all questions:
   a. Could you tell me a little more about that please?
   b. Could you think of an example?
   c. Why did that work so well?
   d. How could have that been improved?
   e. Why do you think this is?

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