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Translating primary care to telehealth: Analysis of in-person consultations on diabetes and cardiovascular disease

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Abstract

Background

The COVID-19 pandemic significantly impacted primary care, resulting in rapid uptake of telehealth. Patients with chronic conditions like Type-2 Diabetes Mellitus (T2DM) and cardiovascular disease (CVD) relied heavily on telehealth consultations during this period. It is important to assess whether tasks observed during T2DM or CVD in-person consultations are translatable to telehealth.

Aim

To explore the extent to which in-person GP consultations are translatable to telehealth for patients with T2DM or CVD.

Design and Setting

This study screened 281 GP consultations conducted in 2017 within the UK general practice setting for consultations pertaining to T2DM or CVD. Seventeen in-person consultations (in de-identified video and transcript) were selected for further analysis.

Method

Detailed reporting of tasks, physical artefacts, and physical examinations observed during in-person GP consultations. A new scoring method applying two key metrics, supporting definitions and examples was designed to assess translatability of clinical tasks, to telehealth.

Results

Across 17 T2DM or CVD in-person consultations analysed, 23 clinical tasks, 21 physical artefacts, and 9 physical examinations were observed. 60% of tasks analysed were deemed easily translatable to telehealth. 26% of tasks were rated as 'translatable to telehealth' but may require a patient obtaining their own equipment. 13% of tasks were rated as 'potentially translatable to telehealth'. No clinical tasks for these cohorts were rated as untranslatable to telehealth.

Conclusion

Majority of tasks observed during T2DM or CVD in-person GP consultations are translatable to telehealth. Further research is warranted to investigate emergent safety concerns from increased uptake of telehealth.

Keywords

General practice, telehealth, primary healthcare, COVID-19, Type 2 Diabetes Mellitus, Cardiovascular Disease

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How this fits in

There is a growing body of work evaluating the effectiveness of telehealth as a modality for primary healthcare. There are numerous studies on patient and clinician attitudes, and growing evidence that telehealth is effective for managing T2DM and CVD. However, there are no prior studies, to our knowledge, on how translatable tasks observed during in-person primary care consultations are to telehealth. This study aims to determine the translatability of telehealth for clinical tasks performed for these cohorts.

Introduction

Prior to the COVID-19 pandemic, telehealth accounted for only a fraction of GP encounters. (1, 2) As a result of the pandemic, many nations enacted policy responses to expand the eligibility and financial viability of telehealth services, (3, 4) resulting in a worldwide surge in the delivery of GP consultations over telehealth. (5, 6) This rapid shift towards global telehealth adoption means it is difficult to ascertain whether in-person aspects of consultations have been adequately substituted in telehealth.

Patients with chronic diseases require regular contact with GPs for the management of their conditions. (7) This includes performing a variety of clinical tasks including blood pressure measurement, foot examinations, prescribing medication, and pathology test referrals." (8, 9) During the pandemic, many have had to use telehealth to maintain continuity of care. However, it is unclear if in-person chronic disease management visits in primary care are indeed translatable to telehealth settings. Patients with Type-2 Diabetes Mellitus (T2DM) and cardiovascular disease (CVD) require extra precaution because they are at high risk of developing COVID-related complications. (10) While T2DM and CVD are distinct diseases, they are closely linked because they share common risk factors, and people with diabetes are at increased risk of developing

CVD. (7) It is vital to ascertain whether telehealth is an adequate substitute for tasks observed during in-person consultations for T2DM or CVD management in primary care.

Previous studies have demonstrated the effectiveness of telehealth for managing patients with heart failure (11) and hypertension. (12,13) Multiple systematic reviews show that telehealth can improve the control of blood glucose levels and other health outcomes for patients with T2DM. (14,15) Other studies have demonstrated the importance of effective communication in the absence of physical interactions, (16) Some researchers are investigating the impact of telehealth by analysing primary care system usage before and during COVID-19. (17) However, no studies to our knowledge, have investigated the extent to which tasks observed during in-person GP consultations are 'translatable' to telehealth. In this study - focusing on UK in-person GP consultations, and concerning T2DM or CVD - we aim to identify clinical tasks, physical examinations, and physical artefacts utilised during in-person GP consultations, and analyse whether in-person aspects of a consultation are translatable to telehealth. With telehealth set to become a mainstay in health service delivery, this study has important implications for next generation design of virtual care in primary care settings.

Method

Study Design

A detailed secondary analysis was conducted of videos recorded in GP consultations, originating from an NHS-ethical approved project "Harnessing resources from the internet to maximize outcomes for GP consultations (HaRI): A mixed qualitative methods study to investigate the internet use in GP. The HaRI study video-recorded 281 consultations from ten GPs working at eight GP surgeries during 2017, across London and the Home Counties. See Ethics Approval section for details.

Data Collection

Two hundred and eighty-one HaRI video recordings and transcripts were passed through inclusion and exclusion criteria to restrict the analysis to consultations pertaining to T2DM or CVD. (See Supplementary Table 1) Two researchers (KD,JR) independently read each GP consultation transcript, and coded types of chronic diseases and presenting issues using NVivo software. Twenty-one relevant transcripts were identified, but four of the 21 were removed due to problems with video data, leaving 17 (nine T2DM and eight CVD) consultations for final analysis (See flowchart in Supplementary Figure 1).

Deidentification

To maintain privacy of patients and health personnel, a custom-made software comprised of a low pass filter was developed in-house to blur the faces of individuals in the videos. Thus, all individuals and their faces were blurred and de-identified prior to any analysis.

Data Analysis

Descriptive Analysis

Descriptive statistical analysis was applied to patient and consultation characteristics extracted from relevant transcripts.

Video and Transcript Analysis

Two researchers (KD, JR) independently read all 17 transcripts and watched all 17 videos, extracted any mention of physical artefacts or physical examinations in the transcripts and/or videos, and recorded them for analysis. In all instances where clinical tasks, physical examinations, or physical artefacts were performed or identified, matching transcript excerpts were extracted and recorded within an Excel spread sheet, allocated to categories inductively formulated during the data extraction process. These categories include:

1. Tasks performed during in-person consultations (e.g. prescribing medication)
2. Physical examinations (e.g. auscultation) performed during in-person consultations
3. Physical artefacts (e.g. stethoscope) identified during in-person consultations

Data Verification

A third researcher (JL) analysed all videos and transcripts to verify extracted information from the initial analysis. All information regarding tasks, physical examinations, and physical artefacts were re-extracted, cross-checked against the initial analysis, and amended as required. In addition, physical artefacts were further categorised into three groups:

- Physical artefacts that are readily found in patient's home setting (e.g. computer)
- Physical artefacts that are easily acquired through purchase or provision (e.g. thermometer)
- Physical artefacts that are not easily acquired by patients in the community (e.g. stethoscope)

Personal items such as mobile phones were excluded from the physical artefact list, unless they were used to support a task (e.g. Fitbit used to support a discussion about exercise).

Time Analysis

One researcher (JL) re-analysed all 17 videos and extracted the following information:
length of entire consultation; number of physical examinations per consultation;
length of time for physical examination(s). These analyses were also performed independently for each condition (T2DM and CVD).

Translatability to Telehealth Analysis

A scoring system was developed to rate the 'translatability' of in-person GP tasks to telehealth. This was partly adapted from a study by Croymans et al. who developed a rating scale to rank the appropriateness of certain conditions to telehealth. (18) Rather than ranking conditions, our research aimed to develop a rating system for individual tasks performed during consultations. Developing the scoring system involved analysing de-identified consultation videos, discussions between researchers (JL, KW, SR), and reviewing relevant literature. It became apparent that tasks requiring specialised equipment or in-person expertise, e.g. physical examinations, were the key factors in how readily tasks could be replicated using telehealth. These discussions and analyses led to the development of the following scoring system procedure:

- **Step 1**: Assess the extent to which a task requires *'clinical endorsement'*, based on a 5-point score. (Table 1 Metric 1).
- **Step 2**: Assess the extent to which a task requires *'physical artefacts or physical interaction'*, based on a 5-point score. (Table 1 Metric 2).
- **Step 3**: Sum up the scores from Steps 1 and 2 to calculate an overall score out of 10 that describes how well this task can be translated to telehealth, i.e. *Translatability to Telehealth Score* (See Table 2).
- **Step 4:** Categorise the type of *Virtual Care Solution* proposed for this task, based on the 10-point score from Step 3, according to rules defined in Table 3.

Table 1 describes the metrics from Steps 1 and 2 and includes definitions and examples for each point-score for each of the key domains. These descriptions are used as a guide to score each task identified during in-person GP consultations. See Supplementary Table 2 for scoring system rationale for different task-types.

Table 1: Metrics used to score translatability of in-person tasks

Metric 1: Clinical endorsement Score	
Score	**Description**
1/5	Requires in-person clinical expertise e.g. swabs, smears, excising lesions, giving injections.
2/5	In-person clinical expertise is preferred but remote digital solutions are possible e.g. skin inspections, auscultation, palpation, foot examinations.
3/5	Clinical endorsement is required for interpretation of results that the patient can collect in their homes, as well as for tasks that have current digital solutions e.g. temperature checks, weight, blood pressure, glucose readings, oxygen saturation, heart rate.
4/5	Medical endorsement is required for tasks, such as targeted history taking, but no specific equipment is required, making it easier to perform over telehealth.
5/5	Medical expertise may not necessarily be required to complete this task e.g. printing.
Metric 2: Physical Artefacts or Physical Interactions Score	
Score	**Description**
1/5	Requires equipment or physical examination in a manner not translatable to telehealth e.g. swabs, smears etc.
2/5	Requires equipment or physical examination potentially translatable to telehealth but preferable in-person e.g. auscultation, physical inspection involving palpation.
3/5	Requires equipment that is easily purchasable in most pharmacies, or requires pick-up/delivery e.g. thermometers, blood pressure monitors.
4/5	Requires equipment that is easily accessible in a patient’s home, and thus can be translated over telehealth e.g. computer, printer, weight scale.
5/5	Does not require any equipment, thus readily translatable over telehealth e.g. discussing diet or medication use.

Table 2 describes how the two key metrics are combined to calculate the ‘Translatability to Telehealth’ score out of 10.

Table 2: Translatability to Telehealth Score Interpretation

Metric 1: Clinical endorsement Score	Metric 2: Physical Artefacts or Physical Interactions Score				
	5	4	3	2	1
5	10	9	8	7	6*

4	9	8	7	6	5*
3	8	7	6	5	4*
2	7	6	5	4	3*
1	6*	5*	4*	3*	2*

*Not currently translatable to telehealth - careful attention required when evaluating whether a task (with this score combination) is indeed translatable using current forms of technology.

9-10/10: Easily translatable over telehealth with no additional physical artefacts required = Type 5
7-8/10: Relatively easy to translate over telehealth, with minimal but easily accessible equipment required = Type 4
5-6/10: Moderately translatable over telehealth but may require patient to acquire their own equipment to do so= Type 3
4/10: Has the potential to be translated over telehealth but may require clinician to administer virtual examination, and may require patient to obtain special equipment and training= Type 2
2-3/10: Not amenable to being replicated over telehealth at this stage= Type 1

Table 3 describes how the scores from Table 2 are further categorised into five 'Types', corresponding to appropriate Virtual Care Solutions – designated as Type 1 through to Type 5.

Table 3: Translatability to telehealth score and corresponding virtual care solution type

Translatability to Telehealth Score	Description	Virtual Care Solution	Description
9-10/10 = Type 5	Easily translatable over Telehealth with no additional physical artefacts required	Type 5	Clinicians and/or patients can easily exchange information over the telephone and/or video (e.g. discussing diet or medication)
7-8/10 = Type 4	Relatively easy to translate over Telehealth, with minimal but easily accessible equipment required	Type 4	Patients conduct self-assessment at home and communicate self-reported findings e.g. measuring weight, print electronic requests/results

5-6/10 = Type 3	Moderately translatable over Telehealth but may require patient to acquire their own equipment to do so	Type 3	Patients acquire necessary artefacts through purchase or pick-up, and perform and communicate findings. Virtual guidance or training may be required e.g. measuring oxygen saturation or blood pressure
4/10 = Type 2	Has the potential to be translated over Telehealth but may require clinician to administer virtual examination, and may require patient to obtain special equipment and training	Type 2	Clinician administers virtual examination. May require patient to obtain special equipment and training e.g. virtual foot examination.
2-3/10 = Type 1	Not amenable to being replicated over Telehealth at this stage	N/A	N/A

Results

Patient and Consultation Characteristics

Overall, 17 T2DM or CVD in-person consultations are analysed in this study, where nine pertain to T2DM patients and eight pertain to CVD patients. Refer to Supplementary Table 3 for patient and consultation characteristics.

Physical examinations performed during in-person consultations

Figure 1 describes the frequency of physical examinations across observed consultations. Overall, nine physical examinations were conducted across these 17 in-person consultations. 88% (15/17) of consultations featured physical examinations.

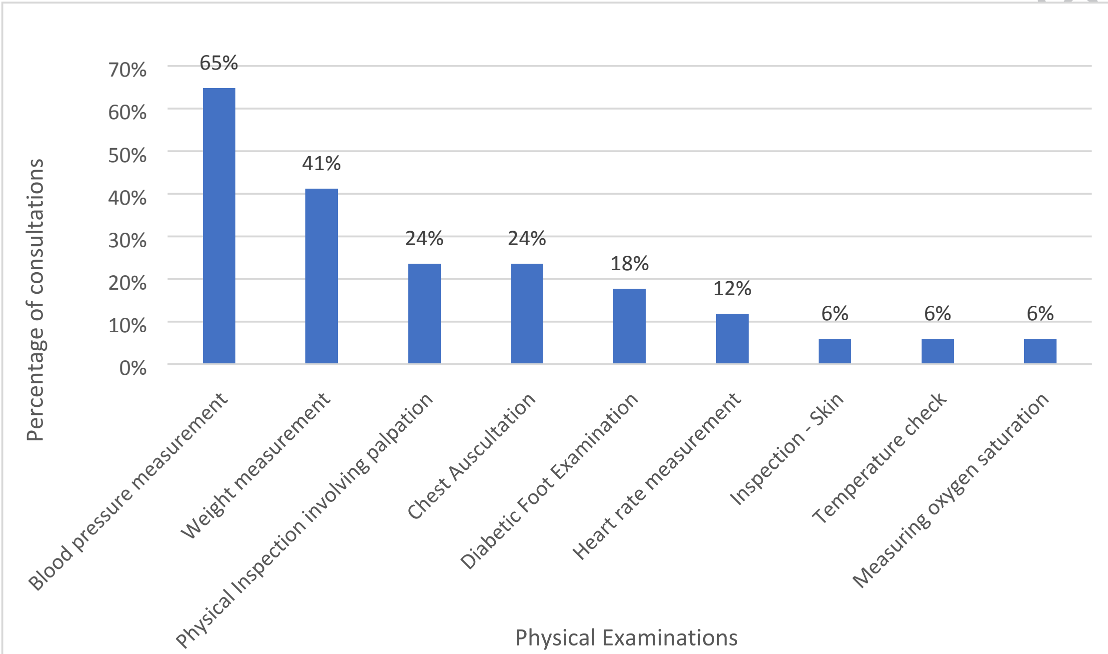

Figure 1: Frequency of physical examinations performed during in-person consultations, as a percentage of total consultations (n = 17)

Time Analysis of Physical examination(s) during Consultation

Thirty-three physical examinations were observed across these 17 in-person consultations. The average total length of GP consultations was 13 minutes 02 seconds. The average time spent on physical examinations(s) during a consultation was 2 minutes 26 seconds. The average time taken for physical examinations during consultations was 1 minute and 55 seconds for T2DM patients, and 2 minutes and 53 seconds for CVD patients. On average, 22% of total consultation time is devoted to physical examinations(s). Refer to Supplementary Table 4.

Physical artefacts used during in-person consultations

Figure 2 outlines the frequency of physical artefacts observed across in-person T2DM or CVD consultations. Overall, 21 physical artefacts (e.g., computer, stethoscope) were identified across these 17 consultations. Of the 21 physical artefacts observed, 12 were defined as *readily found* *in a patient's home setting*, six were defined as *easily acquired through purchase or provision*, and three were defined as *not easily acquired*. (Supplementary Tables 5, 6, and 7).

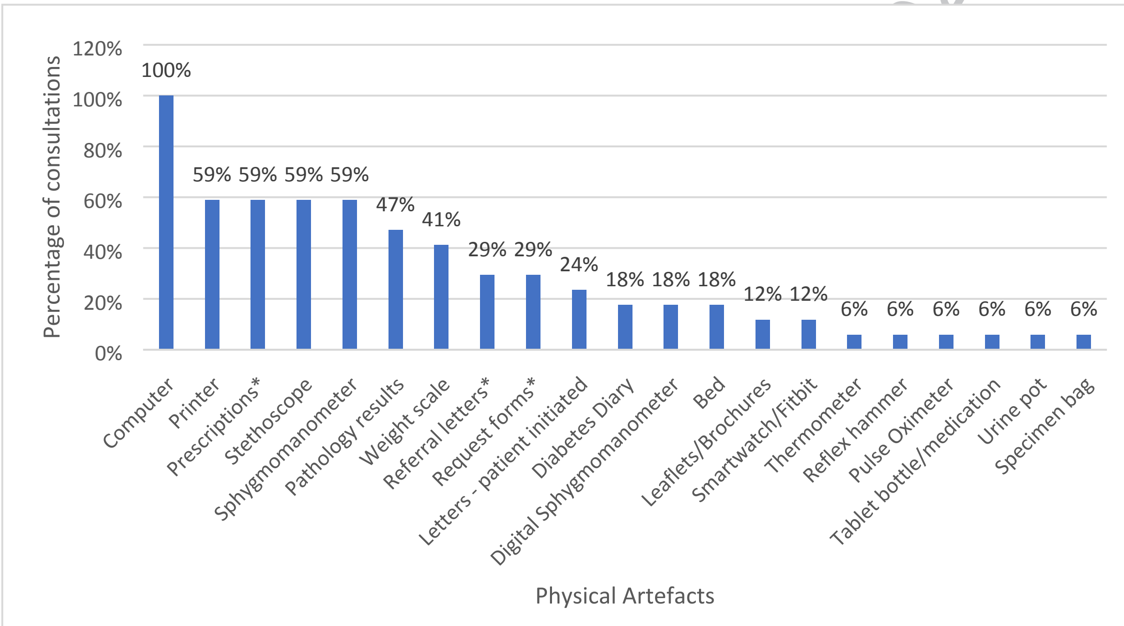

Figure 2: Frequency of physical artefacts used during in-person consultations (n = 17)
*Physical artefact dispensed either by GP or at GP reception desk

Tasks performed during in-person consultations

Figure 3 outlines the frequency of tasks observed across T2DM or CVD in-person consultations. A total of 23 tasks were observed across 17 consultations. Out of the 23 tasks performed, 39% (9/23) involved physical examination, and 74% (17/23) of these tasks required physical artefacts at least some or all of the time.

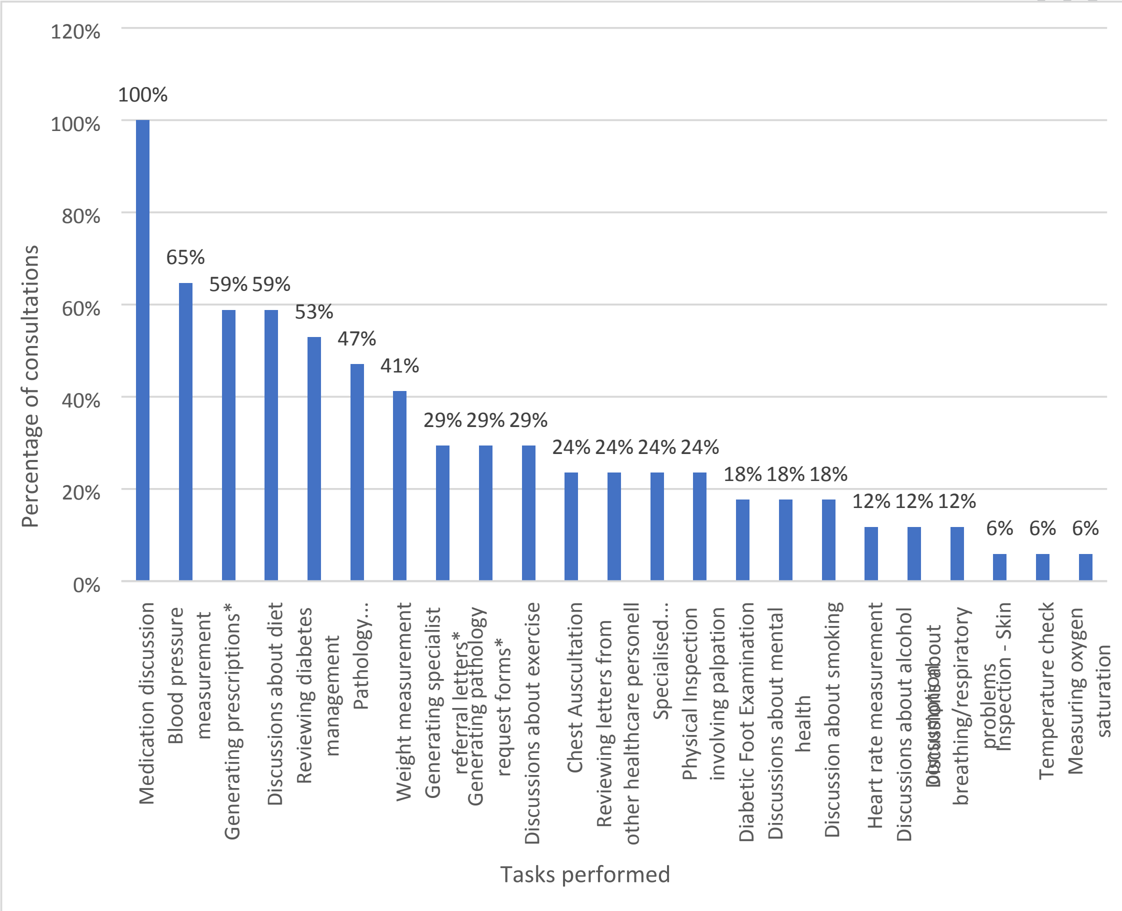

Figure 3: Tasks performed during in-person T2DM or CVD GP consultations as a percentage of total consultations, ordered by frequency (n = 17).

*Physical dispensation either by GP or at GP reception desk

Translatability of tasks to Telehealth

Supplementary Table 8 describes how translatable these 23 clinical tasks are to telehealth across T2DM and CVD consultations. Across the 23 tasks, the *average* score for telehealth metric:

- *Clinical endorsement* was 3.4/5 (where score 1 = ‘Requires in-person clinical expertise’, 5 = ‘Clinical expertise is not necessarily required to complete this task’);

- *Physical artefacts or physical interactions* was 3.8/5 (where score 1 = 'Requires equipment or physical examination in a manner not translatable to telehealth', 5 = 'Does not require any equipment, thus readily translatable over telehealth'); and
- *Translatability to Telehealth* was 7.2/10 (where score 1 = 'Not amenable to being replicated over telehealth at this stage', 10 = 'Easily translatable over telehealth with no additional physical artefacts required').

Regarding telehealth metric of virtual care solution types, all 23 tasks observed across T2DM or CVD consultations were deemed translatable/potentially translatable to telehealth. Overall,

- No tasks were rated as *Type-1* ('Not amenable to being replicated over telehealth at this stage').
- 13% (3/23) of tasks were rated as *Type-2* ('Has the potential to be translated over telehealth but may require clinician to administer virtual examination, and may require patient to obtain special equipment and training'). Example: chest auscultation.
- 26% (6/23) were rated as *Type-3* ('Moderately translatable over telehealth but may require patient to acquire their own equipment'). Example: measuring oxygen saturation.
- 30% (7/23) were rated as *Type-4* ('Relatively easy to translate over telehealth, with minimal but easily accessible equipment required'). Example: measuring weight.
- 30% (7/23) were rated as *Type-5* ('Easily translatable over telehealth with no additional physical artefacts required'). Example: discussion about exercise.

Discussion

Summary

The average *Translatability to Telehealth* score was 7.2 out of 10, indicating that overall, tasks for T2DM or CVD cohorts were 'relatively easy to translate over telehealth, with minimal but easily accessible equipment required'. The findings revealed that 78% of consultation time for these cohorts is devoted to tasks that involve no physical examination. While 88% of consultations involved one or more physical examination(s), most of these physical examinations require equipment that can be easily acquired, and results communicated remotely for medical interpretation. Analysis of physical artefacts revealed that 85% of physical artefacts are either readily available in home settings, or easily acquired through purchase or provision.

The 'Translatability to Telehealth' scoring system found that while on average tasks were rated as easily translatable, certain important tasks are not easily translated to telehealth at this time. This includes certain essential tasks e.g. chest auscultation. Categorising tasks and virtual care solutions is useful for identifying the gaps that still exist in telehealth and where future research into digital solutions is required, if telehealth is to have a role in primary care delivery in the long run.

Strengths and limitations

The major strength of this study was that it analysed actual GP consultation data via video and transcript – rather than using self-report data such as survey and interview. This objective analysis permits less capacity for recall bias and measurement error commonly associated with self-report methods. This study involved analysis of consultations across multiple GPs and GP clinics, thereby reducing potential clinician bias.

These findings were limited to a sample size of 17 consultations and low sample size could result in an incomplete understanding of the scope of clinical tasks for these cohorts. All consultations occurred in the UK and were conducted in English, potentially limiting generalisability of our findings to other contexts (e.g. non-English speaking countries, other healthcare systems). Further research using larger data sets and different settings would be useful to identify any differences in disease management for these cohorts. Finally, this study was unable to analyse unique patient factors e.g. digital literacy, cognitive capacity, which impact on the effectiveness of telehealth. Future research should include this patient context when analysing the translatability of clinical tasks to telehealth.

Comparison with existing literature

This HaRI dataset was used by Stevenson et al. to analyse how internet was used during GP consultations. (19) Method used in this study for scoring translatability of tasks to telehealth is a novel approach, to our knowledge. The Appropriateness Scale developed by Croymans et al. scored ‘diabetes management’ 6.5/9, indicating it was appropriate for telehealth, (18) and ‘High blood pressure management’ skewed marginally towards ‘appropriate’ with a score of 5.6/9. (18) Our findings were consistent with other studies analysing telehealth usage for patients with CVD or T2DM. (11-15)

Scoring certain complex tasks as ‘potentially translatable to telehealth’ is consistent with emerging evidence on virtual-care solutions. There is existing guidance for performing remote physical assessments including foot examinations, (20) musculoskeletal examinations, (21) as well as chest auscultation using Bluetooth-connected electronic stethoscopes. (22)

Implications for research and practice

There are safety concerns arising from increased uptake of remote examination. A lack of clinical expertise and an inability to verify the accuracy of home-based equipment could result in measurement error. Measurement errors could lead to misdiagnoses and inappropriate treatment. Greater research is needed on the safety aspects of home monitoring and remote examination.

Certain clinical tasks like chest auscultation are not readily amenable to telehealth at this time. Further research is needed to evaluate the viability of existing digital solutions for these tasks, as well as the development of new technologies for these complex tasks.

There is a risk that telehealth could create 'low-value care' i.e. care that is either ineffective, inefficient, or unwanted. (23) If telehealth patients still require in-person consultations afterwards, this would be inefficient because it would increase the total amount of care in the system. Future research could build on our 'translatability to telehealth' scoring system to develop a more robust telehealth triage protocol.

Telehealth is a tool with the ability to either reduce health inequities through increased access to care, or to widen inequities through digital poverty. Future research is needed to identify how barriers to the adoption of telehealth can be eliminated, as well as identifying strategies to maximise the positive potential of this technology.

It is likely that a hybrid care model, incorporating both in-person and telehealth consultations into routine care, will be commonplace moving forward. Further research will require long-term evaluation of the safety and health outcomes for patients undergoing hybrid care.

Notes

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Ethical Approval

Ethical approval for this analysis was obtained from Macquarie University Human Research Ethics Committee for Medical Sciences (reference number: 52020558018892), as well as the National Health Services (NHS) (REC reference: 19/LO/0364; IRAS project ID: 257924) and NHS (RED reference: 16/LO/1029; IRAS project ID: 197875)".

Provenance

Freely submitted; externally peer reviewed.

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Competing interests

The authors declare that no competing interests exist.

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