

## Refereed paper

# Computer-assisted history-taking systems (CAHTS) in health care: benefits, risks and potential for further development

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## ABSTRACT

**Background** A computer-assisted history-taking system (CAHTS) is a tool that aids clinicians in gathering data from patients to inform a diagnosis or treatment plan. Despite the many possible applications and even though CAHTS have been available for nearly three decades, these remain underused in routine clinical practice.

**Objective** Through an interpretative review of the literature, we provide an overview of the field of CAHTS, which also offers an understanding of the impact of these systems on policy, practice and research.

**Methods** We conducted a search and critique of the literature on CAHTS. Using a comprehensive set of terms, we searched: MEDLINE, EMBASE, The Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, The Cochrane Central Register of Controlled Trials, The Cochrane Methodology Register, Health Technology Assessment Database and the NHS Economic Evaluation Database over a ten-year period (January 1997 to May 2007) to identify systematic reviews, technical reports and health technology assessments, and randomised controlled trials.

**Results** The systematic review of the literature suggests that CAHTS can save professionals' time, improve delivery of care to those with special needs and also facilitate the collection of information,

especially potentially sensitive information (e.g. sexual history, alcohol consumption). The use of CAHTS also has disadvantages that impede the process of history taking and may pose risks to patients. CAHTS are inherently limited when detecting non-verbal communication, may pose irrelevant questions and frustrate the users with technical problems. Our review suggests that barriers such as a preference for pen-and-paper methods and concerns about data loss and security still exist and affect the adoption of CAHTS. In terms of policy and practice, CAHTS make input of data from disparate sites possible, which facilitates work from disparate sites and the collection of data for nationwide screening programmes such as the vascular risk assessment programme for people aged 40–74, now starting in England.

**Conclusions** Our review shows that for CAHTS to be adopted in mainstream health care, important changes should take place in how we conceive, plan and conduct primary and secondary research on the topic so that we provide the framework for a comprehensive evaluation that will lead to an evidence base to inform policy and practice.

**Keywords:** computer-assisted history-taking systems (CAHTS), eHealth

**What this paper adds?**

- The scope of use of CAHTS is wide, involving professionals, patients and the public either on-site or remotely, at all levels of care.
- CAHTS can facilitate history taking from disparate sites and can be used for primary prevention (e.g. population screening programmes) and disease management (e.g. collection of dietary intake information for diabetes care).
- Multiple benefits and risks have implications for policy and clinical practice.
- Important changes should take place in how we conceive, plan and conduct primary and secondary research when evaluating CAHTS.

## Introduction

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Medical history taking lies at the centre of clinical diagnosis and decision-making. As described by Pringle over a decade ago, computer-assisted history-taking systems (CAHTS) are tools that aim to aid clinicians in gathering data from patients to inform a diagnosis and/or treatment plan.<sup>1</sup> Of relevance is the increasing potential for patients to complete aspects of their history, prior to or post the consultation, whilst on-site or remotely. Online systems can also help with data collection for screening programmes, such as England's national vascular risk assessment and management strategy.<sup>2</sup> Despite the many possible applications and even though CAHTS have been available for nearly three decades<sup>3</sup>, they remain underused in routine clinical practice.

## Method

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We conducted a search and critique of the literature on CAHTS to identify the existing modalities and scope of use, as well as the potential benefits and risks of these applications. Using a comprehensive set of terms, we searched: MEDLINE, EMBASE, The Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, The Cochrane Central Register of Controlled Trials, The Cochrane Methodology Register, Health Technology Assessment Database and NHS Economic Evaluation Database over a ten-year period (January 1997 to May 2007) to identify systematic reviews, technical reports and health technology assessments, and randomised controlled trials. We also searched the National Research Register and registers of clinical trials to identify relevant ongoing or unpublished work. We also, where necessary, drew on evidence from the trials identified and a broader body of technical, descriptive, qualitative and policy relevant work. This body of retrieved studies was then synthesised to produce an authoritative and accessible

overview of the field that offers an understanding of the impact of CAHTS on policy, practice and research.

## Results

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### Description

CAHTS can be used by healthcare professionals, or directly by patients, as in the case of pre-consultation interviews.<sup>4-6</sup> CAHTS can be used remotely, for example, via the Internet, telephone or mobile phone messaging, or on-site. They draw on a range of technologies such as personal computers, personal digital assistants (PDAs) and electronic kiosks, and data input happens via keyboard, touch screen and voice-recognition software, among others.

### Scope for use

#### *Health professional led*

Where health professionals input patient details into computers, typically via templates; this can include:

- remote telephone interview
- onsite, interview.

Examples of these include:

- *Emergency services*: Where mobile systems are used in ambulatory services and/or in accident and emergency departments. Sometimes computer-assisted history taking and computer decision-support systems are used in combination. For example, nurses in the out-of-hours, emergency service type in patient responses to questions generated by the computer program and then direct patients to answer further relevant questions leading ultimately to a diagnosis and/or a management plan.<sup>7,8</sup>
- *General practice systems*: Where CAHTS record aspects of the patient's history into a computerised template, which informs part of the patient record.<sup>9</sup>

**Patient/carer completed (self-administered)**

When the computer prompts the patient to input relevant information themselves; this can include:

- on-site, self-interview
- remote, automated telephone self-interview
- remote, online self-interview.

Examples of these include:

- *Pre-consultation questionnaire.* This enables patients to complete the history either on a computer in the waiting room or at home.<sup>4-6,10,11</sup> This has, for example, been shown to help professionals rapidly to appraise psychiatric referrals and prioritise patients.<sup>12,13</sup>
- *Electronic and online health records.* Where the patient types their own history into sections of their electronic health record, which can then link to other similar patient-held records.

With the addition of diagnostic and reminder functionalities, CAHTS may influence all stages of the patient care pathway before, during and after the consultation. For example, with the addition of a diagnostic platform such as probabilistic advice and question-prompting, CAHTS may become instrumental in the decision-making process.

## Benefits and risks of CAHTS

### Saving professionals time on documentation

Professionals have limited time in consultations and, in a traditional face-to-face clinical encounter, it is not always possible to obtain a complete or, in some cases, even relevant medical history.<sup>14</sup> In an evaluation of ambulatory practices, clinicians were found to spend 20% of their day writing.<sup>15,16</sup> In an Ohio family practice, dictation and charting outside examination rooms occupied 56 minutes of an eight-hour working day.<sup>17</sup> In an antenatal clinic, it was estimated that two-thirds of the working day was spent recording information.<sup>18</sup>

### Collection of more comprehensive and valid information

Clinicians need to remember many questions relating to the management of each condition. Omitting an important question can have considerable implications for diagnosis and treatment. For example, studies show that 50% of psychosocial and psychiatric prob-

lems are missed<sup>19</sup> and that 54% of patient problems and 45% of patient concerns are neither elicited by the clinician nor disclosed by the patient.<sup>20</sup> Furthermore, studies have demonstrated fewer errors in PDA data records than in paper diaries and that PDA data sets were correctly completed in 100% of cases,<sup>21</sup> while one study reported patient compliance of 93%.<sup>22</sup>

### Quality and completeness of data

Kerkenbush *et al.* found increased compliance with data entry<sup>23</sup> and noted that Invivodata™ (a company specialising in electronic diary technology) showed that patients responded in a timely way to 93% of all the electronic data gathering prompts.<sup>24</sup> Also, Kamarack *et al.* found 99% compliance with assessments that needed to be completed every 45 minutes during waking hours over a six-day period.<sup>25</sup> Furthermore, if patients use a PDA for a CAHTS, they are less likely to falsify data when compared with those using pen-and-paper, as demonstrated, by four randomised controlled trials.<sup>21,26-28</sup>

### Benefits for patients

CAHTS can be used in several clinical settings and are particularly useful in eliciting potentially sensitive information, for example, on alcohol consumption,<sup>29,30</sup> psychiatric care,<sup>31-34</sup> sexual health<sup>35</sup> and gynaecological health.<sup>36</sup> Using CAHTS before the consultation would also, in principle, allow more time for the patient to discuss their actual health problem rather than routine aspects of medical history with their physician.

### Facilitating delivery of care to those with special needs

There are important potential benefits of CAHTS in the care of people with special needs. For example, computers can allow questions to be asked in a number of different languages. They can also provide multimedia forms for patients who cannot read and write through making computers voice questions and digitally record spoken responses.<sup>4,37</sup>

One study reports that 'young people find computerised questionnaires equally or more acceptable than the usual clinical interview or a written questionnaire'.<sup>29</sup> In another study, parents originally assumed that an interview using a computer was not as 'friendly and personal', but became more optimistic after the interview was completed.<sup>31</sup>

## Irrelevant questioning

A central limitation of CAHTS may be that not every question can be meaningfully answered in a questionnaire; such issues are likely to be particularly relevant when using general questionnaires which may include questions irrelevant to individual patient concerns and needs.<sup>38</sup>

## Failure to record non-verbal communication

CAHTS are inherently limited with respect to non-verbal communication. Computers are currently unable to detect non-verbal behaviour since a computer cannot, for example, sense a patient's mood which might easily be picked up in a consultation.<sup>4</sup> Another related concern is that computers may depersonalise the doctor–patient relationship, although this has not actually been demonstrated in the clinical setting.<sup>6</sup>

## Technical problems and frustration with the system

A systematic review assessed the use of PDA-based templates for CAHTS by medical trainees.<sup>39</sup> The review highlighted that although most medical trainees who use handheld computers for patient history taking appear comfortable and generally satisfied with them, certain barriers still exist, such as: (1) a lack of technical experience; (2) a preference for pen-and-paper; (3) difficulty handling the small device; and (4) concerns about data loss and security.<sup>39</sup>

## Discussion

### Implications for policy

Based on their strong potential and empirically demonstrated benefits (discussed earlier), consideration needs to be given to incorporating professional templates into future iterations of electronic health record systems for use in specialties or contexts where history-taking routines are well characterised and not particularly dependent on clinical intuition.

The progressive change in focus from hospital care to community-based care means that staff will become more mobile and therefore need to access and input data at the point-of-care. There is also a drive within health systems globally to focus on health promotion, disease prevention and the early detection of disease. For example, in England, a vascular risk assessment

programme for people aged 40–74 is now starting; CAHTS can be helpful in collecting risk factor and behavioural data for this.<sup>40,41</sup>

### Implications for practice

Several studies have found that self-administered computer-assisted interviewing is perceived favourably by patients because computer systems cannot be judgemental towards sensitive behavioural data such as sexual history and domestic violence.<sup>42</sup> Clinician and patient-operated CAHTS data are potentially important additions to the electronic health record as they can help to improve data quality through: data entry forms with data validation checks; encoding of data; legibility; easier access to past records; attribution of entries; easier availability; and facilitating patient checks of their own data. Consideration also needs to be given to incorporating patient-completed diaries online, thereby allowing information on key complaints and self-generated data (e.g. blood pressure or peak expiratory flow) to be made available to clinicians before the actual consultation. This may result in more complete history taking and more time available to spend on the actual consultation.

### Looking ahead

Seminal reports on quality and safety of health care<sup>43</sup> invariably recognise information technology as one of the main vehicles for making radical improvements in the delivery of health care. Although CAHTS have been available for around 30 years, successful use in routine health care is still variable. Our review shows that substantial effort and time will be required to realise the mainstream operation of CAHTS. Important changes should take place in how we conceive, plan and conduct primary and secondary research on CAHTS so that we provide the framework for a comprehensive evaluation that will lead to an evidence base to inform policy and practice. The findings of any comprehensive evaluation should also inform a sustainability model that views CAHTS as an integral component and working platform for electronic health records (EHR).

Relatively few studies reported on safety outcomes<sup>44</sup> when evaluating CAHTS, whereas others sometimes failed to assess the most salient dimensions of quality such as access, accessibility and equity.<sup>45</sup> Although CAHTS are frequently promoted as being 'cost-saving',<sup>46–51</sup> this attribute was rarely evaluated rigorously. Most of the technologies are at present supported only by face validity and modest or weak empirical evidence. Unless these systems are adequately studied, they may not 'mature' to the extent that is

needed to realise their full potential when deployed in everyday clinical settings.<sup>45</sup>

Additional research on the reliability of different methods of data collection would also be useful in assessing the value of collecting data using CAHTS in healthcare settings.<sup>43</sup> Moreover, even after successful interventions, accuracy may not be maintained over time. Medical processes are complex and changing, and data error, as well as procedural changes may occur due to the high turnover of personnel.<sup>52</sup> Hence, there is a pressing need for regular evaluations of CAHTS, analogous to techniques used in continuous quality improvement.<sup>40,51,52</sup>

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