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ISSN: 2475-5435

Research Article

International Journal of Psychiatry

Structured Solutions For Medical History Taking: A Historical Review

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Submitted: 08 Jun 2022; **Accepted**: 13 Jun 2022; **Published**: 20 Jun 2022

Citation: *Helio G Rocha Neto, Maria Tavares Cavalcanti., Diogo Telles Correia. (2022). Structured Solutions For Medical History Taking: A Historical Review. Int J Psychiatry 7(2):144-152.*

Abstract

Introduction: *History taking (HT) is the basis for medical practice. Although its format lacks a standard, many HT Instruments (HTI) were developed, applied, and automated throughout history. Objective: To build a history line about HTI development, its pros and cons.*

Method: *We accessed medline and lilacs database through the bvs search engine, using HT equivalents in english, portuguese, french, spanish, and german. Original papers and reviews about HTI aiming general practice were selected, and their content comprehensively analyzed and discussed, following PRISMA guidelines.*

Results: *From 24904 initial entries about HT since 1900, 105 were selected for analysis. First HTI was identified before the 1st World War, mainly as mental screening tools. Later, other general practices HTI were developed, integrating statistical and branching reasoning. Two advantages were consistently reported about clinician time saving and improvement on information gathering. However, their use did not become widespread, restricted to research scenarios and specific guidelines for clinical intervention.*

Conclusions: *HTI benefits may result from ht systematization, and it is not clear if clinical time-saving results in economic and quality of care improvement. However, the systematization of HT and the use of computational processing power may help medical practice and should not be overlooked. Better comprehension of the diagnostic HT clinical act will help comprehend how HTI may be useful for clinical practice, reasoning and doctor patient relationship.*

Keywords: Medical History Taking; Diagnosis; Data Collection; Data Accuracy; Interview as a Topic

Introduction

History taking (HT) is assumed as an obligatory and "must be done" activity for physician practice. However, there were no registries about HT until 1850 [1]. Until then, most emphasis was given to physical signs and patient's complaints were irrelevant for clinical evaluation and diagnostic elaboration. Interest in HT increased after the first World War, reflecting its role in diagnosis and treatment, becaming clear that HT findings were as important as physical signs to diagnostic process [2-4].

Nowadays, there is a consensus that a "good" or "complete" HT must follow Engels' biopsychosocial model, composed by 3 main sections: Identification data (eg. name, age, gender, ethnic background, housing, matrimonial status, nationality, etc), previous history findings (eg. Previous diseases, development marks, allergies, etc), and main complaint plus History of Present Illness HPI. [3]. The first two sections are composed of nominal data, and thus can be self reported, using pre-filled sheets, or as structured interviews applied by lay interviewers or machines. Interviews aiming HPI were developed too, and these could be self, lay or professionally applied.

Despite such developments, there is no known standard for how or when these History Taking Instruments (HTI) should be applied, or which content might be considered "minimum" for a diagnose consultation. Medical textbooks usually have a HT session, but accessed contents varies among authors, and usually only clinical registries have a sound structure through POMR (Problem Oriented Medical Registry), using SOAP formula (Subjective, Objective, Assessment and Plan) [5]. However, those are methods to record previously acquired clinical findings, and not how to acquire these data.

Our aim in the present study is to explore the instruments developed as an aid, or substitute for medical HT, but also to check for the existence of a minimum data standard to be gathered in a diagnostic consultation. For that objective, we developed a history line with the methods used to retrieve medical subjective data by HTI and, then, discuss the barriers to its clinical use and some considerations about HTI limits.

Methods

We retrieved articles for HTI through a systematic search in HT publications, then references of references were manually selected and included in the final pool. The search was carried out in February 2020, on the Virtual Health Library (BVS) portal, including MEDLINE and LILACS library. A search carried in the Descriptors in Health Science (DeCS) and Medical Subjects Headings (MeSH), shown that both libraries associate HT with "Medical History Taking", "diagnosis" and "medical records" in English. Thus, the search string was composed of the words "Medical History Taking", "diagnosis" and "medical records", as equivalents for HT. We included the equivalent terms in Portuguese, Spanish, French and German, retrieving the English, Portuguese and Spanish terms from the DeCS database thesaurus for BVS library, and the French and German from the translated MeSH database.

Title, Abstracts, and Subject fields were screened, with the following string: "anamnese" or "anamnesis" or "medical history taking" or "anamnèse" or "anamneseerhebung" [words in the title]; "anamnese" or "anamnesis" or "medical history taking" or "anamnèse" or "anamneseerhebung" [Subject fields]; "anamnese" or "anamnesis" or "medical history taking" or "anamnèse" or "anamneseerhebung" [Abstracts]".

Articles were firstly screened by title and then by abstract reading. Articles not related to HT, about a specific medical specialty/disease/medical condition (ex. How to HT in migraine) or not related to general medicine (ex. dentistry) were excluded. The numbers of entries, deletions, and new entries are explained in figure 1.

Articles were read, looking for methods and examples of HTI, and a comprehensive summary obtained. Data synthesis was developed in a narrative historical description and then discussed. The final article list is offered as complementary file and on authors request. Risk of Bias and quality measurement were not accessed, and this study have not been submitted to an ethical review board, since it is a historical review.

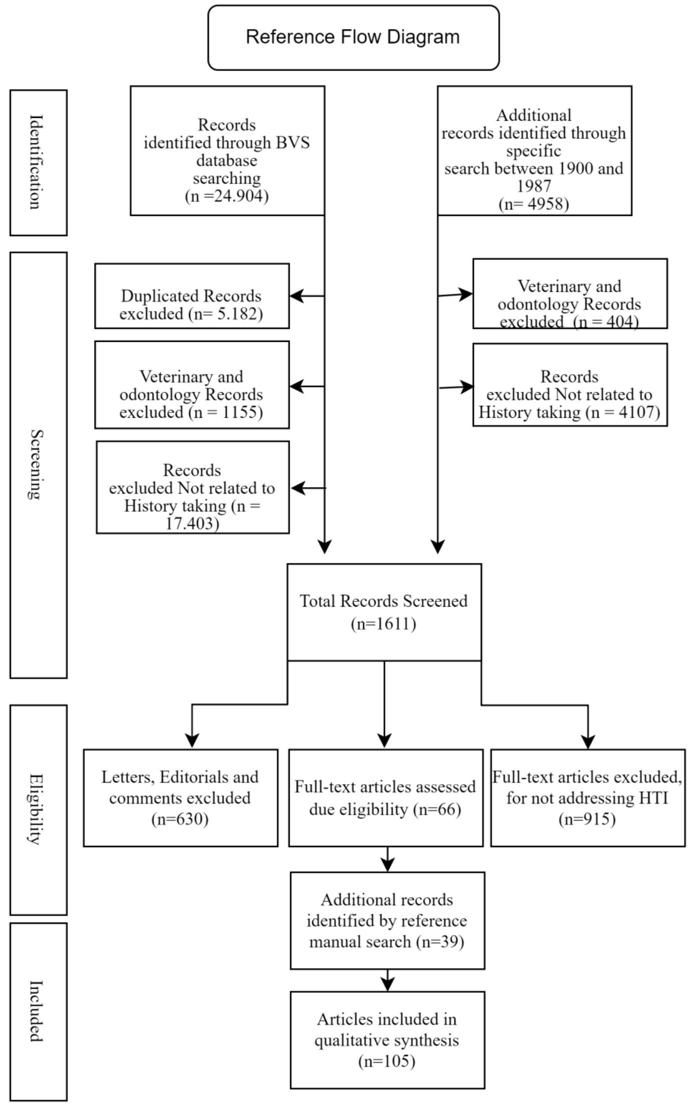

Figure 1: Reference Workflow Diagram

Results

Number of articles by decade and HTI technological characteristics are reported in table 1. HTI commonly reported strengths and flaws can be found at table 2. Sixty-six articles were retrieved from the final pool. Another 39 were obtained manually by reference of reference searches, ranging from 1928 to 2020. Those articles were critically read and a narrative historical description is presented below. We could not identify among all references any citations or models that could be considered a standard or a "must to be collected data" in HT, or even a justification for why some information should or should not be questioned. The final list of consulted references is provided as supplementary material.

Table 1: Number of articles by decade, country and developed technologies

Period	No of Articles	Countries	Introduced Technology
Before 1940	2	2 USA	First HTI Developed. HTI used to measure/evaluate mental disturbances (WPDS) by health professional.
1940s and 1950s	7	5 USA 1United Kingdom 1 Danish	Development of CMI. Self applied HTI to screen for diseases. Cochrane shows that observer error can lead to misdiagnosis.
1960s	22	18 USA 3United Kingdom 1 Canadian	First reference about computer HTI. Reports of high reliability for self HTI. Use of sequential logic approach to reduce the number of answered questions, in a large pool of options.
1970s and 1980s	52	33 USA 2 German 2 Netherlands 1 Belgium 2 Canada 12 United Kingdom 1Multinational	Development of diagnostic aids and self HTI that could generate diagnosis. Development of Bayeasian and statistical methods in software bases HTI. Increase in the number of computer based HTI prototypes. Preponderance of HTI development in psychiatry (24 of 52 articles related with that specialty)
1990s and 2000s	12	8 USA 1 UK 1 German 2 Multinational	HTI consistently reported to be more efficient than clinicians to obtain clinical data, but without impact in practice. Definition of a common baseline characteristic for the development of computer HTI. HTI integrated with EHR.
2010s	11	6 USA 1 Singapore 2United Kingdom 1 Sweden 1Multinational	EHR with HTI templates automatically generates diagnostic hypothesis and suggests clinical intervention. Artificial intelligence programmed to learn with clinician choices and procedures to generate prognostic data, and to keep improving its own performance. Internet based HTI allows patients to send online data previous to clinical evaluation. Huge databases matches epidemiological, self HTI and clinical HT data to aid in clinician decision. Wearable devices generates information about physiological status and behavior, but without known use for clinical practice.
HT – History Taking; HIT – History Taking Instrument; CMI – Cornell Medical Index; WPDS – Woodworth Personal Data Sheet; EHR – Electronic Health Record. Table created by the authors.			

Table 2: History Taking Instruments: Advantages and disadvantages

Advantages	Disadvantages
Saves clinician time	Generate data that may not be clinically useful.
Retrieve data in a standard pattern	Exposition to previously gathered information may lead to reasoning bias.
Generate data for machine/software based diagnostic aid	Interfere with clinician natural hypothetical deductive reasoning in diagnosis
Higher sensibility and reliability to subjective and history of previous illness data	Affect consult flow and clinician patient interaction
Enable lay or non medical triage, and the use of algorithms based procedures	As a preconceived instrument, could not detect complains that were not foreseen by the developer
May help reduce reasoning bias	Standardization may lead to the use of words unknown by lay people
Usually satisfactory for patients	When written, is not accessible for illiterate or sight impaired.
	Risk of answers based on misinterpretation
	Reduction of “bureaucratic” data gathering may lead to overbooking in clinician agenda

Table created by the authors.

Historical background

Before 1940

The first HTI identified was the Woodworth Personal Data Sheet (WPDS), used in soldiers triage, in 1928 [6]. The Great War challenged doctors with large military subjects suffering from mental conditions, requiring psychiatric evaluation after war [7]. WPDS was a psychiatric screening tool to segregate "neurotic" from "normal" subjects, and could be used in large groups through a self applied sheet.

WPDS is only one of many instruments developed with this aim, and some articles reveals many similar self-applied questionnaires around the thirties [8]. Those self-applied questionnaires were mainly for mental illness screening, and a HTI for general practice was developed only during the forties. These are examples of a trend for the following decades: The need to deal with a high demand in health evaluation, with limited resources.

The 1940s and 50s

In 1946 a HTI for general practice was published in the United States (US): The Cornell Medical Index (CMI) [9]. It was an answer to "the need… for an instrument to a rapid psychiatric evaluation of a large number of persons within a variety of situations" [9]. It was a dichotomous questionnaire for self-evaluation divided in many "forms", ranging from 62 to 101 questions. CMI is a standardized HTI to be used in psychiatry, neurological wards, outpatient settings, industry admission screening, research and to evaluate returning veterans from war [9].

Lately, it was expanded to be the first HTI to cover other medical specialties, screening for diagnosis in 18 areas through 200 questions [10]. It was a screening tool for many scenarios, usually used as a way to "spare" medical time, so the clinician could formulate some hypothesis before patient´s arrival [11]. It was used for 30 years, then gradually abandoned and formally decommissioned in the 1990s [12]. CMI was not the only self HTI that was developed, but it is an example of the HTI models used during the forties and fifties.

The 1960s

Automated HT experiences followed computers popularization and a better comprehension of human cognitive decision process. We observed an increase in the publications with "computer HT" as a subject, and reports about high reliability of information obtained by HTI using punched cards, keyboards, and cathodic ray monitors [13-16].

An example was Anderson´s self-applied HTI: It is a "paper and pencil" based questionnaire with 531 questions, developed to be quickly answered. Using a sequential diagnosis approach, the result of each answer guided the patient to questions that were probabilistic related to its main complaint, resulting in a mean of 245 answers by subject, usually done in an hour. The questionnaire was sent to patient's home, which would mail it back to the doctors´ office before appointment [17].

Psychiatry was again a spearhead, with Spitzer's "The Mental Status Schedule", a standard tool for mental screening and examination. It works as a guide to clinical interview, or which questions to answer, as well as a system for registering observed disturbances [18]. Spitzer later developed DIAGNO, a software for psychiatric diagnose, using his HTI, but never clinically widespread [19].

The 1970s and 80s

The 1970's introduced reliability and validity issues among HT and data obtained by computer interviews [20-23]. Although a new HTI strategy was not identified, the use of machine and software based systems have important developments. This was achieved through the use of larger data banks for HT answers, and hypothesis generation aids for clinicians.

Most papers describes new ways to process obtained data in a software based system, trying to emulate clinical reasoning. Nevertheless, the major breakthrough was the change from a sequential based heuristics to a Bayesian based algorithm [21, 24, 25]. Sequential algorithms generates "next question" without weighting previous answers, so the order of questions don´t change, and all hypotheses need to be tested, resulting in a time-consuming questionnaire application. However, with Bayesian algorithms, the software "selects" the next question based on the probability of a positive finding related to previous answers, reducing the length and time for HTI application.

In the 80s, we identified many trials of software as a substitute for physicians or as a screening tool [26-28]. A review from Houziaux defends that such systems were not in use instead, and clinicians were suspicious about it: They believed computers were competitors to be avoided, not assistants. Despite that, the collected data were reliable and more accurate than face-to-face interviews [29].

These two decades represents almost half the entries in our search, and reflects an enthusiasm with software based HTI. Many prototypes were presented, and at least eight papers presented "the basis" for how a software based HTI should work [20, 24, 30-35]. The use of a self, software based, HTI was presented as an affordable solution for health personnel shortage, since their use would allow clinical evaluation and decisions to be made automatically [36].

Almost half of the retrieved articles were related with the development of HTI for psychiatry during this period, and two systems were well developed: DIAGNO and CATEGO. These systems were developed to process data retrieved by Spitzer´s Mental State Schedule (DIAGNO) and Wing´s PSE – SCAN (CATEGO) with extensive field tests, and positive results for validity and reliability, as observed with the other HTI [19, 37, 38]. A positive convergence on reliability among many clinicians' classification of signals and symptoms with its use, reflected a learning effect of repetitive use and supervision after HTI application, which suggests other benefits for practice. [39]. Notwithstanding, none of these systems thrived for too long and are not in use nowadays.

The 1990s and 2000s

In the nineties, Wenner, Goodyear, and Roizen presented more evidence about self HTI information reliability [4, 40, 41]. The use of HTI for other areas of HT was observed, like the usefulness of a self-applied review of systems in family medicine [42].

Review of systems is a subroutine in HT, a "screening by systems" effort to identify signs and symptoms not covered by HPI, and Verdon's dichotomous self-applied review of systems results in new information from a tenth of patients [42, 43]. However, such data had low specificity and did not result in a new diagnosis, although these findings reinforced patient's ability to screen their disease and bring valid diagnostic information.

In 1992, a new system for self HT using computers was described [44]. This system exemplifies three facets considered essential by him for any automatic HT system, as to reduce patient answered questions: explicitness, hierarchical structure, and generality. All this characteristics were related to software programming, complementing the definitions from the seventies. Explicitness is related to data acquisition organization, and generality about it's accessibility with different entry systems (ex. Keyboard, speech, etc). Finally, hierarchical structure represents an evolution anticipated in the sixties: a strategy to use Bayesian and sequential processing with grouping of signs and symptoms, using boolean operators. Clinical complaints statistically occur together, so a positive answer guides to a related question, reducing the total length of answers [17, 44].

Besides the benefits for practice, efficiency, and diagnosis shown by these HTI, their use still not widespread. By the end of the nineties, HTIs were not clinically used in US [45]. A review about computer HT, [46] tried to answer its limits: the contributions were not considered decisive for clinicians, have low specificity, and raise issues to clinician workflow [46].

Zakim also evaluated the relevance of a HT software in clinical practice, and information quality assessments [47]. He used a system matching clinical complaints, boolean operators, decision trees and physiological data to select the next question, and shown again that a HTI is more sensitive than non structured HT by clinicians. However, he suggested the use of a HTI as a compliment for clinical HT, since many of the gathered data was not related with actual complaint, and did not result in new diagnostic hypothesis [47].

The agreement on a self past medical HTI to an in-person interview was also evaluated, and the reliability between both methods was not always high. Although the agreement was at least acceptable, non-severe diseases were less probable to be retrieved by the HTI, with unknown implications for clinical (and software) reasoning [48].

The 2010s

By the 2000s, technology used as HTI was still under development, but without effective implementation in practice. In 2011, a review about Computer-Assisted History-Taking Systems (CATHS) evaluated its pros and cons, aiming CATHS implementation in the English National Health System [49]. Seventy years after CMI, "saving clinician time" was still one of the major contributions of HTI for practice and research. Other improvements would be delivering care at distant places (recently expanded during COVID-19 pandemics), but without improvements on diagnostic practice. Some drawbacks were difficulties in technology use and its impacts on consultation flow [46, 50].

A system for self HT, before clinician evaluation, was developed in the last decade, integrating the technology of Bayesian and sequential diagnosis described in the sixties with promising results [51-54]. It starts with 232 primary questions, guiding the subject throw almost 6000 diagnostic queries, and achieves high agreement between self-report and clinicians opinion. However, clinicians have shown interest only in family and social histories obtained by the HTI, and not the HPI generating hypothesis reports.

The use of HTI's is being developed over 7 decades now, and some powerful tools were here described. Indeed, there is no reason for not including them in clinical practice, but HTI's still not being used [55]. Except for the Structured Diagnostic Interviews, used for diagnostic in psychiatric research scenarios (ex. SCID and MINIplus), no other standard HTI was found to be in use nowadays.

Discussion

HTI was created and developed during the last century for clinical practice improvement. It was initially developed as an aid for mental health screening, where it thrived and became over-represented. Its use in psychiatry is probably a consequence for low-reliability issues, and political troubles like the anti-psychiatric movement [56]. Even so, HTIs did not became an everyday use tool in that specialty or in general medical practice either, besides some clear benefits (Table 2).

Psychiatry is, nowadays, the only clinical specialty with fully structured HTI, at least for HPI, represented by SCID, MINIplus, and other similar instruments. These instruments are, nevertheless, restricted to research scenarios [57]. In others fields of medicine, the only HTI reminiscences could be found in diagnostic and treatment guidelines for specific diseases (ex. Lupus diagnostic criteria) and syndromes (ex. Thoracic pain protocol). We described several advantages of HTI (table 2), but it could be resumed in two: Time saving and high-quality information assessment.

Patients are reliable and consistent when giving information, and self-report or diagnostic information checking should be encouraged. Another conclusion is that HT obtained by clinician non-standard-assessment fails to grasp all available clinical data, when compared with HTI. [4, 10, 23, 26, 40-42, 47, 48, 58, 59]. However, the reasons for HTI's capacity to identify more symptoms/complaints are not clear: it could be related to its intrinsic questioning logic, mathematics and data banks processing capacities, or just a consequence of HT standardization.

The use of an operational checklist for diagnosis causes the "checklist effect", improving data acquisition due a systematic approach of complaints [47]. Although some defend HTI good results to be somewhat different (and better) than this effect, such improvement was identified since the firsts paper and pencil trials with CMI [10]. Data acquisition improvement by "checklist effect" was reported in other analogical instruments, and even in review of systems subroutine. Consequently, it is a systematic approach to information gathering that seems to be fundamental, not a machine data processing system.

Henceforth, this advantage is not intrinsic to HTI, but to a standard evaluation, forcing a positive bias in HT. These findings are reinforced by studies that identifies "early stop" as an important diagnostic bias, usually prevented by the use of a systematic approach [60]. It is unfortunate that a standard diagnostic, "all purpose", HTI has not been yet developed. Such "must to be checked" information is usually known for independent diseases and some specialists evaluation (eg. Tobacco use history and cardiovascular disease), but not for general practice. The relevance and fundamental aspects of sociodemographic and previous history findings for general diagnostic elaboration are yet to be demonstrated, so a standard HTI can be proposed.

Another issue yet to be solved is the usefulness of retrieved data. Most information missed by clinician's is about the nominal, objective sections of HT (identification and previous history findings), and not the section where clinical reasoning usually generates hypothesis (HPI). Even in a powerful computer HTI, the most appreciated section was identification and previous history findings, the same reported by Kanner, Slack, and others in previous decades [15, 51, 61].

Practitioners time-saving was reliably and recurrently reported with HTI's use. The use of standard and common data repositories was consistently reported as having a positive impact in clinical time saving also [49, 62, 63]. However, it was not clear if economic or practice improvements were achieved with HTI application.

Clinician time-saving was not related with the use of a specific HTI, but with a reliable and accessible electronic patient record, as foreseen in the sixties [64]. The use of an eletronic HTI was associated with a reduction in time consultation, but this findings were not replicated [15]. On the other hand, Pecoraro shown that self HT and clinical HT requires similar time, while Maultsby and Rockart reported conflicting results, with some advantage to reduction of time spent [23, 30, 58]. Other authors only supposes that the previous use of a HTI will reduce consultation time, or provide information at no clinician time expense, but did not provide any empirical evidence [4,9,52,55,61-63,65,66,10,11,16,42,45-47,49]. Beyond that, the benefits for clinician and patients of a time saving routine were not clear.

Time-saving could be relevant if used for doctor-patient relationship improvement or diagnostic investigation, since short consultation time is negatively related to patient satisfaction and clinician's health [67,68]. Feeling pressured, stressed, or unable to think adequately is also related to diagnostic and decision mistakes. Consequently, increasing the number of patients to be evaluated by a clinician worked hour seems to be a bad enterprise, both for patients and physicians [69, 70]. HT and interest in client experiences were also related to better medical-patient relationship, and have therapeutic relevance [71].However, if time-saved were to be used for new appointments that would result in even less time for consultation [15].

There are at least two important issues not approached by the reviewed papers: the risk of bias introduced by giving previous information to a clinician, before patient evaluation, and the risk of bias to language misinterpretation by the patient [72]. In HT, a clinician acts as a translator for subjective illness experience to medical language, where clinical reasoning and diagnostic algorithms may work upon [73].

Previous history findings and demographics background is easier to translate to yes and no questions, but HPI may be not. That is probably why clinicians reports HTI "useful parts" to be nominal and non-interpretative information, like allergies and family background. For HPI to be self or software usefully collected, it would be necessary to release the clinician from double checking the correct meaning of each answer. Otherwise, it adds another burdensome routine [52, 58]. At least for the HPI segment of HT, no HTI seems to have achieved a performance equivalent to a clinician, which partially explains why its is not widespread.

Reasoning bias by symptom order presentation (ordination effect and diagnostic momentum) may also cause bias in diagnosing, if HTI results are presented before clinical evaluation [74]. So, HTI may be a good compliment for clinical practice, giving the patient an opportunity to check again his information after consultation, instead of a substitute or time-saving protocol [61].

The expansion of internet, data processing, and computer capacities are producing clinically useful information, but no HTI software has been largely implemented or is in clinical use. The limits of HTIs might not be related to its design, but with a yet no totally understood phenomena of what happens during a diagnostic HT interview. This subject must be better explored by philosophy, information of science and clinicians. Also, the clinical relevance of increasing obtained data for diagnosis, which information is always essential to be retrieved, and its impacts for the medical patient relationship in delegating information for self or lay HTI deserves further clarification.

Our study has several limitations that should be noticed: The systematic review was performed specifically for for HT, and not questionnaire or electronic instruments literature. However, our sample shows evidence of significant redundancy and thematic saturation, implying a good representation of HTI universe, an evidence accepted in qualitative research [75]. Also, we decided to keep ourselves restricted to the MeSH and DeCs thesaurus terms related to HT, so articles reported with other words (like clinical interview, POMR or SOAP) were not included.

LILACS and MEDLINE are North and Latin America based systems, and it may result in a narrow assessment of literature, here represented by a US publication bias, even using five languages Thesaurus operators in the search string. Another possibility for the here presented US bias is the supposed problem for non native English speakers to be accepted by international journals, and publishing restriction for scientific developments made by non-English speaking researchers, limits them to local journals, not included in that databases [76, 77]. US have also been the cradle both of HTI and computer development, and only recently (in a historical perspective) software industry became relevant in other countries.

Conclusions

We conclude that HTI main advantages are probably the result of a standard and systematic approach for HT, especially for nominal and objective information. HTI still do not have a well understood standard model, and a better comprehension of what are the "must not forget to ask" data for general diagnostic reasoning is needed. Clinicians are still the only options to translate subjective complaints to clinical useful data, especially in HPI section of HT, and none of the HTI analyzed solved this gap so far.

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