Health information technology in primary health care in developing countries: a literature review

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Abstract This paper explores the debate and initiatives concerning the use of information technology (IT) in primary health care in developing countries. The literature from 1992–2002 was identified from searches of the MEDLINE, Latin American and Caribbean Health Science Literature Database (LILACS), Cochrane Library and Web of Science databases. The search identified 884 references, 350 of which were classified according to the scheme described by the Pan American Health Organization (PAHO). For the analysis of advantages, problems and perspectives of IT applications and systems, 52 articles were selected according to their potential contribution to the primary health-care processes in non-developed countries. These included: 10 on electronic patient registries (EPR), 22 on process and programmatic action evaluation and management systems (PPAEM) and 20 on clinical decision-support systems (CDS). The main advantages, limitations and perspectives are discussed.

Keywords Primary health care; Information technology; Information systems/utilization; Decision support systems, Clinical/utilization; Medical records systems, Computerized/utilization; Education, Distance; Telemedicine/utilization; Review literature; Developing countries (*source: MeSH, NLM*).

Mots clés Soins santé primaire; Technologie de l'information; Système information/utilisation; Système informatique aide décision clinique/utilisation; Dossier médical informatisé/utilisation; Enseignement à distance; Télémédecine/utilisation; Revue de la littérature; Pays en développement (*source: MeSH, INSERM*).

Palabras clave Atención primaria de salud; Tecnología de la información; Sistemas de información/utilización; Sistemas de apoyo a decisiones clínicas/utilización; Sistemas de registros médicos computarizados/utilización; Educación a distancia; Telemedicina/utilización; Literatura de revisión; Países en desarrollo (*fuente: DeCS, BIREME*).

الكلمات المفتاحية: الرعاية الصحية الأولية؛ تكنولوجيا المعلومات؛ الاستفادة من نُظُم المعلومات؛ الاستفادة من نُظُم دعم القرار السريري؛ نُظُم السجلات الطبية المحوسبة؛ التعليم عن بُعْد؛ الاستفادة من التطبيب عن بُعْد؛ مراجعة الأدبيات المنشورة؛ البلدان النامية. (المصدر: رؤوس الموضوعات الطبية – المكتب الإقليمي لشرق المتوسط)

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Introduction

In health care, especially in developed countries, the use of different types of information technology (IT) has progressed considerably since the beginning of electronic patient registration, leading to improvements in the interfacing and fusion capabilities of a large variety of computer and telecommunication technologies. Such evolution can be attributed partly to the peculiarities of the health-care sector — namely, its scope, its status as a large market for computer businesses, and its need for facilities for information storage and management, improvements in quality of care, and expenditure control, in both the public and private sectors.

The health-care systems of developed countries have generally been in existence for at least two decades longer than those in developing countries and have been accumulating experience in the use of such technologies, especially in primary health care, which has provided relevant lessons regarding the use of IT in the health-care system as a whole. The computerization of medical records in hospitals and health clinics; the use of the Internet for communication and information exchange; the development of magnetic cards for user identification; electronic scheduling systems for appointments, examinations and hospital admissions; and computerized protocols for diagnosis and treatment support are just a few examples. Health IT has facilitated access to health literature, both to online journals, books and databases, and offline to informational CD-ROMs, that support practising professionals.

A recent review of the literature on the computerization process in basic health care between 1980 and 1997 summarizes in its title the current situation, i.e. "*a descriptive feast but evaluative famine*" (*1*). The authors pointed out the lack of research on the impact of IT on the health status of the population, and the methodological limitations in the design of the studies published so far.

In Brazil, as in other developing countries, structural deficiencies due to the current economic situation have led to considerable deficits in social policies — including those related to public health care. Changes in demographic and epidemiological profiles, in urbanization and in the level of industrialization have created a need for new models of health care. Such models attribute an increasing level of importance to primary

health care, the strengthening of which is considered central to the improvement of health-care coverage (*2, 3*).

The goal of the present review is to explore the debate and initiatives concerning the use of IT in primary health care in developing countries.

Methodology
Identification of publications
Publications were identified by an initial generic search using words from any database field (i.e. words from titles, keywords and abstracts) after which all keywords yielding relevant publications were listed. Some of the search terms used were:

- database management systems AND primary health care;
- health information AND primary health care;
- IT AND primary health care;
- information systems AND primary health care;
- software AND primary health care; and
- software AND ambulatory care information systems.

Searches were performed for publication dates ranging from 1992 to 2002, and data sources included MEDLINE, Latin American and Caribbean Health Science Literature Database (LILACS), Cochrane Library and Web of Science. Some additional relevant studies were identified using a demonstration version of EMBASE and from the web site www.hi-europe.info.

Inclusion and exclusion criteria
Duplicate references were excluded, as were references without abstracts, those not specifically related to health, and those that were not concerned with health IT. Publications with abstracts were classified according to the PAHO criteria (Table 1) (*4*). From the PAHO classification, the three categories most closely related to primary health-care practices were selected, i.e. systems for facilities, decision-support systems and electronic patient registration. The decision-support systems were subdivided into two groups: clinical decision-support (CDS) systems and process and programmatic action evaluation and management (PPAEM) systems. The systems initially considered as belonging to the facility category were later reclassified as belonging either to electronic patient registries (EPR) or to PPAEM.

A further selection of abstracts was performed, including those related to the development and/or evaluation of IT within the scope of primary health care, which emphasized their potential contribution to health-care evaluations. Papers included at this stage were assigned to the following categories: benefits, barriers to implementation and improvement requisites.

Results
The search yielded a total of 884 publications (Fig. 1). Of these, 534 (60.4%) were excluded (references that did not include both an abstract and full text (331); those that were duplicated between databases (14); those with no mention of any kind of health IT, beyond opinion articles, editorials and essays on generic issues related to the subject (139); and publications dealing solely with technical specifications for the writing of software, not necessarily for the health sector (50)).

According to the PAHO classification (Table 1), most of the publications identified (27.7%) described the development and/or implementation of information systems at health facilities, including hospitals, clinics, physician's offices and diagnosis and treatment support centres. These information systems were
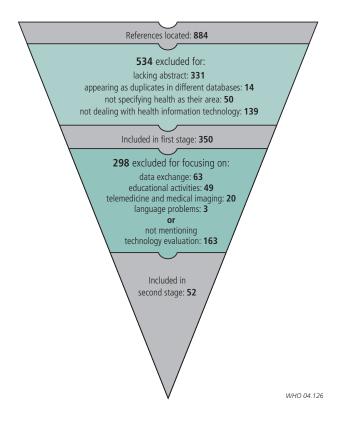
Table 1. **Distribution of health information technology references, according to area of applicability**

Area of applicability[a]	No. of references	%
Systems for health-care facilities	97	27.7
Decision-support systems	81	23.1
Electronic data exchange	66	18.9
Educational activity support	49	14.0
Electronic patient registration	37	10.6
Telemedicine	11	3.1
Medical imaging	9	2.6
Total	**350**	**100**

[a] According to Pan American Health Organization classification.

Fig. 1. **Distribution of information technology references according to exclusion and inclusion criteria**

References located: **884**

534 excluded for:
lacking abstract: **331**
appearing as duplicates in different databases: **14**
not specifying health as their area: **50**
not dealing with health information technology: **139**

Included in first stage: **350**

298 excluded for focusing on:
data exchange: **63**
educational activities: **49**
telemedicine and medical imaging: **20**
language problems: **3**
or
not mentioning
technology evaluation: **163**

Included in
second stage: **52**

WHO 04.126

used for data storage, processing, recovery or diffusion purposes. This group also included articles about systems designed for the management of clinical and administrative information within a specific facility or between different facilities.

The next group (23.1% of the publications identified) was related to decision-support systems that facilitate clinical and administrative decision-making by means of interactive dialogues. These include clinical diagnosis, individual monitoring applications, facility and institution management applications and "virtual health libraries". The third group (18.9%), were publications dealing with electronic data exchange, including general infrastructure designed to allow interaction and information exchange between the users and services and between systems themselves, by means of the Internet and electronic mail. The next group dealt with support systems for educational activity, directed towards distance-learning and

improvement of teaching ability in the education and training of health-care professionals (14.0%). Electronic patient registries were the subject of 10.6% of the publications. These are systems that integrate and promote access (from a single site to multiple locations) to collections of clinical and administrative data concerning the patient, based on a distributed database and including different means of support, such as intelligent optical card technology.

The final group comprised publications related to telemedicine such as support systems for diagnosis teleconferences, transmission of high-resolution images and vital signs for long-distance diagnosis and robotic telesurgery. These subjects accounted for 3.1% of the publications, and medical imaging systems designed to store, process, recover and transmit medical images for 2.6%.

Following a detailed analysis of the 350 abstracts included in Table 1, 135 were excluded. These were publications concerned with data exchange, educational activities, and telemedicine or medical imaging, or because of language problems (three). Of the 215 remaining references, 163 were not concerned with the evaluation of technology (Fig. 1).

We attempted to obtain the full texts of the remaining 52 publications: 45 of them were successfully located, corresponding to 13% of the total. We then proceeded to the identification of advantages, problems and potential solutions related to the use of computerized systems in primary health care. From the reference lists included in the articles, and further searches using other sources, seven more relevant publications were located, giving a total of 52.

Electronic patient registries

When compared to manual registration, the main advantages of electronic patient registries (EPR) are greater accuracy (5) and a higher proportion of correct information (6, 7); time saved in locating information (8); more economical use of financial resources; and greater ease and speed of recovery of patient data (12).

Several articles reported on the limitations of such technologies, highlighting the resistance and difficulties of using EPR among health-care professionals, especially physicians

(13–15). Emphasis was also placed on aspects related to confidentiality of information and respect for privacy, the need for continuing training and support for human resources (16, 17), and the lack of automatic standardization and codification of the data entered (14).

Most authors agreed on the need for a gradual replacement of paper-based registries with electronic ones, as well as on the need for user-friendly interfaces, and for at least minimal training programmes (18, 19).

Process and programmatic action evaluation and management systems

The first group of process and programmatic action evaluation and management (PPAEM) systems identified were those concerning patient referral and "counter-referral activities" (i.e. the return of the patient to his or her physician after specialist consultation) both between different levels of care (e.g. to specialists or hospitals) and, for example, for the electronic return of the results of laboratory examinations. Their main advantages are reliability (7), speed (8) and the optimization of available resources (7).

The second group of applications were those designed for the monitoring of patients linked to specific health programmes, such as immunization at mother and child clinics, antenatal care and diabetes programmes. This monitoring was mainly carried out by means of "notices" generated when patients missed scheduled appointments, and the issuing of pre-appointment reminders. The advantages reported included reductions in registration errors, identification of absentees, integration of prevention and control activities, and detection of risk factors and complications (8, 20–22).

A third set of publications was concerned with the analysis and extraction of selected information from electronic patient registries, allowing the identification of risk factors and groups of at-risk patients and the obtainment of care-quality indicators and their comparison between different health units (23, 24). The authors agreed that such systems could assist with evaluations of morbidity and patterns of drug prescription (25), allow managers to monitor compliance with conduct and norms

Table 2. **Articles dealing with electronic patient registries (EPR)**

Author	Year/country	Subject	Focus
Manchester et al. (13)	1992/USA	Implementation of a hybrid system – manual and electronic	Physician adhesion
Ornstein et al. (9)	1993/USA	System for family physicians	Potentialities
Singh et al. (10)	1994/Sweden	Analysis of patient registry computerization forms	Potentialities
Flygt et al. (6)	1995/Sweden	Evaluation of 1 year of EPR use in primary health care	Performance, costs, usefulness for clinical activity
Chin & Krall (14)	1998/USA	Evaluation of EPR use by group medicine services	Strategy and experience with large-scale implementation
Wager et al. (12)	2000/USA	Impact of EPR on primary health care services	Essential requisites
Blignaut et al. (16)	2001/South Africa	EPR prototype development and implementation in primary health care clinics	Essential requisites
Souther (15)	2001/USA	EPR implementation methodology	Human resources, attributions and motivation
Hassey et al. (5)	2001/England	Validity and utility of EPR	Evaluation methodology
Mangoud & Al-Ruwashed (18)	2002/Saudi Arabia	Description of EPR	Potentialities

Table 3. **Articles dealing with process and programmatic action evaluation and management (PPAEM) systems**

Author	Year/country	Subject	Focus
Assaf et al. (*24*)	1992/USA	Extraction of electronic registry information from different units	Heart health
Branger et al. (*11*)	1992/England	Patient referral and counter-referral	Primary and secondary health care
Ivankovic et al. (*27*)	1993/Croatia	Electronic registry data analysis module	Temporal indicators Comparison between units
*Dewey et al.	1993/USA	EPR[a] implementation with several modules and utilities	Computer on the doctor's desk
*Bergvin et al.	1993/Sweden	Patient counter-referral	Laboratory examinations
Cibulskis et al. (*44*)	1995/Papua New Guinea	Indicator monitoring	Immunization
Szecsenyi et al. (*21*)	1995/Germany	Computerized vigilance system	Influenza
Wilson et al. (*25*)	1995/England	Extraction of electronic registry information from different units	Risk factors for heart disease, asthma and diabetes
Wei et al. (*22*)	1996/USA	Centralized information system for vigilance, evaluation and planning	Maternal and child health
Borowitz (*8*)	1996/USA	Electronic monitoring	Paediatrics
Gaudet (*7*)	1996/USA	Referral to other social services	Elderly patients
*Af Klercker & Zetraeus	1997/Sweden	Evaluation of documents for computerized system development	Common ear, nose and throat infections
Singh et al. (*20*)	1997/India	Application development after implementation	Antenatal care and immunization of infants
*Shiffman et al.	1997/USA	Quality of appointment documentation for electronic medical record	Paediatrics
*Ross	1998/USA	Electronic appointment scheduling	Advantages
Milne et al. (*26*)	1998/Scotland	Extraction of electronic registry information from different units	Morbidity, prescription patterns
Branger et al. (*11*)	1999/England	Evaluation of electronic registry information	Diabetes
Rascon-Pacheco et al. (*28*)	2000/Mexico	Evaluation of surveillance quality	Diabetes
McColl et al. (*29*)	2000/England	Extraction of electronic registry information from different units	Need for application standardization and team training
Adams et al. (*23*)	2000/USA	Data entry in registries at the time of care delivery	Immunization
Letrilliart et al. (*30*)	2000/USA	Automatic diagnosis codification in primary health care for hospital reference	Disease classification for primary health care
Williamson et al. (*17*)	2001/South Africa	District-wide system for health information	Requisites for effective implementation

* Full publication details of references marked with an asterisk are available in the web version only (www.who.int/bulletin).
[a] EPR = electronic patient registries.

regulated between different levels of care (*26*), and optimize the prevention and early detection of risk factors (*27*).

One limitation is the lack of studies evaluating the impact of the use of these systems on quality of care (*11*). Another drawback is the lack of standardization among the different systems which reduces the usefulness of automatically generated indicators (*28*). When data entry is retrospective, there is a tendency to transfer the deficiencies of a manual registry to the computerized registry (*29*). It is often necessary to develop additional system tools, such as, for example, codification of the reasons for appointments (*30*).

Clinical decision-support systems

This category of products includes mainly those that function as computerized protocols for patient management, both for diagnosis and treatment, including electronic prescription and requests for laboratory tests. These may be rule-based systems, cognitive and simulation (Bayesian) systems, or tree-decision systems that could include active patient participation.

Problems such as hypertension and cardiopathies in general (*31*, *32*), asthma (*33–35*), and depression (*36*, *37*) are among the most cited examples of clinical decision-support (CDS) systems. Such health problems, together with prevention programmes, constitute the main reasons for utilization of primary health care, making the adoption of standardized protocols that can be optimized with the support of IT easier (*34*). Positive experiences have been reported to result from implementation of these systems (*38*), including increases in physician adherence to standardized therapeutic plans (*32*, *33*, *39*), cost reduction (*33*), and easier standardization and regulation of requests for secondary and tertiary health care and for examinations (*40*), thus reducing variability between services.

From an administrative point of view, it is possible to obtain greater adhesion to public policies (*41*). Standardized

Table 4. **Articles dealing with clinical decision-support (CDS) systems**

Author	Year/country	Subject	Focus
Pinciroli et al. (*31*)	1992/Italy	Computerized protocol for patient management	Cardiopathies and hypertension
*Margolis et al.	1992/Israel	Computerized protocol for patient management	Common problems in childhood
Alonso Lopez et al. (*40*)	1993/Spain	Electronic prescription	Medication for patients with chronic illness
*Gordon et al.	1994/Ireland	Computerized protocol for prescription	Oncology
*Safran	1995/Germany	Evaluation of physician and nurse adhesion to computerized protocols	Human immunodeficiency virus
*Hobbs	1996/England	Computerized protocol for patient management	Hyperglycaemia
Austin et al. (*33*)	1996/USA	Computerized protocol for patient management	Asthma
Kobak et al. (*36*)	1997/USA	Evaluation of the validity and clinical utility of a computerized system for telephone interviews	Mental conditions
Khoury (*34*)	1998/USA	Evaluation of adhesion to computerized protocols	Aspirin for heart disease; influenza vaccination for the elderly; asthma management
Chuang (*41*)	1998/People's Republic of China	Diagnosis support system	Requests for laboratory tests
*Peters & Davidson	1998/USA	Impact evaluation of computerized patient management system	Diabetes
*Tirol & Menezes	1998/Brazil	Diagnosis support system	Psychiatric interviews
Bradley & King (*38*)	1998/USA	Management system for pregnant women	Antenatal care
*Gerbert & Bronstone	2000/USA	Diagnosis screening support system	Skin cancer
Starkey & Michaelis (*32*)	2000/England	Computerized protocol for patient management	Ischaemic heart disease
*Fitzmaurice & Hobbs	2000/England	Computerized protocol for patient management	Use of oral anticoagulants
Unutzer et al. (*37*)	2001/USA	Computerized protocol for patient management	Depression among the elderly
Papshev & Peterson (*39*)	2001/USA	Electronic prescription	Advantages and disadvantages
FitzHenry et al. (*42*)	2002/USA	Use of medical history in electronic records to justify the selected procedure	Requests for examinations
Eccles et al. (*35*)	2002/England	Computerized evaluation of protocol use	Asthma and angina

* Full publication details of references marked with an asterisk are available in the web version only (www.who.int/bulletin).

programmes for the early detection of diseases would tend to have greater diagnostic value thus contributing towards the promotion of equity, and the reduction of complications and costs related to more complex treatments (*42*).

As with the other technologies reviewed, the limitations were related to the low adhesion rates among health-care professionals, the great variety of systems available which hindered evaluation of their validity and reproducibility, and difficulties in standardization and integration with other applications (*43*).

Discussion

Given the rapid progress in health IT in developed countries and in spite of the differences in infrastructure and health facilities, it is useful to extract some relevant lessons for developing countries, especially those that are trying to design health informatics policies for primary care services. MEDLINE, LILACS, the Cochrane Library and the Web of Science were the main sources of published papers, which mainly reported the experiences of developed countries. One possible gap in the present review is related to the fact that papers from non-indexed journals (i.e. those not registered in international databases, such as MEDLINE) could not be identified. We tried to minimize this potential bias by including both papers that reported the

experiences in developed countries and experiences in developing countries.

Even with the aid of the PAHO classification, a detailed examination revealed that a single paper may simultaneously encompass several categories, such as electronic patient registries, clinical and management decision-support systems, and process and programmatic action evaluation tools. A further limitation was that many references did not provide abstracts and full text (37%), a possible source of selection bias. However, we consider that the most important papers were included because their abstracts were available from indexed journals. Many papers were focused solely on opinions on the advantages and disadvantages of the use of IT, and lacked any evaluation of their concrete application to health care. This may be partly attributed to the search strategy adopted, which was based on widely inclusive keywords: almost 200 of the publications found were not related to application of IT to the health sector.

There is a consensus concerning the usefulness of computerized systems in primary health care, especially for promoting greater efficiency in management processes. Although studies evaluating the impact of such technologies on indicators of health and quality of care are still rare, most authors agree that positive effects attributed to the implementation of the

different systems and applications can be maintained during routine use and improved through monitoring. With regard to EPR the main lessons are related to system security, especially the maintenance of privacy and confidentiality. The interconnection between different systems and software is another relevant issue. It would be imperative to adopt standards for vocabulary, contents, images, objects and communication tasks.

The finding of a low level of adhesion among physicians to protocols for computerization in primary health care is almost ubiquitous. Although the reasons have yet to be explained, it is possible that the autonomy regarding clinical decisions — a paradigm of traditional medical practice — must be made to coexist with regulated and more cooperative activities, although this will be no easy task. Furthermore, a substantial number of the articles reviewed stressed the need for continued motivation and training for all team members as an important requisite for the success of any initiative in this area (*19*). This lesson would be very relevant to the establishment of IT in primary health-care systems. It may be pertinent here to quote the reflections by Branco (*2*) on the significance of training, that is, the amplification of knowledge: "… knowledge of the logic behind health information production and flux must be provided to all persons involved, and should include the understanding of the goals of the systems to which they have access, and of the utilization possibilities of the information produced …"

Another consensual aspect was the difficulty of finding adequate methods for evaluation, given the enormous variety of applications and contexts in which IT is used. Similarly to the situation for medicinal drugs some 40 years ago, IT has not yet been regulated to ensure its safety and efficacy. Thus, every facility or organization, in order to fulfil its particular needs, "orders" specific products to provide a solution to specific problems, reproducing the specialists' view of health in their administrative and evaluative demands. The results of specific evaluations lack external validation, because health services are extremely variable in terms of population seen, team composition, qualifications, motivation and extent of computerization. This hampers comparability and generalizability (*37*). In addition, the complexity of clinical and organizational management processes is often underestimated (*44*).

In the consideration of CDS systems in particular, emphasis has been placed on quality and safety concerns. The main drawbacks of such systems include the lack of consensual standardization for a number of conditions, the probably negative effect on the physician–patient relationship (for example, the perception that computers take over the physician's role), the difficulty in addressing complex conditions, the profusion of different systems with different formats, and the need for training and support (*1*).

The most important lesson comes from the trends in adoption of national health information systems. Countries such as Australia, Canada and England have recently been heavily involved in implementing large information systems in an unprecedented effort towards standardization and the incorporation of new technologies (*48–50*). Scotland is another example; it maintains a single information system that functions in 75% of its services, thus facilitating the comparison of data and the extension of benefits resulting from its improvement (*26*). Brazil is currently planning a national health information policy that should lead to a significant improvement in public health care, especially in primary health-care services. If the developing countries learnt the important lessons provided by the developed countries, they would be able to reduce the time and resources required to increase IT utilization. ■

Conflicts of interest: none declared.

Résumé

Technologies de l'information et soins de santé primaires dans les pays en développement : une revue de la littérature

Le présent article examine les débats et les initiatives concernant l'utilisation des technologies de l'information dans le cadre des soins de santé primaires dans les pays en développement. Les articles publiés en 1992-2002 ont été identifiés au moyen d'une recherche dans plusieurs bases de données - MEDLINE, LILACS (Latin American and Caribbean Health Science Literature Database), Cochrane Library et Web of Science. La recherche a fourni 884 références, dont 350 ont été classées selon le système décrit par l'Organisation panaméricaine de la Santé. Pour l'analyse des avantages, des limites et des perspectives des applications et systèmes informatiques, 52 articles ont été sélectionnés pour leur contribution potentielle aux processus de soins de santé primaires dans les pays non développés : 10 concernaient les dossiers médicaux informatisés, 22 les systèmes d'évaluation et de gestion des processus et de l'action programmatique et 20 les systèmes d'aide à la décision clinique. L'article présente une discussion des principaux avantages, limites et perspectives de ces applications et systèmes.

Resumen

Tecnologías de la información sanitaria en la atención primaria en los países en desarrollo: una revisión de la literatura

En este artículo se analizan el debate y las iniciativas relacionadas con el uso de las tecnologías de la información (TI) en la atención primaria en los países en desarrollo. Se buscaron publicaciones del periodo 1992–2002 a través de MEDLINE, de la Base de Datos de la Literatura Latinoamericana y del Caribe en Ciencias de la Salud (LILACS), de la Biblioteca Cochrane y de la base de datos Web of Science. Se localizaron 884 referencias, 350 de las cuales se clasificaron conforme al sistema descrito por la Organización Panamericana de la Salud (OPS). Al objeto de analizar las ventajas, los problemas y las perspectivas de las aplicaciones y los sistemas de IT, se seleccionaron 52 artículos de acuerdo con su contribución potencial a los procesos de atención primaria en los países no desarrollados. Esa cifra se desglosa así: 10 artículos sobre los registros electrónicos de pacientes, 22 sobre los sistemas de evaluación y gestión de procesos y acciones programáticas, y 20 sobre los sistemas de apoyo a las decisiones clínicas. Se examinan las principales ventajas, limitaciones y perspectivas.

ملخص

الاستفادة من تكنولوجيا المعلومات الصحية في الرعاية الصحية الأولية في البلدان النامية: مراجعة الأدبيات المنشورة

مـــلخص: تستطلع هذه الورقة البحثية المناقشات والمبادرات المتعلقة باستخدام تكنولوجيا المعلومات في مجال الرعاية الصحية الأولية في البلدان النامية. وتم تحديد الأدبيات التي نُشرت في الفترة ما بين عام ١٩٩٢ وعام ٢٠٠٢ من خلال البحث في خط استرجاع النشريات الطبية "شبكة ميدلاين"، وقاعدة معطيات دراسات العلوم الصحية لأمريكا اللاتينية ومنطقة البحر الكاريبــي (ليلاكس)، ومكتبة كوكران، وشبكة قواعد المعطيات العلمية. وقد حدّد البحث ٨٨٤ مرجعاً، وتم تصنيف ٣٥٠ مرجعاً منها وفقـاً للبرنامج المحدد

من قبل منظمة الصحة للبلدان الأمريكية. وتم انتقاء ٥٢ مقالاً وفقاً لإسهاماتها المحتملة في عمليات الرعاية الصحية الأولية في البلدان غير النامية، وذلك بُغْيــة تحليــل مزايـــا ومشاكل وآفـاق تطبيقــات ونُظُم تكنولوجيا المعلومــات. وقد تضمَّنت هــذه المقـــالات: ١٠ مقالات حول السجلات الإلكترونية للمرضى، و٢٢ مقالاً حول نُظُم إدارة وتقييم إجراءات وأنشطة البرنامج، و٢٠ مقالاً حول نُظُم دعم القرار السريري. ونوقشت المزايا الرئيسية والقيود والآفاق المستقبلية.

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