# Impacts of e-health on the outcomes of care in low- and middle-income countries: where do we go from here?

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**Abstract** E-health encompasses a diverse set of informatics tools that have been designed to improve public health and health care. Little information is available on the impacts of e-health programmes, particularly in low- and middle-income countries. We therefore conducted a scoping review of the published and non-published literature to identify data on the effects of e-health on health outcomes and costs. The emphasis was on the identification of unanswered questions for future research, particularly on topics relevant to low- and middle-income countries. Although e-health tools supporting clinical practice have growing penetration globally, there is more evidence of benefits for tools that support clinical decisions and laboratory information systems than for those that support picture archiving and communication systems. Community information systems for disease surveillance have been implemented successfully in several low- and middle-income countries. Although information on outcomes is generally lacking, a large project in Brazil has documented notable impacts on health-system efficiency. Meta-analyses and rigorous trials have documented the benefits of text messaging for improving outcomes such as patients' self-care. Automated telephone monitoring and self-care support calls have been shown to improve some outcomes of chronic disease management, such as glycaemia and blood pressure control, in low- and middle-income countries. Although large programmes for e-health implementation and research are being conducted in many low- and middle-income countries, more information on the impacts of e-health on outcomes and costs in these settings is still needed.

**Abstracts in عربي, 中文, Français, Русский and Español at the end of each article.**

## Introduction

Difficulties in achieving health targets, such as the Millennium Development Goals, and growing consumer demand have forced health planners to look for innovative ways to improve the outcomes of health-care and public-health initiatives while controlling service costs. Health systems must address diverse population needs, provide high-quality services even in remote and resource-poor environments, and improve training and support for health-care workers. Services that can be scaled up and are reliable (despite any infrastructural deficits) and cost-effective are in high demand worldwide, especially in low- and middle-income countries. E-health systems have the potential to support these objectives in ways that are both economically viable and sustainable.

E-health tools are designed to improve health surveillance, health-system management, health education and clinical decision-making, and to support behavioural changes related to public-health priorities and disease management.[1] Some systematic evidence of the benefits of e-health in general,[2–4] and of specific areas of e-health, such as decision-support systems for clinicians[5,6] or patient-targeted text messaging,[7–10] already exists. The objectives of the current review were to highlight gaps in our knowledge of the benefits of e-health and identify areas of potentially useful future research on e-health. There were three main topics of interest: outcomes among patients with chronic health conditions, the cost-effectiveness of various e-health approaches, and the impact of e-health in low- and middle-income countries.

## Evidence collection

We focused on evidence for the impact of e-health in three areas identified by prior reviews: (1) systems facilitating clinical practice; (2) institutional systems, and (3) systems facilitating care at a distance.[3,4]

Systems facilitating clinical practice include electronic medical record systems, picture archiving and communication systems for managing digital medical images, and laboratory information systems that automate laboratory workflow and reporting. Institutional systems include systems for health information and management, early disease warning and disaster management. These systems aggregate data from health facilities and patients to create community-wide views of disease trends and clinical activity.[11,12] Systems facilitating care at a distance include the use of a short message service (SMS) or other text messaging to improve outcomes through patient reminders; between-visit monitoring and/or health education; videoconferencing facilities for live consultations and asynchronous communication between clinicians, and automated telephone calls with recorded messages (sometimes called interactive voice response calls).

Multiple systematic reviews have been conducted on some of these e-health approaches, whereas the rest are barely

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covered in the peer-reviewed literature. To provide a rapid updated summary of the evidence for decision-makers, we conducted a scoping review by gathering information through targeted scans of scientific databases, reviews of reference lists and conversations with other experts.[13] Emphasis was given to projects that provided insights on the impact of e-health on the outcomes of chronic disease management and the scalability of e-health tools and/or data relevant to low- and middle-income countries. Throughout the review we highlight priorities for future research.

## Systems facilitating clinical practice

### Examples

In developed countries, usage of electronic medical-record systems varies widely. For example, such systems are used for nearly all primary care patients in Denmark, the Netherlands, Sweden and the United Kingdom of Great Britain and Northern Ireland, but for less than 20% of such patients in the United States.[14,15] In low- and middle-income countries, electronic medical record systems, such as Dream, OpenMRS, Baobab Health (in Malawi) and the ZEPRS antenatal system (in Zambia), are available in some larger specialist hospitals but are rarely available in smaller health centres.[16–19] The use of picture archiving and communication systems in low- and middle-income countries is, however, increasing rapidly.[20–22]

### Impact on outcomes and health-care costs

A recent review of reviews of decision-support systems found that, although 52 (57%) of 91 unique studies demonstrated improved practitioner performance, only 25 (30%) of the 82 in which patient outcomes were assessed showed benefits to patient outcomes.[5] In a series of meta-analyses, the prompting of clinicians via electronic medical record systems was found to increase the number of guideline-recommended preventive care services that were performed by a mean of 13%.[6] In Kenya, order rates for overdue CD4+ lymphocyte counts were 53% (or even 63% if summaries that could not be printed were excluded) in a clinic that used computer-generated reminders produced in an electronic medical record system, but only 38% in a control clinic that had no such system.[23] Although in a systematic review published in 1997 most studies of picture archiving and communication systems were found to cite the benefits of such systems, evidence of improvements in health outcomes, efficiency or costs was nil.[24] There also appeared to be no convincing proof that digital X-ray images were at least as good as conventional X-ray films in terms of diagnostic accuracy.[24] Information on the impact of laboratory information systems on outcomes is also fragmentary, although the use of such systems within the National Peruvian Tuberculosis Programme was associated with significant reductions in reporting errors and delays.[25] A 2008 study involving over 5000 health-care organizations in the United States showed that, while hospitals were implementing laboratory information systems at a steady rate, many lacked fully integrated administration and clinical application modules or fail-safe strategies for handling downtime events.[26]

Very little has been published on the costs of implementing and maintaining electronic medical record systems and decision support systems in low- and middle-income countries. The adoption of specification standards may drive down implementation costs as buyers choose or build systems with compatible components, rather than being limited to proprietary systems.[27] The use of picture archiving and communication systems may lead to reductions in hospital stays and increased clinical efficiency, which, in turn, may also reduce costs.[28] The web-based laboratory information system used for tuberculosis care in Peru, eChasqui, was estimated to cost only 1% of the entire budget of the National Peruvian Tuberculosis Programme.[29] Electronic picture-archiving and communication systems could be particularly cost-effective in low- and middle-income countries, where access to film and chemicals is often difficult. The second opinions made possible via easily shared electronic images could also improve patient outcomes. However, in areas with intermittent power supplies and unreliable infrastructure, relying on servers and computers for radiographic images involves considerable risks. The scale-up of electronic systems for picture archiving and communication to be implemented across regions or nations requires the resolution of many practical problems, such as widespread staff training and the provision of adequate network bandwidth.[30] To be useful, the large-scale implementation of both picture archiving and communication systems and of laboratory information systems in low- and middle-income countries calls for effective off-site data backup.

## Institutional systems

### Examples

Examples of community information systems used in low- and middle-income countries include the District Health Information System in Malawi, Rwanda and South Africa, which collects data on routine health-care events from clinics. Other examples include the TRACnet system in Rwanda, which aggregates data on the care of patients infected with human immunodeficiency virus (HIV) from large numbers of clinics, and the Monitoring, Evaluation, and Surveillance Interface in Haiti, which performs a similar function.[31] The Mekong Basin Disease Surveillance system, which covers various regions of six countries, tracks malaria, dengue, cholera and other diseases. The *Sistema Integrado de Gestão e Atenção à Saúde* [Integrated System for Health Management and Care], which operates in the Brazilian city of São Paulo, is an example of a large health information and management system that also manages patient flow.[32,33] One health information system for clinical care, public health reporting and drug supply management covers the whole of Belize.[32] Few low- and middle-income countries have adequate operability between their community-level systems of health information and other information systems,[32,33] although this forms part of the planned e-health architecture in countries like Rwanda.[12]

The Bill & Melinda Gates Foundation commissioned a survey of efforts to deploy systems for health information and management in low- and middle-income countries.[32] A case study from Brazil showed that, by adopting standards and defining a proper architecture, it is possible to scale up such systems to a multi-institutional level.[32,33] More recently, the *Sistema Integrado* began integrating with three accredited laboratory systems in São Paulo city using standards such as HL7 (Health Level Seven) and LOINC® (Logical Observation Identifiers Names and Codes).[34]

### Impact on outcomes and costs

The District Health Information System used in Malawi, Rwanda and South Africa may have limited impact on outcomes in settings where data quality is poor. Unfortunately, many such settings exist in low- and middle-income countries because of a general paucity of effective data-collection tools and training for data collectors in health facilities.[35–37] More data exist regarding the potential impact of the District Health Information System on efficiency and costs than on the system's potential impact on the outcomes of care. Preliminary results indicate that, following the implementation of the *Sistema Integrado*, optimization of resource use and patient flow led to a 35% increase in the productivity of outpatient services in São Paulo city.[32] After the same system was implemented in the Brazilian city of Campinas, health officials there saw a 30% increase in patient visits without the need for any additional human resources.[32] The *Programa Mãe Paulistana* [São Paulo Mothers' Programme], which is largely based on the *Sistema Integrado*, has managed the health information on more than 440 000 pregnant women and 460 000 babies in São Paulo city. Since this programme's inception in 2006, the proportion of pregnant women in the programme area who complete all six scheduled prenatal visits has increased from 10% to 80%, transmission of syphilis and maternal deaths from hypertension have decreased, and the percentage of children visited by a health-care worker within 15 days of birth has increased from 15% to 82%.[38] However, since many other administrative and demographic changes have taken place in the programme area over this period, further studies are required to define the health benefits specifically attributable to the *Programa Mãe Paulistana*. Moreover, the data collected so far have focused primarily on productivity and treatment quality, and more research on the impact of the institutional systems on health outcomes and the overall cost of care is needed.

## Systems facilitating care at a distance

### Examples

In a recent World Health Organization Global mHealth Survey, 60% of high-income countries and 30% of low- and middle-income countries reported some use of SMS messages or other mobile health communication tools for improving treatment compliance.[39] The related programmes in low- and middle-income countries address a variety of priority health concerns, including H1N1 influenza virus infection, HIV infection, vaccination, reproductive health and management of chronic illness.[39,40] Large-scale implementations of live "telehealth" programmes include the Ontario Telemedicine Network in Canada, Kaiser Permanente programmes in Kaiser Permanente in the United States, and programmes offered throughout Mexico via the federal *Centro Nacional de Excelencia Tecnológica en Salud* [National Centre for Excellence in Technology in Health].[41–43] Large-scale implementations of programmes that use a "store and forward" approach to accommodate intermittent telephone connectivity include the Swinfen Trust and iPath models, both of which are in use in several low- and middle-income countries.[44,45] The COSMOS model is being implemented in parts of Chile for the care of patients with type 2 diabetes via "interactive voice response" calls, and similar calls are being made via the CarePartner model for the management of non-communicable diseases in parts of Honduras, Mexico and the United States.[46–48]

### Impact on outcomes and health-care costs

Literature reviews indicate that SMS messages and other tools for communicating with patients between medical visits can improve health behaviours and physiological outcomes.[7–10] In a review of seven intervention studies, including four randomized trials, text messaging showed significant promise for improving adherence rates.[7] Controlled evaluations of SMS-based appointment reminders implemented in several countries, including Australia, Brazil, China and the United Kingdom, gave mixed results.[9] In a recent randomized trial, both text-message reminders and live telephone calls improved attendance rates for chronic disease follow-up among patients in Malaysia, with no statistically significant differences in impact between the two communication methods.[49] In Kenya, text messages to health workers significantly improved their adherence to guidelines for malaria treatment.[50]

Studies on the effectiveness of SMS messages for health promotion have also shown improvements in the outcomes of care.[51–53] In a trial of smoking cessation support that included 5800 participants, the percentage of participants who had quit smoking (verified biochemically) had more than doubled 6 months after a "txt2stop" intervention.[52] The results of other controlled trials indicate that SMS messages can help increase weight loss, physical activity and sunscreen use, as well as improve other outcomes.[54–56] Evidence for the long-term maintenance of such beneficial health behaviours is, however, lacking. Studies on the use of SMS messages in support of the self-management of diabetes show potential for improving health behaviours and physiological control.[8–10] Asthma peak flow monitoring can also be improved by text-based interventions,[57] but a study of the home monitoring of blood pressure by patients with hypertension showed that such interventions had no significant effect.[58]

Benefits, in terms of diagnostic accuracy, reduced waiting times, better referral management and greater satisfaction with services, have been observed in most studies on the use of "asynchronous telehealth", in which clinically important digital samples (e.g. still images, video, audio or text files) and relevant data are collected in one location and transmitted for interpretation by health professionals working at a remote site.[59] Although the evidence indicates that this approach leads to a reduction in the number of in-person visits, evidence of impact on other outcomes is lacking. In six of 14 trials of asynchronous telehealth interventions, declines in blood haemoglobin A1c concentration were moderately or substantially greater in the intervention group than in controls.[60]

Trials of "interactive voice response" calls that were part of the CarePartner programme in the United States and low- and middle-income countries demonstrated that such calls led to significantly better self-care and physiological outcomes, including better control of glycaemia and blood pressure.[47,61] In a recent randomized trial of self-management among patients with poorly controlled hypertension in Honduras and Mexico, use of "interactive voice response" calls was associated with a decrease in systolic pressure (by a mean of a 8.8 mmHg) and improvements

in the patients' perceived health, depressive symptoms and medication-related problems.[62] Such calls may be an important alternative to SMS messages among patients with low literacy or when the intervention to promote a behavioural change calls for more interactivity than is achievable with SMS.

In a meta-analysis of 21 randomized trials that included 5715 patients who had suffered heart failure, the cost per patient of treatment including remote monitoring was about 300–1000 euros less than the cost of more conventional treatment. These cost savings, combined with a modest gain of 0.06 of a quality-adjusted life-year per patient, indicated that remote patient monitoring was worthwhile.[63] Telemedicine applications such as "teledermatology" have also shown promise as cost-saving services, with outcomes at least as good as those observed with conventional care.[64]

With the worldwide explosion in the use of mobile phones as well as growing internet access through mobile data services, low- and middle-income countries increasingly have the opportunity to benefit from SMS-based services, live and asynchronous telemedicine, and interactive voice response calls. These services can address the major problems of access to care and the support of behavioural changes that will benefit health. Studies on the impact of such services on maternal and child health would be extremely valuable in the development of policies against some major causes of morbidity and mortality in low- and middle-income countries. Between-visit monitoring systems that result in much more frequent patient contact run the risk of increasing the use and cost of health services, as the often relatively crude data streams may lead clinicians to conduct telephone or in-person follow-ups for potentially minor or self-limiting conditions. Better data on both the positive and negative cost implications of mobile health services in low- and middle-income countries are badly needed.

# Discussion

## Limitations of the review

The current report is based on an author-driven review of published studies as well as the authors' experience with large-scale implementations that have not been described in the published literature. The authors have had considerable experience in e-health research and implementation projects and represent institutions in Africa, Asia, Europe and South and North America. Nevertheless, the current review was not systematic and the results probably under-represent innovative work that has not been described in the peer-reviewed literature or by professional organizations.

As is typical of scoping reviews, the quality of the source materials was not systematically evaluated using the tools employed by more exhaustive approaches to evidence synthesis.[65] Peer-reviewed studies with negative findings are probably under-represented because such studies are less likely to be published. Although several of the largest implementation projects discussed above come from low- and middle-income countries, the scientific evidence for the impact of e-health continues to be dominated by studies in industrialized nations. Studies that evaluate the cost-effectiveness of e-health tools in low- and middle-income countries are particularly under-represented in the published literature. Rigorous trials to evaluate the impacts of such tools on outcomes and treatment costs in low- and middle-income countries should be a priority for future research.

Buntin et al. have indicated that 92% of recent articles on e-health reached generally positive conclusions.[66] However, few studies clearly identify the features of interventions that are more likely to be effective. Patient communication via SMS messages, interactive voice response calls or other modalities is more likely to have an effect if the content is theoretically driven, and culture-specific factors may well influence uptake.[8,67] Ultimately, independent development streams will need to be integrated to produce interoperable services that have standardized infrastructures and produce information that is useful to patients, clinicians and public health agencies.

## Implications for large implementation projects

Deploying community-wide systems is much more complex than deploying smaller or short-term pilot projects, since, to avoid fragmentation, poor communication and poor interoperability, integration with existing systems becomes vital. Apart from the obvious need for a good infrastructure for general communications and information technology, systems intended to work in large settings need to embody an architecture that supports unique identifiers for patients, as well as open standards for data coding and exchange, to make it possible to integrate the novel systems with existing information systems and other new initiatives. Deploying an e-health tool in large settings requires a high degree of organizational skill and administrative systems for the ongoing training and supervision of health-care professionals where the tool is to be used. Since effective allocation of scant health resources is a major priority in low- and middle-income countries, evidence regarding the short-term impact of e-health systems on outcomes and costs (i.e. the returns on investment) is critical if decision-makers are to remain committed to the system's support.

## Directions for research

Large randomized trials, such as those by Free et al.[52] and Zurovac et al.,[50] provide strong evidence of the efficacy of e-health solutions and their potential impact on outcomes. However, highly controlled studies fail to answer questions about the reach of e-health in vulnerable communities or whether such systems can be adopted, scaled up and maintained outside the environments in which they were originally studied. New approaches to implementation science, emphasizing both qualitative and quantitative methods, community-based participatory research, and organizational theory can complement controlled trials and ensure that e-health systems are relevant and flexible enough to adapt to multiple environments.[68] In particular, systems facilitating clinical care (e.g. electronic medical record systems) and institutional-level services (e.g. laboratory information systems) are difficult to evaluate, since appropriate designs require randomization at the facility level, which in turn requires involvement of multiple facilities and potentially thousands of patients. Traditional, large, multi-site trials are expensive and can take years to produce information. Investment in such studies should be carefully weighed against the funding of larger numbers of smaller and innovative (albeit less definitive) studies of solutions adapted to different cultures and environments. Also, "step-wedge" designs, in which software or improved functionality is gradually rolled out to new sites, can be more efficient.

Preliminary evidence shows that e-health systems can have a beneficial impact on the process of clinical care in low- and middle-income countries. However, more studies, particularly to examine the key information needs of health-care workers as well as the effects of e-health services on patient outcomes, are required in resource-poor settings. Research focused on large-scale implementation should address how an e-health architecture can help connect disparate health information systems, how interoperability can support co-ordination between multiple points of care, and how this coordination can improve health outcomes. Given the encouraging evidence regarding the benefits of mobile health tools, studies of their costs and impact on outcomes in low- and middle-income countries should be a priority. ■

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## ملخص

### آثار الصحة الإلكترونية على حصائل الرعاية في البلدان منخفضة ومتوسطة الدخل: ما الذي يتعين علينا فعله تاليًا؟

تضم الصحة الإلكترونية مجموعة متنوعة من أدوات المعلوماتية التي تم تصميمها لتحسين الصحة العمومية والرعاية الصحية. ولا تتوفر سوى معلومات قليلة عن آثار برامج الصحة الإلكترونية، وبالأخص في البلدان منخفضة ومتوسطة الدخل. ولذلك، أجرينا استعراضًا دقيقًا للأبحاث المنشورة وغير المنشورة بغية التعرف على البيانات الخاصة بتأثيرات الصحة الإلكترونية على الحصائل الصحية وتكاليفها. وانصب التركيز على تحديد الأسئلة التي يتم الإجابة عنها لإجراء بحوث بشأنها في المستقبل، وبالأخص حول المواضيع ذات الصلة بالبلدان منخفضة ومتوسطة الدخل. وبرغم ما تحظى به أدوات الصحة الإلكترونية الداعمة للممارسات السريرية من اختراق متنام على الصعيد العالمي، يتوفر المزيد من البيّنات حول فوائد الأدوات التي تدعم القرارات السريرية ونظم المعلومات المختبرية مقارنة بتلك التي تدعم أنظمة الأرشفة بالصور والاتصالات. وتم بنجاح تنفيذ نظم المعلومات المجتمعية لترصد الأمـراض في العديد من البلدان منخفضة ومتوسطة الدخل. وبرغم النقص في المعلومات الخاصة بالحصائل بشكل عام، وثق أحد المشروعات الضخمة في البرازيل آثارًا ملحوظة على كفاءة النظام الصحي. كما وثقت استعراضات التحاليل والتجارب الصارمة فوائد الرسائل النصية في تحسين حصائل مثل الرعاية الذاتية للمرضى. واتضح أن الرصد الآلي للهواتف ومكالمات دعم الرعاية الذاتية تؤدي إلى تحسين بعض حصائل إدارة الأمراض المزمنة مثل سكر الدم والتحكم في ضغط الدم في البلدان منخفضة ومتوسطة الدخل. وعلى الرغم من إدارة برامج ضخمة لتنفيذ الصحة الإلكترونية وأبحاثها في العديد من البلدان منخفضة ومتوسطة الدخل، لا تزال هناك حاجة إلى مزيد من المعلومات عن آثار الصحة الإلكترونية على حصائل هذه المواقع وتكاليفها.

## 摘要

### 电子卫生对中低收入国家医疗护理结果的影响：何去何从？

电子卫生涵盖各种各样设计用以提高公众健康和卫生保健的信息学工具。有关电子卫生方案的影响的可用信息很少，尤其是在中低收入国家。因此，我们审查一定范围的发表和未发表的文献，确定电子卫生对健康状况和成本的影响数据。重点在于确定未来研究的悬而未决的问题，特别是中低收入国家的相关主题。虽然支持临床实践的电子卫生工具已经日益在全球渗透，但是支持临床决策和实验室信息系统的工具的好处得到的证据比支持图片存档和通信系统的工具更多。社区疾病监测信息系统已成功地在一些中低收入国家实施。虽然普遍缺乏效果信息，巴西的一个大型项目对医疗系统效率的显著影响却是有据可查。Meta分析和严格的试验记录了短信息在改善医疗效果方面的益处，如病人的自理。电话自动监测和自理支持电话显示其有助于改善中低收入国家一些慢性疾病管理的成果，如血糖和血压控制。虽然许多中低收入国家正在开展电子卫生实施和研究的大型方案，仍然需要更多有关电子卫生在这些情况下成果和成本影响方面的信息。

## Résumé

### Impacts de la télésanté sur les résultats sanitaires dans les pays à revenu faible et moyen: quelle direction prendre?

La télésanté couvre un ensemble diversifié d'outils informatiques conçus pour améliorer la santé publique et les soins de santé. Peu d'informations sont disponibles sur les impacts des programmes de télésanté, en particulier dans les pays à revenu faible et moyen. Nous avons donc effectué une étude exploratoire de la documentation publiée et non publiée pour identifier les données relatives aux effets de la télésanté sur les résultats et les coûts sanitaires. L'accent a été mis sur l'identification des questions sans réponse pour la recherche future, en particulier sur des sujets pertinents pour les pays à revenu faible et moyen. Bien que la pénétration des outils de télésanté assistant la pratique clinique progresse au niveau mondial, on dispose de plus de preuves des avantages procurés par les outils assistant les décisions cliniques et les systèmes d'information de laboratoire que de ceux assistant l'archivage d'image et les systèmes de communication. La mise en œuvre de systèmes d'information communautaires pour la surveillance des maladies a été réalisée avec succès dans plusieurs pays à revenu faible et moyen. Bien que les informations relatives aux résultats fassent en général défaut, un grand projet au Brésil a exposé de manière documentée les impacts notables sur l'efficacité du système sanitaire. Des méta-analyses et des essais rigoureux ont exposé de manière documentée les avantages de la messagerie texte pour l'amélioration des résultats, comme ceux des soins auto-administrés. Il a été démontré que le suivi téléphonique automatisé et les appels d'assistance aux soins auto-administrés amélioraient certains résultats de la gestion des

maladies chroniques, comme le contrôle de la glycémie et de la tension artérielle dans les pays à revenu faible et moyen. Bien que de grands programmes de mise en œuvre et de recherche en termes de télésanté soient menés dans de nombreux pays à revenu faible et moyen, on a besoin de plus d'informations sur les impacts de la télésanté en termes de résultats et de coûts dans ce contexte.

## Резюме

### Влияние "электронного" здравоохранения на результаты лечения в странах с низким и средним уровнем дохода: куда мы движемся?

"Электронное" здравоохранение включает в себя набор разнообразных информационных инструментов, созданных для повышения уровня общественного здравоохранения и медицинского обслуживания. Имеющейся информации о воздействии программ "электронного" здравоохранения, особенно в странах с низким и средним уровнем дохода, недостаточно. В связи с этим мы провели обзорное исследование как изданной, так и неиздающейся литературы, чтобы установить влияние "электронного" здравоохранения на результаты и стоимость лечения. Акцент был сделан на выявлении нерешенных вопросов для будущих исследований, особенно касающихся стран с низким и средним уровнем дохода. Хотя внедрение поддерживающих клиническую практику инструментов "электронного" здравоохранения растет в глобальных масштабах, согласно полученным данным, большей эффективности позволяют добиться тех из них, которые применяются для оказания поддержки при принятии клинических решений и в использовании лабораторных информационных систем, в сравнении с применяемыми для архивирования изображений и организации систем связи. В ряде стран с низким и средним уровнем дохода успешно реализованы общественные информационные системы наблюдения за распространением заболеваний. Несмотря на то, что информации о результатах, как правило, недостаточно, заметное влияние на эффективность системы здравоохранения было зафиксировано в ходе реализации крупного проекта в Бразилии. Мета-анализ и тщательные исследования зафиксировали эффективность применения текстовых сообщений для улучшения таких результатов, как самообслуживание пациентов. В странах с низким и средним уровнем дохода улучшение результатов ведения хронических больных, в частности, контроля за артериальным давлением и содержанием сахара в крови, показали автоматизированный телефонный мониторинг и звонки для поддержки самообслуживания. Хотя во многих странах с низким и средним уровнем дохода осуществляются масштабные программы по внедрению и исследованию систем "электронного" здравоохранения, необходимость в дополнительной информации об их влиянии на результаты и стоимость лечения в подобных условиях по-прежнему сохраняется.

## Resumen

### El impacto de la cibersalud en los resultados de la asistencia en países con ingresos bajos y medios: ¿cómo actuar a partir de ahora?

La cibersalud abarca un conjunto diverso de herramientas informáticas diseñadas para mejorar la sanidad pública y la asistencia sanitaria. Se dispone de poca información acerca del impacto de los programas de cibersalud, especialmente, en países con ingresos bajos y medios. Por ello, llevamos a cabo una revisión sistemática exploratoria de la literatura publicada y no publicada para identificar datos sobre los efectos de la cibersalud en los resultados y en los costes sanitarios. Se puso énfasis en la identificación de preguntas no respondidas para futuras investigaciones, en especial, sobre temas relacionados con países de ingresos bajos y medios. Aunque las herramientas de cibersalud que apoyan la práctica clínica se han implementado globalmente y en creciente medida, únicamente hay evidencias sobre los beneficios de las que apoyan los archivos de imágenes y los sistemas de comunicación, pero de las herramientas que apoyan decisiones clínicas y sistemas de información de laboratorio. Los sistemas de información comunitarios para la vigilancia de enfermedades se han implementado satisfactoriamente en diversos países con ingresos bajos y medios. Aunque, por lo general, falta información relativa a los resultados, un proyecto de gran amplitud en Brasil ha documentado impactos notables en el sistema sanitario. Los metanálisis y los ensayos rigurosos han documentado los beneficios de los mensajes de texto en la mejora de resultados tales como la autoasistencia de los pacientes. El control por teléfono automatizado y las llamadas de autoasistencia de apoyo han demostrado que mejoran algunos resultados de gestión de enfermedades crónicas, como el control glucémico y de la presión sanguínea, en países con ingresos bajos y medios. Aunque se han llevado a cabo amplios programas para la implementación e investigación de la cibersalud en muchos países con ingresos bajos y medios, se necesita más información sobre los impactos de la cibersalud y sobre los costes en estos lugares.

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