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Recommendations to promote the digital healthcare transformation in the clinical practice: findings from an international consensus development method

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Abstract

Background Healthcare professionals are a fundamental component of the digital health transformation in all healthcare systems. However, the barriers still affecting the digital transformation in the healthcare sector suggest that the processes used to develop policies, mainly top-down, require some innovation.

Objective Development and validation of recommendations to support healthcare professionals in the digital transformation of their daily practice, involving multisectoral and international stakeholders.

Methods A consensus development method covering the years 2021 to 2023, combining top-down and bottom-up approaches, was employed by the Digital Educational programme Involving hEalth pROfessionals (DELIVER) consortium. Policy, literature and needs analyses were conducted at national level and then combined at international level to develop recommendations. Subsequently, experts in the field of digital health, healthcare professionals, managers and others were involved in the final DELIVER Transnational Consensus Development Conference to validate the recommendations developed.

Results Ten recommendations classified into three main domains were validated: (a) encouraging healthcare professionals to welcome the digitalization of the workplace (three recommendations); (b) ensuring basic/advanced and general/specific competencies (four recommendations); and (c) offering technical and organizational support (three recommendations).

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Conclusions The recommendations should be considered by multi-sectoral stakeholders, particularly policymakers and healthcare managers, to address the still-present critical issues preventing the digital health transformation in the clinical practice.

Keywords Digital transformation, Digital health, Health personnel, Consensus development method, Recommendations

Background

In the modern era, healthcare systems worldwide are facing several challenges in transforming their processes and incorporating the best use of digital health in their daily practice. The term “digital health” has been defined by the World Health Organization (WHO) as an umbrella concept [1], and it encompasses the use of information and communications technology to support healthcare professionals (HCPs) in delivering efficient, cost-effective, timely, and accessible services. The COVID-19 pandemic has further triggered the digital health transformation as the integration of digital technology into the clinical practice and healthcare service delivery; consequently, a range of technology-based services and processes [2, 3] have been introduced to improve data communication, ensure accessibility but decentralising the healthcare delivery [4]. The widespread implementation of digital health has been recommended for dismantling inequalities, overcoming geographical as well as physical barriers to healthcare access [5], and for contributing to improving the quality of care [6].

Despite the policies and evidence established by multi-sectoral stakeholders, and research covering different aspects of digital health at international (e.g. [7]), national (e.g. [8]), and local levels (e.g. [9]), healthcare services still encounter difficulties in effectively addressing the digital transformation processes in daily practice. The complexity and multifaceted characteristics of the digital transformation need carefully planned and tailored actions facilitating its successful implementation [10]. Moreover, to promote a cultural shift towards innovative digital health solutions, education should be seen as a pillar [2]. Furthermore, healthcare managers (HCMs) have been recognized as playing a crucial role in promoting or hindering this transformation [11], while the digital competence of HCPs should be considered a primary indicator both in the analysis of needs and as an outcome showing whether this transformation has been conducted successfully [12].

The barriers still affecting the digital transformation in the healthcare sector suggest that the processes used to develop policies, mainly top-down, require some innovation. Evidence available highlights the need to reduce existing distances between the cultures of digital technologies and healthcare settings. These distances may be overcome by involving HCPs across all phases of policy development, from the digital design to its

implementation [13], by considering their needs, preferences and perspectives [14]. However, to the best of our knowledge, no recommendations combining top-down (i.e. high-level planning and decision-making) with bottom-up (i.e. needs analysis) approaches have been conducted to date, as the former are focused on high-level planning and decision-making, and the latter on the implementation and execution at the contextual level [15]. Relatedly, to the best of our knowledge, no trans-national European approaches have been documented to date promoting international harmonization of best practices [16], bearing in mind as well the free circulation of HCPs and patients across the continent that would benefit from common recommendations. Therefore, the present study was aimed at identifying and validating recommendations to promote the digital transformation of health services at the point of care across Europe by using a combination of top-down and bottom-up approaches.

Methods

Study design

The study was conducted within the Digital Educational programme Involving hEalth pROfessionals (DELIVER) project [17]. Four European countries took part in the consortium: Denmark, Italy, Slovenia, and Spain (Catalonia). An internationally based consensus development method (CDM) [18] was used to develop and validate the recommendations, following a combination of top-down and bottom-up approaches.

The whole study design includes (a) a policy analysis, (b) followed by a scientific literature review, (c) and a needs assessment involving HCPs from the countries forming the consortium; and additional two phases based on (d) the development of recommendations and (e) their validation. Following these different phases ensured that the final recommendations were in line with policy documents, available evidence on the ground and the needs of HCPs.

Among the various CDM approaches (e.g. the nominal group or the Delphi technique), the consensus development conference (CDC) was used as an interactive face-to-face method to validate the recommendations that emerged through the involvement of panel members in a public forum [18]. The CDC was chosen for its recognized value in: (a) developing guidelines for improving the quality of healthcare; (b) evaluating and disseminating healthcare technologies for clinical practices; and

(c) embedding a dissemination process for the findings by holding a form of press conference [18]. Furthermore, both the CDM and CDC approaches were chosen because the intent of the study was to validate comprehensive recommendations based on a consensus of expert opinion on data that emerged from a common view as existing evidence from policy documents and literature, and that emerged from the needs assessment conducted at the international level [18].

Policy analysis

At the upper level [19], the results from an international multiple policy case study that was conducted from 2021 to 2022 involving the partner countries were considered [9]. Policies available on digital health service transformation were collected, translated, and analysed for their main features (details available on [9]). According to the results, each participating territory had developed relevant policies and certain government departments had begun to address the digital transformation of their respective health sectors [9]. However, the competencies expected of HCPs had not been defined. Furthermore, according to the analyses, there were no formal and standardised plans for undergraduate, postgraduate or continuing education [9].

Literature analysis

To provide an overview of the existing evidence on recommendations hindering or facilitating the digital health transformation, a non-systematic literature analysis was conducted in June 2023. The PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Scopus, and Google Scholar databases were consulted by the DELIVER partners using the keywords “digital health”, “digitalization”, “healthcare professionals”, “policies”, “recommendations”, and “implementation”. No limitations on language and time were applied; moreover, only studies deemed relevant to digital health transformation were included and factors influencing implementation were extracted and summarized in a narrative form. The literature analysis (e.g., [20, 21]) revealed that cultivating a positive attitude, knowledge, competence, self-efficacy, and appropriate responses towards health technologies were vital in ensuring the effective incorporation of digital devices into daily practices.

Needs analysis

At the contextual level [19], a targeted needs analysis was conducted [17] involving a convenient sample of nurses, midwives, physiotherapists, occupational therapists, physicians, psychologists, HCMs, and professionals leading human resources, continuing education, administrative and social services. International quantitative and qualitative studies were conducted in a multi-method

approach [22] to identify the needs and factors that promote or hinder digital health transformation in clinical practice. First a survey involving overall 395 HCPs and HCMs, followed by a focus group with 74 HCMs. The data analysis (available on request from the authors) highlighted the need to address some issues in all four countries as follows: (a) inadequate training in terms of lack of time and resources; (b) data security and privacy policies that may limit access to and ability to share information; (c) attitudes of HCPs, especially older staff, e.g. fear of new technologies and reluctance to share information; (d) digital solutions that are not adapted to the work requirements or are counter-intuitive and not user-friendly, as well as technical issues.

Development of recommendations

Each data source from which recommendations can be derived was integrated into an input document (available on request from the authors) and analysed by the DELIVER project partners from July 2023. Several online sessions were held among the project participants to discuss and integrate the data from the policy and literature review and the needs assessment. The first draft based on integrated data contained 12 recommendations, which were agreed upon after a two-hour online meeting on September 1. The recommendations were then subdivided for clarification, resulting in nine further recommendations. Then, a purposeful sample [23] of 10 HCPs and 10 HCMs in each country was recruited as key informants [24] to assess the comprehensibility and exhaustiveness of the recommendations. Changes to the sentences were proposed, but there were no additional recommendations. The recommendations were discussed again by the members of the DELIVER project during a two-hour online meeting on October 6. Linguistic adjustments were made, and the final draft was discussed at an in-person meeting in Italy on November 23, 2023.

Validation of recommendations

A multinational consensus was arrived at during the DELIVER congress [25] on 24th November 2023 in Slovenia where a specific session was dedicated to recommendations. First, the 21 drafted recommendations were presented, as well as the process undertaken to identify them. Then, the validation vote took place in a session where HCMs, educators, researchers, and students from each country participated, both in person and remotely (55 and 43 participants, respectively). Validation was sought by asking participants to vote on a five-point Likert scale (1– *strongly disagree*; 5– *strongly agree*), with responses collected digitally via the participants' smartphones or laptops using a quick response (QR) code linked to Microsoft Forms [26]. A level of accordance > 75% including *strongly agree* and *agree* responses

was required to approve each recommendation [27]. After the multinational consensus phase, the recommendations were collated according to the feedback gathered during the session, linguistically revised, and each was accompanied by a rationale as developed by the consortium. The final version was then approved by the DELIVER project partners in a meeting conducted after the DELIVER congress.

Results

By combining the top-down and bottom-up approaches, integrating a multiple-case international study on policies, the evidence available as documented in the literature, and the needs analysis at each national level, a total of ten recommendations and a rationale for each one (Table 1) were developed and approved. Recommendations were classified into three main domains: (a) encouraging HCPs to welcome the digitalization of the workplace (three recommendations); (b) ensuring basic/advanced and general/specific competencies (four recommendations); and (c) offering technical and organizational support (three recommendations).

Encouraging HCPs to embrace the digitalization of the workplace

Three recommendations have emerged in this area: (1) involving HCPs in all phases of digitalization, (2) creating conditions that allow HCPs to reflect on the ethical and legal aspects of the digital transformation of healthcare in daily work practice, and (3) increasing HCPs' awareness of the benefits, opportunities and limitations of digital health technologies (Table 1). The recommendations in this area aim to encourage HCPs to embrace the digitalization of their workplace and promote an effective and sustainable digital transformation that places HCPs at the heart of this process. Actively involving HCPs in all stages of digitalization helps to increase trust, improve attitudes, break down barriers and ensure that digital solutions meet real clinical needs. At the same time, creating conditions that allow HCPs to reflect on the ethical and legal implications of digital health in daily practice is central to raising awareness of these issues, which may become barriers to digital transformation. Finally, to promote a proactive and informed use of digital tools in everyday clinical practice, it is essential to improve clinicians' understanding of the benefits, opportunities and limitations of digital technologies.

Ensuring basic/advanced and general/specific competencies

Four recommendations were made in this area: (1) designing comprehensive educational pathways for HCPs from undergraduate to postgraduate level and through lifelong learning opportunities, with programs at local

and macro (regional, national and international) levels, (2) using a modular approach in educational programs and delivery, (3) recognizing the time HCPs spend on attending digitalization courses as working time and rewarding them for achieving goals related to the digital transformation of the healthcare system, and (4) providing certification with validated tools that recognize and map the level of digital competence among HCPs (Table 1).

The recommendations in this area focus on ensuring the digital competencies of HCPs. It is recognized that it is important to create comprehensive educational pathways from undergraduate to postgraduate training and continuing lifelong learning opportunities. A modular approach should be adopted that enables HCPs to gradually develop essential digital skills. In addition, the time invested in digital training should be formally recognized as working time, with clear incentives and rewards to emphasize the importance and responsibility of developing digital skills. Finally, a certification system with validated tools should be introduced to recognize and map the digital skills of HCPs. A clear and transparent classification system should be used at all levels of the healthcare system (local, regional and national).

Offering technical and organizational support

Three recommendations have emerged in this area: (1) providing technical support for HCPs and a secondary plan for managing their work if digital technology fails, (2) facilitating interoperability of services for HCPs working in outpatient and inpatient settings, and (3) providing intuitive digital health systems for HCPs that enable data extraction for use in clinical and research reports (Table 1).

The recommendations in this area focus on ensuring technical and organizational support for HCPs. HCPs should be able to access technical support and contingency plans that ensure continuity of care in the event of system failures. This includes 24/7 support services, reliable technological backups and temporary paper-based solutions that are only used when necessary. In addition, promoting interoperability between in-hospital and out-of-hospital systems is crucial to ensure that HCPs can access integrated, updated and secure health information. Digital health systems must also be user-friendly and designed to facilitate data extraction for clinical and research reporting.

Discussion

The present study sought to integrate both top-down (policy- and evidence-based) and bottom-up methods (needs assessment data tailored to HCPs in the participating countries) to develop recommendations for promoting digital health transformation in clinical practice

Table 1 Recommendations for promoting digital transformation in the clinical practice

Domains/Statements	Rationale
<i>(a) Encouraging HCPs to welcome the digitalization of the workplace</i>	
1. Involving HCPs in all phases of digitalization	HCPs should be involved at all stages of the digitalization process to build trust, improve attitudes and break down barriers. Their involvement is therefore crucial. Examples include testing new digital tools and deciding on their implementation in the light of HCP feedback, designing training courses following a needs analysis, ensuring the maintenance and evolution of tools considering HCP requirements and issues raised by current systems, and updating hardware and software to limit obsolescence and ensure efficiency
2. Creating conditions that enable HCPs to reflect on the ethical and legal aspects regarding digital health transformation in daily working practices	When using digital technologies, new ethical and legal issues may arise that may also prevent effective implementation at the bedside. Discussing such issues with HCPs using practical cases, examples and possible solutions may increase awareness and trust and prevent further problems from arising
3. Increasing HCPs' awareness of the benefits, potentialities, and limits of digital health technologies	Digitalization should enable all HCPs to experience its potential and benefits, develop a positive attitude and mindset, and motivate stakeholders to use digital tools in their daily practice. HCPs also need to be sensitized to the limitations of digital health applications (e.g. when they are not recommended and/or when they should be avoided)
<i>(b) Ensuring basic/advanced and general/specific competencies</i>	
4. Designing comprehensive educational pathways for HCPs from the undergraduate to the postgraduate levels and through lifelong learning opportunities, with programmes at the local and macro (regional, national and international) levels	Digital transformation is a constantly evolving process. For this reason, training should be continuous and involve all HCPs from the beginning of their career (i.e. diploma, bachelor or similar) through their postgraduate education (i.e. master or doctorate) to lifelong learning. Educational programmes should be structured according to the objectives of digital health policy (top-down model) while considering the different responsibilities of health professionals and the specificities of the context and perceived needs (bottom-up model). Programmes should be based on current knowledge from the field of adult education to maximise learning outcomes. New educational strategies may also be used, such as Massive Open Online Courses with intuitive digital interfaces and gamification rules to increase impact
5. Using a modular approach in educational programmes and during implementation, ensuring that HCPs gradually develop the requisite digital skills	HCPs will need time to get used to and learn these skills. Strategies should be adopted that take a modular approach, breaking down the changes and current workflows and habits into smaller phases so that HCPs do not feel overwhelmed. The digital divide in the population will inevitably impact some HCPs. Different needs, mainly due to different starting levels of digital literacy, should therefore be considered to ensure that all HCPs develop common basic digital skills. Examples of basic digital skills include word processing, emailing, searching and browsing the internet and health-related databases, using spreadsheets and presentation software, and accessing electronic medical records
6. Recognizing the time spent by HCPs attending digitalization courses as working time and rewarding the achievement of goals relating to digital health transformation	Appropriate incentives should be created for the goals of digitalization, e.g. through economic and/or recognition strategies and continuing education credits. The development of digital skills should be prioritized and mandatory due to their importance for healthcare. Learning and/or updating digital skills is not only a right, but also the professional responsibility of all HCPs
7. Certification using validated instruments that recognize and map the HCPs' level of digital competence	Certified training with validated instruments is required to recognize and adequately map the competence of HCPs. A homogeneous digital health classification system that is transparent, stable and unambiguous (at local, regional and national level) should be used for this purpose
<i>(c) Offering technical and organizational support</i>	
8. Offering HCPs the possibility of technical support and a secondary plan for managing their work if the digital technology fails	Patient care should not be interrupted in the event of problems with digital systems. Technical support should be available both in person and remotely around the clock and when needed. Digital healthcare systems should be designed with built-in technological redundancy in case of service interruptions and ensure an equivalent backup system on demand. Paper documentation should only be used as an interim solution when technological backup is not available (to avoid data duplication and wasted time)
9. Facilitating the interoperability of services of HCPs working in out-of- and in-hospital settings	Interoperability within sectors at local, regional and national level is important to ensure that patients and HCPs have access to integrated, available, updated and protected health information in order to overcome barriers and anticipate potential issues. When interoperability is not possible, the same information must be documented in multiple systems. There are two arguments for this: firstly, the increased use of technology must not increase the physician's workload, e.g. by documenting the same information in two systems; secondly, interoperability between sectors ensures that the physician has access to the relevant and necessary information, which is a matter of patient safety
10. Providing HCPs with intuitive digital health systems that enable data extraction for use in clinical and research reports	The choice of user-friendly digital health tools (e.g. electronic medical records) in all settings (i.e. hospital and home care) reduces learning time and simplifies the work of medical staff. The software should enable the generation of reports on clinical activities, internal quality assessments and research proposals

Legend: HCPs Healthcare professionals

across Europe. To our knowledge, there are no previous studies that aim to make recommendations on digital transformation using a similar methodology at an international level or to achieve definitive validation of the recommendations in a multinational healthcare context. Although there are other recommendations (e.g. [1, 28]), this study is characterized by several methodological and contextual specificities:

- (a) from a methodological perspective, the inclusion of a needs assessment conducted directly among HCPs from participating countries as a bottom-up component, allowing for the capture of local and context-specific needs that may not be adequately addressed in global policy documents, and the testing of the resulting recommendations in a CDC setting, which allowed for direct, transparent interactions with real-time discussions to validate the recommendations,
- (b) from a contextual perspective, the study provides recommendations directed at the European countries involved, although these may also be considered by other countries and systems. The integrated and constructive approach concluded with a consensus conference that generated ten detailed recommendations categorized in three primary domains of investment and aligned closely with the needs of HCPs. Moreover, the study has acknowledged the contribution of HCPs (i.e. those who are in contact with patients): their involvement is especially significant given that digitalization is likely to transform their daily routines, their education [29], and their interaction with patients and relatives [30]. Their effective engagement in the process of developing recommendations may also promote the involvement of patients in accepting digital tools, thus embedding a dissemination process regarding the value of digitalization [18].

When analysing the individual recommendations that have emerged, some thought should be given to their implementation. First, it is suggested that the generational gap across HCPs should be considered, such as the differences in ideas, behaviours, cultural norms, and ways of approaching life, including regarding digitalization. In this context, the digital divide has been considered an important factor [31], since young HCPs (millennials/generation Z) are digital natives while those born in previous decades (e.g. baby boomers) may struggle to recognize the potential of digital solutions [32]. Therefore, as emerged from the recommendations, encouraging HCPs to welcome the digitalization of the workplace, and ensuring basic/advanced and general/specific competence, is crucial for harmonizing the digital literacy

possessed by HCPs that may facilitate the transformation. In addition, the shortage of HCPs (e.g., nurses in the four countries included) could be a potential barrier that further hinders the digital transformation in healthcare.

Second, specific recommendations relate to ethical and legal aspects while using digital health technologies in practice. Strong ethical and legal foundations have been considered mandatory for their successful and respectful use [33]. The developed recommendations underline the importance of creating conditions that enable HCPs to reflect on these issues bound into their daily working practices; while it could be argued that this constitutes the basis for the digital transformation of healthcare, it is also important to note that due to the profound differences across healthcare systems, societies, and legal frameworks, specific training should be performed on a local and case-to-case basis [33].

Third, given the high speed at which digital technology evolves, it should be noted that recommendations approved refer to the current Healthcare 4.0, where smart healthcare is healthcare that implements all the technologies of Industry 4.0, which includes big data, the Internet of Things (i.e. Internet of Health Things, Internet of Medical Things, and Internet of Nano Things), augmented reality, virtual reality, artificial intelligence, and robotics, together with high-performance mobile connectivity (e.g., 5G) and a pervasive use of cloud computing [34, 35]. Furthermore, digital transformation concerns not only systems and tools but also a new way of managing infrastructures, applications, and services, and the creation of innovative solutions for the management and maintenance of machines and programs, including security and privacy management [34, 35]. In other words, the approved recommendations may be considered at the micro level for healthcare service delivery purposes and may be expanded in other directions embracing all aspects of digitalization.

The implementation of the proposed recommendations should be designed at micro and macro, local, regional, and national levels. Above all, since the ten recommendations are focused on HCPs, they should also be involved in evaluating their effectiveness. An initial self-evaluation aimed at detecting the stage of digital maturity [36] may address how to shape the approved recommendation regarding their implementation and effectiveness.

Strengths and limitations

This study has some strengths and several limitations that should be acknowledged.

The combination of top-down and bottom-up approaches to ensure comprehensive stakeholder engagement has been addressed with strong methodology. This multifaceted strategy ensures that recommendations are informed by a wide range of perspectives and

can be implemented practically in daily care. The broad engagement of a diverse group of stakeholders, including HCPs, HCMs, and multi-professional participants, in the DELIVER project and Transnational Congress was crucial for the development of well-rounded and widely acceptable recommendations. The various phases of the study, which spanned more than three years, have been summarized here to ensure transparency regarding the timetable, objectives, content and actors involved, with the authors' data available on specific elements.

However, only four European countries were involved in the study, which may limit the generalizability of the recommendations to other regions, particularly those with different healthcare systems, digital maturity levels, and cultural contexts. Therefore, more countries should be included in future studies. Moreover, although several HCPs were involved, researchers should engage HCPs from more diverse backgrounds and age groups, and with different experiences of digitalization. Furthermore, a comprehensive approach without differentiating between the various kinds of technologies that might be applied in healthcare has been adopted (e.g. [37]), resulting in general recommendations that should be shaped according, also, to the technologies implemented.

Furthermore, in formulating the recommendations, we did not explicitly follow a specific theoretical framework for digital transformation, such as the Technology, People, Organizations, and Management (TPOM) Framework [38]. Nonetheless, the fundamental principles regarding the interplay between technology, people, their organization and management have been incorporated into the content of the recommendations. Future studies based on an established theoretical foundation could provide a clear framework for evaluating the effectiveness of the implementation of the recommendations. This could include measures such as adoption rates, user satisfaction and improvements in healthcare and patient outcomes.

Conclusions

The digital health transformation is still facing barriers in the clinical practice. To address these challenges, we have applied an innovative methodology that combines a top-down with a bottom-up approach, followed by a consensus method involving stakeholders at international level. The validated recommendations aim to encourage HCPs to embrace the digitalization of the workplace; address how to ensure that HCPs have basic/advanced and generic/specific skills; and provide technical and organizational support. These recommendations are closely linked: The need for both basic/advanced and generic/specific education systems is important for fostering digital skills and attitudes at the individual level, which may also transform the ability of work environments to welcome such transformation; furthermore, the

supportive networks and incentives may address critical issues and thus facilitate successful digital transformation. The practical recommendations developed may be followed by policy makers and health authorities to promote digital transformation in health. Future studies are needed to validate the developed recommendations in other countries (e.g. developing countries). As new digital technologies evolve (e.g. artificial intelligence), the recommendations made here may need to be updated.

Abbreviations

CINAHL	Cumulative Index to Nursing and Allied Health Literature
CDC	Consensus development conference
CDM	Consensus development method
COVID-19	Coronavirus disease 2019
DELIVER	Digital Educational programme Involving hEalth pROfessionals
HCMs	Healthcare managers
HCPs	Healthcare professionals
QR	Quick response
WHO	World Health Organization

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Authors' contributions

AG methodology; data curation; validation; writing—original draft preparation. FF formal analysis; investigation; data curation; writing—original draft preparation. SC methodology; data curation; writing—original draft preparation. LJ conceptualization; investigation; writing—review and editing; project administration; funding acquisition. MSF methodology; data curation; writing—original draft preparation. RLB validation; investigation. MM conceptualization; validation; formal analysis; investigation; writing—original draft preparation. MDSP methodology; writing—original draft preparation. ERE conceptualization; investigation; data curation. AP conceptualization; methodology; validation; data curation; writing—review and editing; supervision; funding acquisition. All authors have read and agreed to the published version of the manuscript.

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Data availability

The dataset used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Not required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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