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From research to evidence-informed decision making: a systematic approach

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ABSTRACT

Background Knowledge creation forms an integral part of the knowledge-to-action framework aimed at bridging the gap between research and evidence-informed decision making. Although principles of science communication, data visualisation and user-centred design largely impact the effectiveness of communication, their role in knowledge creation is still limited. Hence, this article aims to provide researchers a systematic approach on how knowledge creation can be put into practice.

Methods A systematic two-phased approach towards knowledge creation was formulated and executed. First, during a preparation phase the purpose and audience of the knowledge were defined. Subsequently, a developmental phase facilitated how the content is 'said' (language) and communicated (channel). This developmental phase proceeded via two pathways: a translational cycle and design cycle, during which core translational and design components were incorporated. The entire approach was demonstrated by a case study.

Results The case study demonstrated how the phases in this systematic approach can be operationalised. It furthermore illustrated how created knowledge can be delivered.

Conclusion The proposed approach offers researchers a systematic, practical and easy-to-implement tool to facilitate effective knowledge creation towards decision-makers in healthcare. Through the integration of core components of knowledge creation evidence-informed decision making will ultimately be optimized.

Keywords implementation science, knowledge translation, policy making, public health, science communication

Building upon a knowledge translation framework

Knowledge translation (KT) aims to fill the evidential gap between knowledge and practice; a process that is considered by the World Health Organization (WHO) to be one of the most important public health challenges of this century.[1] The knowledge gap has often been referred to as the knowledge-to-action (KtA) gap. This term implies a broader application of knowledge, involving decision-makers, health practitioners, patients and the public.

Using this broader definition of KT, Graham *et al.*[2] developed a KtA framework that conceptualizes the process of KT. This framework, comprises two distinct but related components. The 'Action Cycle' represents the activities that are needed to apply evidence-based knowledge to practice. This includes tailoring interventions to the local context and identifying and evaluating barriers and facilitators to implementation. The 'Knowledge Creation funnel', on the other hand, refers to the simultaneous process of the generation of the tools and key messages that aid in the Action Cycle.

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These are created by distiling and tailoring core messages from research knowledge to the needs of the knowledge user. In its broadest definition, knowledge users include, policy-makers, health practitioners and the general public. This article will focus on KT to decision-makers (In this article decision-makers include managerial decision-makers (e.g. managers in hospital, community organisations and private business.) as well as policy decision-makers at the national, provincial, district and local levels.[7]) as they are in the best position to influence health decisions and benefit public health through evidence-informed decision making.

Even though the action process and the knowledge creation process must form part of any KT model, it remains ambiguous how these processes should be executed. Large inconsistencies can especially be identified in the knowledge creation process due to a lacking systematic approach on how to put the process into practice.[3] This article strives to provide a systematic approach on how the knowledge creation process can be put into practice. More specifically it focuses on what, based on the literature, are the core components of the knowledge creation process that every researcher engaging with KT should consider. The use of a case study will demonstrate how the systematic approach can be used by researchers to effectively establish evidence-informed decision making.

With the focus shifting from knowledge dissemination to KT, the role of reciprocity between decision-makers and researchers in facilitating evidence-informed decision making has become widely acknowledged.[4] Whereas the traditional and more linear model—'the science push model'—underlines the supply of evidence to inform evidence-informed decision making, the interaction model reflects the need of reciprocity and partnership building. The latter, suggests that the more sustained the interaction between researchers and policy-makers is, the larger the impact of evidence-informed decision making becomes.[5–9] This interactive KT model is, however, a complex, time-consuming step that is hampered by political instability, high turn-over of policy-making staff[6] and perceived cultural differences between researchers and policy-makers.[10,11] Consequently, the traditional, linear approach remains the most common used approach.

Pitfalls in knowledge creation

Despite the less complex nature of the traditional science push model, in practice, researchers and policy-makers rarely speak the same language. Evidence provided to decision-makers is generally considered to be too complex, too detailed, too technical or lacking in timeliness.[6,12,13] Aside from these substantive elements, inattentiveness to design and structure of a research report can also trouble the communication from researchers to decision-makers.[14]

Tailored communication: a conceptual framework

In order to avoid these pitfalls, it is paramount to tailor knowledge to the level of understanding, needs and demands of the target audience. Guided by Lavis' extension of Lasswell's communication model effective communication depends on tailoring what is being said (content), how it is being said (language), how it is communicated (channel) to whom (audience) and with what purpose (intended effect).[7,15] Although the 'who', the 'what' and the 'to whom' are often taken into consideration, the 'how' is often overlooked in communication to decision-makers.[7,16] Strikingly, it is precisely this 'how' aspect of the communication process that might be crucial in influencing evidence-informed decision making. Drawn from the literature on the field of science communication, visual communication and user-centred design, we formulated a number of core components approaching this 'how' aspect (Fig. 1). These components can be divided in translational components and design components, determining how the content is said, or how the content is communicated, respectively.

Core components on how the content is said

The first core component, the translational component, entails that content should be target-audience appropriate and packaged in a mode of communication that is familiar to the target audience. Information should be concise and understandable, adapted in terms of length and complexity of grammar.[6,14] In addition, messages that are meant to prompt action should be expressed as an actionable message. This can be established by integrating concepts of applicability (i.e. feasibility of an intervention), and transferability (i.e. likelihood that the intervention will equally benefit health in this specific setting).[17]

Knowledge should moreover be represented in a form that facilitates understanding.[18] Representation forms include common used textual statements, compelling narratives (storytelling) or the visualisation of data into graphs or infographics. Visualisation of data is an effective means of representing complex ideas of information in a format that is quickly understood.[18–20] Storytelling, an increasingly used tool in public health communication,[21,22] provides context to the situation by anchoring a problem in the real world.[14,23] The

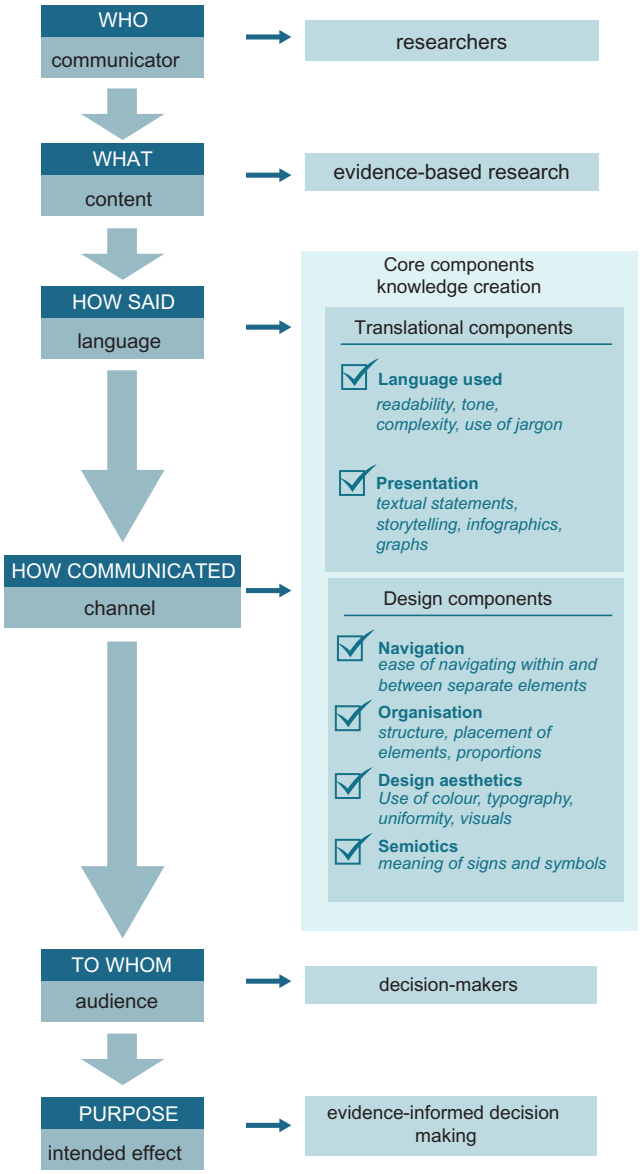

Fig. 1 Conceptual framework adopted from Lasswell's communication model and its extension by Lavis *et al.* Each step in the sequence represents further interpretations of the framework when communicating evidence-based research (content) to decision-makers (audience) with the purpose to influence evidence-informed decision making. Core components on knowledge creation provide elaborate interpretation of how the content is said and communicated.

power of storytelling lies therefore, beside the transfer of explicit knowledge, in the transfer of tacit knowledge.

Core components on how the content is communicated

Apart from the choice on language and representation one should tailor how content is being communicated to the target audience. Simply communicating information in a form and language tailored to the needs and demands of decision-makers does not sufficiently influence evidence-informed decision making.[24,25] The majority of research evidence is consumed by decision-makers via a written channel.[12,13] Therefore, elements of design, including navigation, organisation,[25,26] design aesthetics[27] and semiotics should also be taken into account.[14,28]

This means that navigation between information should be intuitive and information should be presented in an orderly way.[28] Online repositories such as the 'HealthCOMpass'[29] and 'Science for Environment Policy'[30] are generally effective in transferring knowledge by presenting information in separate self-contained 'chunks' of information, enabling decision-makers to access the information in the order they choose. Furthermore, it is important to create and incorporate design aesthetics. An appealing exterior can be accomplished through the use of complementing colours, a polished house style, simple typography and the appropriate use of visual aids.[31,32] Ultimately, visual aids can become more meaningful via the utilisation of semiotics. Semiotics refers to the interpretation of a visual into the meaning that goes with it. Pictograms can be ideal to communicate a subject as they derive their meaning from an iconic relation with what they refer to and are understood universally.[33,34]

This article takes one approach in how researchers can communicate knowledge to decision-makers with the purpose of influencing evidence-based decision making. It should be noted that this article does not attempt to cover all aspects of KT to decision-makers. Rather, takes a starting point in how to create knowledge (tools and key messages) in such a way that it fits the needs and demands of decision-makers. In the following section, using a case study we provide an approach on how core components of knowledge creation can be integrated in an easy-to-implement tool.

Methodology

A case study

The knowledge gap is apparent in all areas of public health. However, it may be even more evident in low- and middle-income countries (LMICs).[35–37] LMICs are generally characterized by suboptimal primary care standards, general poor health and significant challenges in implementing clinically and cost-effective interventions.[35,36,38,39] There is a growing recognition of the need to improve the translation of evidence into practice in these LMICs and to adapt evidence-based interventions proven to be effective in developed settings to the local context.[35,40,41] The FRESH AIR study, aimed at addressing the need to prevent, diagnose and treat

non-communicable lung diseases (NCLDs) in LMICs is considered an ideal case study. Exploring barriers and facilitators to the implementation of evidence-based interventions in low-resources settings and tailoring them to the context are key elements to reach the FRESH AIR aim. Due to this implementation design, KT and creation were included as an integral part of the FRESH AIR study. The protocol has been published elsewhere.[42] This case study elucidates one of the methods FRESH AIR is using to create knowledge tailored to decision-makers.

A systematic approach to knowledge creation

The approach to knowledge creation was guided by Lasswell's adapted communication model and consisted of two phases: a preparation and a developmental phase. Both are schematically depicted in Fig. 2. Creating a knowledge platform requires the developer to think and approach the subject matter from multiple angles, making use of scientific and analytical knowledge as well as editorial reasoning. Due to the complexity of this iterative process, one should therefore keep in mind that Fig. 2 is a simplification of the developmental process.

Preparation and developmental phase

During the preparation phase the purpose of the knowledge platform was defined through the formulation of the main objectives. A main audience was defined to specify the 'to whom' aspect. Both the objective and the audience were decisive in 'what' was to be communicated. Subsequently, the 'what' led to the development of a framework of the knowledge platform, comprising all topics the knowledge platform should address.

The second phase, the developmental phase, provides an approach towards the 'how' aspect of the communication model. The approach to 'how it is said' and 'how it is communicated' were guided by two separate pathways, respectively, the translational cycle and the design cycle. The translational cycle involves the translation of scientific data and information into tailored content. Whereas, the design cycle is the incorporation of core components on navigation, organisation, design aesthetics and semiotics. For conceptual and illustrative purposes, we made a clear distinction between the approaches. In practice however, the two approaches are complex and intertwined with each other.

Translational cycle

During the translational cycle research findings (non-translated knowledge) generated during the FRESH AIR project were passed through a number of consecutive steps. Through the integration of the translational core components this resulted in the generation of content tailored to decision-makers (translated knowledge). As individual studies rarely provide sufficient evidence for decision making, evidence was also synthesised from other sources.[43]

Evidence acquired per topic (Step 1) was synthesised and critically appraised (Step 2). Critical appraisal, defined as the examination of research evidence on the level of evidence and relevance, is an important step within the translational process.[44] Critical appraisal was performed using a flow-chart like tool. The flow-chart integrated multiple appraisal tools on grey literature with the Scottish Intercollegiate Guidelines Network (SIGN) grading system on scientific evidence to create a tool that can be applied to all types of evidence.[45,46] The level of evidence and relevance was categorized into five categories. Scientific evidence that was based on meta-analysis, rigorous systematic reviews or RCT with very low risk of bias according to the SIGN grading system (Grade A), was extracted (Step 3). In the case of disputable evidence (Grade E or D) due to either a high risk of bias, low level of evidence or evidence-based on non-analytical studies such as expert opinion or a case report, an annotation was added.

Based on the extracted data key message were formulated (Step 4) and data was aggregated into explorative or explanatory overview charts, infographics, visuals, textual statements or narratives (Step 5). Before incorporation into the knowledge platform the product was run through a set of criteria to determine whether all core translational components were sufficiently integrated (see checklist in Fig. 2). When the translated knowledge product scored insufficiently, it re-entered the translational cycle.

Design cycle

Parallel to the translational cycle the communication channel was designed. Core components on navigation, organisation, design aesthetics and semiotics were integrated into so called 'proof of concepts' (trial products) which were subsequently tested on the experience of the user (user-experience analysis). 'Proof of concepts' allow for iterative amendments during several moments of evaluation, thereby warranting feasibility and sustainability early on.[47,48]

Results

Study deliverables

The following section presents how the systematic knowledge creation approach was put into practice within the FRESH AIR project.

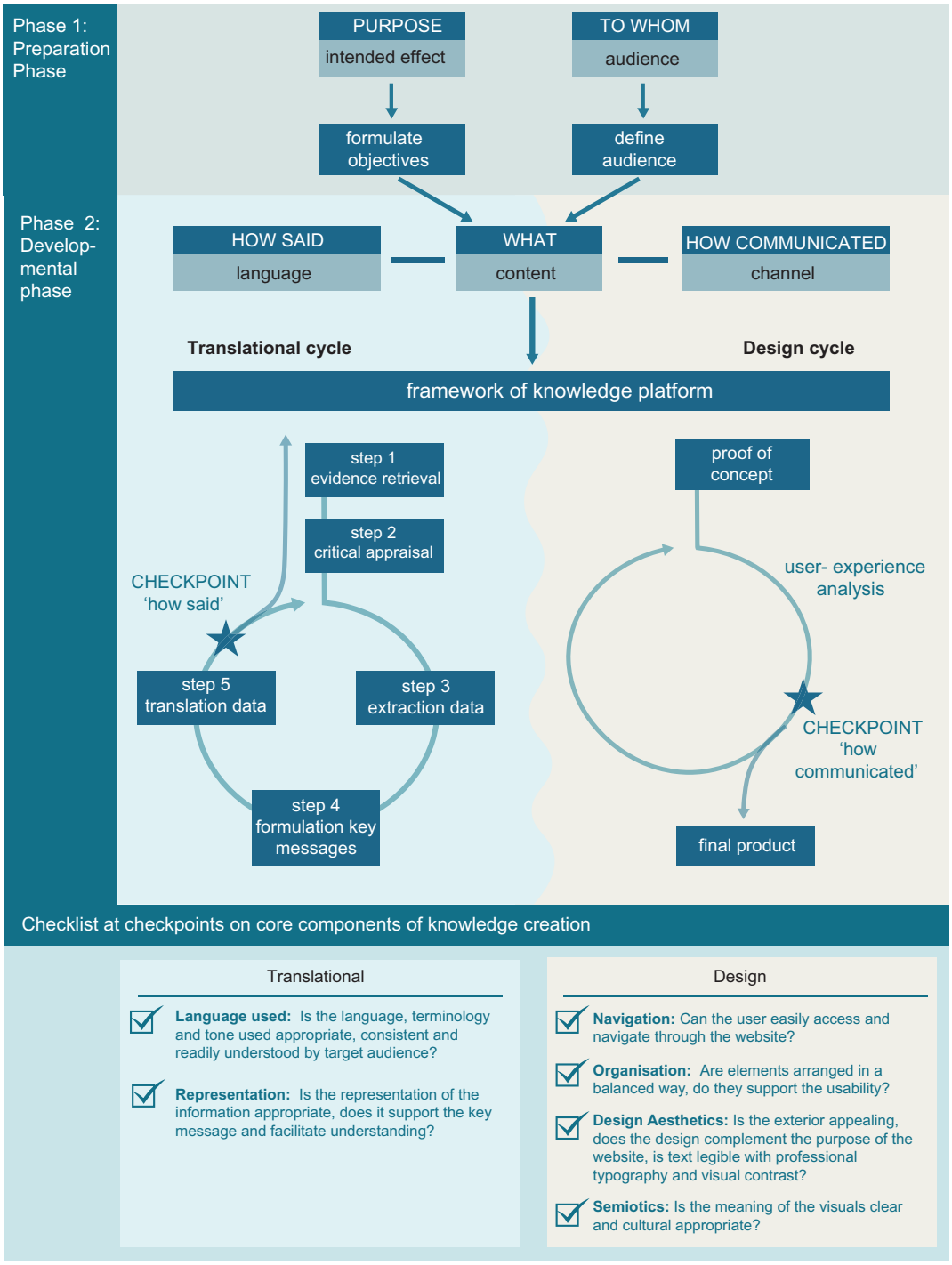

Fig. 2 Methodological approach towards knowledge creation Integration of Lasswell's adapted communication model with Graham's knowledge-to-action framework. Separate phases provide a step-by-step approach towards knowledge creation.

Preparation phase

In the FRESH AIR knowledge dissemination strategy several objectives of the knowledge platform have been formulated. The first objective is to inform decision-makers and other stakeholders about the prevalence of NCLD diseases, risk factors and present feasible context-specific solutions. The second objective is to share materials that assist in the implementation of these context-specific solutions. Since purpose and audience determine the knowledge that is to be communicated, two separate channels were created, each

serving one of the above mentioned objectives. A public website serves the first objective whereas a linked knowledge base serves the second. A knowledge base offers access to a large range of documents, including scientific publications, translated policy briefs, protocols and educational materials. Since the knowledge base complements the website as a source of information the following section will focus on the development of the public website.

Developmental phase

The translational- and design cycle served as a template to develop the public website. Figure 3 depicts an example of how the translational cycle was operationalised. After retrieval of evidence (Step 1) and critical appraisal of evidence (Step 2), relevant data was extracted (Step 3). This was then used to formulate key messages and create visualisations (Steps 4 and 5). Correct interpretation of the visualisations was supported by adding a simplification of the key messages (Step 5).

Figure 4 illustrates a concept of the home-page of the FRESH AIR public website, demonstrating the integration of the core components of knowledge creation. As the development of the website is an on-going project and has not yet been delivered, intermediate results are presented and complemented by future ideas.

Future plans

Novel knowledge is continuously generated during the FRESH AIR project. Hence, core components of knowledge creation will be integrated in several additional ways. Information will be presented in various forms. Global prevalence of disease will be expressed in a bubble chart. Bubble charts are explorative rather than explanatory, allowing comparison between settings and different measures.

Furthermore, storytelling will be used to trigger action or share knowledge by presenting successful implementation stories. Excessive detail will be avoided to permit the reader to be able to imagine a comparable solution within their own situation. Composite stories will be created from interview narratives derived from the qualitative FRESH AIR data.

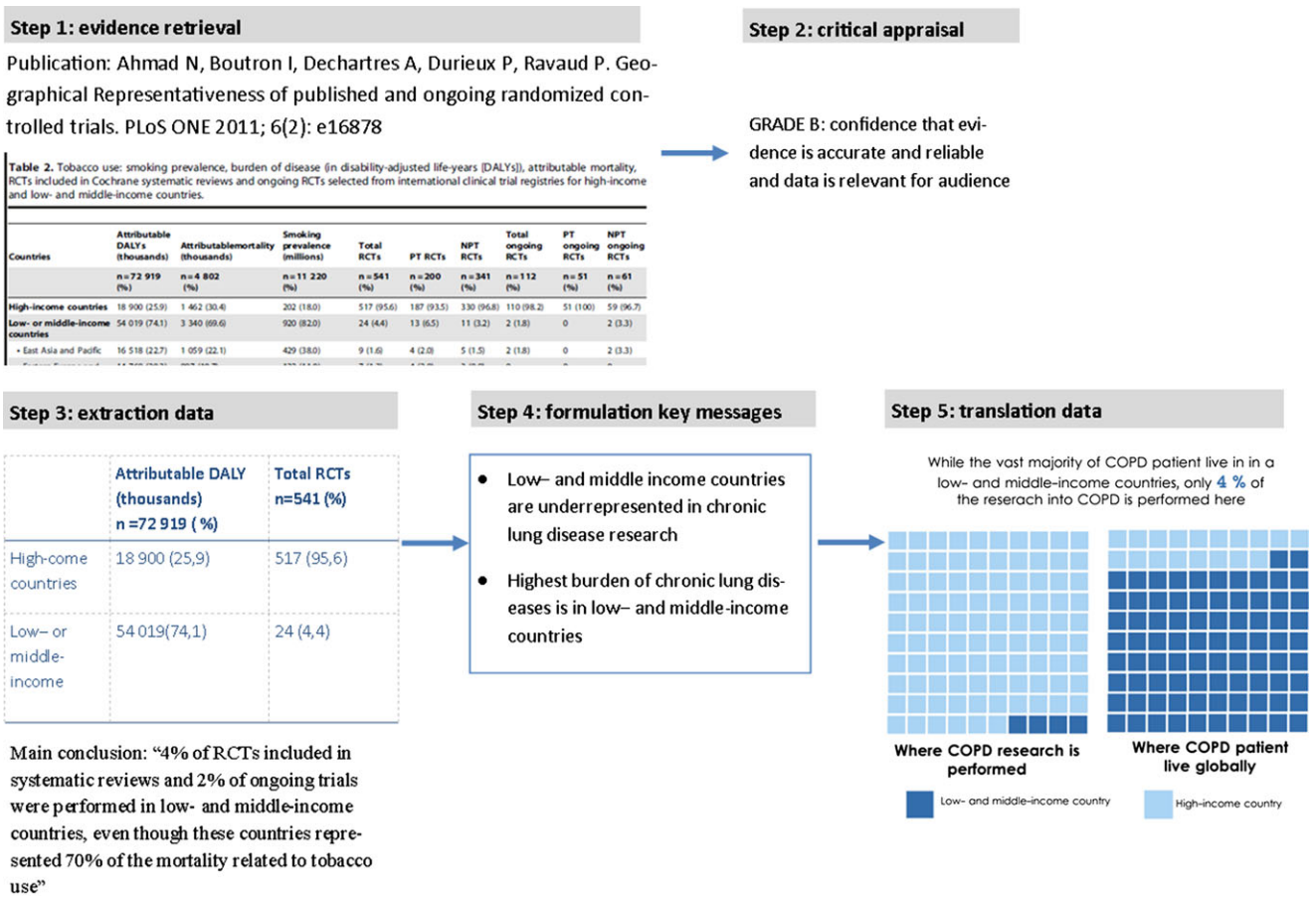

Fig. 3 From evidence to visual representation of data in five steps. A case study example providing interpretation of the different steps of the translational cycle.

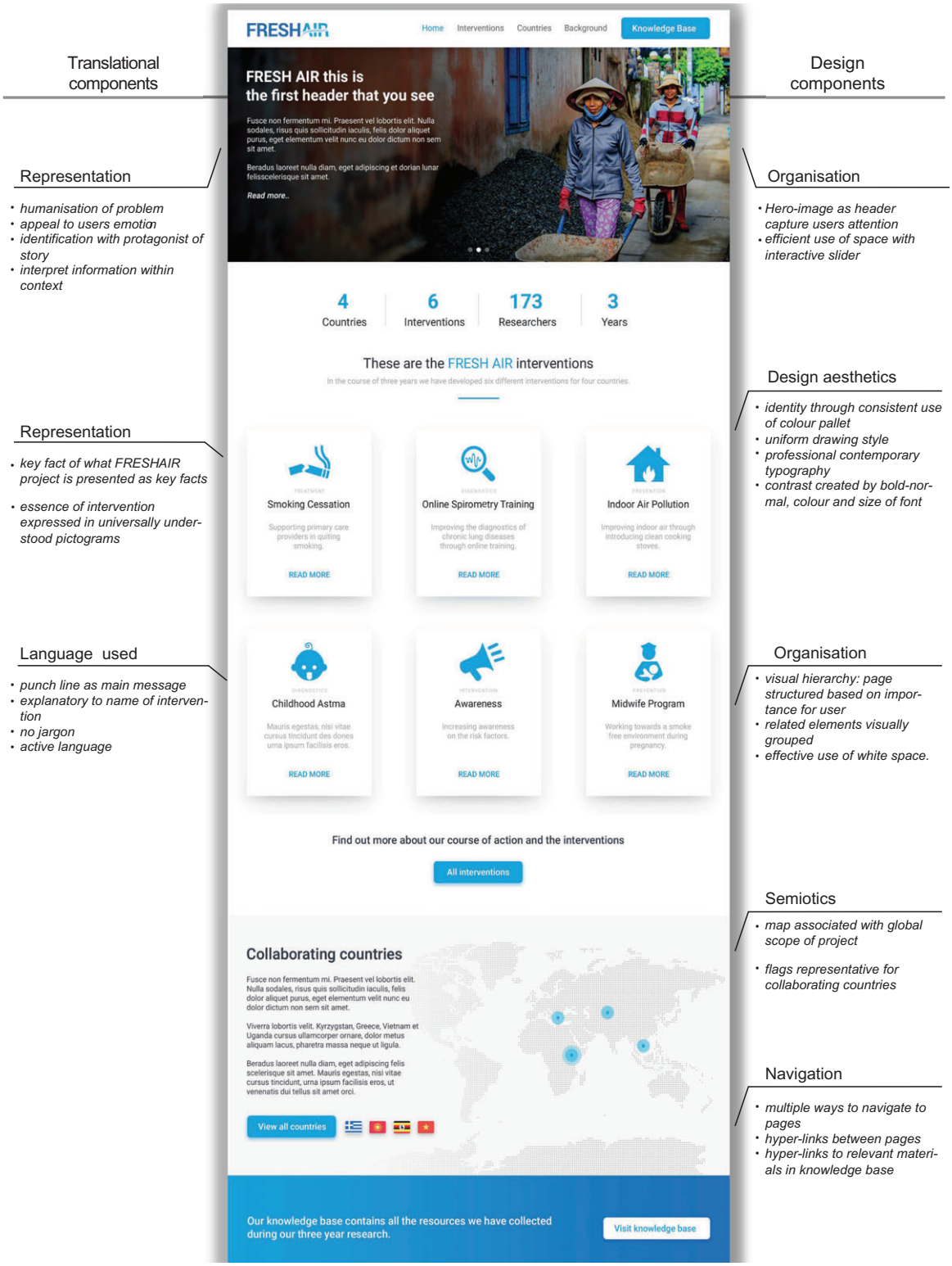

Fig. 4 Core components of knowledge creation integrated into the homepage of the website.

Warranting sustainability and outreach

Elements regarding sustainability, outreach and dissemination will furthermore be taken into account. Sustainability will be warranted by basing the website on a WordPress platform. This free content-management software does not require programming skills and allows for content management independent of a web designer. Outreach to a non-academic audience, including decision-makers, will be maximized through the integration of several social media channels and hyperlinks to leading health institutions.

Discussion

In this paper we presented a systematic approach towards knowledge creation- the tailoring of research knowledge to decision-makers to facilitate evidence-informed decision making. We elaborated on the knowledge creation cycle, an integral part of the KtA framework by Graham *et al.*[49] Guided by Lasswell's widely known communication model, we formulated an approach that incorporates how content should be communicated—an overlooked but essential component. The approach integrates two core components: (i) the translation of knowledge towards the audience and (ii) the design of knowledge created. Through a case study we demonstrated how these two core components can be put into practice.

This systematic approach is, to our knowledge, the first to provide a practical approach to knowledge creation. A systematic approach to knowledge creation was urgently needed for two reasons. Firstly, the vast amount of literature covering the question on how to communicate scientific evidence to a target audience, indicates a lack of an overall effective approach.[31,50,51] Secondly, the European Commission increasingly emphasizes to include strategies on knowledge dissemination to a non-academic audience in project proposals.[52] Consequently, researchers are expected to engage in knowledge creation; a skill that they have generally not been trained in.

Whereas decision-makers have been equipped with multiple tools to assist in using research evidence for evidence-informed decision making,[53,54] researchers have hardly been provided with any. The SUPPORT tool, developed for decision-makers and researchers presents a variety of activities on KT, but does not provide a practical approach on how these activities can be operationalised.[16,55] Our approach complements herein, as it provides researchers engaging in knowledge creation with a simple, easy-to-implement tool that does not require advanced training.

As previously noted, this paper only covers a small portion of the broad and complex process knowledge translation entails. While we have proposed a strategy to warrant that researcher and policy makers 'speak the same language', our approach should not be considered a stand-alone solution, but one embedded within the KtA cycle. As suggested by Graham *et al.*, knowledge has to go through a number of phases before it can shape practice. These phases include adaptation to the local context, assessing barriers to implementation and monitoring knowledge use.[49,56] Furthermore, researchers should build capacity for implementation by formulating, implementing and evaluating capacity building plans.

Even though our approach was developed towards communicating research evidence to decision-makers, it may be widely applicable as the approach integrates essential and universal components of science communication, data visualisation and user-centred design. Regardless of the specific audience, the questions concerning 'how something is said' and 'how it is communicated' should always be given full attention in the process of communicating research-evidence.

Conclusion

To conclude, this approach offers researchers a tool to facilitate effective knowledge creation towards decision-makers in healthcare. The tool complements existing approaches; it is systematic, practical and designed to be easily implemented by researchers engaging in KT. However, it should not be considered a stand-alone communication tool, but rather a tool within the communication process of KT. Nonetheless, through the integration of core components on knowledge creation an approach has been established that may be widely applicable to similar projects, ultimately optimising evidence-informed decision making.

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Conflicts of interest

The authors declare no conflict of interest. All authors have contributed to writing and revision of the article.

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