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REVIEWS

Introduction to behavioral science and its practical applications in public health

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ABSTRACT

The World Health Organization (WHO) highlights the importance of improving the design of public health interventions and policies by applying principles from the behavioral sciences. These sciences play a crucial role in modifying behaviors and addressing a wide range of health challenges, from pandemics and chronic diseases to the climate crisis. This article examines the transformative impact of behavioral sciences on public health promotion, focusing on the factors that influence decision-making and intervention strategies based on the six principles developed by the WHO Technical Advisory Group. Additionally, it addresses the significant shortage of Spanish-language literature on this topic, reviewing contributions from influential scientists and key theoretical models. The WHO's recommendations for the effective implementation of these interventions in public health are also discussed. This work not only fills a critical gap in the Spanish-language literature but also provides practical tools to improve public health in Spanish-speaking countries.

KEYWORDS Behavioral science, public health, intervention design, behavior change

INTRODUCTION

Behavioral science has emerged as a fundamental theoretical paradigm and an essential tool for designing and implementing effective policies. This multidisciplinary field, which combines insights from psychology, economics, neuroscience, and other disciplines, focuses on understanding how people make decisions and how social, cognitive, and emotional factors influence their behaviors. By investigating the drivers and barriers that affect human behavior, behavioral science systematizes evidence at the individual, community, and population levels, enabling more effective design of programs, policies, and incentives that promote healthy behaviors [1,2].

Behavioral sciences are crucial to addressing contemporary challenges such as noncommunicable diseases, pandemics, and other global health crises [3]. Major disease risk factors, such as smoking, sedentarism, and malnutrition, are linked to modifiable behaviors. It is estimated that about 50% of premature deaths can be attributed to unhealthy choices and behaviors [4]. This underscores the importance of designing effective interventions that promote positive behavioral changes.

Theories and models derived from this field, such as Fogg's behavioral model [5], the behavior change wheel [6], and the capability, opportunity, motivation-behavior (COM-B) model [7], provide robust frameworks for the design and evaluation of interventions that seek to promote healthy behaviors, reduce risk factors, and improve health outcomes (Table 1). As noted by psychologist Kurt Lewin, "There is nothing more practical than a good theory" [8]. However, some health researchers still question the usefulness of evidence-based theories without recognizing how they could strengthen their scientific work. Communicating these theories is critical when developing and evaluating health interventions. Theories suggest how interventions can influence health and what aspects should be modified and provide valuable explanations when an intervention fails to achieve the expected outcomes [8].

However, it is important to recognize that within the behavioral sciences, critical and alternative approaches question traditional behavioral interventions. Models such as those based on social justice or those that critique direct intervention

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MAIN MESSAGES

- There is a significant lack of Spanish-language literature on applying behavioral science in public health, which limits its adoption in Spanish-speaking countries.
- This article provides a comprehensive perspective in Spanish. It analyzes how behavioral science can improve public health and offers a practical approach to its implementation.
- The research focuses on established models and principles, which may restrict the exploration of new and emerging theories in the field of behavioral sciences.
- The article offers practical and relevant tools, based on globally recognized principles, to improve public health in Spanish-speaking contexts and promote the integration of behavioral sciences into public health policies and programs.

highlight the need to consider the structural and systemic determinants of health. These approaches complement established models by providing a more holistic perspective, focused on changing individual behaviors, addressing inequalities, and promoting social justice [9]. In addition, it has been pointed out that certain interventions based on behavioral economics may cross ethical boundaries by manipulating decisions under the guise of nudges or subtle encouragement [10,11]. If these practices are not transparent or do not respect individual autonomy, they can reinforce inequalities or generate distrust in public policies. Although this article focuses primarily on consolidated frameworks such as capacity, opportunity, motivation-behavior, and the behavior change wheel, integrating these critical perspectives allows for designing and implementing more balanced, ethical, and equitable interventions.

Despite the growing importance of behavioral sciences in health care, their application and knowledge in Spanish-speaking countries remain limited. A significant barrier to their adoption is the limited availability of Spanish-language literature and resources, which hinders the training of researchers, practitioners, and policymakers in the region. This impedes the full exploitation of behavioral sciences' potential to improve public health in the Americas and Spain [12,13].

According to the World Health Organization (WHO), behavioral sciences are crucial in improving the design of public health interventions and policies. These address challenges ranging from pandemics to chronic diseases and climate crises [1]. The 76th World Health Assembly, held in May 2023, recognized the importance of these sciences in improving health outcomes, promoting universal coverage, and strengthening preparation for health emergencies. It also urged Member States to integrate behavioral science approaches into their public health policies [14,15].

The main objective of this article is to introduce the reader to the key concepts and definitions of behavioral science, present some of its most relevant theoretical frameworks, and explore its specific application in the field of public health. In addition, this article provides a unique perspective in Spanish on the application and evolution of behavioral sciences in public health, highlighting the urgent need to increase the production and availability of literature in this language to address current and future challenges in health [1,16].

BEHAVIORAL SCIENCE: PRINCIPLES, MODELS, AND APPLICATIONS IN PUBLIC HEALTH

This article presents a non-systematic, narrative literature review with two objectives: identifying behavioral science models and theoretical frameworks applicable to public health and exploring their implementation. Both approaches are based on the WHO models. Also, a comparative analysis examining the application of these principles in Spanish-speaking countries is carried out.

Table 1. Application of the first principles of behavioral science in public health.

Principle	Component of COM-B	Example of public health intervention	Type of influence
Cognitive and psychological factors	Motivation	Treatment adherence: Implementation of personalized reminders and positive reinforcement to improve medication adherence.	Psychological
Social and cultural contexts	Automatic motivation	Vaccination campaigns: use of nudges and participatory public health approaches to increase adherence to COVID-19 vaccination.	Psychological/social
External environmental factors	Opportunity	Physical activity promotion: design of urban environments with walking trails and green areas to encourage physical activity.	Environmental

COM-B, capacity, opportunity, motivation-behavior.
Notes: The first three principles are applied according to the COM-B model.
Source: Prepared by the authors based on the results of the study.

The model was established by the WHO Technical Advisory Group on Behavioral Sciences for Health [3]. It provides a comprehensive guide to understanding the cognitive, social, and environmental factors that influence human behavior [16]. In addition, key contributions and fundamental theoretical models such as the theoretical domain framework, Fogg's behavioral model, the behavior change wheel, and the capability, opportunity, and motivation-behavior model are reviewed, assessing their usefulness in the Spanish-speaking context and providing several examples of their application.

APPLIED BEHAVIORAL SCIENCE PRINCIPLES

The WHO emphasizes that approaching public health from a behavioral science perspective requires focusing on individuals and their context. Key principles include understanding cognitive, social, and environmental influences and applying this understanding to design and evaluate interventions. Strategies should focus on overcoming specific barriers, conducting ongoing evaluations, and collaborating with communities to create effective solutions.

Principle 1: Cognitive and emotional factors underlie human behavior

Behavioral science research shows that cognition, motivation, and emotion profoundly influence health decision-making. In many Spanish-speaking countries, public health policies do not sufficiently integrate this knowledge, limiting the effectiveness of interventions. Implementing strategies that consider these factors could significantly improve adherence to treatment and the promotion of healthy habits [5,6,17].

A consolidated finding is that cognitive and affective biases are fundamental in human behavior, often associated with heuristics or intuitive judgments. In his work on systems thinking, Nobel laureate Daniel Kahneman highlights that people often make health-related decisions intuitively and emotionally rather than reasoning logically [17–19]. Therefore, public health interventions should be designed to consider these cognitive and emotional biases and better align with people's decision-making processes.

It is important to emphasize that when we speak of "choices", we are not saying that people consciously engage in "unhealthy" behaviors. Nor are we seeking to promote a blaming discourse that places all responsibility on individuals for their "lifestyles," as is sometimes suggested. Rather, integrating behavioral sciences into public health offers a new perspective for understanding and addressing behavior and maximizing the impact of behavioral interventions [20].

Principle 2: Social and cultural contexts, along with the rules, values, and practices accompanying them, influence behavior

Social and cultural contexts profoundly influence individual behaviors, including local values, rules, and practices. Understanding and addressing these behaviors requires gathering evidence through community strategies and thoroughly assessing local circumstances. Health decision-making is a complex process influenced by a dynamic interplay of social and contextual factors. Therefore, it is critical to identify barriers and facilitators at different levels and design targeted and effective interventions that integrate these elements. Social norms, cultural constructs, local practices, identity, social support systems, and cultural commitments are all key factors that influence human behavior [1,6].

However, health programs do not adequately incorporate this behavioral science approach in many parts of Latin America and the Caribbean. Consequently, interventions do not effectively address individual behaviors deeply influenced by local norms and practices. This disconnect has limited the effectiveness of many public health policies. Integrating an approach that considers social and cultural contexts would enable more effective and culturally appropriate programs to be designed. This will increase the relevance and impact of interventions in the Americas region.

Principle 3: External environmental factors can encourage or discourage healthy behaviors

External factors, such as healthcare systems, policies, municipalities, communities, and available resources, can promote or discourage healthy behaviors. Actions such as healthy eating, physical activity, safe sexual practices, vaccination, and smoking cessation are profoundly influenced by the environment in which people live and make decisions. It is crucial to gather evidence to understand how these factors act as barriers or facilitators of healthy behaviors and to use this information to redesign environmental aspects that promote beneficial behaviors.

However, environments in many Spanish-speaking countries are not designed to promote health effectively. This is reflected in low infrastructure for physical activity or limited access to healthy foods. All of this contributes to problems such as obesity and chronic diseases. Redesigning these factors, for example, by creating spaces for exercise and improving access to healthy foods, could encourage significant changes in health behaviors. Strategies such as installing condom dispensers in accessible spaces can also increase condom use among young people by promoting safe sexual practices. Implementing interventions that improve the environment is key to encouraging healthy habits and addressing regional public health challenges [21,22].

Principle 4: Behavioral evidence and theory should be used in the planning, designing, and implementing health policies and programs

To maximize the impact of health interventions, it is crucial that policy planning, design, and implementation be based on evidence and behavioral theories. Collecting data on the influences on human behavior allows for a better understanding of behavioral problems. In addition, it helps to identify key behaviors, stakeholders, and existing barriers and facilitators.

Interventions are most effective when they target the specific factors that influence behavior and combine various strategies, such as programs, communications, financial measures, and regulatory mechanisms.

In Spanish-speaking countries, the application of behavioral science theories and evidence in health policy has been limited. This has resulted in ineffective interventions and inefficient use of resources. Improving the integration of these theories could optimize healthcare outcomes and optimize policies. Understanding why interventions fail is crucial to understanding how human behavior works in public health. It is also fundamental to establishing the basis for behavior change. This involves using tools and theoretical frameworks such as the nudge approach, the domain-theoretic framework, the capability, opportunity, motivation-behavior model, behavior change techniques, the behavior change wheel, and Fogg's model. For a more detailed description of the relevant theoretical models, see Table 1. Theoretical frameworks and models of behavior change applied in public health.

Examples in the application of tools and theoretical frameworks.

Treatment adherence:

- Psychological influence (motivation): treatment adherence is crucial in chronic disease management. To improve medication adherence, personalized reminders, and positive reinforcement can be implemented. This type of intervention is based on understanding the cognitive and psychological factors that influence the patient's motivation to follow his or her treatment regimen. For example, a daily reminder sent by text message and a short motivational phrase can help patients remember to take their medication and feel supported in their treatment. This strategy aligns with the "motivation" component of the ability, opportunity, and motivation-behavior model, which emphasizes the importance of psychological factors in behavior modification [23].

Public health campaigns:

- Social influence (automatic motivation): vaccination campaigns, especially during the COVID-19 pandemic, have demonstrated the importance of influencing automatic motivation through social and economic interventions. Using principles of the nudge approach, based on intuitive and automatic decision processes, public health campaigns have successfully increased vaccination rates. For example, making the option of vaccination the simplest and most accessible or sending messages reinforcing the social acceptance of vaccination are strategies that take advantage of social norms and cultural contexts to encourage healthy behaviors. This approach is aligned with the "automatic motivation" component of the capability, opportunity, motivation-behavior model and focuses on social influences to facilitate healthy decision-making [22,24–27]

Physical activity promotion:

- Environmental influence (opportunity): the design of urban environments that promote physical activity is a clear example of how environmental factors can create opportunities for healthier behaviors. Installing walking paths, parks, and green spaces in urban areas makes it easier for people to integrate physical activity into their daily routines. These architectural interventions provide a safe and attractive space for physical activity and remove barriers to access, such as a lack of adequate infrastructure. This approach corresponds to the "opportunity" component of the capacity, opportunity, motivation-behavior model, emphasizing the importance of environmental factors in promoting healthy behaviors [28–30].

The following table synthesizes how the first three behavioral science principles apply, connecting them with specific examples and the capability, opportunity, and motivation-behavior model for clear and practical understanding (Table 1).

Principle 5: Evaluate strategies and interventions to provide empirical evidence on healthy behavior facilitators

It is essential to evaluate strategies and interventions to obtain empirical evidence on their effectiveness in promoting healthy behaviors. This process involves devoting time and resources to testing, learning, and adjusting during the intervention cycle. Evaluations, especially in specific contexts and on a smaller scale, such as pilot projects, are crucial to identifying what works, what does not, in what setting, and why.

Results should be documented and shared to strengthen the evidence base before scaling up interventions [31–34].

However, in many Spanish-speaking countries, systematic evaluation of health interventions is a practice that is not yet sufficiently entrenched. Health policies are often implemented without rigorous evaluation to identify their real effectiveness. This lack of evaluation limits the ability to learn from mistakes and adjust interventions to make them more effective. This can result in inefficient use of resources and suboptimal results in promoting public health in the region.

Principle 6: Participatory approaches should be used in the planning, designing, and implementing public health policies and programs

Adopting participatory approaches in planning, designing, and implementing health policies and programs is essential. Behavioral and social scientists should actively co-design strategies and interventions with affected communities, with special emphasis on including marginalized populations. Involving key community stakeholders, such as citizens,

policymakers, and healthcare providers, early in the process builds trust. This trust is crucial for promoting healthy behaviors and achieving more equitable health outcomes [35,36].

PROPOSALS FOR IMPLEMENTING BEHAVIORAL SCIENCE IN PUBLIC HEALTH

The implementation of behavioral science in public health faces several challenges, which must be addressed to maximize its impact:

Integrating into education

It is essential to reformulate academic curricula (undergraduate and graduate) in health sciences to incorporate behavioral approaches. This will ensure that future professionals have the tools to apply behavioral principles in clinical and public health practice.

Replicability of research

Improving design standards and transparency in research is crucial to strengthen confidence in scientific findings. Replicability of studies is critical to validate interventions and ensure their efficacy in different contexts.

Use of established taxonomies

Employing theoretical structures and frameworks such as the behavior change wheel and the capability, opportunity, and motivation-behavior model facilitates communication and collaboration across disciplines. This promotes a consistent and systematic approach to the application of behavioral science.

Digital interventions

Further research is needed on the effectiveness of digital behavior change interventions, especially those using artificial intelligence. These emerging technologies have the potential to personalize interventions and expand their reach but require rigorous evaluation to ensure their efficacy and equity. Digital interventions have proven to be valuable tools in public health by enabling real-time monitoring and personalized behavioral incentives. This is especially notable in mental health management, through applications that facilitate self-regulation, and in monitoring chronic diseases such as diabetes. These approaches integrate frameworks such as the capability, opportunity, and motivation-behavior model to overcome behavioral barriers and optimize health outcomes [37,38].

ETHICS IN BEHAVIORAL INTERVENTIONS: A PARTICIPATORY APPROACH

When designing behavioral interventions, it is critical to consider the inherent ethical risks. These risks include potential manipulation of decisions, invasion of personal autonomy, and the stigma that can arise from holding individuals accountable for their choices. To address these challenges, strategies must be transparent, respect user autonomy, and avoid approaches that perpetuate individual blame. In this context, the ethical principles developed by the Organisation for Economic Cooperation and Development (OECD) provide practical tools, such as checklists and guiding questions, to guide the design of responsible interventions [39]. In addition, integrating participatory approaches from the earliest stages allows for the involvement of affected communities, ensuring that strategies are culturally sensitive, aligned with local values, and accepted by those who will be impacted. This approach builds trust and promotes sustainable and equitable behavior change.

To ensure the effective and scalable implementation of behavioral science-based interventions, it is critical to use strategies such as pilot testing to validate interventions in local contexts and adapt their design to cultural realities before scaling up [40,41]. Methodologies such as digital technologies and message personalization have proven effective in vaccination and chronic disease management programs, facilitating replicability and sustainability [42,43].

Limitations

A first limitation is the fact that the article focuses on consolidated models such as capability, opportunity, motivation-behavior, and the behavior change wheel, which may limit the exploration of emerging theories and alternative approaches. Similarly, the narrative review does not involve a systematic analysis of all available literature, which may restrict completeness in selecting examples and cases. Finally, although local examples are included, the cases discussed may not reflect the totality of experiences in Spanish-speaking countries, limiting their generalizability.

CONCLUSIONS

Behavioral sciences provide an innovative and effective approach to addressing contemporary challenges in public health, offering practical tools that can promote healthy behaviors and improve health outcomes globally. However, their implementation faces significant obstacles, such as fragmentation of the field, public resistance, professional resistance, and difficulties in evaluating interventions. To overcome these challenges, it is crucial to adopt a collaborative approach that includes greater investment in research and development, especially in Spanish-speaking contexts, where the adoption of these sciences is still limited.

Systematically integrating behavioral science knowledge into public health policies and programs will advance a healthier and more equitable future and ensure that interventions are culturally tailored, effective, and sustainable. The key to success is contextualizing and consistently applying these principles to local realities. This will help close the implementation gap and maximize the positive impact on public health.

BOX 1.

Theoretical frameworks and models of behavior change applied in public health.

DESCRIPCIÓN DE MODELOS

COM-B Model: COM-B (Capacity, Opportunity, Motivation - Behavior), proposed by Susan Michie and colleagues, provides a solid basis for understanding and designing behavior change interventions by focusing on capacity, opportunity, and motivation for change. Thus, it allows exploration of individual, social, and environmental influences on human behavior [7].

Behavior Change Wheel, also known as Behavior Change Wheel (BCW), is a theoretical model that provides a structure for designing interventions to promote behavior change. It is based on the COM-B model and offers a systematic and structured approach to understanding and changing behavior [6].

Fogg's model focuses on three key elements: motivation, capability, and triggers. It assumes that health interventions should be tailored to the individual's motivation, simplifying the behavior or modifying the environment through triggers to achieve effective change. The model is particularly useful for promoting "small habits" or well-defined behaviors [5].

Theoretical domain framework: This framework simplifies 33 theories into 14 domains, providing a structure for understanding the factors that influence human behavior. It is used to understand the determinants of behavior in different health contexts and to identify key areas where interventions can be made to promote healthy behaviors, such as improving confidence in one's ability to perform healthy behaviors [44].

Nudge approach: The nudge approach, proposed by Richard Thaler and Cass Sunstein, uses small stimuli and changes in the environment to influence decisions and behaviors in a predictable manner without the need for coercion. By leveraging intuitive and automatic decision processes, nudges encourage healthy behaviors, such as fruit and vegetable consumption, through prominent placement in stores or on menus [45].

Behavior change techniques are specific strategies used to modify human behavior. They are based on evidence and behavior change theory and are used to design effective interventions in public health and related fields [12,46].

Notes: These tools and models offer an evidence_based approach to understanding and modifying behaviors, facilitating the design of more effective interventions and maximizing the impact of public health strategies.

Source: Prepared by the authors based on the study results.

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Introducción a la ciencia del comportamiento y sus aplicaciones prácticas en la salud pública

RESUMEN

La Organización Mundial de la Salud (OMS) destaca la importancia de mejorar el diseño de intervenciones y políticas de salud pública mediante la aplicación de principios de las ciencias del comportamiento. Estas ciencias juegan un papel crucial en la modificación de comportamientos, abordando una amplia gama de desafíos de salud, que van desde pandemias y enfermedades crónicas hasta la crisis climática. Este artículo analiza el impacto transformador de las ciencias del comportamiento en la promoción de la salud pública, enfocándose en los factores que influyen en la toma de decisiones y en las estrategias de intervención basadas en los seis principios desarrollados por el Grupo Asesor Técnico de la OMS. Además, se aborda la significativa escasez de literatura en habla/lengua española sobre este tema, revisando las contribuciones de científicos influyentes y modelos teóricos clave. Asimismo, se discuten las recomendaciones de la OMS para la implementación efectiva de estas intervenciones en salud pública. Este trabajo no solo llena un vacío crítico en la literatura en español, sino que también ofrece herramientas prácticas para mejorar la salud pública en los países de habla castellana.