Effective communication strategies and practices for dengue and other arboviral diseases

Systematic review

PAHO
Pan American Health Organization
World Health Organization
Americas Region
Co-funded by the European Union

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Contents

Abbreviations and acronyms

DPSA	dengue-related public service announcement
IEC	information, education, and communication
MAP	Manuel A. Pérez housing project
MOH	Ministry of Health
NEA	National Environmental Agency
PAHO	Pan American Health Organization
PD	positive deviance
RC	risk communication
SI	social innovation
WHO	World Health Organization

Acknowledgments

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Introduction

The dengue situation in the Region of the Americas

In the Region of the Americas, approximately 500 million people are at risk of contracting dengue, with a significant increase in cases over the past four decades. In the 1980s there were 1.5 million cumulative cases, a figure that rose to 16.2 million in the 2010–2019 period. In 2023, a record 4 565 911 cases, including 7653 severe cases and 2340 deaths, were recorded. High transmission continued in 2024, with 673 267 cases reported through epidemiological week 5, representing an increase of 157% over the same period in 2023 and 225% compared to the five-year average. The worrisome situation in the Americas is reflected in the most recent epidemiological data on dengue. Between epidemiological weeks 1 and 13 in 2024, an alarming total of 4 820 955 suspected cases of dengue fever were recorded, with a cumulative incidence of 511 cases per 100 000 population. This drastic increase (260% compared to the same period in 2023 and 448% compared to the average for the previous five years) demonstrates the seriousness of the situation.

The four dengue virus serotypes circulate throughout the Americas, a situation that increases the risk of severe disease and mortality in people infected with different successive serotypes. Simultaneous circulation of two or more serotypes has been observed in at least 21 countries and territories on the continent. The *Aedes aegypti* mosquito, the dengue vector, is present throughout the continent, with the exception of Canada and continental Chile. Although Uruguay has not reported cases of dengue, this vector is also found in its territory.

To address these circumstances, which affect public health in the Region, the Pan American Health Organization (PAHO) has played a key role in the prevention and control of dengue and other arboviral diseases through the implementation of an integrated management strategy adopted by Member States in 2016. In addition, the Dengue Laboratory Network of the Americas (RELDA) was established in 2008 to strengthen diagnostic capabilities. Subsequently, the network was expanded to include chikungunya and Zika virus disease; 40 laboratories from 35 countries in the Americas currently participate. In parallel, PAHO is collaborating in the development of a model for an integrated epidemiological surveillance system for dengue, chikungunya, and Zika that incorporates epidemiological, clinical, laboratory, and entomological surveillance to generate standardized, timely information for decision-making. In addition to these efforts, the concept of "collaborative surveillance" is being promoted through virtual collaboration spaces so that countries can analyze their epidemiological, clinical, laboratory, and entomological data in real time, as well as generate automated reports and bulletins in conjunction with PAHO.

PAHO is also focused on strengthening national capacities for the clinical diagnosis and management of dengue, chikungunya, and Zika cases in the Region through the promotion of a clinical cooperation package that includes technical documents, clinical guidelines, and virtual self-learning courses, as well as the formation of national networks of clinical experts in arboviral diseases. PAHO is also driving the strengthening of regional and national capacity for vector prevention and control, in line with the *Plan of Action on Entomology and Vector Control 2018–2023*, which includes initiatives to improve entomological surveillance systems, monitor and manage insecticide resistance, and train professionals in entomology through virtual courses. In addition, a new model of interventions to control *Aedes aegypti* is in implementation, and support is being provided to countries for the adoption of new vector control approaches and technologies.

While recognizing the value of the efforts made to date and noting the positive impact of these measures on the management and control of arbovirus-related diseases in the Region, it is clear that further efforts are needed to curb the escalation of cases. The social sciences – with their wealth of knowledge regarding behavior change, the dissemination of crucial information, and the implementation of a variety of measures at the individual, community, organizational, and political levels – could contribute significantly to improving the situation of dengue and other arbovirus-related diseases in the Americas. Health communication, through its various strategies – such as risk communication, community participation, the COMBI (Communication for Behavioral Impact) methodology, digital and analog mass communication, interpersonal communication, and social marketing, among others – has proved to be highly effective in addressing issues of great relevance to public health. In the current emergency in the Region of the Americas, health communication is therefore of great value in recognizing, compiling, and disseminating effective practices in behavior change with respect to the prevention, control, and treatment of dengue and other arboviruses.

[1] In 2000, the World Health Organization (WHO) promoted the COMBI methodology (communication for behavioral impact) for planning communication and social mobilization actions.

Health communication and its impact on public health

In the last three decades of the twentieth century, health communication emerged as a field of great importance internationally, playing an essential role in health education, behavior change, and the dissemination of information to achieve a positive impact on public health. In this field, it is recognized that any prevention and health education process involves effective communication, and that the knowledge acquired in this area is fundamental to achieving positive population health outcomes. Several of the Millennium Development Goals – focusing on issues such as nutrition, maternal and child health, HIV/AIDS, obesity, and communicable and noncommunicable diseases – highlight the importance of communication in promoting healthy lifestyles and disease prevention. In this context, health communication is particularly relevant in addressing complex issues such as sexuality, substance abuse, access to health services, and diseases that require behavior change for their management and cure (because there are no vaccines or definitive treatments), while strengthening community participation and helping to empower the population.

The beginnings of health communication date back to the 1970s, when psychologists, sociologists, and communication experts began to explore how social and psychological aspects influence health. This evolved into an interdisciplinary area that examines how communication affects public health and health services delivery, as well as its strategic use in promoting health and preventing disease. Since then, health communication has been defined as the study and use of communication strategies that inform and influence individual and community decisions to promote health. In other key areas of action (contextual, lifestyle, and health system), health communication can play a fundamental role in promoting healthy lifestyles, empowering health system users, and improving the quality of services.

In recent years, the proliferation of new technologies (computers, software, mobile devices, etc.), along with the popularization of social networks such as Facebook, Instagram, and WhatsApp, have led to significant changes in the healthcare system. Such changes are reflected both in how people access health information and how they communicate about health-related issues in their daily lives. A comprehensive analysis was conducted of the role of information and communication technologies (ICTs) in communication processes within hospital settings, as well as their impact on health outcomes in this specific context. The role of ICTs as facilitators in health systems has also been investigated, ranging from personal health records and the use of e-mails between patients and physicians to improve the efficiency of care to the dynamics and content of healthy eating groups in social networks. A fundamental conclusion in this area of research is that the enormous influence of the media and social networks on individual and group decisions on health-related issues cannot be underestimated.

Health communication and arboviral diseases

As expected, health communication has been shown to play a crucial role in addressing diseases such as dengue, Zika, and chikungunya, for which there are no definitive or easily accessible vaccines. In this context, health communication is a fundamental tool for encouraging behavior change and promoting preventive practices that reduce the transmission of these diseases. In the absence of a definitive medical solution, accurate and timely information that is effectively disseminated through educational campaigns, media, and public health channels, can significantly influence individual and community actions to control the spread of mosquito-borne viruses. Health communication can be used to implement strategies on aspects such as the elimination of mosquito breeding sites, use of repellents, proper management of stagnant water, and promotion of hygiene practices, thus contributing to the protection of public health and the well-being of affected communities.

The accumulated research on the threat of arboviral diseases such as dengue, Zika, and chikungunya has resulted in a series of recommendations on specific communication activities, such as disseminating timely and accurate information that integrates public health concerns and the information needs of the population, especially vulnerable groups such as women of childbearing age, pregnant women, and healthcare workers. In addition, the proposal calls for continued efforts to promote behavior change, social mobilization, and community participation to control the vector and eliminate its breeding sites, while keeping the public informed about the risks of infection and ongoing public health processes and research. Two other essential aspects relate to maintaining institutional credibility through the dissemination of accurate, evidence-based information, and the establishment of a monitoring system to quickly address speculation and rumors. This will allow an effective response to the concerns and information needs of the population and partners, and ensure consistency in the messages issued by health authorities.

To achieve these objectives, this publication proposes the adoption of a unified, coherent governmental approach to strategic and operational communication that involves partners from the nongovernmental sector. This requires the creation and implementation of a system that ensures consistency in the messages produced by both the national government and local health authorities, as well as the development of content guidelines aimed at obtaining unified messages and defining protocols for the release of public information during health emergencies, such as the spread of dengue and other diseases caused by arboviruses. In summary, the goal is comprehensive, coordinated, and evidence-based communication to effectively address the public health emergency posed by arboviral diseases.

Although some initial guidelines are presented here, the current dengue emergency demands rigorous, systematic work based on empirical evidence regarding effective communication products and practices for the prevention, control, and treatment of dengue and other arboviruses.

The objectives of this research are presented below.

General objective

To summarize the state of the art of the most effective practices aimed at generating behavior changes related to the prevention, control, and treatment of dengue and other arboviruses.

Specific objectives

- Establish the countries and geographic regions where the research was conducted, and the target audiences.

- Describe the communication and behavior change strategies used to prevent dengue and other vector-borne diseases.

- Analyze the practices, communication products, campaigns, and public announcements that were effective in changing behavior related to the prevention, control, and treatment of dengue and other arboviral diseases.

- Determine the role of risk communication and community participation in the prevention of dengue and other vector-borne diseases.

The following section details the methodology followed to achieve each proposed objective.

Methodology

A descriptive, longitudinal, systematic review-type study was carried out. The research question was structured using the PICO methodology: P (problem), I (intervention), C (comparison), and O (outcomes). The research question was:

What is the state of the art of effective behavior change practices for the prevention, control, and treatment of dengue and other arboviruses? (Table 1).

Table 1. Research question with the PICO methodology

Problem	Intervention	Outcomes
Effective practices	Behavior change	Prevention, control, and treatment of dengue and other arboviruses

Source: Authors.

The Web of Science (WoS) and Scopus databases were selected, both of which are considered to have the greatest impact and recognition in the scientific field at the international level. It should be noted that these two databases include most of the scientific journals in the health field.

The keywords used for the search, which was conducted for the 2014–2024 period, were: practices, communication, dengue, Zika, chikungunya, behavior, strategies, campaigns, prevent, public service announcements, mobilization, community engagement, risk communication, health, promotion, neighborhood, actions with the Boolean operator "AND."

The keywords, which were combined in the search box, yielded a total of 277 scientific publications (159 for WoS and 118 for Scopus) (Table 2).

Table 2. Combination of keywords for searching for scientific publications in WoS and Scopus

No.	Combination	No. of publications	
		WoS	Scopus
1	practices AND communication AND dengue	46	38
2	behavior AND communication AND dengue	43	36
3	behavior AND strategies AND communication AND dengue	20	14
4	campaigns AND strategies AND prevent AND dengue	20	7
5	public AND service AND announcements AND dengue	2	2
6	dengue AND mobilization AND social AND community AND engagement	3	3
7	risk AND communication AND dengue AND Zika AND chikungunya	13	12
8	health AND promotion AND dengue	11	5
9	neighborhood AND actions AND dengue	1	1
Total		**159**	**118**

Source: Authors.

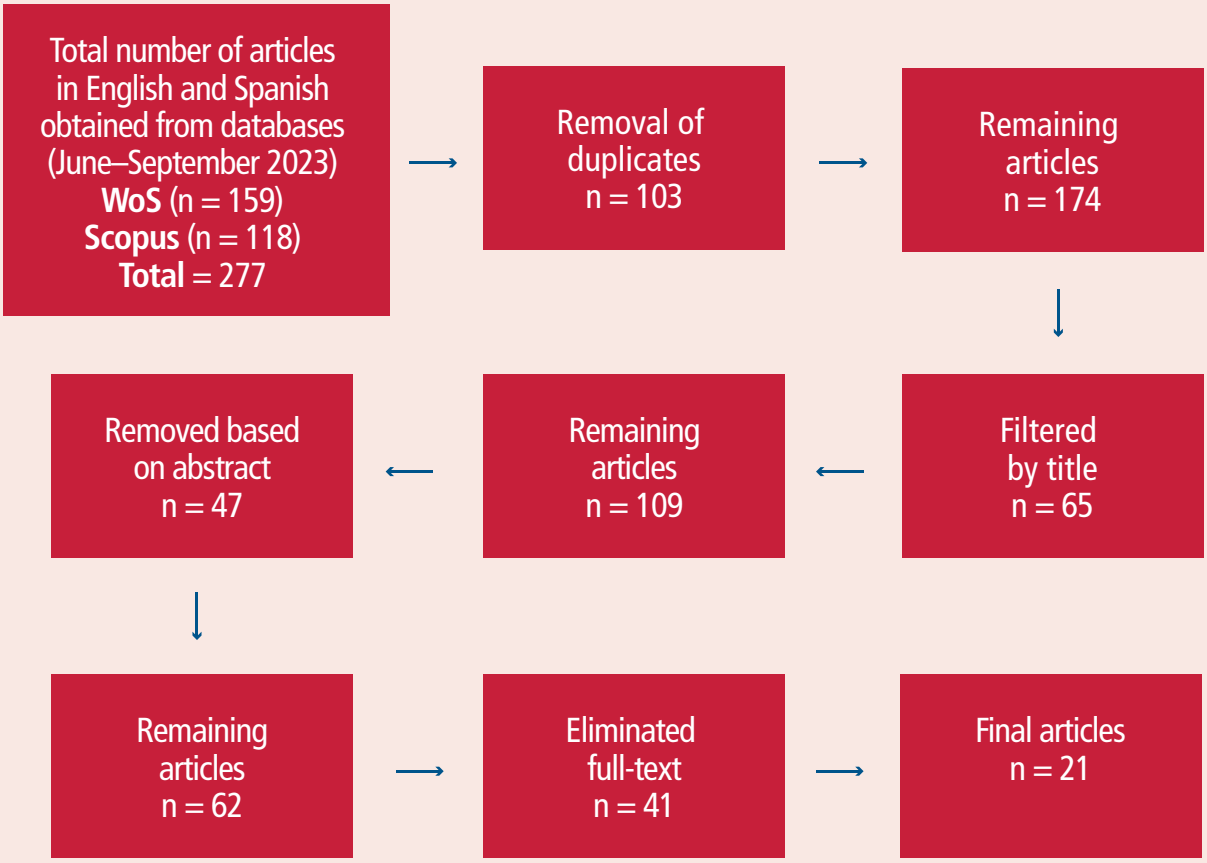
The filters used for the search included publications from the last 10 years in the categories "medicine" and "social sciences" in English, Spanish, and Portuguese.

The inclusion criteria consisted of scientific articles on the following topics:

- Prevention, treatment, and control strategies for arbovirus diseases;
- Risk communication;
- Social mobilization;
- Behavior change.

The defined filters were applied manually and duplicate items were deleted. For the final publication selection process, those that were not related to the subject of interest were removed using a three-layer filtering process: by title, abstract, and full text, in that order. After applying these steps, a total of 21 articles were obtained. Figure 1 illustrates the search process according to the PRISMA model.[2]

Figure 1. Flowchart of the selection process for scientific publications according to the PRISMA model



Source: Authors.

Note: PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) is a model for researchers based on a guide published in 2009 that brings together the information elements suggested for systematic reviews and meta-analyses.

Subsequently, a table was prepared according to the general and specific objectives, questions based on the objectives, and the response categories in order to systematize the information extracted from the articles in an Excel-type template and proceed with their analysis (Table 3).

[2] The PRISMA model (Preferred Reporting Items for Systematic reviews and Meta-Analyses) is a guide published in 2009 that brings together, as its name suggests, the information elements suggested for systematic reviews and meta-analyses.

Table 3. Relationship between the objectives and research questions

Objetives		Questions
General	**Specific**	
To summarize the state of the art of effective practices to generate behavior changes in the prevention, control, and treatment of dengue and other arboviruses.	Establish the countries and geographic regions where the research was conducted and the target audiences.	Which countries or geographic regions were studied?
		Who were the target audiences for the strategies?
	Describe the communication and behavior change strategies used to prevent dengue and other vector-borne diseases.	What communication and behavior change strategies were used in the prevention of dengue and other vector-borne diseases?
	Analyze the practices, communication products, campaigns, and public announcements that were effective in changing behavior related to the prevention, control, and treatment of dengue and other arboviral diseases.	What type of communication practices and products were effective for behavior change in the prevention, control, and treatment of dengue and other arboviral diseases?
		What types of campaigns and public announcements are related to behavior changes to prevent vector-borne diseases?
	Determine the role of risk communication and community participation in the prevention of dengue and other vector-borne diseases.	How were risk communication and community participation used in the prevention of dengue and other vector-borne diseases?

Source: Authors.

Outcomes

A total of 277 publications were identified from the WoS (n = 159) and Scopus (n = 118) databases, of which 21 were selected for analysis (Figure 1).

Although the study period covered the last 10 years (2014–2024), higher scientific production on the subject studied is observed in 2021 (five articles), followed by 2020 and 2015 (three articles each), and 2019, 2017, and 2022 (two articles). In 2014, 2013, 2018, and 2023 production was lower, with one article published each year.

The following results relate to the specific objectives of the research.

Specific objective 1: Establish the countries and geographic regions where the research was conducted and the target audiences.

- **Countries or geographic regions under study**

  Brazil (Albarado et al., 2021; Caprara et al., 2015; Clancy et al., 2021), Burkina Faso (Hébert et al., 2020), Cambodia (Echaubard et al., 2020), China (Lun et al., 2023), Colombia (Escudero and Villareal, 2015), India (Raza et al., 2020; Nivedita, 2016), Indonesia (Hendra, Alfah, and Pedani, 2022), Mexico (Morales-Pérez et al., 2017; Alvarado-Castro et al., 2019; Tapia-Conyer, Méndez-Galván, and Burciaga-Zúñiga, 2012), Curaçao (van Goudoever et al., 2021), Pakistan (Malik et al., 2021; Shafique et al., 2022); Peru (Dammert, Galdo, and Galdo, 2014), Puerto Rico (Poehlman et al., 2019; Juarbe-Rey et al., 2018), Singapore (Vijaykumar et al., 2017), and Sri Lanka (Lwin et al., 2016).

- **Characterization of the audiences to whom the strategies were addressed**

  Brazilian citizens (Albarado et al., 2021; Caprara et al., 2015; Clancy et al., 2021), residents of the Punjab (Raza et al., 2020) and Rajasthan (Nivedita, 2016) provinces in India, communities in the coastal region of the state of Guerrero in Mexico (Morales-Pérez et al., 2017; Alvarado-Castro et al., 2019), the population of Peru (Dammert, Galdo, and Galdo, 2014), the local population of Curaçao (van Goudoever et al., 2021), pregnant women, their partners, and communities in Puerto Rico (Poehlman et al., 2019), students and health professionals from Burkina Faso (Hébert et al., 2020), schoolchildren in Indonesia (Hendra, Alfah, and Pedani, 2022), the population of Pakistan (Malik et al., 2021; Shafique et al., 2022), community members in China (Lun et al., 2023), the general population of Sri Lanka (Lwin et al., 2016), community members in Cambodia (Echaubard et al., 2020), and the residents of the Manuel A. Pérez (MAP) housing project in Puerto Rico (Juarbe-Rey et al., 2018).

Specific objective 2: Describe the communication and behavior change strategies used to prevent dengue and other vector-borne diseases.

- **Communication strategies and behavior change**

  In a study conducted in southern Mexico (Camino Verde), the research team comprised of researchers, facilitators (graduates in psychology or social anthropology), and *brigadistas* (community volunteers), received theoretical and practical training on community research (designs, results, focus groups, and communication approaches) about the vector (life cycle of *Aedes aegypti*, control mechanisms, symptoms of dengue disease, inspections of domestic water containers). Community meetings were held to provide information about the project in the intervention communities. Local leadership structures were identified and active social groups were involved. Focus groups were created to share the information obtained from the baseline survey and about the life cycle of the mosquitoes. Household-level actions were identified to control the mosquito, as well as outreach strategies that *brigadistas* could use in the community.

  The strategies implemented were: i) locally-defined vector control actions at the household level to discuss the project in order to prevent dengue fever; ii) home visits to check the condition of the breeding sites; iii) locally-defined vector control actions at the community level through joint efforts with schools (leading to out-of-school activities such as sports competitions and local marches related to the dengue vector), health services (educational messages on dengue prevention and treatment and referral of suspected dengue cases), and the Secretariat of Development (to share evidence on dengue prevention with beneficiaries of the government's "Oportunidades" program), and iv) biological control actions using fish (*brigadistas* helped residents catch certain kinds of fish in local ponds and streams, and then demonstrated how these fish feed on mosquito larvae). At the start of the intervention, most local health authorities were not interested because they considered dengue prevention to be a governmental responsibility and that the problem should be solved through governmental larvicide and fumigation programs. However, as *brigadistas* shared evidence of other (non-chemical) ways to control the vector in their communities, confidence in this approach grew. The attitudes of local health authorities also began to change and they started to support the *brigadistas* in their tasks. They joined the community effort, demonstrating greater community respect for healthcare personnel.

  Different age groups were successfully included in the brigades. Initially, it was thought that children would work only with their peers, but they gradually became part of the overall neighborhood movements, helping spread the evidence among their peers and helping the teams gain entry to homes (Morales-Perez et al., 2017).

The social capital components include personal relationships, social support networks, citizen participation and trust, and rules for cooperation. Social capital (i.e., the benefits that individuals or groups can gain through their relationships, networks, and social connections) can be important to the health of a population. In this same project, the Camino Verde intervention found a significant association between a high level of social capital and low rates of dengue vectors, as households in intervention communities with high social capital were less likely to have immature forms of the vector (Alvarado-Castro et al., 2019).

The study conducted by Vijaykumar et al. (2017) found that the Facebook social network was a very positive tool for raising public awareness and sharing information during public health emergencies in Singapore. Indeed, the National Environment Agency (NEA) and the Ministry of Health (MoH) published, respectively, 33 and 35 Zika-related messages between March 2015 and September 2016. In terms of user interaction, MoH posts received almost twice as many "likes" (average 35.5) and were shared almost six times more (average 30.1) than posts by the NEA. However, NEA posts received more comments (average 4.5) than MoH posts. Thematic analyses show that NEA messages focused mainly on prevention followed by interventions, while MoH messages centered on situation updates and investigations. Research-related posts received the most "likes" on average, although posts about status updates received the most shares and comments. According to the researchers, Facebook provides a valuable real-time interface for public health authorities to disseminate information when an outbreak occurs and to identify and follow "the pulse" of social conversations (also called "social listening") in real time. The researchers conclude that "These capabilities might enable them to address public anxiety, quell rumors by providing frequent updates and information, and bolster trustworthy relationships with communities during outbreaks that trigger confusion and uncertainty among societies" (p. 5).

Caprara et al. (2015) conducted an intervention in the city of Fortaleza, Brazil, to increase dengue-related entomological impact using social participation as a strategy. The intervention lasted approximately one year and included community workshops; community participation in clean-up campaigns; covering elevated garbage containers; in-house garbage disposal without larvicides; mobilization of schoolchildren and older community members; and distribution of information, education, and communication (IEC) materials in the community. The results of the study showed the effectiveness of the eco-health program in achieving a significant reduction in the dengue vector population through interventions targeted at the most productive container types. The project also succeeded in increasing the population's knowledge about dengue and its willingness to participate in preventive actions. It should be noted that this study used a rigorous methodology, a cluster randomized controlled trial comparing 10 intervention clusters with 10 control clusters that implemented routine vector control activities. The intervention strategy was based on community participation and a partnership approach with public control services. The researchers emphasized that social participation and environmental management were feasible and significantly reduced vector densities, emphasizing that this participatory eco-health approach

offers a promising alternative to routine vector control measures carried out by services, often based solely on larviciding or space-spraying and without social participation (p. 104).

Another experience carried out in Jodhpur, India, which also employed IEC strategies, showed successful results with regard to the acquisition of knowledge about dengue transmission and prevention. Nivedita (2016) reports that city residents received training on basic knowledge of dengue-transmitting agents, symptoms, preventive measures against mosquito bites (such as the use of mosquito nets and the application of repellent at night on exposed areas of the body), proper coverings for domestic water storage containers, and the importance of going to public health centers for disease diagnosis and treatment. One year after the end of the training, 50% of the households (100 houses) were revisited to assess the change in their knowledge, attitudes, and behavioral practices in the dengue-related context between December 2010 and January 2011. The findings showed that the IEC strategies resulted in a great improvement, particularly in the head of household's awareness of dengue fever symptoms (which increased from 6.5% before implementation of the strategies to 84% post-IEC). The increase in visits to public health facilities (12% of households before versus 45% after the intervention) indicates that it is possible to change community behaviors. The researcher concludes that "with mass awareness programme in the communities through group discussion and audio-visual aids, desired results in prevention and control of dengue transmission can be achieved" (p. 282).

Escudero-Támara and Villareal-Amaris (2015) reported on the effectiveness of an educational intervention carried out in Sincelejo (in Sucre, Colombia) to a group of 54 families located in 31 neighborhoods with poverty characteristics. The educational strategy, called "United against dengue: collect the unusable – wash and cover tanks," was based on four components: i) the objective; ii) the behavior promoted; iii) the methodological process for guiding the adoption of the behavior (based on the precaution adoption theory and community participation elements of the COMBI methodology strategy); and iv) the targets. The components were coordinated so as to motivate and stimulate behavior change for the elimination of dengue vector breeding sites. The researchers reported very positive results as a consequence of the educational intervention. For example, in the post-intervention period, levels of misinformation about dengue and the vector's behavior decreased from 14.8% to 3.7% ($p = 0.109$), and incorrect beliefs decreased from 20.4% to 5.6%. Correct practices increased from 24% to 87% ($p = 0.001$). At the end of the process, 64.8% of the participating groups reached the action stage, in which they adopted the recommended practice. The number of intradomiciliary mosquito breeding sites was reduced from 92.6% to 35.2% ($p = 0.001$). The researchers suggest that to achieve changes in the adoption of favorable practices and control the emergence of dengue, educational activities should be diversified according to the person's need and stage of change, considering aspects such as existing risk factors, the level of motivation and willingness to change, and ongoing monitoring so that educational programs are successful (p. 24). The study

empirically demonstrates the effectiveness of the educational strategy in getting participants to adhere to the promoted vector control behavior.

Echaubard et al. (2020) presented encouraging results from an ongoing project related to a set of interventions that include source reduction procedures based on integrated vector management, experimental health education using a COMBI methodology, and community participation. These interventions are having a significant impact on reducing entomological indicators of dengue in rural primary schools and households in two districts of Kampong Cham, Cambodia. The strategy included community participation methodologies and training activities; participation of teachers, school principals, and representatives of the Ministry of Education in the redefinition of the curriculum for dengue-related health education; student participation in the development of strategies and key messages to be distributed in the community and the school; and community definition of the channels to implement the proposed solution. While the project is still ongoing, the researchers emphasize that the interventions so far have contributed to the emergence of culturally relevant social innovation (SI) products and provided initial clues about: i) the conditions that allow SI to arise; ii) the specific mechanisms by which it occurs; and iii) how external parties can facilitate it. The study concludes that, overall, there appears to be a strong case for supporting SI as a desirable outcome of project implementation to build adaptive capacity and resilience, and for using this project's implementation support protocol as an operational guidance document for adaptive management of other vector-borne diseases in the region (p. 11).

The study conducted by Shafique et al. (2022) in Islamabad, Pakistan, used the positive deviance (PD) model to better understand the effectiveness of the community participation approach in dengue prevention and control. PD is a community engagement model for behavior change that was originally implemented to improve nutritional outcomes in Viet Nam. This successful experience was subsequently replicated in over 40 countries around the world. The premise of PD is that in every community there are a few "positive deviants" who deviate from social norms and practice uncommon behaviors that help them and their families enjoy better health outcomes than their peers and neighbors, with whom they share similar risks and resources. The community discovered existing positive behaviors around dengue prevention and control, which were shared with all participants through interactive activities. After two months, the results showed a significant improvement in dengue-related knowledge, attitudes, and practices in the intervention group compared to the control group. Furthermore, after another two months, knowledge about dengue transmission, prevention practices, and symptoms not only persisted, but continued to improve, with statistically significant differences between the intervention and control groups. The researchers concluded that "PD is an 'inside-out,' community-led behavior change intervention that ensures active community participation throughout the process, which is a key requirement of vector control programs. Therefore, PD should be further replicated and scaled up to better determine the effectiveness

of the approach. [PD] could be a potential behavior change tool for dengue prevention and control in Pakistan and elsewhere" (p. 16).

Researchers Tapia-Conyer, Méndez-Galván and Burciaga-Zúñiga (2012) examined the Patio Limpio ("Clean Patio") strategy, which sought to involve the local population in the organized identification and elimination of vector breeding sites by focusing on the importance of each household in the fight against dengue in the state of Guerrero, Mexico. The project began with local assemblies to train the group, ask them to commit to keeping the environment clean, and identify community leaders in each neighborhood block. Communication strategies included the placement of 18 signs and 130 posters; 3 daily loudspeaker broadcasts in areas such as shopping malls and markets throughout the community; and the distribution of leaflets to all households visited by so-called "block activators" (the block activators were mostly women who were in charge of visiting households to provide training on the identification and elimination of breeding sites, conduct monthly assessments, and attend community meetings). This initiative not only promoted dengue prevention but also fostered a healthy family environment and recreational activities, strengthening the group's sense of community and empowerment. The households already visited and trained were identified with stickers. The results show that more than 1000 block activators were generated and trained, with an average of approximately 15 households managed by each activator. Of a sample of 5477 backyards, approximately 54% (2918) were designated as "clean and free of breeding sites." Further analysis revealed that households that were not visited and evaluated by a block activator had a 2.4 times higher risk of developing dengue compared to those trained and supervised by an activator. In addition, 80% of the households trained were able to identify a breeding site and mosquito larvae at the three-month follow-up visit. However, after one year, only 30% of the households trained had a clean backyard and were aware of the risks associated with breeding sites. The researchers emphasized that to encourage continuity of programs, community leaders are effective channels through which to disseminate information, educate communities, and catalyze behavior change at the household level, in turn fostering progress in the wider community (p. 12).

Specific objective 3: Analyze the practices, communication products, campaigns and public announcements that were effective in changing behavior related to the prevention, control, and treatment of dengue and other arboviral diseases.

- **Type of communication practices and products for the prevention, control, and treatment of dengue and other arboviral diseases**

Due to the constant changes that occur in practice in work contexts where professionals need to know how to respond quickly and appropriately to health problems such as dengue

and other emerging pathologies, the study by Hébert et al. (2020) explored the use of video as a knowledge transfer tool in Burkina Faso where there is a high prevalence of dengue fever and lack of training for health workers. The authors identified the perceptions of the participants (students and health professionals) who were exposed to three videos that had the same message, but three different narrative genres: journalism, drama, and animation. The results proved that video offers an effective way of communicating evidence and that health personnel prefer to acquire new knowledge through video rather than written documentation. There is no doubt that its playful nature makes it a particularly attractive tool for reaching health professionals. Regarding the narrative genres, it was found that the groups with the dramatic and animated genres increased their knowledge scores significantly more than the group that used the journalistic video. This suggests that the narrative genre of the video influences the viewer's ability to retain information and that some narrative elements promote knowledge transfer more than others. In addition, the study identified the importance of four key aspects for a video to be effective: i) transmitting information in narrative form; ii) choosing good communicators; iii) creating a visual instrument to reinforce the message; and iv) adapting the message to the local context (Hébert et al., 2020).

Research by Albarado et al. (2021), conducted in Brazil, showed that television is no longer decisive in increasing the audience for public health campaigns, since the health authorities treat reception as a mere stage in a verticalized and institutional communication process. By contrast, today's audience is less controlled and has access to alternative media, producing and choosing what it wants to consume. Based on the reports, it can be observed that the audiovisual campaigns broadcast nationally have not met the population's need for information and guidance; indeed, people may end up adopting practices that are even dangerous due to the "old issues of misinformation."

Another successful strategy identified was peer education in school settings. Researchers Hendra, Alfah, and Pedani (2022) provided four days of training for youth peers about general information, etiology, clinical manifestation, transmission, prevention, and treatment and management of dengue using various materials over Google Meet and WhatsApp. The student leaders then explained the content to their peers by presenting the material, watching a video, and encouraging discussions based on the materials reviewed. The research method consisted of a quasi-experiment with a two-group design (pre- and post-test), and the instrument used was a questionnaire about dengue-related knowledge and practices. The results showed that, after receiving a peer education intervention, there was a significant increase in knowledge about dengue hemorrhagic fever and prevention, as well as the etiology, transmission, clinical manifestation, and treatment of dengue. With respect to prevention practices, there was an increase in knowledge regarding the prevention of mosquito breeding sites

and mosquito bites. This study concludes that "Peer education influences adolescent behavior through their role models who have reputable credibility and innovators in their group." (p. 29).

In Peru, researchers Dammert, Galdo, and Galdo (2014) presented evidence about the effectiveness of cell-phone technologies to improve household preventive health behavior in dengue-endemic areas. The intervention consisted of sending 30 cell-phone messages during a three-month period prior to the peak of the dengue season. The information provided covered the life cycle of the mosquito (e.g., eggs are deposited on the wet walls of water containers), the conditions that allow the spread of dengue, and various strategies to control the spread of the disease. According to the researchers' findings, repeated exposure to preventive health information positively affected household behavior. Overall, the Breteau index, an objective measure of dengue infestation, showed that households repeatedly exposed to preventive information experienced a decrease of –0.10 standard deviations relative to the mean for the control group. This is explained by positive changes in household behavior and translated into a reduction in the self-reported incidence of dengue symptoms. The researchers emphasize that this approach is highly cost-effective, since mobile telephone service allows a wide range of individual information to be disseminated instantaneously and inexpensively. Repeated dissemination of appropriate information can mitigate the effects of contexts of poverty, weak institutional structures, and imperfect markets, in which information is often costly and incomplete.

Similarly, Lwin et al. (2016) conducted a study in Colombo, Sri Lanka, that was characterized as a baseline for a mobile phone intervention called "Mo-Buzz." The research consisted of a survey to explore (n = 404) the individual, institutional, and cultural factors that influenced the potential intention to use Mo-Buzz, as well as whether these aspects vary according to demographic factors. The Mo-Buzz intervention not only enables dengue surveillance through mobile crowdsourcing, but also integrates this with shared health education and digital mapping of the disease. It also has the added advantage of having a direct communication channel with the Department of Public Health, which monitors and responds to reports of dengue cases. Descriptive analysis revealed high levels of perceived ease of use, perceived usefulness, and intention to use among participants. Analysis of variance suggested that participants in the 31–40 years age group had the highest perceived ease of use, while the older age group had high perceived institutional efficacy and collectivist tendencies. Regression analysis showed that perceived usefulness, behavioral control, institutional efficacy, and collectivism were significant predictors of intention to use. While the researchers maintain that these are very positive findings, they are very cautious in recommending the strategy. They suggest that, while making use of the power of cell phones to capture the intelligence of crowds to strengthen infectious

disease prevention and management is an exciting idea for public health professionals and researchers, it is fraught with complex challenges. The first is its elemental dependence on people's participation, which, as our study shows, involves complex behavioral considerations (p. 479).

- **Types of vector-borne disease prevention campaigns and public announcements**

  In a study conducted in Brazil to determine the effectiveness of prevention campaigns and actions to control arboviral diseases, respondents reported that it was clear to them that the messages were meant to promote prevention and provide guidance on care and on actions to eliminate mosquito breeding sites, and were focused on the stories of real people. However, in the focus groups, they described an evident association between prevention/care and loss/suffering. Some participants mentioned that campaigns have to "shock," because "unfortunately" people only care about doing something when their incentive is fear. Regarding the campaign ads, the vast majority showed paved streets, clean spaces, concrete residences, and access to garbage collection services, public transportation, and potable water, which is not the standard situation in Brazil. The participants' own comments (which point out differences ranging from the use of concrete slabs to cultural aspects) corroborate the relevance of considering social determinants and a regionalized strategy. In addition to situations related to determinants, if people identify with the aesthetics of campaigns and public announcements, this could help increase social mobilization. When people recognize themselves and see themselves represented, their feeling of co-responsibility and belonging increases (Albarado et al., 2021).

  The provincial government of Punjab has issued a remarkable number of public announcements as part of the country's epidemic control strategy. The study by Raza et al. (2020) anticipated, based on the existing literature, that the relationship between exposure to public announcements about dengue and preventive behavior would be mediated by attention and information elaboration and surveillance. However, the results showed a different scenario in the Punjab sample (dengue-affected province). Attention to dengue-related public service announcements (DPSAs) was identified as a strong mediator in predicting the adoption of preventive behavior (i.e., if people paid more attention to health-related content in media such as DPSAs, they might increase the adoption of preventive behaviors). In addition, information surveillance also improves dengue-related preventive behavior by mediating its relationship with DPSAs. Therefore, information-seeking and guiding people to information related to health risks during the epidemic can further improve the level of adoption of preventive behaviors. On the other hand, elaboration, which is the process by which people connect new information with prior knowledge, did not show a significant direct relationship with preventive behavior. Therefore, in health-related campaigns that use public announcements, it is important to consider the inclusion of attractive factors to catch people’s attention. In that

sense, governmental epidemic control actions could consider factors such as attention and use more attractive public announcements (Raza et al., 2020).

Where time is of the essence and action must be taken in emergency contexts, it is important to examine the design and implementation of the "Stop Zika" campaign, aimed at pregnant women, their partners, and the communities of Puerto Rico. In only two months, the campaign developed concepts, messages, and materials tailored to the needs of the audience. Although the research was not formative in the strict sense of the word, the context survey provided a quick understanding of the communication environment before moving on to the concept development stage. Audience testing provided feedback on draft materials and concepts, as well as information about what pregnant women knew, believed, and felt about the risks of the Zika virus. Efficient identification of locations and partners to support interviews and other testing activities was an integral step in the planning process. This research provided a better understanding of the cultural context and social norms that the campaign would attempt to influence to increase preventive behaviors (Poehlman et al., 2019).

Clancy et al. (2021) conducted a study examining 37 posters that circulated in 2017 in Brazil toward the end of the Zika epidemic to analyze their potential effectiveness in inducing behavior change related to outbreaks of mosquito-borne pathogens. The content analysis revealed the appearance of three key messages in the posters: i) information on arboviruses and their consequences, ii) mosquito control, and iii) the responsibility to protect and prevent. An important finding reported by the researchers is that the posters focused primarily on mosquito transmission and the need to eliminate breeding sites, but neglected the risk of sexual and congenital transmission of Zika, and the importance of adopting alternative preventive actions. The researchers concluded that the posters did not fully reflect the various modes of disease transmission and the range of methods available to reduce risk, especially for pregnant women. In the study conclusions, it was recommended that when developing future risk communication (RC) posters, careful consideration should be given to incorporating components that highlight the potential benefits of adopting preventive behaviors and the means to address potential barriers that may arise in the target population.

Specific objective 4: Determine the role of risk communication and community participation in the prevention of dengue and other vector-borne diseases.

- **Risk communication and community engagement**

In Curaçao, research was conducted to compare the news with the local perspectives of the population and health professionals. It was evident that RC strategies were hampered by the lack of structure, organization, and governmental communication. The information channels through which locals reported receiving information on dengue, chikungunya, and Zika were: newspapers, radio,

television, individuals (family, friends, and doctors), social media, and international media. They did not directly mention the government as an information channel. On the recommendation of an RC expert from the Ministry of Health, a brochure on chikungunya was produced in four languages: Papiamento, Dutch, English, and Spanish (languages widely spoken on the island). A postal company was responsible for distribution to the community. However, during the evaluation of the communication campaign it became clear that the brochures were not distributed as agreed. In addition, the respondents showed little knowledge about disease transmission. This lack of coordination and communication between institutions prevented the public and the government from accessing vital information about risks. Regarding the perception of locals, experts, government officials, and local journalists, the general consensus was that RC arrived too late, at the peak of the epidemic. This suggested that, despite the media coverage of the disease (in the case of Zika), the government and the media had underestimated the risk, leading to an attenuated response. The influence of trust was reflected in the way participants often described the content provided by the government as "official information" and therefore, something they trusted. Social networks and journalists were singled out as less trustworthy (van Goudoever et al., 2021).

In Puerto Rico, a pilot study was conducted to analyze a risk communication initiative (United against Zika) to increase awareness of the virus and health-enhancing behaviors among residents of the Manuel A. Pérez (MAP) housing project. The primary focus was to develop a community engagement and RC project that would apply an interactive information and feedback process to understand the concerns and meet the unique needs of the MAP community. Partnering with community members allowed the contextualization of RC strategies to convey health information in formats that were easily understood and well-received. In addition, community participation in the planning, development, and implementation of this RC initiative contributed to a greater sense of project ownership and more robust empowerment of the inhabitants since they were also contributors to the research process. The results demonstrated positive and significant changes in respondents' recognition of their personal and community responsibility in preventing Zika virus infection; increased knowledge of Zika virus prevention strategies; and increased participation in preventive behaviors for mosquito control. All of this highlighted the importance of residents of low-income communities making informed decisions to protect themselves against Zika virus and other mosquito-borne diseases (Juarbe-Rey et al., 2018).

In August 2019, Pakistan experienced a serious dengue outbreak that activated the WHO Public Health Emergency Operations Center for cross-sectoral collaboration in response activities. The activation procedure for the operations center included the development and implementation of the incident management structure, the incident action plan, and the RC plan. The RC team was responsible for developing the information, education, and communication (IEC) material. The RC plan was prepared with the intention of developing specific material to promote

community awareness through social media platforms, distribute printed material on dengue prevention and control, and coordinate actions with print and digital media stakeholders. In addition to the general public, the printed material was also developed for and distributed to schools and different organizations (such as the Akhtar Hameed Khan National Center for Rural Development, the Health Services Academy, and COMSATS University). In the last week of November, cases decreased by 95–99%. Communication prevented the duplication of efforts to gather information, facilitated the collection of quality surveillance data and response activities, and promoted timely actions against the threat. It also ensured a clear channel of communication between the different teams and public departments involved in response activities. The use of modern tools, such as different social media platforms, played an important role in raising health-related awareness among the general public, since it allowed reach to a wider audience in a shorter time, which clearly favored outbreak mitigation efforts. In addition, it worked for conducting awareness campaigns aimed at the general public (Malik et al., 2021).

Contributions to surveys aimed at identifying useful media and channels

Lun et al. (2023) explored the effects of various sources of dengue-related information and knowledge on mosquito control behavior among residents of areas at high risk for this disease. The study had the ultimate goal of identifying effective ways to improve such behavior. The results obtained indicate that mass media advertising (WeChat accounts, magazines, newspapers, brochures, television, radio, Internet) had a direct impact on dengue knowledge and mosquito control behavior, and an indirect impact on the latter through increased knowledge about the disease. Likewise, the organized publicity campaigns, which included information provided by medical personnel and community information, had a direct effect on dengue-related knowledge and an indirect effect on mosquito control behavior by increasing knowledge about the disease. In addition, it was observed that the level of dengue-related knowledge among residents had a positive and significant effect on their mosquito control behavior.

Use of mobile telephones to provide information about vectors

Carrillo et al. (2021) conducted a systematic literature search that identified a total of 1289 records, of which 32 met the inclusion criteria; 4 additional records were added based on lists of references. In total, the meta-analysis conducted included 36 studies from 20 different countries. This review showed that 5 cell-phone services used: mobile applications (n = 18), short message services (n = 7), phones with cameras (n = 6), cell-phone tracking data (n = 4), and simple mobile

communication (n = 1). Cell phones were used in various activities, such as surveillance, prevention, diagnosis, and communication. They were shown to be effective; were well accepted by users, who found them easy to use; and were feasible and effective in real situations, helping to reduce vectors and disease, and promoting behavior changes. In conclusion, cell phones have clear advantages in the control of arboviral and other epidemic diseases, although further studies focusing on aspects such as acceptance, cost, and large-scale efficacy are recommended.

Summary of main findings

Effective communication strategies, practices, and products to fight dengue and other arboviral diseases

- **Communication strategies and behavior change**
  - Projects that rely on community engagement, involve diverse social groups, and segment the population well have proved to be effective in communicating prevention messages to the community and in vector control actions (Caprara et al., 2015; Echaubard et al., 2020; Morales-Pérez et al., 2017; Tapia-Conyer, Méndez-Galván, and Burciaga-Zúñiga, 2012).

  - Schools have proved to be good partners in education processes related to both vector control management and disease prevention (Echaubard et al., 2020; Escudero-Támara and Villareal-Amaris, 2015).

  - The positive deviance strategy has been effective in increasing knowledge about dengue transmission and prevention practices. Capitalizing on practices that already exist in the community during an intervention seems to be a very effective strategy, starting "from the inside out" with community participation (Shafique et al., 2022).

- **Communication practices and products**
  - Narrative genres, particularly those that include drama and animation, were found to be an effective part of interventions aimed at increasing knowledge about dengue management (Hébert et al., 2020). In this context, television has been losing strength in public health campaigns, while social media and networks have gained prominence (Albarado et al., 2021).

  - Peer education in school settings has been another successful practice in dengue prevention, in particular to increase knowledge about dengue hemorrhagic fever and its prevention (Hendra, Alfah, and Pedani, 2022).

  - Interventions using mobile technology have proved effective in reaching a broad population and achieving behavior changes in vector management, and have a favorable cost-benefit

ratio (Dammert, Galdo, and Galdo, 2014; Lwin et al., 2016). Constant and repetitive exposure to messages on preventive behaviors is particularly effective, compensating for possible lack of audience attention (Dammert, Galdo, and Galdo, 2014).

- **Campaigns and public announcements**
  - A growing literature confirms the importance of gaining the attention of a segmented audience to ensure that a message is understood and acted upon. Faced with information overload (the average person is continuously exposed to various analog and digital media), campaigns that grab people's attention were found to be more effective (Raza et al., 2020).

  - Another element highlighted by the research is that messages that do not point out the possible consequences of a disease may be ineffective. Extensive literature has confirmed that fear appeal can be a highly effective strategy, achieving the desired impact on the target population (Albarado et al., 2021).

  - Systematic research also shows that it is essential for the messages used in campaigns to be realistic and show contexts that are relatable to community members where an intervention will take place. Although audiovisual media rely heavily on showing ideal environments, if people do not see themselves or their reality represented, they will not find the message credible or trustworthy (Albarado et al., 2021).

  - Other lessons learned from research related to posters or signs about arboviral diseases include the need to provide comprehensive information on the different forms of disease transmission, highlighting the benefits of preventive actions, and offering solutions to possible obstacles in order to achieve the behaviors promoted in the target population (Clancy et al., 2021).

- **Risk communication and community engagement**
  - In contexts in which risk communication addresses circumstances faced by the community, it is essential to provide timely, updated information on the evolution of the disease or outbreak, and what may be required to tackle it. Failure to do so may lead to missing a one-time opportunity to act in time to prevent the situation from escalating to a more serious scenario (van Goudoever et al., 2021).

  - In situation of risk, it has proved to be very useful to involve the community in the different stages of the development of a response (planning, development, implementation), since this results in a high degree of empowerment and participation of community members. In addition, it is important to maintain a participatory process with interactive dialogue to achieve a more effective strategy (Juarbe-Rey et al., 2018).

- The use of modern communication tools, such as social media platforms, has been effective in reaching a wide audience in a short period of time and achieving the expected impact in terms of creating awareness of health issues and reducing dengue transmission (Malik et al., 2021).

Conclusions

In the Region of the Americas, dengue represents a growing public health concern, with a dramatic increase in cases during recent decades. Epidemiological data show a significant increase, with a record 4 565 911 cases in 2023 and a continued increase in 2024, when cases reached a total of 673 267 cases by epidemiological week 5. This alarming increase, which represents an increase of 157% over the same period during the previous year (2023) and 225% compared to the average for the last five years, underscores the seriousness of the situation. Against this backdrop, communication and behavior change play a crucial role in the prevention and control of arboviral diseases that lack effective vaccines or are beyond the reach of a large part of the population.

In the absence of a short-term solution, the emphasis is on preventive measures and behavior modification to reduce the spread of the disease and minimize its impact on public health. Effective communication can increase awareness of the risks associated with these diseases, educate the population about preventive measures, and promote the adoption of healthy behaviors, such as the use of insect repellents, elimination of mosquito breeding sites, and personal protection. In addition, encouraging changes in community behaviors such as participation in vector control programs and solid waste disposal can help to reduce the number of transmitting mosquitoes and the incidence of arboviral diseases.

The systematic research carried out in this study shows that strategies for effective communication and behavior change for the prevention of dengue and other arboviral diseases are based on community participation and segmentation of the population. Projects that involve diverse social groups and capitalize on existing social practices have proved to be effective, especially when they focus on education and community participation (Caprara et al., 2015; Echaubard et al., 2020; Morales-Pérez et al., 2017; Tapia-Conyer, Méndez-Galván, and Burciaga-Zúñiga, 2012).

Schools are a key partner in these efforts, constituting an environment conducive to education on vector control and disease prevention (Echaubard et al., 2020; Escudero-Támara and Villareal-Amaris, 2015). Likewise, strategies such as positive deviance, which focus on building on existing social practices, have proved to be effective in engaging the community and promoting knowledge and prevention practices "from the inside out" (Shafique et al., 2022).

In terms of effective communication practices and products, narratives play a prominent role, especially those that bring together drama and animation, as well as the use of mobile technology and peer education in school environments. These interventions have been shown to be effective in increasing

knowledge and promoting behavior changes for dengue prevention and control (Hébert et al., 2020; Hendra, Alfah, and Pedani, 2022; Dammert, Galdo, and Galdo, 2014; Lwin et al., 2016).

There is a noticeable change in the preferences related to the media used in public health campaigns, with social media and networks gaining ground over other more traditional media, such as television (Albarado et al., 2021). Constant, repeated exposure to prevention messages, especially on mobile devices, stands out as an effective strategy to overcome potential lack of audience attention (Dammert, Galdo, and Galdo, 2014).

In campaigns and public announcements, it is important to capture the attention of the target population and present realistic messages that show the consequences of the disease and offer solutions. Fear appeal is recognized as an effective strategy to generate impact, and it is necessary to present credible contexts and offer complete, practical information about disease transmission mechanisms and prevention (Raza et al., 2020; Albarado et al., 2021; Clancy et al., 2021).

Finally, risk communication and community participation are fundamental in the prevention of dengue and other vector-borne diseases. In this regard, it is essential to provide timely information tailored to the needs of the community, and to actively involve its members in all stages of the process. The use of modern communication tools such as social networks is a particularly effective way to reach a wide audience and generate awareness of health issues (van Goudoever et al., 2021; Juarbe-Rey et al., 2018; Malik et al., 2021).

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Health communication plays a crucial role in addressing diseases such as dengue, Zika, and chikungunya, for which there are no definitive or easily accessible vaccines. In this context, this discipline becomes a fundamental tool to promote behavior change and preventive practices that reduce the transmission of these diseases. In the absence of a definitive medical solution, accurate and timely information, effectively disseminated through educational campaigns, media, and public health communication channels, can significantly influence individual and community actions to control the spread of these mosquito-borne viruses.

The accumulated research around the threat of arboviral diseases brings together a series of recommendations around specific communication activities, such as disseminating timely and accurate information that integrates public health concerns and the information needs of the population, especially vulnerable groups such as women of childbearing age, pregnant women, and health workers. Furthermore, this proposal involves continuing with the initiatives to encourage behavior changes, as well as social mobilization and community participation, with a view to controlling the vector and eliminating its breeding sites, while keeping the public informed about the risks of infection, ongoing public health processes, and research in development.

This work proposes adopting a unified and coherent government approach to strategic and operational communication, involving partners and allies from the nongovernmental sector. This involves defining and implementing a system that guarantees the coherence of messages between the national government and the local health authorities, as well as developing content guides aimed at obtaining unified messages and defining protocols for the release of public information in health emergency situations, such as the spread of dengue and other diseases caused by arboviruses. In summary, comprehensive, coordinated, and evidence-based communication is needed to effectively confront the public health emergency presented by arboviral diseases.

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