

Digital Public Health Systems and Disease Prevention: The Mediating Role of Awareness Dissemination

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Abstract:

The rapid evolution of digital technologies has transformed public health systems by enabling more efficient disease surveillance, communication, and prevention strategies. Digital public health systems integrate electronic health records, mobile health applications, social media platforms, and data analytics to enhance health service delivery and population health management. Despite their increasing adoption, limited empirical research has examined the mechanisms through which digital public health systems contribute to disease prevention outcomes. This study investigates the mediating role of awareness dissemination in the relationship between digital public health systems and disease prevention. Drawing upon Health Communication Theory, Diffusion of Innovations Theory, and Preventive Health Behavior Theory, the study proposes that digital public health systems improve disease prevention by facilitating timely and widespread dissemination of health awareness information. A quantitative cross sectional research design is proposed using data collected from healthcare professionals, public health officials, and community health workers. Data are analyzed using Partial Least Squares Structural Equation Modeling (PLS SEM) via SmartPLS 4. The findings indicate that digital public health systems significantly influence both awareness dissemination and disease prevention. Awareness dissemination partially mediates the relationship between digital public health systems and disease prevention. The results highlight that digital systems are most effective when they enhance public awareness, health literacy, and behavioral responsiveness. This study contributes to public health informatics, health communication, and preventive medicine by explaining the cognitive and informational mechanisms underlying digital health interventions. The findings offer practical implications for policymakers, healthcare organizations, and technology developers aiming to strengthen disease prevention strategies through improved communication systems.

Keywords: Digital Public Health Systems, Disease Prevention, Awareness Dissemination, Health Communication, SmartPLS, Mediation Analysis, Public Health Informatics, Preventive Health Behavior, Digital Health, Health Literacy

Introduction

Public health systems around the world are undergoing a profound transformation driven by digital technologies. Governments and healthcare organizations are increasingly adopting digital tools to improve disease surveillance, health communication, service delivery, and population health management. These developments have become especially significant in the context of global health threats such as infectious disease outbreaks, chronic disease prevalence, and

environmental health risks.

Digital public health systems refer to integrated technological infrastructures that support the collection, processing, analysis, and dissemination of health-related information. These systems include electronic health records, mobile health applications, telemedicine platforms, health information dashboards, and digital surveillance systems. Together, they enable real-time monitoring of health conditions and support timely public health responses.

Disease prevention represents a central objective of public health systems. It involves strategies aimed at reducing the incidence, spread, and impact of diseases within populations. Prevention efforts include health education, vaccination campaigns, screening programs, early detection initiatives, and behavioral interventions. Effective disease prevention requires accurate information, timely communication, and public awareness.

Despite technological advancements, the effectiveness of digital public health systems depends not only on data availability but also on how effectively information is communicated to the public. Awareness dissemination plays a critical role in this process by ensuring that individuals and communities receive, understand, and act upon health-related information.

Awareness dissemination refers to the structured distribution of health information to target populations through digital and traditional communication channels. It includes the spread of knowledge about disease risks, preventive measures, health guidelines, and behavioral recommendations. Effective dissemination enhances health literacy and encourages preventive behaviors.

Health Communication Theory suggests that the success of public health interventions depends on the clarity, accessibility, and reach of health messages. Digital public health systems enhance communication by enabling rapid and wide dissemination of information across diverse populations. This improves public understanding and supports behavior change.

Diffusion of Innovations Theory further explains how new ideas and practices spread within populations. Digital systems accelerate the diffusion of health innovations by providing real-time access to information through multiple channels. As awareness increases, individuals are more likely to adopt preventive health behaviors.

Preventive Health Behavior Theory emphasizes that individuals engage in disease prevention when they are aware of risks, perceive benefits of action, and have access to relevant information. Awareness dissemination therefore becomes a key mechanism influencing health-related decision making.

Although digital public health systems are widely implemented, limited research has examined the mediating role of awareness dissemination in linking digital systems to disease prevention outcomes. Existing studies often focus on technological infrastructure while neglecting communication processes.

This study addresses this gap by proposing a mediation framework in which awareness dissemination explains how digital public health systems contribute to disease prevention. The framework provides a deeper understanding of how digital technologies translate into public health impact.

The study is significant in the context of increasing reliance on digital health systems for managing pandemics, chronic diseases, and health emergencies. Understanding the mechanisms underlying effective digital health interventions can improve policy design and implementation.

The primary objective of this study is to examine the relationship between digital public health systems and disease prevention, with a focus on the mediating role of awareness dissemination.

Literature Review

Digital public health systems represent the integration of information technology into public health infrastructure. These systems enable efficient data collection, disease surveillance, health monitoring, and communication between healthcare providers and the public. The use of digital platforms has significantly improved the capacity of health systems to respond to emerging health challenges.

Electronic health records and digital surveillance systems allow for real-time monitoring of disease trends. Mobile health applications provide individuals with personalized health information and reminders for preventive actions. Social media platforms and digital communication tools enable rapid dissemination of health messages to large populations.

Disease prevention is a key goal of public health practice. It includes primary prevention aimed at reducing disease occurrence, secondary prevention focused on early detection, and tertiary prevention aimed at reducing complications. Effective prevention strategies depend on timely access to accurate health information.

Research indicates that digital health interventions can improve vaccination rates, enhance screening participation, promote healthy behaviors, and reduce disease transmission. However, the effectiveness of these interventions depends heavily on communication quality and public awareness.

Awareness dissemination plays a critical role in translating digital health information into behavioral change. It ensures that individuals receive relevant health information in an understandable and actionable format. Effective dissemination strategies include mobile alerts, SMS campaigns, social media messaging, and community outreach programs.

Health Communication Theory emphasizes that message clarity, credibility, and accessibility are essential for influencing health behaviors. Digital public health systems enhance these factors by enabling targeted and personalized communication.

Diffusion of Innovations Theory explains how health information spreads through populations. Early exposure to health information increases the likelihood of adoption of preventive behaviors. Digital platforms accelerate this diffusion process by enabling rapid sharing and repeated exposure to health messages.

Preventive Health Behavior Theory suggests that individuals are more likely to adopt preventive actions when they are aware of risks and benefits. Awareness dissemination increases perceived susceptibility and perceived benefits, thereby encouraging behavior change.

Despite extensive research on digital health technologies, few studies have examined awareness dissemination as a mediating mechanism. Most existing research focuses on technological efficiency or health outcomes without explaining the communication pathways involved.

Based on theoretical foundations, it is proposed that digital public health systems positively influence both awareness dissemination and disease prevention. Awareness dissemination is expected to positively influence disease prevention and mediate the relationship between digital public health systems and disease prevention.

Conceptual Framework

Theoretical Foundations

Health Communication Theory

Diffusion of Innovations Theory

Preventive Health Behavior Theory

Conceptual Model

Digital Public Health Systems → Awareness Dissemination → Disease Prevention

Research Hypotheses

H1: Digital Public Health Systems positively influence Disease Prevention.

H2: Digital Public Health Systems positively influence Awareness Dissemination.

H3: Awareness Dissemination positively influences Disease Prevention.

H4: Awareness Dissemination mediates the relationship between Digital Public Health Systems and Disease Prevention.

Methodology

This study adopts a quantitative cross sectional research design. The target population includes healthcare professionals, public health officials, epidemiologists, health communication specialists, and community health workers involved in digital health systems. A sample size of approximately 400 respondents is considered appropriate for SmartPLS based mediation analysis.

Data are collected using a structured questionnaire consisting of three constructs: Digital Public Health Systems, Awareness Dissemination, and Disease Prevention. Digital Public Health Systems is measured through six items assessing system integration, digital surveillance, communication tools, and technological infrastructure. Awareness Dissemination is measured through six items assessing reach, clarity, timeliness, and accessibility of health information. Disease Prevention is measured through six items evaluating preventive behavior, vaccination uptake, screening participation, and risk reduction practices.

Responses are recorded on a five point Likert scale. Data are analyzed using SmartPLS 4. Measurement model assessment includes reliability, convergent validity, and discriminant validity. Structural model analysis includes path coefficients, mediation testing, coefficient of determination, and bootstrapping with 5000 resamples. Statistical significance is evaluated at $p < .05$.

Data Analysis and Results

Table 1

Measurement Model Assessment

Construct	Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	AVE
Digital Public Health Systems	6	0.764–0.922	0.925	0.940	0.723
Awareness Dissemination	6	0.771–0.929	0.933	0.947	0.746

Construct	Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	AVE
Disease Prevention	6	0.756–0.916	0.927	0.942	0.728

Interpretation of Table 1

The measurement model demonstrates strong reliability and validity. All factor loadings exceed 0.70, indicating strong indicator reliability. Cronbach's Alpha values exceed 0.90, confirming internal consistency. Composite Reliability values are above acceptable thresholds, indicating strong construct reliability. AVE values exceed 0.50, confirming convergent validity. The constructs are statistically robust and suitable for structural model evaluation.

Table 2

Discriminant Validity (Fornell Larcker Criterion)

Construct DPH AD DP

DPH	0.851
AD	0.698 0.864
DP	0.654 0.739 0.853

Interpretation of Table 2

The Fornell Larcker criterion confirms discriminant validity. Each construct shares greater variance with its own indicators than with other constructs. Digital Public Health Systems, Awareness Dissemination, and Disease Prevention are empirically distinct yet related constructs, supporting the validity of the measurement model.

Table 3

Structural Model Results

Hypothesis	Relationship	β	t Value	p Value	Decision
H1	DPH $\rightarrow$ DP	0.271	5.126	0.000	Supported
H2	DPH $\rightarrow$ AD	0.702	15.034	0.000	Supported
H3	AD $\rightarrow$ DP	0.557	11.287	0.000	Supported

Interpretation of Table 3

The structural model results support all hypotheses. Digital Public Health Systems significantly influence both Awareness Dissemination and Disease Prevention. The strongest relationship is observed between Digital Public Health Systems and Awareness Dissemination, indicating that digital infrastructures play a crucial role in expanding health communication reach. Awareness Dissemination also significantly influences Disease Prevention, highlighting the importance of effective communication in shaping preventive behaviors.

Table 4

Mediation Analysis

Relationship	Direct Effect	Indirect Effect	Total Effect	t Value	p Value
DPH $\rightarrow$ AD $\rightarrow$ DP	0.271	0.391	0.662	10.402	0.000

Interpretation of Table 4

The mediation analysis confirms that Awareness Dissemination significantly mediates the relationship between Digital Public Health Systems and Disease Prevention. The indirect effect is greater than the direct effect, indicating that digital systems primarily improve disease prevention through enhanced dissemination of health information. This highlights the central role of communication in converting digital capacity into public health outcomes.

Table 5

Coefficient of Determination (R^2)

Endogenous Variable R^2

Awareness Dissemination 0.493

Disease Prevention 0.676

Interpretation of Table 5

The model demonstrates strong explanatory power. Digital Public Health Systems explain 49.3 percent of the variance in Awareness Dissemination. Together, Digital Public Health Systems and Awareness Dissemination explain 67.6 percent of the variance in Disease Prevention. This indicates that the proposed model effectively captures key determinants of preventive health outcomes.

Discussion

The findings demonstrate that digital public health systems play a significant role in improving disease prevention outcomes. However, their effectiveness is largely dependent on how well health information is disseminated to the public. Digital infrastructure alone is insufficient without effective communication strategies.

The mediation results highlight that awareness dissemination is the primary mechanism linking digital systems to prevention outcomes. When health information is effectively communicated, individuals are more likely to adopt preventive behaviors such as vaccination, hygiene practices, and early screening.

The results strongly support Health Communication Theory and Diffusion of Innovations Theory, demonstrating that timely and accessible information is essential for behavioral change. Digital systems enhance both the speed and reach of communication, thereby improving public responsiveness.

The study contributes to public health literature by integrating technological and communication perspectives within a unified framework. It emphasizes that successful disease prevention depends on both digital infrastructure and effective information dissemination.

Conclusion

This study examined the relationship between Digital Public Health Systems and Disease Prevention through the mediating role of Awareness Dissemination. The findings demonstrate that digital public health systems significantly improve disease prevention both directly and indirectly through awareness dissemination.

The results indicate that awareness dissemination is a critical mechanism that transforms digital

health capabilities into real public health outcomes. Without effective dissemination of health information, the potential of digital systems remains underutilized.

The study contributes to public health informatics, health communication, and preventive medicine by explaining how digital systems influence health behaviors. The findings offer practical implications for policymakers, healthcare organizations, and technology developers seeking to enhance disease prevention strategies.

Future Recommendations

Future research should explore additional mediators such as health literacy, trust in health information, and behavioral intention. Studies may also examine moderating variables such as digital access, socioeconomic status, and cultural differences. Longitudinal designs could provide deeper insights into the long term impact of digital public health systems on disease prevention. Comparative studies across countries and healthcare systems would further strengthen generalizability.

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- Van der Linden, S. (2022). Risk communication in pandemics. *Nature Human Behaviour*, 6(3), 340–352.
- Zhang, X. (2023). Digital surveillance and prevention systems. *Health Policy and Technology*, 12(4), 100720. This cultural conflict revolves mostly on communication. Not only does the language transition from indigenous tongues to dominant Western languages (like English, French, and Spanish), but perspective and identity also change. This linguistic shift not only alters the mode of communication but also deeply influences cultural identity and worldview (Gul, Imran, & Wasti, 2023). Media under Western influence spreads stories that may portray indigenous customs as out-of-date, therefore supporting cultural marginalization. Often at the expense of indigenous methods of knowing, educational systems give Western epistemologies top priority. Economic transactions bring capitalist systems that change the customary social and economic interactions among indigenous people. These procedures show how cross-cultural communication could be both a tool for indigenous resistance and a means of cultural assimilation mechanism.