

► INTERNATIONAL PERSPECTIVES

Decoding the Impact of Digital Media on Climate Health and Smog Solutions in Pakistan: Adherent Health Behaviors and Mediating Factors

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Abstract Smog poses many challenges in South Asia, especially in Pakistan, where poor air quality is prevalent, undeniably so in the city of Lahore, which ranks among the top three cities for the worst smog-affected air quality index. Our study aims to explore the role of digital media, which is now the dominant platform compared with conventional media, in shaping smog-related adherent health behaviors. We developed a conceptual framework based on the literature to examine the direct relationship between digital media and adherent behavior, with the mediating effects of subjective norms, personality traits, and environmental concerns examined among the residents of Lahore. A sample size of 2,000 individuals ages 18 to 60 years was selected from this metropolitan city using convenience sampling. Our study findings reveal a significant relationship between digital media and adherence behavior and identify key mediating factors and their significant relationships. We developed useful conclusions for future designs, highlighting the significant role of media in shaping tailored strategies for public engagement in climate resilience and environmental behavior. We emphasize the urgency of our study in addressing the relevant findings, offering practical recommendations, and outlining social and theoretical implications for enhancing environmental conservation efforts and measuring public response to media influence in Pakistan.

Keywords: smog, climate health behavior, digital media, air quality, Pakistan

Introduction

We live in the age of mediated realities wherein media shapes understanding of the social world around us (Okocha et al., 2023). Media awareness of the public about environmental issues can foster protective behaviors

(Iftikhar, Yousaf, et al., 2024) and can promote democratic participation (Ijaz & Yousaf, 2023). Climate change is one of the threats of the 21st century that is mediated by media outlets. Having media outlets highlight via rapid resilience-building the various under-

mining environmental and social determinants of health is essential. The health community can lead in advocating for climate action, ensuring healthcare resilience and influencing other sectors (Campbell-Lendrum et al., 2023). The climate emergency needs urgent action amid the current ecological imbalance. Heightened legal measures to address climate change conflicts underscore the imperative for continuous constitutional dialogue on human rights (de Carvalho & de Rosa, 2023; Levin et al., 2023).

Research indicates that polluted air adversely affects human health, causing a range of issues including respiratory diseases, heart conditions, and lung cancer (Colls & Micallef, 1997; Turner et al., 2011). Smog, which is a significant contributor to health problems, can cause throat spasms and more severe conditions such as asthma (Safi, 2017). The World Health Organization (WHO, 2014) reported that 17 of the world's 30 cities with the worst air quality are in South Asia; these cities have particularly high carbon dioxide (CO₂) emissions, which is a leading health risk and contributes to smog formation and to 13.0–21.7% of all deaths (Gakidou et al., 2017; Shindell et al., 2017).

The South Asian nation of Pakistan faces numerous environmental challenges (Ali & Athar, 2010; Hussain et al., 2018; Joyo & Ram, 2016). Lahore, the most populous and polluted city in Pakistan, faces the worsening issue of smog every winter with a greater intensity (Ashraf et al., 2022), with continuous effects deteriorating public health. These effects are compounded by a lack of collec-

tive awareness of much-needed mitigation efforts (Hussain et al., 2018). Thus, public awareness and adherence to health information are vital for preventing severe negative health effects (Iftikhar et al., 2019; Iftikhar & Mughal, 2019; Kulmala, 2015; Saucier et al., 2024).

Mass media plays a key role in spreading health information, promoting preventive behaviors, and influencing well-being (Hong & Kim, 2020; Manisha, 2023). Likewise in Pakistan, media both conventional and digital is widely consumed and accessible, but its impact on public health behavior is uncertain. Understanding how media—specifically digital media—can influence residents' health behaviors, particularly in Lahore, is vital for mitigating the impacts of smog and safeguarding the city's future (Nahar et al., 2021).

Addressing these issues is essential to protect current and future generations (Iftikhar & Yousaf, 2021; Kulmala, 2015; Nahar et al., 2021). Thus, our study is imperative for elucidating how digital media sways climate-adherent behavior in response to smog in Lahore, the top smog-affected city in the world (Ashraf et al., 2022). Although the influence of conventional media has already been examined and has showed some persuasive effects (Iftikhar & Yousaf, 2021), digital media's impact and the roles of new factors are still unexplored in shaping climate-adherent behaviors to develop effective smog mitigation strategies via digital media, which is the most consumed media in Pakistan (Iftikhar, Mat, et al., 2024).

Our study underscores the urgent need for developing strategic communication and public education, as well as empowering policymakers and health professionals to foster climate health and environmental sustainability in Lahore and beyond in Pakistan. Our study objectives were to:

1. Evaluate how digital media influences climate health behaviors in response to smog in Lahore.
2. Investigate the mediating roles that subjective norms, personality traits, and environmental concerns play in this relationship.
3. Provide strategic recommendations for improving public engagement in smog mitigation.
4. Explore the broader implications of digital media's role in shaping health behaviors and informing environmental policy.

Literature Review

The predominant catalyst of climate change is human activity. Climate change poses substantial health risks, particularly for at-risk communities (Karmaker & Lemon, 2024). Human activity leads to global warming and severe biophysical changes (White, 2024) and has complex environmental and societal implications (Tavory & Wagner-Pacifici, 2022). Indigenous communities emphasize emotional geographies and environmental self-determination in response to climate change (Sakakibara, 2024). This global threat has direct and indirect health effects (Johnson, 2022), with rising carbon dioxide levels highlighting the urgency (Kabir et al., 2023). Climate change affects migration differently across regions (Rikani et al., 2023).

In Pakistan, temperature increases (estimated to be 2.0–3.2 °C by 2044) affect water, disaster management, and health (Abbas et al., 2024; Khan et al., 2024). In Lahore, climate-induced smog and extreme temperatures emphasize the importance of awareness among students (Agustina et al., 2020; Mohsin et al., 2022). Other Asian countries are also facing severe climate-related environmental issues (Zhu et al., 2019). China faces severe smog that exacerbates pollution threats for neighboring countries such as Pakistan (Wang et al., 2019) and India (Chakravorty, 2020).

In recent times, people are finding it increasingly difficult to breathe in such environments but are often unaware of the harmful consequences to their health (Huang et al., 2019; Wang et al., 2019). This severe pollution extends to neighboring countries, which exacerbates global environmental health issues (Raza, Zaman, et al., 2021). Many countries around the globe are facing these challenges, but the most vulnerable continent is Asia, with major climate-caused health implications (Ahsan et al., 2020; Borah et al., 2024; Iftikhar & Yousaf, 2021; Wang et al., 2021).

As an example, crop burning in India is a major contributor to regional smog, causing school closures in New Delhi and surrounding areas (Guttikunda & Jawahar, 2020; Shabbir et al., 2019). Smog significantly affects public health in Pakistan (Iftikhar & Yousaf, 2021), particularly in cities such as Lahore and Peshawar. Climate change, industrial emissions, and transboundary pollution

from neighboring countries exacerbate the problem (Ung et al., 2016; Yu et al., 2020). Smog has been linked to severe health issues, including respiratory problems and increased mortality (Saleem et al., 2019; Syed et al., 2012). In Pakistan, smog is responsible for >60,000 deaths each year due to respiratory diseases (WHO, 2014). In Lahore, smog causes breathing difficulties, eye irritation, and throat issues, with nearly 1,000 new cases reported daily during periods of smog (Raza et al., 2022; Shabbir et al., 2019). The air pollution in Pakistan is predicted to reduce life expectancy by up to 11 years and underscores the urgent need for effective interventions (Purohit et al., 2013).

In response, the Government of Punjab has introduced measures such as health warnings, mask advisories, and smog counters in hospitals. Despite these efforts, smog remains a severe challenge due to its persistent nature and harmful effects on health (Iftikhar, Yousaf, et al., 2024). Awareness is a top mitigation strategy. The media can play a crucial role in raising awareness about smog and encouraging preventive measures. Both conventional and new media platforms can shape public perception and behavior by providing updates on air quality and health risks (Olausson, 2011; Yang & Shi, 2017). Media outlets can drive behavior change via engaging content (McAlister et al., 2016) and influence pro-environmental intentions, with acceptance strengthening the link between media messages and environmental protection (Lee & Cho, 2020).

Smog poses a serious public health threat in Pakistan, increasing mortality and healthcare costs. Therefore, effective media coverage and government actions are essential for managing the issue and promoting public awareness alongside preventive measures (Bilal et al., 2020; Hong & Kim, 2020). Extreme weather and climate events (e.g., heat waves, floods) can cause major health issues. Despite past declines in these impacts, climate change and population shifts could reverse the trend.

Increasing frequency and intensity of these climate events and unavoidable health risks can be mitigated by enhancing climate-resilient health systems, but immediate action is necessary to address these urgent risks (Ebi et al., 2021). Key health challenges include reducing carbon emissions while improving

health; developing climate-resilient, low-carbon health systems; and implementing measures to mitigate climate-related health risks (Campbell-Lendrum et al., 2023). Climate change worsens health disparities, disproportionately affects vulnerable populations, and highlights the need for equitable climate action (Deivanayagam et al., 2023).

Simultaneously, the rise of digital media has transformed communication and access to information, with online platforms enhancing public awareness and engagement on crucial issues (Alfarizi et al., 2024; Jana et al., 2024; Yamin, 2019). Moreover, the dissemination of information has become universally accessible via smart devices, allowing for rapid and widespread communication (Raza et al., 2022). As a result, the lines between news producers, curators, aggregators, and consumers are increasingly blurred, reflecting a profound shift in how information is shared, consumed, and created (Fleerackers et al., 2022). Digital media platforms (e.g., YouTube) enhance climate change communication by promoting action (Paek et al., 2024; Yoo et al., 2020). The Paris Agreement of 2015 highlights the role of social media as a tool to support developing nations (Mavrodieva et al., 2019) with social media's ability to integrate diverse scales and foster engagement, thereby contributing to public interaction and civic participation (Boulianne & Theocharis, 2018).

Digital media can also influence public health communication (Snyder, 2023). Despite its potential, limited research exists on social media's role in grassroots initiatives and its influence on heavily polluted and climate-affected countries (Ahsan et al., 2020; Iftikhar & Yousaf, 2022; Melki et al., 2020; Raza et al., 2022). For climate change resilience awareness, mass media must raise awareness and advocate for stronger environmental regulations (Borah et al., 2024).

The literature reports that climate change intensifies health predicaments and extends momentous risks, particularly to vulnerable populations living in South Asia. This reporting underscores the urgent need for equitable climate action and effective interventions. The rise of digital media has revolutionized communication, enhancing public awareness and engagement on climate-related issues while blurring traditional roles in information dissemination. Despite these advancements, ongoing challenges (e.g., severe pol-

lution, health impacts) necessitate continued advocacy and robust action from both media and governments to address and mitigate the effects of climate change. Additionally, a critical need exists for focused research in countries such as Pakistan to better understand local climate impacts and develop targeted strategies for effective climate adaptation and health protection.

Conceptual Framework and Hypotheses Building

Climate change poses universal and long-term threats and risks and therefore requires unique methodologies for their estimation and comparison with other environmental variations. The Global Burden of Disease Study 2010 has addressed interconnected threats and historical health experiences (Lim et al., 2012). Expanding research on the effects of climate change on health and behavior from regional to global levels is crucial (Campbell-Lendrum & Corvalán, 2007; Costello et al., 2009).

Therefore, we developed a conceptual framework by taking one independent, one dependent, and three mediators guided by various theories, and models from the literature. According to Lasswell's model of communication (1948), key components are source, channel, message, receiver, effect, and feedback. Media rhetoric is effective in promoting preventive health behaviors (Niederdeppe et al., 2013; Raza, Saeed, et al., 2021), although the public often takes independent actions (Leung & Rosenthal, 2019). Research has demonstrated that media significantly influences public opinion and behavior (Kahneman & Tversky, 2013), particularly in countries such as Pakistan (Abbas et al., 2024; Jamil & Bhuj, 2022; Khan et al., 2024). In Pakistan currently, digital information processing influences societal factors (Khan et al., 2024) to health behaviors (Lee & Cho, 2020). Therefore, we treated digital media as an independent variable and climate health behavior as a dependent variable. **Hypothesis 1:** Digital media has a direct and significant effect on climate health behavior.

In China, public environmental concerns have significantly influenced governance and pollution control, reducing urban air pollution, albeit with a lag (Zhao et al., 2023). Of note, economic and technological factors can cause regional variations in these con-

cerns (Yang et al., 2023; Zhao et al., 2023). Such concerns drive digital transformation in polluting enterprises, especially nonstate-owned, green-image, and high-tech firms (Wu et al., 2023). Government and public concerns reduce urban haze, notably in areas with sparse internet development and in the West (Zheng et al., 2022). Public concerns, however, do not always boost engagement, and trust in government can reduce participation (Hang & Zhan, 2023).

Media, including newspapers, shape public opinion and promote sustainability through ecologicistic analysis (Ismat et al., 2024). Media influences socioenvironmental conflicts, public opinion, and democratic quality (Gorostidi et al., 2024). Effective communication requires diverse perspectives (Abbasi et al., 2022). Social media disseminates information during crises and promotes awareness (Durkin, 2022). Media reports on hazards lead to health-protective behaviors, especially for children (Mello & Hornik, 2016). Effective risk communication builds public trust and enhances risk perception (Del Fabbro, 2022). In these ways, media exposure shapes public concerns and influences health behaviors and decision-making. **Hypothesis 2:** Environmental concern mediates the relationship between digital media and climate health behavior.

The study of climate-adherent health behavior is complex and shaped by individual perceptions, attitudes, and self-capabilities (Stern, 2000). Factors such as demographics and sociopsychological elements influence these behaviors (Yang et al., 2015). Literature on climate change has often focused on sociodemographic factors and psychological aspects (Hadler & Haller, 2011; Patel et al., 2017), which impact health via psychological and social pathways (Epstein, 2005; McMichael, 2013).

Effective prediction of health behavior requires understanding of information processing and demographic factors (Zillmann & Bryant, 2013). Research on public awareness and smog-related behavior, considering psychographics, remains limited (Wang et al., 2016). Personality traits—neuroticism, conscientiousness, agreeableness, openness, and extraversion—play a large role in influencing climate-adherent health behavior (Aschwanden et al., 2020). Neuroticism, which is linked to emotional instabil-

ity, correlates with poorer health outcomes (Eysenck, 1991; Gilbert, 2014).

Conversely, conscientiousness, which is associated with organization and diligence, predicts better health and longevity (Friedman et al., 2014; Terracciano et al., 2014). There is mixed evidence for agreeableness (which is related to compassion and social harmony) with regard to climate-adherent health behavior (He & Veronesi, 2017; Tang & Lam, 2017). Openness to experience has varied effects on climate-adherent health behavior (Akhtar, 2019; Aschwanden et al., 2020; Pavalache-Ilie & Cazan, 2018). The influence of extraversion on health is not settled, with studies showing both positive and negative associations with emotional distress (Hulbert-Williams et al., 2012; Lindert, 2021).

Our study aims to address the gap in understanding of how personality traits moderate the relationship between perceived threats and climate-adherent health behavior through the health belief model, especially in the context of Pakistan (Obara-Gołębiowska & Michałek-Kwiecień, 2020). Therefore, personality traits are treated as a mediator variable. **Hypothesis 3:** Personality traits mediate the relationship between digital media and climate health behavior.

The Norm Activation Model developed by Schwartz (1977) identifies the factors influencing human intention toward altruistic and pro-environmental behaviors (Onwezen et al., 2013). Pro-environmental behavior is often viewed as a form of pro-social behavior, positively affecting others, and includes actions that minimize a person's harmful impacts on natural systems shared across multiple human and nonhuman communities (Kollmuss & Agyeman, 2002; Steg & de Groot, 2010). In the Norm Activation Model, behaviors and intentions are shaped by personal norms, which are influenced by awareness of consequences and ascription of responsibility (Savari et al., 2023). The communication model demonstrates how media on smog hazards influences climate health behavior by prompting individuals to process information and consider social norms (Floyd et al., 2000; Santana et al., 2024).

Adding social norms to this model assists in promoting climate health behavior (Leung & Rosenthal, 2019), with social axioms affecting precaution adherence (Tong et al., 2020). Social norms, which are distinct from

habits or legal rules, shape public actions (Bicchieri, 2014). Theories such as Social Learning Theory (Bandura, 2006) and the Theory of Planned Behavior (Fishbein & Ajzen, 1975) highlight the role of societal cues and subjective norms, which are central in behavior (Gifford & Nilsson, 2014). Research shows that subjective norms significantly affect behavior (Han & Hyun, 2018; Niemiec et al., 2020), with climate health behaviors increasingly becoming societal norms (Obara-Gołębiowska & Michałek-Kwiecień, 2020; Patel et al., 2017). Therefore, subjective norms have been treated as a mediator variable in this conceptual framework. **Hypothesis 4:** Subjective norms mediate the relationship between digital media and climate health behavior.

Methods

A cross-sectional research design was used, employing a survey method to validate the conceptual model in the context of smog in Pakistan. Our study surveyed a sample of 2,000 respondents across diverse demographics and geographies of Pakistan from January to February 2023, which is during the smog season. The sample consisted of permanent residents ages 18 to 65 years from 9 administrative zones who were selected by probability sampling. The respondents were categorized into age brackets of 18–24, 25–35, 36–45, 46–55, and ≥56 years.

The survey instrument was a closed-ended questionnaire designed to measure our study's key constructs: digital media, environmental concern, personality traits, subjective norms, and climate health behavior. Each construct was assessed using established scales from the literature. For instance, the effect of digital media was measured through items adapted from Paek et al. (2024), while environmental concern and climate health behavior were evaluated using scales from Sajjad et al., 2020 and Yuen et al., 2020, respectively. Personality traits were assessed based on measures from Malik et al., 2021, and subjective norms were gauged using instruments from Gollust et al., 2019. We used the Schultz Environmental Concern Scale described in Ivanova et al. (2023). This methodological approach ensured comprehensive coverage and reliable measurement of each variable, contributing to robust analysis and insights into climate resilience behaviors in Pakistan.

Results

We developed a path diagram for the proposed hypothesis (Figure 1). For this figure, the variables include:

- Climate health behavior (dependent variable) = Y
- Digital media (independent variable) = X
- Environmental concern (mediator) = M_1
- Personality traits (mediator) = M_2
- Subjective norms (mediator) = M_3

Parameter Estimates

The results of hypothesis testing are reported in Table 1. Environmental concerns, subjective norms, and personality traits played a mediating role between digital media and climate health behavior. The socioeconomic model (SEM) showed a statistically significant and strong negative relationship or path estimate between digital media and environmental concerns, with a parameter estimate of -0.1159 ($p < .05$). There was a strong positive path estimate from digital media to subjective norms (0.0984 , $p < .05$). There was a strong positive path estimate from digital media to personality traits (0.1925 , $p < .05$). There was a strong positive path estimate from digital media to climate health behavior (0.0638 , $p < .05$). There was a strong positive path estimate from environmental concerns to climate health behavior (0.1242 , $p < .05$).

In contrast, there was a statistically insignificant and weak positive path estimate from subjective norms to climate health behavior (0.0235 , $p > .05$). Lastly, there was a strong positive path estimate from personality traits to climate health behavior (0.0990 , $p < .05$).

Mediation Analysis

Parallel mediation analysis was proposed to examine the direct relationship between digital media and climate health behavior, with the mediating effects of environmental concerns, subjective norms, and personality traits among Lahore's populace.

Indirect Effect Key for Parallel Mediation Analysis With Three Mediators

- Indirect effect 1: Digital media → Environmental concern → Climate health behavior
- Indirect effect 2: Digital media → Subjective norms → Climate health behavior
- Indirect effect 3: Digital media → Personality traits → Climate health behavior

The possible models were:

- Model 1
 $\text{Environmental concern} = a + a_1 \text{ digital media}$
 $\text{Environmental concern} = 50.6633 - 0.1159 \text{ digital media}$
- Model 2
 $\text{Subjective norms} = a + a_2 \text{ digital media}$
 $\text{Subjective norms} = 13.9587 + 0.0984 \text{ digital media}$
- Model 3
 $\text{Personality traits} = a + a_3 \text{ digital media}$
 $\text{Personality traits} = 31.5661 + 0.1925 \text{ digital media}$
- Model 4
 $\text{Climate health behavior} = a + c' \text{ digital media} + b_1 \text{ environmental concern} + b_2 \text{ subjective norms} + b_3 \text{ personality traits}$
 $\text{Climate health behavior} = 5.2905 + 0.0638 \text{ digital media} + 0.1242 \text{ environmental concern} + 0.0235 \text{ subjective norms} + 0.0990 \text{ personality traits}$

Indirect Effect of X on Y Through $M_i = a_i b_i$

- Indirect effect of X on Y through $M_1 = a_1 b_1$
 $= (-0.1159 \times 0.1242) = -0.0144$
- Indirect effect of X on Y through $M_2 = a_2 b_2$
 $= (0.0984 \times 0.0235) = 0.0023$
- Indirect effect of X on Y through $M_3 = a_3 b_3$
 $= (0.1925 \times 0.0990) = 0.0191$
- A sum of all indirect effects = 0.007
- Direct effect of X on Y = $c' = 0.0638$
- Total effects of X on Y = $0.007 + 0.0638 = 0.0708$

Therefore, the indirect effect is 0.007. Table 2 shows the direct and indirect effects of digital media on climate health behavior. We found that the effect of digital media on climate health behavior was parallel mediated by environmental concerns, subjective norms, and personality traits, with direct effect (0.0638, $p < .05$) and total effect (0.0708, $p < .05$) being positively significant. Figure 2 uses the path diagram we developed for our proposed hypothesis with the added effect values from our different models.

Discussion

The effect of digital media on climate health behavior demonstrated complex interfaces

FIGURE 1

Path Diagram for the Proposed Hypothesis

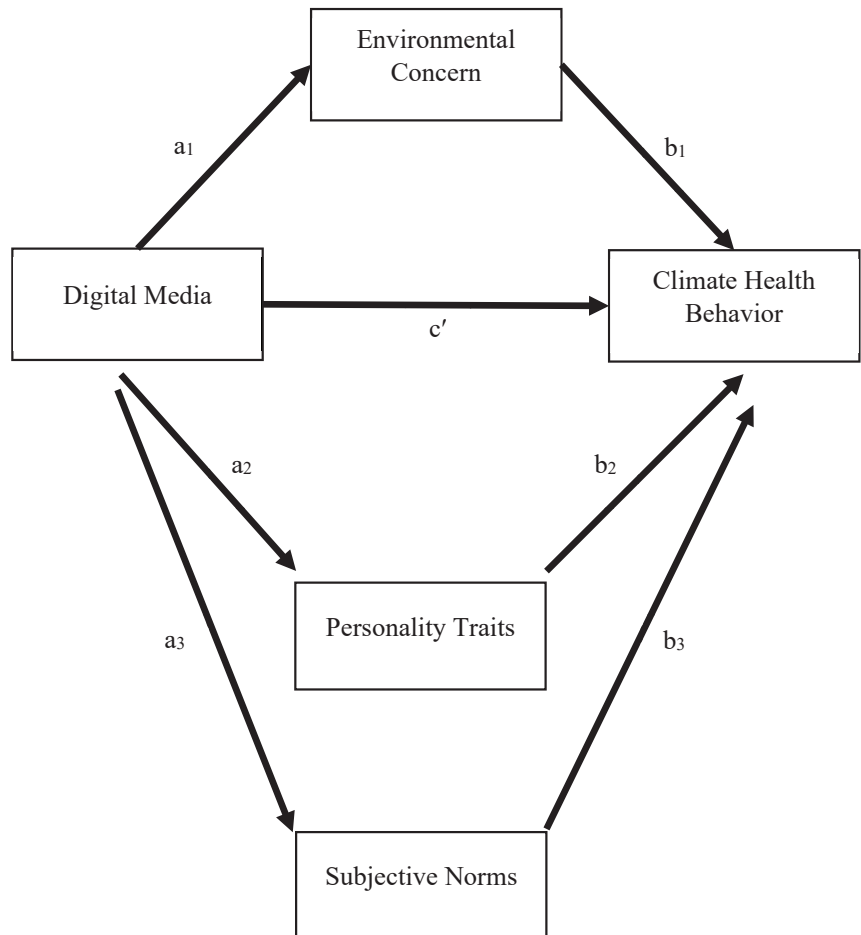


TABLE 1

Hypothesis Testing

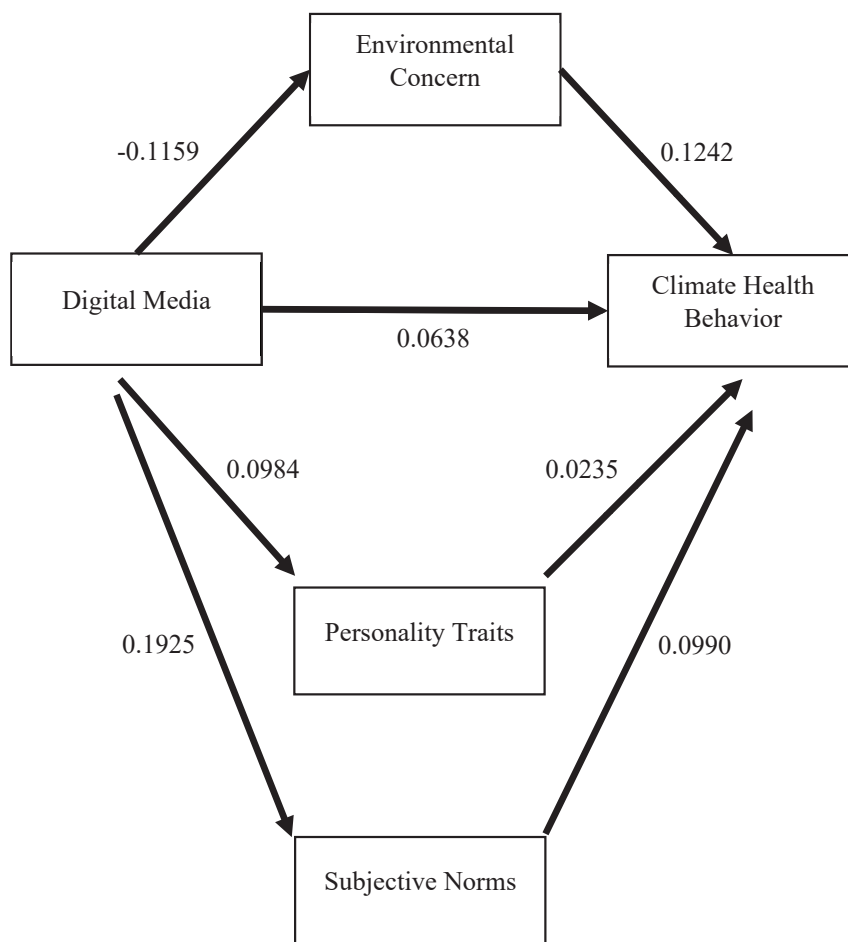
Path From	To	Parameter Estimate	SE	t-Value	p-Value
Digital media	Environmental concerns	-0.1159	0.0555	-2.0888	.0369
Digital media	Subjective norms	0.0984	0.0373	2.6356	.0085
Digital media	Personality traits	0.1925	0.0350	5.4999	.0000
Digital media	Climate health behavior	0.0638	0.0182	3.5086	.0000
Environmental concerns	Climate health behavior	0.1242	0.0095	13.0332	.0000
Subjective norms	Climate health behavior	0.0235	0.0135	1.7423	.0817
Personality traits	Climate health behavior	0.0990	0.0150	6.5993	.0000

TABLE 2

Hypothesis Testing for Indirect, Direct, and Total Effects

Effect	Coefficient	SE	t-Value	p-Value
Indirect	0.0070	0.0122	–	–
Direct	0.0638	0.0182	3.5086	.0005
Total	0.0708	0.0200	3.5383	.0004

FIGURE 2

Path Diagram for the Proposed Hypothesis With the Effect Model Values

through multiple pathways. We found a negative indirect effect through environmental concerns, which could be due to the nature of digital media content failing to effectively raise environmental awareness, which aligns with previous findings (Durkin, 2022). But the direct effect of digital media directly affects climate health behavior, which high-

lights that human actions, amplified by these platforms, are major drivers of climate change and associated health risks (Karmaker & Lemon, 2024). Environmental concern, however, remains strongly linked to preemptive climate actions (Stern, 2000; Yang et al., 2015), which highlights the need for media to better convey these hazards.

The positive but minimal influence of digital media through subjective norms indicates that although social expectations on digital platforms slightly encourage climate health actions, social expectations are not a major driving force (Fishbein & Ajzen, 1975; Rimal & Real, 2005). This finding reflects the complex societal impacts of climate change, including shifting migration patterns and varied regional responses (Rikani et al., 2023; Sakakibara, 2024). Digital media's significant effect on personality traits and its subsequent effect on climate health behavior supports the idea that media shapes traits relevant to environmental actions (Aschwanden et al., 2020; McAlister et al., 2016). This idea is particularly relevant in the context of severe regional issues, such as Lahore's climate-induced smog and rising temperatures, which exacerbate health risks (Abbas et al., 2024; Mohsin et al., 2022).

Our study underscores that while digital media plays a crucial role in shaping behavior, its direct effects are more substantial than the indirect effects (Olausson, 2011). Effective media coverage and actions are essential for managing issues (Iftikhar, Yousaf, et al., 2024) such as smog, which has severe health consequences in cities such as Lahore (Iftikhar & Yousaf, 2021; Saleem et al., 2019). Enhanced climate-resilient health systems and continued advocacy are necessary to address these urgent risks (Campbell-Lendrum et al., 2023; Ebi et al., 2021). Digital media's role in climate communication is transformative, but ongoing challenges (e.g., severe pollution and its negative health impacts) highlight the need for more robust media and governmental responses (Iftikhar & Yousaf, 2021; Jana et al., 2024). Focused research in regions such as Lahore is crucial to developing targeted strategies for climate adaptation and health mitigation (Melki et al., 2020; Yousaf et al., 2022).

Practical Implications

The findings of our study offer valuable insights for developing effective climate communication strategies in Pakistan. As practical steps, policymakers and environmental organizations could leverage digital media to target and enhance personality traits that are conducive to climate health behavior. Given that digital media influences personality traits, campaigns should focus on fostering traits such as environmental responsibility and proactiv-

ity. Additionally, although the direct impact of digital media on environmental concerns was found to be negative, our research suggests that content strategies could be refined to better engage viewers and raise awareness. By creating compelling and relatable content that resonates with personal values and experiences, digital media can more effectively drive positive climate actions. Addressing these nuances can lead to more impactful public health campaigns and initiatives aimed at mitigating smog and improving environmental health.

Theoretical Implications

Our study contributes to the deeper understanding of the interplay between digital media, personality traits, and environmental concerns within the framework of climate health behavior. Our findings challenge the traditional assumptions that digital media directly enhances environmental concern and highlights the role of personality traits as significant mediators. This shifted focus suggests that existing models of climate behavior might need to be revised to incorporate the complex ways in which digital media influences personality and behavioral outcomes. Furthermore, our study findings highlight the need for a more nuanced approach to theoretical frame-

works in environmental psychology and communication studies, and our results suggest that future research should explore how different mediating variables interact in shaping climate health behavior. This expanded understanding can lead to more refined models that better capture the dynamics of digital media's impact on climate resilience.

Recommendations

1. Extend our study focus to other smog-affected cities of Pakistan.
2. Explore using virtual reality and AI for immersive climate health messaging.
3. Incorporate behavioral nudges to subtly influence climate-related decisions.
4. Develop interactive platforms for real-time engagement in climate challenges.
5. Foster collaboration among digital media experts, psychologists, and environmental scientists.
6. Assess the impact of digital media on climate-related policies and regulations.
7. Support community-led digital media initiatives focused on local climate issues.

Conclusion

This study elucidated the multifaceted impact of digital media on climate health

behavior within Lahore, Pakistan. Although digital media exerts a substantial direct effect in promoting climate-positive actions, its indirect influence through environmental concerns and subjective norms remains relatively modest. Our findings highlight that digital media significantly shapes personality traits conducive to climate health behavior, underscoring its potential to foster individual engagement in climate actions. Serious local challenges, however, such as pervasive smog and escalating temperatures, underscore the urgent need for more strategic media interventions and enhanced measures by government. Addressing these critical environmental and public health issues requires a synergistic approach that not only maximizes the benefits of digital media but also implements robust, targeted strategies to mitigate the adverse effects of climate change in Lahore. ✨

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