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REACH VERSUS RELEVANCE: PUBLIC SERVICE MESSAGES, SOCIAL MEDIA AND SMOG-PROTECTIVE BEHAVIOR IN FAISALABAD, PAKISTAN

Talha Javeed[1], Dr. Ashraf Iqbal[*2]

[1]*PhD Scholar, Department of Mass Communication, Government College University, Faisalabad, Pakistan*
[*2]*Assistant Professor, Department of Mass Communication, Government College University, Faisalabad, Pakistan*

[1]talhajaveed09@gmail.com, [*2]ashrafiqbal@gcuf.edu.pk

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Dr. Ashraf Iqbal

Abstract
Punjab's health agencies increasingly issue smog advisories through social media. This study examined whether the media channels residents are most exposed to are also those associated with protective action. Adults (N = 400) across all six tehsils of District Faisalabad, Pakistan, were surveyed during the 2025–2026 smog season. Media exposure was measured as attention to smog-related content in eight channels, alongside four actions: wearing a mask, staying at home, using an air purifier and changing diet. Robust regression with demographic controls and dominance analysis were used. Exposure was highest for social networking sites (M = 3.28) and user-generated video (M = 3.17) and lowest for public service messages (M = 2.29). The channels explained an additional 18.3–26.1% of the variance in individual actions and 33.4% in the composite. Public service messages were the only channel uniquely associated with all four actions (β = .15–.22), accounting for a quarter of the explained variance, whereas social networking sites and user-generated content showed no unique association. Blogs and wikis were linked to air-purifier use and documentaries to mask-wearing; logistic models confirmed the pattern. Greater media exposure does not by itself produce protection; agencies should place actionable, public-service-style content

INTRODUCTION
Punjab's health and environment departments issue a series of alerts during the winter season urging the use of masks, to stay away from outdoor activities during the smog and to keep children away from high levels of air pollution. This is a time-sensitive issue. As a result of being the most polluted city in Pakistan, in a polluted country, Faisalabad has the highest annual fine-particulate concentration of any Pakistani city, which is associated with respiratory disease, cardiovascular disease and eye disease, and the seasonal smog has been associated with increased hospital attendance (Batool et al., 2024; Iram et al., 2025). The emissions behind them like fires using crop residues, traffic, factories, and brick kilns which remain close to ground due to winter inversions (Majeed et al., 2024) can not be switched off during one season. The actions of its residents can have an impact on their own exposure, and the way in which these recommendations are delivered can impact residents' exposure.

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It's no longer that way. Ten years ago, the warnings of smog in Pakistan were primarily broadcasted on TV, newspapers and Government bulletins. Much of the content on smog has been spread across various social media platforms, including Facebook, X, WhatsApp, and YouTube, with images of air-quality screenshots, hazy streets, and home remedies battling for visibility with official information (Iftikhar et al., 2025). Campaign planners have been tracking the audience to these platforms. The basis of the working assumption is simple: A message that is seen more a message that works more.

That notion is not without doubt. Channels not only vary in reach, they vary in content. PSAs are centered on a recommended action, while documentaries provide explanations of causes and mechanisms, and social feeds are a blend of warnings, entertainment, opinion and sometimes even misleading health claims (Suarez-Lledo & Alvarez-Galvez, 2021; Wang et al., 2019). Research on the coverage of Pakistani smog shows that the mainstream media coverage focuses mainly on hazard readings and disruptions instead of what people can do (Javed et al., 2023; Mushtaq et al., 2024; Qusien, 2024). Channels that are not most closely connected to protection can be the most attended to channels that provide the most practical guidance.

Previous studies in Pakistan have analysed media usage as overall exposure or attention to media rather than separating them (Iftikhar & Yousaf, 2021; Iftikhar et al., 2024, 2025). The latter demonstrates that the media are important, but does not specify which media. Nor has anyone questioned if channels correlate differently with different actions; the latter range from a low cost mask to a high cost purifier. This study separates both parties of the equation. It explores how residents access smog information, through which channels, and how this access differs across social groups, as well as which channels are uniquely linked to which of four protective actions after accounting for the other channels and demographic characteristics, using survey data from District Faisalabad.

Three questions guided the analysis:

RQ1: To which media channels do residents of District Faisalabad attend for smog-related information, and does this attention differ by gender, area of residence, education and age?

RQ2: Which channels are uniquely associated with wearing a mask, staying at home, using an air purifier and changing diet during smog, after the other channels and demographic characteristics are held constant?

RQ3: How is the explained variance in protective behavior distributed across channels, and does a channel's share correspond to how much attention it receives?

Background

From Media Use to Media Channels

The learning that takes place from a media experience is better predicted by attention than by exposure to the media (Chaffee & Schleuder, 1986). Also, channel matters: mass-media campaigns have modest but reliable effects when they repeatedly reach audiences through channels (such as television, print, or radio) that they use to receive information (Snyder et al., 2004; Wakefield et al., 2010). It is important that content type is as significant as volume because of the theory of social cognitive theory. Individuals learn and adopt a behavior after they learn what to do, observe others engaging in the behavior and believe that they are able to do that behavior as well (Bandura, 2001). A channel which does not display a response but does display a hazard provides the motivation but not the means to act.

Chances also vary in terms of how people get to them. The uses and gratifications approach suggests that audiences choose to consume media content because they have specific needs that they wish to satisfy (Katz et al., 1973). A homeowner who is considering purchasing an air purifier will likely make a conscious effort to look for reviews, explanations and comparisons, while a homeowner who is scrolling through a social feed will be looking for smog content "limb by limb." There can be significant differences between deliberate search and incidental encounter with respect to behavior.

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Channels in the Pakistani Smog Context

There are two types of evidence available on smog communication in Pakistan. The content analyses also revealed the nature of newspaper and television coverage of the pandemic: episodic, crisis-driven and lacking in practical information (Javed et al., 2023; Mushtaq et al., 2024; Qusien, 2024). Audience surveys found that the overall use of media was correlated with health behavior in response to smog with Iftikhar and Yousaf (2021) reporting a correlation of mass-media usage and health behavior for Lahore, and Iftikar et al. (2024) reporting a similar correlation with digital media for 2,000 individuals in Lahore. Beijing residents' knowledge and risk perception of air pollution were linked to environmental news and a widely watched documentary elsewhere (Chen & Liu, 2021). At the same time, only about 15.9% of the adults surveyed in South Punjab were aware of any government campaign to tackle smog and 6.1% always took precautions (Hassan et al., 2025). A systematic review of air-quality warning systems also concluded that compliance with the health messages is partial in general (D'Antoni et al., 2017).

None of these studies differentiate between channels within the same model, nor do they differentiate between protective actions. The present study does both. It also asks if there is a pattern that would be relevant for practice: a disparity between those channels that get the most attention and those that are most likely to be linked to protection.

Method

Participants and Procedure

The data come from a cross-sectional survey of adults living in District Faisalabad, a district of about 9.08 million people in central Punjab (Pakistan Bureau of Statistics [PBS], 2023). Between October 2025 and January 2026, the researcher and trained enumerators approached residents in markets, neighbourhoods, workplaces, colleges and village centres across all six tehsils and invited those who met the eligibility criteria to take part. Eligible respondents were 18–60 years old, had lived in the district through the previous smog season and could complete the questionnaire alone or with an enumerator reading it aloud in Urdu. Selection was purposive, so tehsil shares in the sample differ from census shares: Faisalabad City contributed 116 respondents, Faisalabad Sadar 81, Jaranwala 61, Samundri 58, Tandlianwala 45 and Chak Jhumra 39. All 400 returned questionnaires were complete.

The respondents' mean age was 35.1 years (SD = 9.1); 232 were men and 168 women. Just under half (49.2%) lived in urban localities, 39.0% in villages and 11.8% in peri-urban settlements. Educational attainment ranged widely: 26.0% had studied up to middle school or not at all, 38.8% had a matriculation or intermediate certificate, and 35.3% held a bachelor's or postgraduate degree.

Measures

The questionnaire was bilingual, with each English statement followed by its Urdu version, and had been pretested on 100 residents who did not take part in the main survey.

Channel attention. Respondents were asked how much attention they had paid, during the last smog season, to smog-related messages in eight channels, each in online and offline form: public service messages; news on television, radio, newspapers and news websites; science-themed documentaries; science-themed movies; blogs; wikis; user-generated content such as YouTube; and social networking sites such as Facebook and X. Each channel was rated separately from 1 (never) to 5 (almost always) and analysed as a single item. For a secondary analysis, channels were also grouped into three descriptive indices: traditional (public service messages and news), science-oriented (documentaries, science-themed movies and wikis) and online (blogs, user-generated content and social networking sites). Because these groupings are conceptual rather than psychometric, their internal consistency was modest (α = .59, .54, .56).*Protective actions.* Respondents reported how often, during smog, they wore a mask, stayed at home, used an air filter or purifier and changed their diet to cope with its effects, each from 1 (never) to 5 (almost always). Each action was analysed separately, and

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the mean of the four served as a composite (α = .79).

Covariates. Age (years), gender (0 = man, 1 = woman), education (seven ordered levels from no schooling to postgraduate), monthly household income (six ordered bands) and area of residence (rural and peri-urban indicators, with urban as reference) were included in all models.

Analysis

Channel attention was described with means, standard deviations and the proportion of respondents attending often or almost always (4 or 5). Differences by gender were tested with independent-samples t tests and Cohen's d, differences by area of residence and education with one-way ANOVA and η^2, and associations with age with Pearson correlations. For RQ2, each action and the composite were regressed first on the covariates and then on the covariates plus all eight channels; the increment in R^2 indexed the channels' joint contribution, and each channel's coefficient indexed its unique association. Standard errors were computed with the HC3 heteroscedasticity-consistent estimator (Hayes & Cai, 2007). Variance inflation factors were inspected for multicollinearity. For RQ3, general dominance analysis was applied to each model with the covariates always included: each channel's dominance weight is its average increment in R^2 across all 128 subsets of the other channels, so the weights sum to the channels' total contribution and are not distorted by overlap among channels (Azen & Budescu, 2003). As a sensitivity check, each action was dichotomized into frequent (4 or 5) versus less frequent use and modelled with logistic regression. Analyses were run in Python using code written for this study.

Ethics

The Board of Advanced Studies and Research, Government College University Faisalabad, approved the project. Respondents were told the purpose of the survey, gave consent before answering, could skip any question or stop at any time, and were not asked for names or contact details.

Results

Where Residents Look for Smog Information (RQ1)

Attention was concentrated in a few channels (Table 1). Social networking sites and user-generated content drew the most attention, with nearly half of respondents attending to them often or almost always, followed closely by news. Public service messages, documentaries, wikis and science-themed movies drew little: roughly a third or more of respondents never attended to smog content in public service messages, documentaries or wikis, and 45.0% never did so in science-themed movies. Protection was similarly uneven. Wearing a mask was the most common action (53.2% did so often or almost always), whereas using an air purifier was the least common (16.5%).

Table 1 Attention to Smog-Related Content by Channel and Frequency of Protective Actions

Item	M	SD	Often or almost always (%)	Never (%)
Public service messages	2.29	1.17	17.8	32.5
News	3.13	1.19	34.8	8.0
Science documentaries	2.23	1.14	16.3	32.0
Science-themed movies	1.98	1.12	11.0	45.0
Blogs	2.56	1.18	18.3	20.0
Wikis	2.02	1.06	9.0	41.0
User-generated content	3.17	1.19	44.0	9.8

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Item	M	SD	Often or almost always (%)	Never (%)
Social networking sites	3.28	1.34	48.0	16.0
Protective actions				
Wearing a mask	3.45	1.22	53.3	—
Staying at home	3.02	1.25	34.8	—
Using an air purifier	2.27	1.16	16.5	—
Changing diet	2.54	1.17	21.3	—

Note. N = 400. All items were rated from 1 (never) to 5 (almost always).

Group differences in channel attention were small (Table 2). Men attended more than women to smog content in news, blogs and user-generated content, with small effects (d = 0.21–0.34). Attention to news rose with education, and attention to user-generated content was marginally lower among rural respondents. Age was unrelated to attention in every channel (|r| ≤ .07). No group difference exceeded a small effect size, so the channel pattern in Table 1 was broadly shared across the population.

Table 2 Channel Attention by Gender, Area of Residence and Education

Channel	Men	Women	p (d)	Urban	Rural	Peri-urban	p	Low edu.	Mid edu.	High edu.	P
Public service messages	2.31	2.26	.683 (0.04)	2.38	2.16	2.34	.202	2.18	2.23	2.43	.187
News	3.26	2.96	.011 (0.26)	3.19	3.03	3.26	.359	2.94	3.10	3.31	.049
Science documentaries	2.32	2.10	.054 (0.20)	2.28	2.19	2.13	.608	2.14	2.22	2.30	.546
Science-themed movies	2.00	1.96	.782 (0.03)	2.04	1.92	1.94	.590	1.85	1.99	2.07	.294
Blogs	2.66	2.42	.044 (0.21)	2.66	2.46	2.49	.229	2.40	2.52	2.72	.097
Wikis	2.04	1.99	.638 (0.05)	2.11	1.97	1.77	.109	2.08	1.97	2.02	.748
User-generated content	3.34	2.93	< .001 (0.34)	3.28	2.99	3.30	.053	3.11	3.15	3.23	.686
Social networking sites	3.31	3.24	.596 (0.05)	3.35	3.16	3.38	.359	3.05	3.27	3.46	.059

Note. N = 400 (men 232, women 168; urban 197, rural 156, peri-urban 47; education up to middle 104, matric or intermediate 155, bachelor or higher 141). Gender: independent-samples t tests with Cohen's d (positive = men higher). Residence and education: one-way ANOVA.

Which Channels Are Linked to Which Actions (RQ2)

Every channel was positively correlated with every action at the bivariate level (r = .18–.51; all p < .001), including social networking sites (r = .31 with the composite) and user-generated content (r = .35). Variance inflation factors for

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the channels ranged from 1.18 to 1.64, well below conventional thresholds, so the channel coefficients could be estimated separately.

Covariates alone explained between 6.9% (diet) and 14.4% (staying at home) of the variance in individual actions. Adding the eight channels raised the explained variance substantially for every action: by 18.9 percentage points for mask-wearing, 21.4 for staying at home, 26.1 for air-purifier use and 18.3 for dietary change, and by 33.4 points for the composite ($F(8, 385) = 31.16$, $p < .001$; all increments $p < .001$).

The unique associations, however, were unevenly spread (Table 3; Figure 1). Public service messages were the only channel uniquely associated with all four actions ($\beta = .15$ to $.22$), and they had the largest coefficient for the composite ($\beta = .23$, $p < .001$). Science documentaries were associated with mask-wearing; science-themed movies with staying at home and purifier use; blogs most strongly with purifier use ($\beta = .23$, $p < .001$) and also with mask-wearing; and wikis with purifier use and dietary change. News reached significance only for the composite. Social networking sites and user-generated content, the two most-attended channels, had no unique association with any action; their coefficients ranged from −.05 to .09 and none was significant.

Table 3 Standardized Coefficients for Channel Attention Predicting Protective Actions

Channel	Mask	Stay at home	Air purifier	Diet	Composite
Public service messages	.22***	.20***	.15**	.15*	.23***
News	.09	.10	.10	.05	.11*
Science documentaries	.14*	.09	.08	.10	.13**
Science-themed movies	.09	.10*	.11*	.07	.12**
Blogs	.10*	.09	.23***	.09	.16***
Wikis	.05	.07	.11*	.12*	.11*
User-generated content	−.03	.01	−.05	.09	.01
Social networking sites	−.04	.08	.06	−.02	.03
R^2 (covariates only)	.10	.14	.08	.07	.15
R^2 (covariates + channels)	.29	.36	.34	.25	.48
ΔR^2	.19***	.21***	.26***	.18***	.33***

Note. N = 400. Coefficients are standardized; significance tests use HC3 robust standard errors. All models include age, gender, education, household income and area of residence. *p < .05. **p < .01. ***p < .001.

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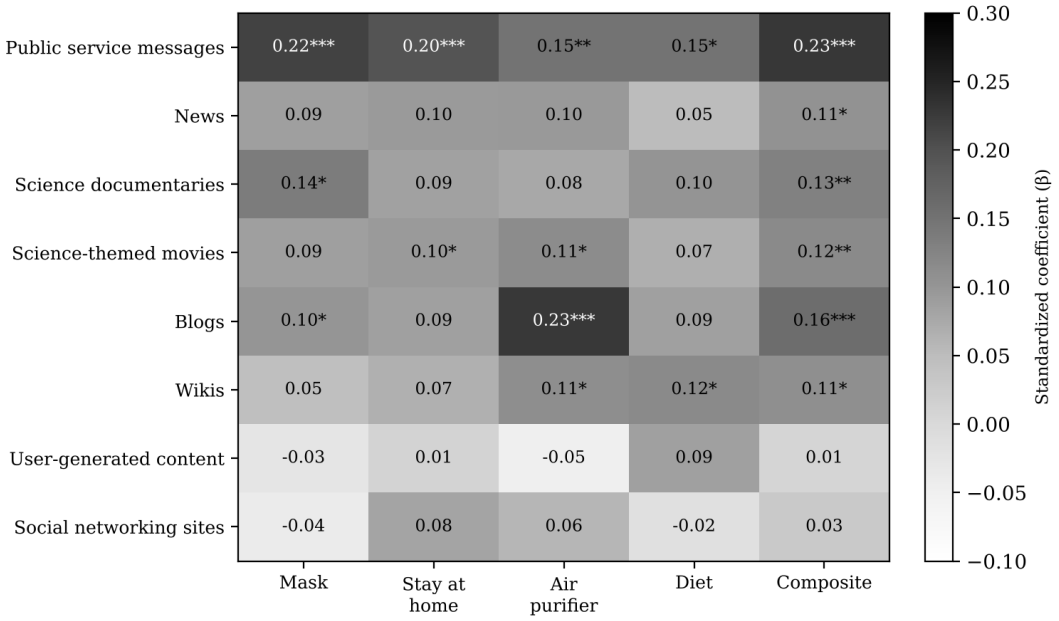


Figure 1 Unique Associations Between Channel Attention and Each Protective Action

Note. Cells show standardized coefficients from models that include all eight channels and the demographic covariates; darker cells indicate stronger positive associations. *p < .05. **p < .01. ***p < .001 (HC3).

Among the covariates, education was positively associated with every action, and rural residents reported less of every action than urban residents. Women reported staying at home less often than men (B = −0.221, p = .038); gender was unrelated to the other actions.

Attention Versus Contribution (RQ3)

Dominance analysis showed how the channels' joint contribution to the composite was shared (Table 4; Figure 2). Public service messages accounted for 25.2% of it, followed by documentaries (15.5%), blogs (15.2%) and news (13.2%). Social networking sites (4.5%) and user-generated content (5.9%) together accounted for 10.4%, although they were the two channels residents attended to most. The two most-attended channels ranked last in contribution, whereas the channel contributing most ranked fifth in attention. The pattern was similar for each action, with two variations: blogs carried the largest share for air-purifier use (26.7%), and user-generated content carried a modest share for dietary change (12.7%).

Table 4 General Dominance Weights: Percentage of Channel-Explained Variance Attributable to Each Channel

Channel	Mean attention	Mask	Stay at home	Air purifier	Diet	Composite
Public service messages	2.29	31.9	26.9	18.1	22.1	25.2
News	3.13	13.2	14.2	12.6	11.1	13.2
Science documentaries	2.23	20.1	13.6	11.5	16.1	15.5
Science-themed movies	1.98	8.2	8.9	9.0	7.1	8.6
Blogs	2.56	12.5	10.6	26.7	11.1	15.2
Wikis	2.02	8.4	10.1	12.1	17.0	11.9

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Channel	Mean attention	Mask	Stay at home	Air purifier	Diet	Composite
User-generated content	3.17	3.8	6.3	3.8	12.7	5.9
Social networking sites	3.28	1.9	9.4	6.2	2.8	4.5
Total channel contribution (ΔR^2)		.19	.21	.26	.18	.33

Note. N = 400. Each weight is the channel's average increment in R^2 across all subsets of the other channels, with the demographic covariates always included, expressed as a percentage of the channels' total contribution. Columns sum to 100.

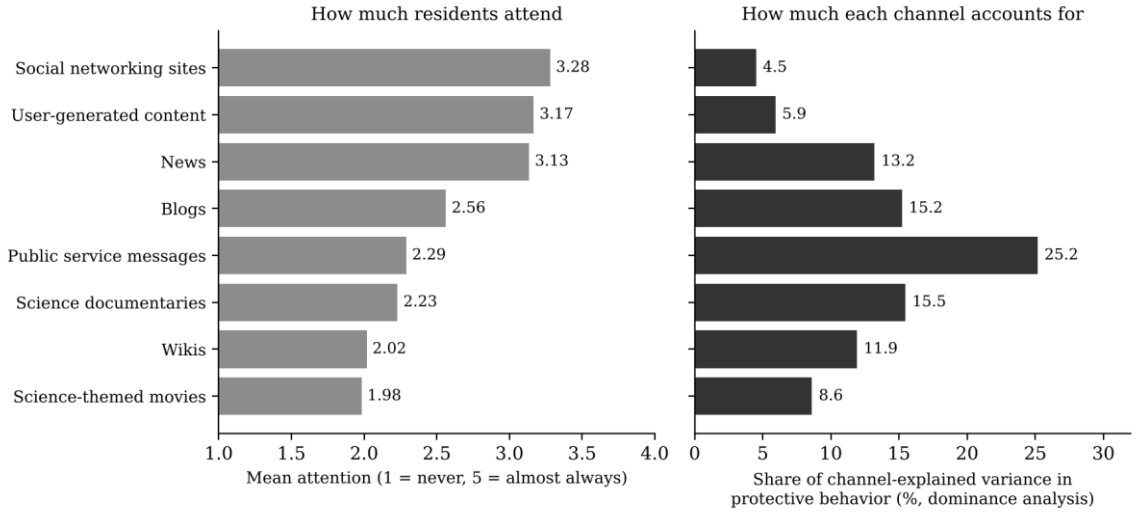


Figure 2 Channel Attention Compared With Each Channel's Share of Explained Variance in Protective Behavior

Note. Left: mean attention to smog content in each channel. Right: each channel's share of the variance in composite protective behavior explained by the eight channels (general dominance weights). Channels are ordered by attention.

Sensitivity Analyses

Three checks supported these results. First, conclusions were the same with conventional and HC3 standard errors. Second, in logistic models contrasting frequent with less frequent performance of each action, public service messages raised the odds of frequent mask-wearing (OR = 1.39), staying at home (OR = 1.52) and dietary change (OR = 1.30), blogs and news raised the odds of frequent purifier use (both OR = 1.60), and neither social networking sites nor user-generated content was significant for any action (OR = 0.81–1.08). Third, when channels were grouped into descriptive indices, traditional (B = 0.274) and science-oriented sources (B = 0.296) were each more strongly associated with the composite than online sources (B = 0.135, p = .011), and online sources were unrelated to mask-wearing (B = 0.015, p = .855).

Discussion

Smog content is disseminated to residents primarily through social feeds and video platforms but attention to these platforms provides little knowledge to the protected individuals once awareness is raised on other platforms. The opposite is true for public service messages: only a minority of residents read them, but of those who do, the public service messages

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are more likely to lead to all protective actions investigated. Most channels that have smog talk are not the channels that have protective instruction.

Why Public Service Messages Stand Out

A recommended response is an element of public service messages. A typical smog announcement includes the name of the hazard, instructions on what to do and sometimes will include an image of someone doing it, which mirrors the elements of social cognitive theory for behavior change: knowledge of the behavior, observational learning, and belief that the behavior is possible (Bandura, 2001). Previous campaign research has consistently shown that messages that call for a specific action are more effective than messages that simply raise awareness (Snyder et al., 2004; Wakefield et al, 2010). This is therefore a missed opportunity in Faisalabad due to low reach of these messages. They are most closely tied to protection and fewer than 20% of residents respond to them frequently.

Why Social Media Add Little Beyond Other Channels

There is no unique association of social networking sites and user-generated content, but that doesn't mean that these sites are not relevant. Both were correlated at bivariate level with protection. Instead, people who pay attention to smog content on social feed are also more likely to pay attention to it elsewhere, but after controlling for those other factors, increase in social feed attention adds little additional benefit. There are three possible explanations. Like mainstream media, the smog presence in social media is largely dominated by air quality readings and pictures of haze and complaint, rather than instructions (Javed et al., 2023; Qusien, 2024). It is embedded in feeds that also include unverified remedies and contradicting claims, as has been identified in the case of health topics on the web (Suarez-Lledo & Alvarez-Galvez, 2021; Wang et al., 2019). One of the problems with attending a feed is that it is often encountered incidentally, and presumably not as a matter of deliberate information seeking as it might be with smog posts (Chaffee & Schleuder, 1986; Katz et al., 1973).

Channels Matched to Actions

The action-specific results corroborate the notion that people look for different information when making different decisions. Blogs and wikis, which are deliberately looked up, were associated with using air-purifiers, the most expensive and considered action of the four. To mask-wearing, the action directly most associated with the body and inhalation, documentaries that explained the negative health impacts of pollution were associated. These associations are cross-sectional, may be limited to those already owning such units who read more about them and indicate that there is a difference between information needs of a cheap habit action and an expensive purchase, and that a channel strategy can be tailored to the action being promoted.

Implications for Smog Communication

These four practical steps emerge from the findings. First, the reach of such public-service-type material should be extended, not displaced: The material is best delivered when it is consumed, so broadcasters and public agencies should devote regular airtime to the same in the season's broadcast schedule, not just during the peak episodes. Second, social media isn't enough. It is important to include the elements of a public service message, a named action, a demonstration, and a reason in the short videos and posts that residents already consume, and ensure a high-profile local media source carries it. Third, information about high cost measures like purifiers should be provided at the place where residents are going to buy a purifier, which is an explainers page, a comparison page and online reference sources in Urdu. Fourth, they have to reach rural and less educated residents via community channels, as these audiences took the least action to protect themselves, as well.

Limitations

These four practical steps emerge from the findings. First, the reach of such public-service-

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type material should be extended, not displaced: The material is best delivered when it is consumed, so broadcasters and public agencies should devote regular airtime to the same in the season's broadcast schedule, not just during the peak episodes. Second, social media isn't enough. It is important to include the elements of a public service message, a named action, a demonstration, and a reason in the short videos and posts that residents already consume, and ensure a high-profile local media source carries it. Third, information about high cost measures like purifiers should be provided at the place where residents are going to buy a purifier, which is an explainers page, a comparison page and online reference sources in Urdu. Fourth, they have to reach rural and less educated residents via community channels, as these audiences took the least action to protect themselves, as well.

Conclusion

In Faisalabad, the media channels residents attend to most for smog information, social networking sites and user-generated video, add nothing to the prediction of protective action once other channels are known, whereas public service messages, which few residents attend to, are associated with every protective action examined. Reach and usefulness diverge. Smog communication will do more good if it carries the practical, action-focused content of public service messages onto the platforms where residents already spend their attention.

Declarations

Author contributions. Talha Javeed: conceptualization, data collection, analysis and drafting. Ashraf Iqbal: supervision, methodological guidance, and review and editing.

Data overlap. This article uses the survey data collected for the first author's doctoral thesis (Javeed, 2026). Companion articles based on the same survey examine belief pathways between overall media attention and protective behavior and the moderating role of environmental concern. Neither the thesis nor the companion articles analyse individual channels or individual protective actions. This overlap should be stated in the cover letter.

Conflict of interest. None declared.

Funding. None.

Ethics approval. Approved from Advance study board

Data availability. Available on reasonable request.

Use of generative AI. Having English as a second language, author used AI to improve tone, grammar and language settings.

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Appendix

Table A1 Survey Items Analysed in This Article

Item	Wording
Channel attention	During the last smog season, how much attention did you pay to smog-related messages in the online and offline versions of the following sources? (1 = never, 5 = almost always)
Q1	Public service messages
Q2	News (television, radio, newspapers and news websites)
Q3	Science-themed documentaries
Q4	Science-themed movies
Q5	Blogs (e.g., Blogspot, WordPress)
Q6	Wikis (e.g., Wikipedia)
Q7	User-generated content (e.g., YouTube)
Q8	Social networking sites (e.g., Facebook, X/Twitter)
Protective actions	How often do you do the following? (1 = never, 5 = almost always)
Q36	During smog, I wear a mask to protect myself.
Q37	During smog, I stay at home.
Q38	During smog, I use an air filter/purifier to protect myself.
Q39	During smog, I change my diet to cope with its effects.

Note. Items were presented in English followed by an Urdu translation.