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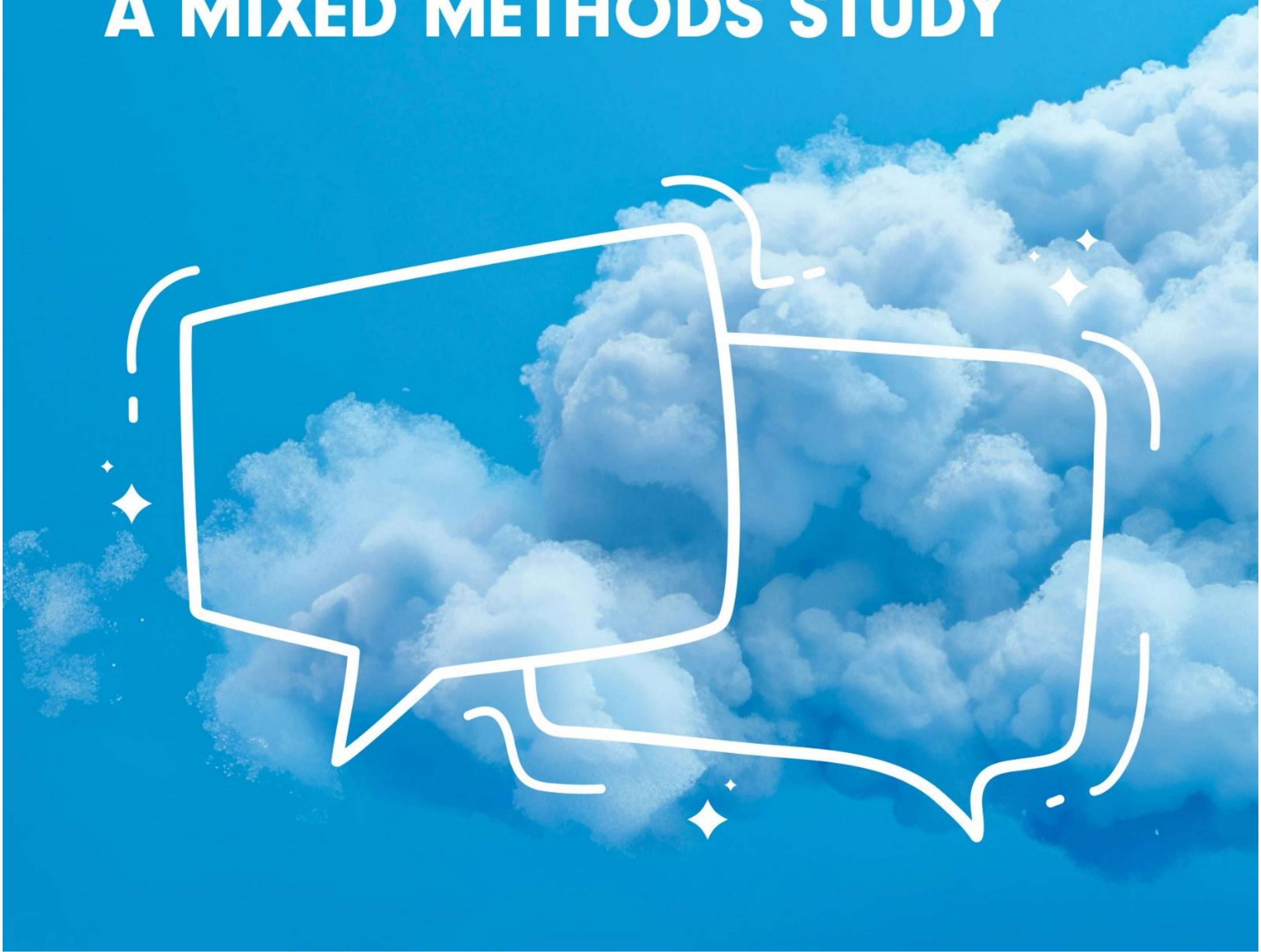
Using behavioural and cultural insights to understand perceptions and behaviour related to air quality in Georgia

A MIXED METHODS STUDY



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Abbreviations

ACT	Analysis and Consulting Team
AQ	Air Quality
BAT	Best Available Techniques
BCI	Behavioural and Cultural Insights
BMJ	British Medical Journal
CATI	Computer-assisted telephone interviews
COM-B	Capability-Motivation-Opportunity-Behaviour
COPD	Chronic Obstructive Pulmonary Disease
CSO	Civil Society Organization
DK	Do not know
EU	European Union
FGD	Focus Group Discussion
GEL	Georgian Lari
GoG	Government of Georgia
HAPA	Health Action Process Approach
HH	Household
IDI	In-Depth Interview
KII	Key Informants Interview
LMIC	Lower- and Middle-Income Countries
MEPA	Ministry of Environmental Protection and Agriculture of Georgia
MESD	Ministry of Economy and Sustainable Development
MoID&LHSA	Ministry of Internally Displaced Persons from the Occupied Territories, Labour, Health and Social Affairs of Georgia
NCDC	National Centre for Disease Control and Public Health
NEA	National Environmental Agency
NHA	National Health Agency
PM	Particulate Matter
PMT	Protection Motivation Theory
SE	Sampling Error
SPSS	Statistical Package for the Social Sciences
TV	Television
UBA	Environment Agency Austria
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
VOC	Volatile Organic Compounds
WHO	World Health Organization

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Executive summary

Georgia faces significant ambient air pollution problems in large urban and industrial areas. Government agencies are addressing this problem and have launched a multi-component project, "Air Quality for Better Citizens' Health", with international partners to improve air quality and better protect the health of people living in Georgia. Joining this effort are the United Nations Development Programme (UNDP), the World Health Organization (WHO) and the United Nations Economic Commission for Europe (UNECE), working in partnership with the Umweltbundesamt - Environment Agency Austria (UBA). The project is expected to last four years.

As part of this project, the Behavioural and Cultural Insights (BCI) Unit at the WHO Regional Office for Europe, along with the WHO Country Office for Georgia and the research company Analysis and Consulting Team (ACT Global), conducted mixed methods research to measure awareness, perceptions and behaviours among the general population related to air quality, as well as barriers and drivers of change among high-risk groups. A total of 2816 computer-assisted telephone interviews were conducted within the framework of a quantitative survey. Four focus group discussions were carried out with individuals with chronic respiratory illnesses in Tbilisi and Kutaisi, 2 focus group discussions with health workers at each location, and 16 in-depth interviews with street vendors working outside in Tbilisi and Kutaisi. Two key informant interviews were conducted with the representatives of private enterprises in Rustavi. Data were collected between November 2024 and January 2025.

Key findings

People are generally very aware of air pollution as a health hazard.
Survey results show that most people are concerned about air quality and believe that protecting themselves from air pollution can prevent serious illness. Those with young children and those who have a chronic respiratory illness or care for someone with a chronic respiratory illness are more concerned about air quality. Urban populations have higher perceived susceptibility than rural populations.

87%	76%	80%
strongly or somewhat concerned about the potential health risks associated with air pollution.	think that they are likely or very likely to experience negative health effects from air quality.	agree/strongly agree that protecting themselves from air pollution can reduce the likelihood of serious illness.

Very few people protect themselves from air pollution.
However, a majority of people have never or only seldom done anything to protect themselves from air pollution in the past 12 months. The majority of the population did not access any tool with an indication of air quality in the past 12 months. Many people think protecting themselves from air pollution means missing out on social events or incurring other negative consequences.

This incongruence between high awareness and high-risk perception, together with low action, is important to understand.

70%	88%	40%
never or only seldom protected themselves from air pollution in the past 12 months.	have not used any AQ indicator over the past 12 months.	think that protecting themselves from would have negative consequences, such as not meeting with others.

Information is not enough to influence behaviour.
Nearly all study participants agree that there is a lack of information in Georgia about air quality, and a majority either never look for or don't know where to look for information about it. However, analysis of survey data also shows that while accurate, timely information is important, providing information alone has little impact on intention to act or on behavioural outcomes.

Perceived control, context and social norms are key.
Instead, contextual factors such as socioeconomic status, the ability to control one's surroundings or how one lives one's life and social norms all play a much larger role. Survey respondents who have white collar jobs (like office workers) were more likely to say they had the intention to take up personal measures to protect themselves from air pollution. For others, the feeling that there was nothing they could do to alter their commute to work or how much time they spent outside left them with little intention to change.

Those at highest risk feel less able to act.
Through qualitative methods, those at high risk of the negative impacts of air pollution confirmed these key findings. Street vendors and people with chronic respiratory illnesses are highly aware of air pollution, and many feel that there is little they can do about it.

> *I think about air quality every time I breathe…"* ***Female with chronic respiratory illness, Kutaisi***

> *"Some people have jobs which you cannot miss, it affects salary, and you are forced to avoid missing… I have such job that my salary is reduced as much as I miss…I attempt to go to my work as much as I can…"* ***Male with chronic respiratory illness, Tbilisi***

Some street vendors report their main concerns relate to more basic financial survival. In a setting with high unemployment, study respondents often note focusing more on maintaining their employment than prioritising protection from air pollution.

> *"How can I stay inside when I work? I want it with all my heart, but I am here every day… Where am I even going? I am always here."* ***Female, street vendor, Tbilisi***

The public sees the government as most responsible for reducing air pollution.
Study respondents feel strongly that the government has a responsibility to reduce air pollution, particularly through regulation and policies. For mitigating impacts to their health, support from employers is considered essential for gaining flexibility in working hours and commute times. Without such engagement, it would be difficult for most people to make changes in their life.

Considerations for action

Integrated findings from quantitative and qualitative components suggest that effective behaviour change interventions in the context of air quality in Georgia must be multidimensional. Successful strategies must include community engagement, policy reform, and structural support in addition to education. The following considerations are explored further in the report and example activities are provided.

1. Enhance capability through targeted education

To address the knowledge gap, there is a need to improve the population's understanding of how air pollution affects health and what protective actions can be taken through training and education tailored to specific audiences and different literacy levels.

2. Strengthen motivation through social norms and fostering beliefs

To strengthen motivation, the most effective messaging emphasizes the personal relevance and effectiveness of individual actions to reduce exposure and foster beliefs about one's capabilities.

3. Increase opportunity through structural and institutional support

To enable sustained behaviour change, environmental and systemic conditions must support the adoption of new practices through accessible AQ data, social support and government action.

4. Leverage health professionals as change agents

Given the high levels of trust in healthcare providers, doctors and nurses can be equipped to serve as effective communicators in a variety of ways.

5. Design for inclusion and accessibility

Special attention is needed for groups with limited access to information and resources, for example, those who are more often exposed due to economic requirements.

Introduction

Air pollution remains a leading direct and indirect cause of morbidity and mortality throughout the world. Small atmospheric particulate matter (PM) like PM2.5 and PM10, ozone, nitrogen and sulphur oxides, carbon monoxide, and many other hazardous, ambient air pollutants contribute to mortality and morbidity related to a range of diseases, including cardiovascular, respiratory, oncological, developmental, and neurodegenerative disorders (Turner et al. 2020, Feigin et al. 2021, Carré et al. 2017, Shi et al. 2021). Millions of deaths are attributable to air pollution annually, with 80% of those occurring in lower- and middle-income countries (LMICs) (Murray et al, 2020). The World Health Organisation (WHO) estimates that 99% of the world's population lives in polluted air (WHO, 2022).

In Georgia, the situation is especially acute in major urban and industrial zones such as Tbilisi, Kutaisi, and Rustavi, mostly due to high vehicle emissions, outdated industrial infrastructure, poorly regulated transportation networks, and widespread household use of biomass fuels for heating and cooking. The resulting pollutants significantly contribute to the burden of noncommunicable diseases, including chronic respiratory diseases, cardiovascular conditions, and cancers.

The impact is not only limited to health; it also encompasses economic costs related to healthcare expenses, lost productivity, and decreased quality of life. Vulnerable groups - such as individuals with chronic respiratory diseases, young children, the elderly, and those working outdoors - are disproportionately affected. Amid growing awareness of environmental health challenges, the Georgian government, with support from international partners including the WHO, UNDP, UNECE, and the Environment Agency Austria, has initiated efforts to address air pollution through improved monitoring and forecasting capacities as well as legislative, regulatory, and public health interventions. These initiatives include the enhancement of air quality monitoring systems, the integration of environmental indicators into health assessments, and the development of public communication campaigns.

However, while policy, regulatory, and advocacy efforts are essential to addressing air pollution in a sustainable and impactful manner, personal-level actions to reduce air pollution exposure can serve as vital stop-gap measures until foundational efforts fully take effect. For individuals living in areas with dangerous air pollution levels, adapting their behaviour can play a crucial role in temporarily reducing their exposure and mitigating health risks. Protective actions, such as avoiding pollution sources, staying indoors, relocating physical activities to less polluted environments and adjusting commute routes can - at least to some degree - provide immediate relief (Laumbach and Cromar, 2022). This is particularly critical for at-risk groups, including children, pregnant individuals, and those with chronic respiratory or cardiovascular conditions (WHO, 2016).

The present study was conducted to complement the overall efforts by focusing on behavioural and cultural determinants of air quality-related actions among the public. Specifically, it aims to provide a baseline understanding of how people perceive air quality and air pollution-associated risks, how they then behave in response to pollution, and what factors help or hinder protective actions. Such insights are essential for designing evidence-based, culturally sensitive interventions that are effective for local populations.

The Project ("Air Quality for Better Citizens' Health") oversight was conducted by the Project Board, comprised of representatives of the MEPA, MESD, National Environmental Agency NEA, MoID&LHSA, NCDC, UNDP, EU, UNECE, and the Environment Agency Austria.

Study Questions

This research was designed to address the following key questions:

- What is the level of awareness and perception of air quality risks among the general population in Georgia?
- What individual or contextual factors influence the adoption of protective behaviours* against air pollution?
- How do specific high-risk groups - such as those with chronic respiratory illness and those working outside (here, street vendors) - experience and respond to air pollution?
- What roles do health professionals and other stakeholders play in enabling or obstructing these behaviours?

By answering these questions, the study contributes to the design of future communication strategies, public health interventions, and policy decisions aimed at improving air quality and reducing its health impacts in Georgia. The findings also add to the global evidence base regarding behavioural responses to air pollution in lower- and middle-income countries (LMICs).

* It is important to note that protective behaviours here are understood to be personal-level actions taken to reduce exposure to air pollution. No individual can fully protect themself from air pollution.

Methods

The study employed a mixed methods approach using an embedded design where qualitative and quantitative data were collected concurrently and analysed in an integrated fashion. The theoretical framework underpinning this research and analysis is the modified Capability-Motivation-Opportunity-Behaviour (COM-B) framework (see chart below; Michie, et al, 2014; Habersaat, et al, 2020). Briefly, capability comprises a range of individual psychological and physical capacities to engage in a given behaviour (e.g., knowledge, skills, and behavioural regulation). Opportunity encompasses all factors exhibiting an influence on behaviour that lie outside of the individual, such as contextual or social influences. Motivation comprises not only overarching goals and behavioural intentions but also all cognitive and emotional processes that drive or direct decision-making and behaviour (Michie et al., 2011). Importantly, these three overarching domains are not assumed to influence behaviour directly. Instead, capability and opportunity are hypothesized to act as "logic gates" by influencing the translation of motivation into behaviour (West & Michie, 2020). Thus this, the COM-B framework allows focusing on behaviour change rather than static determinant-behaviour associations.

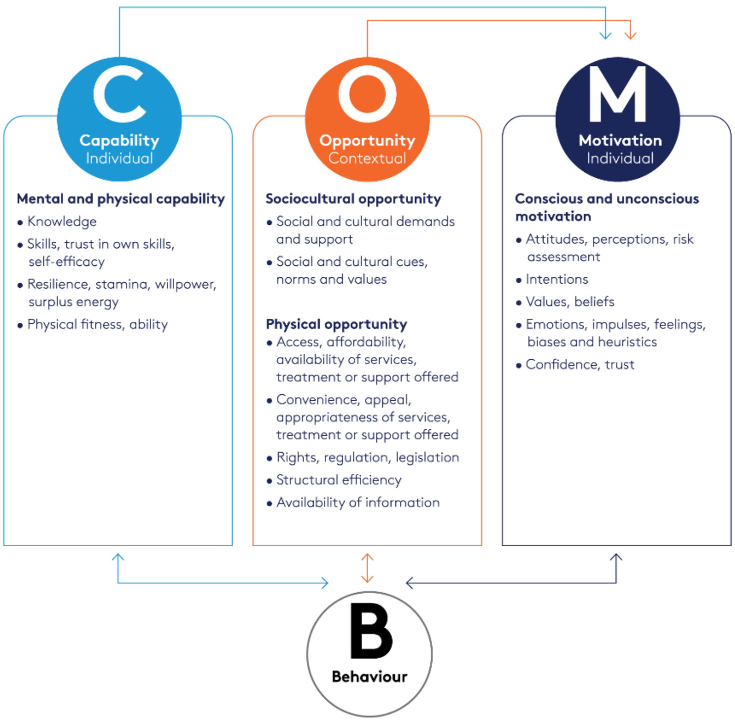

Figure 1. Modified COM-B framework adapted to the Tailoring Health Programs approach.

The COM-B model was operationalized in this study through key determinants of protective behaviours such as awareness, health literacy, perceived risk, social norms, access to information and resources, and behavioural intentions. In both the survey and qualitative tools, items were carefully mapped to COM-B dimensions to ensure consistent and theory-driven data collection.

Capability	Opportunity	Motivation
➢ Awareness of air pollution as a health hazard ➢ Awareness of tools available to measure AQ ➢ Health literacy related to AQ and pollution-associated risks	**Social** ➢ Social norms related to AQ and pollution ➢ Community, government or other social support for individuals concerned about AQ **Physical** ➢ Availability of information about AQ and pollution ➢ Existing and planned policies, laws/legal frameworks ➢ Availability of tools to measure AQ ➢ Infrastructure and other physical systems	➢ Threat appraisal of AQ and pollution risks (perceived susceptibility and severity) ➢ Perceived coping capabilities (response and self-efficacy beliefs) ➢ Intentions to protect oneself from poor AQ impacts ➢ Planning which actions to implement and how to cope in case of unforeseen obstacles ➢ Priority given to air pollution compared to other health risks or different concerns Trust in information sources

Table 1. The focus areas of the COM-B model.

Study design and sampling

The research team implemented a mixed methods design consisting of a cross-sectional quantitative survey and a qualitative study targeting at-risk and enabling groups. This design enabled a broad understanding of general population behaviour and deeper insights into the lived experiences of vulnerable populations. Sampling strategies were tailored to meet the objectives of each component, ensuring representative data from the general population while capturing meaningful narratives from select vulnerable subgroups.

For the quantitative component, a nationally representative sample of 2,816 adults aged 18 and over was recruited using a stratified random sampling approach. The sample was balanced for gender, age group, and regional distribution to reflect the demographic profile of Georgia. Oversampling in underrepresented regions ensured adequate statistical power for regional comparisons. Interviews were conducted using Computer-Assisted Telephone Interviewing (CATI), drawing from a database of randomly generated mobile phone numbers.

For the qualitative component, purposive and snowball sampling methods were employed to identify participants from specific risk groups. These included individuals with chronic respiratory diseases, street vendors who work in polluted outdoor environments, and healthcare professionals engaged in frontline service delivery. The selection criteria were designed to ensure diversity in experiences across gender, age, and geographic location. Participants were recruited from Tbilisi, Kutaisi, and Rustavi - cities with documented high pollution levels.

A total of 8 focus group discussions (FGDs) were conducted - 4 with individuals with chronic respiratory illness (separate by gender and location) and 4 with healthcare providers. Additionally, 16 in-depth interviews (IDIs) were held with street vendors and 2 key informant interviews (KIIs) with representatives of private enterprises. Attempts were made to include municipal authorities, but participation was not secured despite repeated outreach.

All participants provided informed consent, and protocols were reviewed by local and international ethical review boards. This ensured the protection of participant rights and compliance with research standards.

Data collection instruments and procedures

The survey instrument for the quantitative study was developed based on previous research, validated international tools (McCarron et al., 2023) and aligned with the COM-B model (Michie et al., 2011). Additionally, we leveraged two theories of health behaviour that allow to specifically understand protective behaviours as well as the volitional phase of translating motivation into action – Protection Motivation Theory (Rogers, 1975) and the Health Action Process Approach (Schwarzer et al., 2011). Thus, the questionnaire assessed demographic characteristics, awareness and attitudes toward air quality, protective behaviours, and perceived facilitators and barriers. The survey was translated into both Georgian and Russian to ensure linguistic inclusivity. A pilot phase involving 10 test interviews was conducted to assess question clarity, logic flow, and technical feasibility.

Data were collected using a CATI system that enabled automated dialling, skip logic, and secure data storage. Enumerators received intensive training on the survey instrument, data ethics, and communication protocols. Interviews lasted an average of 20–25 minutes and were monitored in real-time to ensure quality.

Qualitative data collection relied on COM-B-based, semi-structured discussion guides tailored to each participant group. The guides covered perceptions of air quality, observed health impacts of air pollution, adaptive behaviours and other coping strategies, and the role of institutions. FGDs and interviews were audio recorded (with consent), and detailed notes were taken using the Rapid Assessment Procedure (RAP) format. Transcripts were anonymized and reviewed for consistency prior to analysis.

In the next section, we delve into the data analysis strategies employed for both quantitative and qualitative components, highlighting how the integrated approach facilitated a holistic interpretation of findings.

Data analysis

Data analysis followed a convergent approach in which quantitative and qualitative data were examined independently and then integrated to produce a richer, more nuanced understanding of behaviours and perceptions related to air quality.

For the quantitative component, data cleaning and validation were conducted using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were generated to understand the distribution of key variables, including demographic characteristics, awareness levels, and protective behaviours. Frequency distributions, cross-tabulations, and chi-square tests were used to assess relationships between categorical variables. For continuous and ordinal data, measures of central tendency and dispersion were computed.

Advanced statistical methods were employed to identify predictors of protective behaviour. Bivariate correlations provided insight into associations between variables, while logistic regression models and structural equation models (SEM) were estimated to assess the likelihood of engaging in protective behaviours based on predictors drawn from the COM-B model. These included perceived susceptibility, severity of air pollution effects, response efficacy, and self-efficacy. The regression models adjusted for potential confounders such as income, education, region, and age.

Qualitative data were analysed thematically using an inductive-deductive coding framework based on the COM-B model. Transcripts from FGDs, IDIs, and KIIs were imported into qualitative analysis software and coded by a team of trained researchers. Initial coding was followed by group discussions to refine themes and ensure inter-coder reliability. Emerging themes were mapped to COM-B categories - capability, opportunity, and motivation - while also allowing for inductive exploration of unanticipated patterns.

The integration of findings occurred through a triangulation process, where quantitative results were compared with qualitative themes to validate and contextualize findings. For example, the low frequency of protective behaviours – in spite of strong risk perceptions – observed quantitatively was explored in relation to qualitative themes such as economic hardship, fatalism, and limited social support.

This integrated approach not only strengthened the validity of findings but also highlighted contradictions and complexities (Sniehotta et al., 2017) that would be missed by a single-method study. The next section presents the study findings in detail, beginning with descriptive results from the quantitative survey and moving into deeper qualitative insights on perceptions and behaviours in context.

Results

The study results are presented in two major subsections corresponding to the quantitative and qualitative components. The quantitative survey provides nationally representative data on awareness, perceptions, and self-reported behaviours regarding air pollution. The qualitative data offer contextual depth and nuance by highlighting individual and community-level experiences, concerns, and constraints, particularly among high-risk groups.

Quantitative findings

The demographic profile of the survey respondents indicates a balanced sample in terms of gender (54% female, 46% male) and a distribution across age groups and regions reflective of the national population. Urban residents comprised 58% of the sample, while rural participants made up 42%. The majority of respondents had completed at least secondary education, with a significant portion possessing higher education qualifications, particularly in Tbilisi.

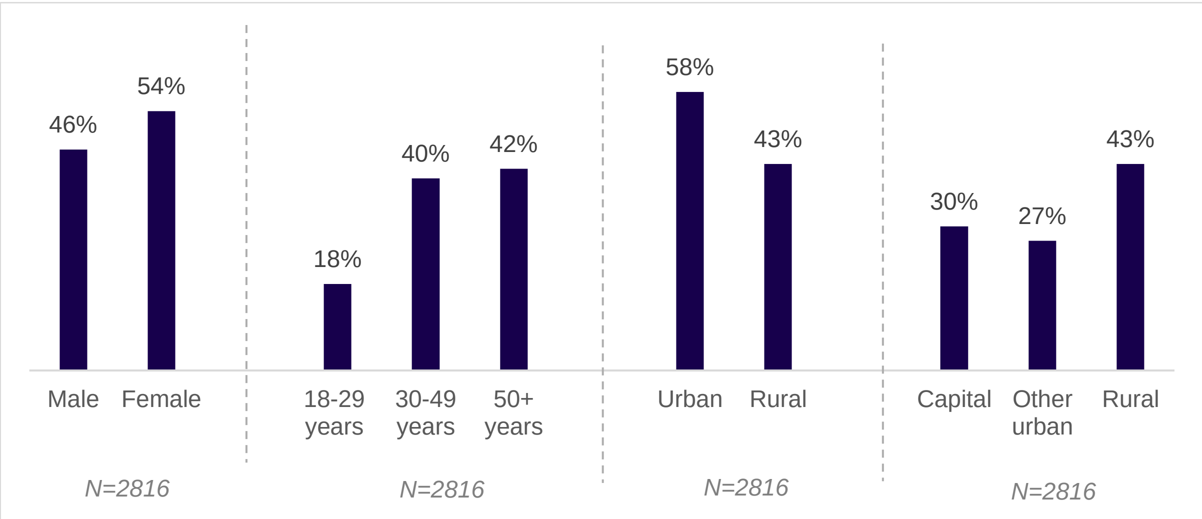

Figure 3. The distribution of the general population by gender, age, and settlement types.

A notable 17% of respondents reported that they or someone in their household suffered from a chronic respiratory condition. This proportion was higher among older adults (12% for those over 50) and among women. Regional analysis showed that residents of Tbilisi, Adjara, and Shida Kartli reported the highest prevalence of respiratory illness.

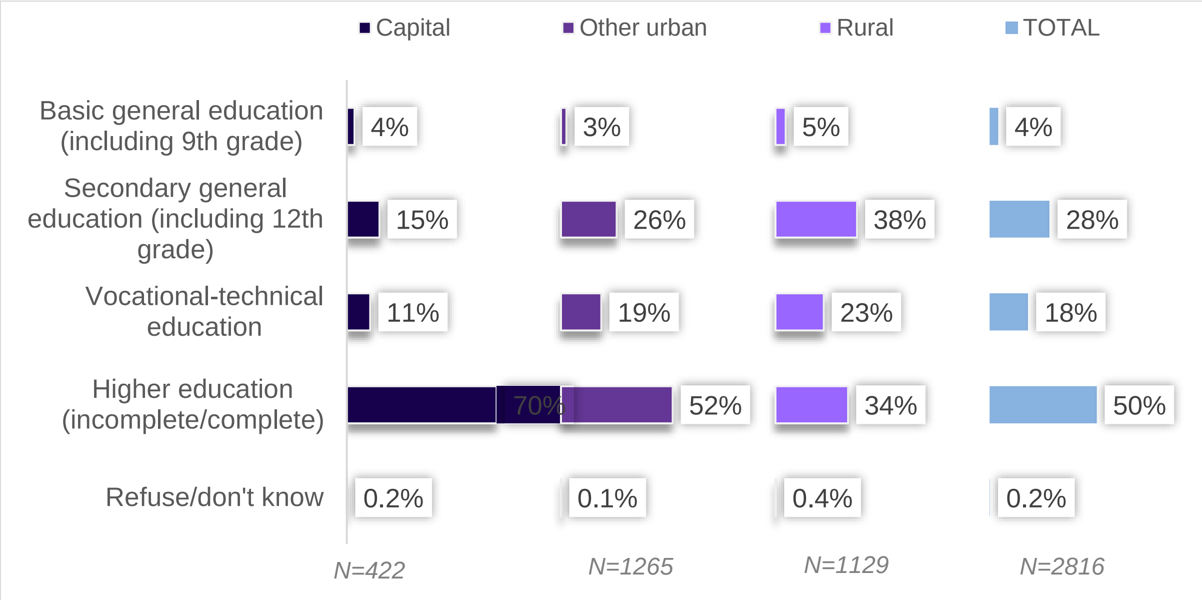

Figure 4. The level of respondents' education by settlement types

When asked about their concerns regarding air pollution, 87% of respondents stated they were either strongly or somewhat concerned about its health effects. Moreover, 76% believed they were likely or very likely to experience negative health impacts due to air pollution, and 80% agreed that personal-level actions to reduce air pollution exposure could reduce the likelihood of serious illness. Importantly, respondents with preschool children in the family (81%) are more strongly concerned about the potential health risks than respondents with school-aged children (76%) and respondents with no children in the family (68%; *chi-square – 0.001).* The place of residence also impacted concerns about potential health risks, as those living in rural settlements (8%) reported twice as often not to be concerned at all compared to those living in urban areas (4%; *chi-square – 0.001).* Unsurprisingly, respondents with chronic respiratory illnesses or HH members with relevant diagnoses (83%) reported stronger concerns about potential health risks than those without such conditions in their families (71%).

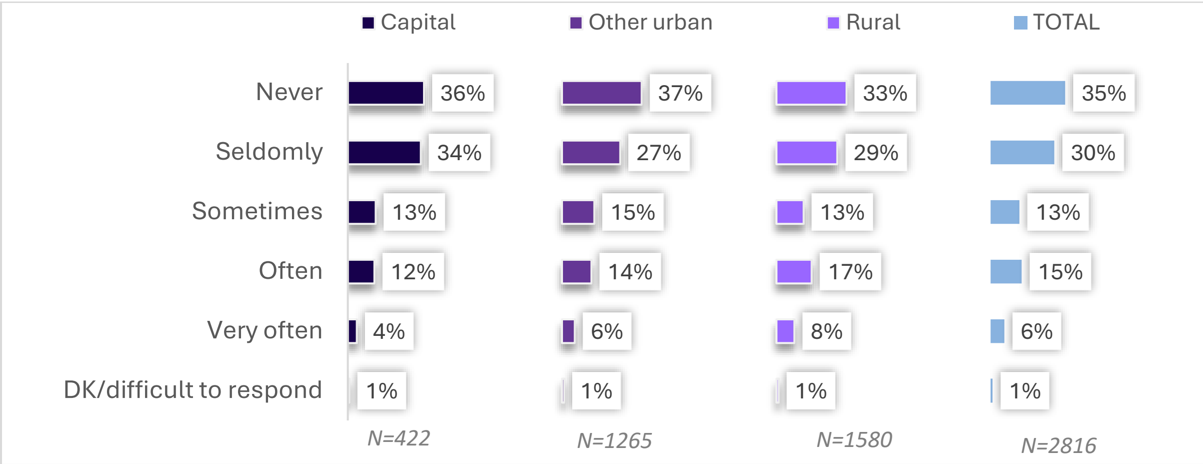

Figure 5. Frequency of personal-level actions to reduce air pollution exposure in the general population over the last twelve months by settlement types.

Despite these high concern levels, behaviour change remained limited. Approximately 70% reported never or only seldom taking actions to protect themselves from air pollution exposure in the past 12 months. The most frequently cited reasons included uncertainty about effective actions, perceived lack of control, and a belief that others were also not taking precautions. Nearly 40% of respondents believed that protecting oneself from air pollution would lead to social or practical disadvantages, such as missing work or social events.

Only 15% of respondents reported receiving advice from a healthcare professional on how to protect themselves from exposure to air pollution. Among these, the most common recommendations included wearing a mask (43%), avoiding outdoor activities (21%), and checking air quality indexes (18%). Differences emerged across settlement types, with rural residents more likely to be advised to keep windows closed and avoid outdoor activities, likely reflecting exposure to agricultural pollutants.

Analysing which COM-B-derived determinants affected intentions to protect oneself as well as frequency of protective behaviours, we still find small effects of knowledge and awareness on intentions. Risk perceptions and confidence in being able to cope with such risks also positively impacted intentions. However, the strongest effect was found for encouraging social norms. Importantly, while this effect was not as strong here, social norms also positively impacted actual protective behaviours.

Interestingly, perceived control over one's actions only had a small effect on intentions. However, this perceived control strongly affected whether respondents planned how to protect themselves and how to cope in case of any barriers they might encounter. Such planning activities were, in turn, strongly linked to actual behaviours. Combining both effects, we find that perceived control over one's capabilities to protect oneself strengthens key strategies such as planning that, in turn, increase adaptive actions.

Qualitative findings

The qualitative component revealed a range of lived experiences and attitudes toward air pollution, especially among high-risk groups. Participants with chronic respiratory illnesses consistently associated their health symptoms with poor air quality. They described seasonal patterns of exacerbation and detailed efforts to manage symptoms, such as using inhalers, wearing masks (not necessarily respirators), or temporarily relocating to areas with cleaner air. Some participants recounted improvements in their health during the COVID-19 lockdown, attributing it to reduced traffic and industrial activity.

> *“When I had some problems, my management has given additionally day-offs, and they did not say anything.”* **Female with chronic respiratory illness, Tbilisi**
>
> *“Nothing, nothing at all. Some people have jobs which you cannot miss otherwise, it affects salary, and you are forced to avoid missing… I have such job that my salary is reduced as much as I miss… I do not have such a job to bring a notice about my health condition and they give me a bulletin… I have never taken a bulletin, I attempt to go to my work as much as I can…”* **Male with chronic respiratory illness, Tbilisi**

Street vendors expressed a strong awareness of the health risks posed by their work environments, often describing long hours spent near traffic-dense areas or industrial zones. Yet economic necessity left them with little flexibility to change behaviours. Many vendors articulated a sense of resignation or fatalism, stating that they had no real choice but to endure the conditions to earn a living. Others noted that they felt unsupported by authorities or employers in managing their exposure.

> *"We think every day. If thinking only helps, then we think every day. I have children and if I have time, I manage to go to the countryside. I have the means to do that. What can someone do who cannot afford it?”* **Male with chronic respiratory illness, Tbilisi**
>
> *“Life is so difficult; how can I have time to think about air quality? I think about survival yet, particularly, right now… The air quality significantly affects my health… You can stay alive without food or water, but you cannot withstand without air… Nowadays, air contains many harmful chemicals.”* **Male, street vendor, Tbilisi**
>
> *„Air quality is a challenge for each street vendor... We breathe bad air... There are rubbish bins next to me. So many cars move and there is so much exhaust. My colleagues and I are in a desperate situation here... I do not know anything more about the air quality..."* **Female, street vendor, Kutaisi**

Healthcare workers were divided in their views. Some doubted the effectiveness of individual behaviour change, particularly among populations facing more pressing survival needs. Others emphasized the importance of patient education and expressed a need for more reliable and accessible information to share with patients. Across all groups, trust in scientific and medical authorities was high, suggesting strong potential for expert-led public education campaigns.

Participants also reported confusion between eradicating pollution and mitigating its health effects. Many believed that since they could not stop pollution itself, there was little point in attempting protective measures. This misunderstanding points to a critical gap in health communication that could be addressed through tailored messaging.

> *"It is one thing to have a polluted environment, but I always say that the baker should bake the bread. Perhaps there is a service that would conduct research or something official and bring it to the people. I know that the air is polluted, but no one tells us how high the pollution level is and what causes it."*
> ***Mother of child with chronic respiratory illness, Tbilisi***
>
> *"I think that information received from the state agencies will be more reliable than from private organizations because private is still private and may receive narrow information.* ***Male with chronic respiratory illness, Kutaisi***

In the next section, we interpret these findings in the context of the COM-B model and explore their implications for future practice and policy development.

Discussion

The findings from this mixed methods study offer valuable insights into the complex interplay of knowledge, attitudes, risk perceptions, social context, and structural factors that influence behaviour related to air quality in Georgia. By applying the COM-B model to both survey and qualitative data, we have identified promising entry points of intervention to promote protective health behaviours and improve environmental health outcomes.

The results reveal a significant gap between awareness and action. Although the majority of respondents were concerned about air pollution and recognized associated health risks, this did not translate into sustained or widespread protective behaviour. This discrepancy points to a deficiency in capability and opportunity - for example, a lack of clear, actionable knowledge and skills on how to respond effectively to air quality threats and existing pathways to actually do so.

This gap is compounded by motivational barriers. Fatalism, perceived inefficacy, and low perceived response efficacy reduce individuals' belief in the value of protective behaviour. The data also indicate that perceived social costs - such as the inconvenience of mask use or reduced mobility - deter people from taking precautionary measures. These findings highlight the importance of shifting public narratives to reinforce the benefits and normalcy of protective actions.

Structural opportunities for behaviour change are also limited as indicated by low levels of perceived behavioural control. Many respondents indicated they lacked access to trusted and timely information, particularly in non-urban areas. Institutional advice, such as guidance from healthcare providers, was rare. Where it was present, it often lacked specificity or feasibility. For instance, advice to "stay indoors" may be unrealistic for economically vulnerable individuals who must work outside. Still, the strong effects of planning on protective behaviours show that provision of targeted and actionable information (combined with a reduction of contextual barriers) could lead to adaptive behaviour change.

The study offers a deeper understanding of the lived realities behind these patterns. Participants from high-risk groups frequently described constraints beyond their control. Chronic illness patients detailed their proactive efforts to protect themselves - such as monitoring symptoms and relocating temporarily - yet felt overwhelmed by environmental conditions beyond their ability to change.

Street vendors exemplified how economic necessity and structural rigidity undermine behaviour change. Even when individuals understood the risks and wished to adapt, they faced insurmountable trade-offs between income and health. These narratives highlight the need for interventions that account for socioeconomic constraints and prioritize feasibility.

Healthcare professionals expressed varying degrees of confidence in the effectiveness of risk communication. While some were highly motivated to educate patients, others expressed frustration with patient compliance or scepticism about the impact of individual action. These ambivalent perspectives underscore the need for system-level support and evidence-informed communication tools.

Trust in scientific authorities emerged as a consistent theme across qualitative interviews. Participants were more receptive to messages delivered by doctors and scientists, rather than politicians or mass media. This suggests that future behaviour change strategies should emphasize expert-led outreach and leverage the credibility of health professionals.

The integration of quantitative and qualitative findings provides several key conclusions:

- People are generally very aware of air pollution as a health hazard.
- Very few people protect themselves from air pollution.
- This incongruence between high awareness and high-risk perception, together with low action, is important to understand.
- Information is not enough to influence behaviour.
- Perceived control, context and social norms are key.
- Those at highest risk feel less able to act.
- The public sees the government as most responsible for reducing air pollution.

These findings suggest that behaviour change interventions must be multidimensional. Education alone will not suffice if individuals are economically constrained or socially discouraged from acting. A successful strategy must include community engagement, policy reform, and structural support.

In the next section, we explore practical recommendations based on these findings and consider how they can be implemented to achieve measurable improvements in public health and environmental resilience.

Implications for future practice

Drawing on the findings of both the quantitative and qualitative components, this section outlines a series of practical recommendations aimed at improving behavioural responses to air pollution in Georgia. These implications address the critical domains of the COM-B model and are intended to support future programmatic and policy efforts. Importantly, these evidence-informed suggestions are based on previous literature in other domains and/or with other populations, since very little data exists on interventions in Georgia.

1. Enhance capability through targeted education

To address the knowledge gap, there is a pressing need to improve the population's understanding of how air pollution affects health and what protective actions can be taken. Public education campaigns could:

- Focus on clear, actionable messages tailored to different literacy levels.
- Use infographics, animated videos and short public service announcements to demonstrate behaviours like checking air quality indexes and optimizing indoor ventilation.
- Translate content into multiple languages spoken in Georgia, including Georgian, Russian, Armenian and Azerbaijani.

- Incorporate education about air pollution into school curricula and community health outreach programs.

2. Strengthen motivation through social norms and emotional appeals

To strengthen motivation, messaging should emphasize the personal relevance and effectiveness of protective behaviours and foster beliefs about one’s capabilities. Campaigns could:

- Foster beliefs through narratives and storytelling, highlighting real-life examples of individuals who adopted protective practices and experienced improved health outcomes.
- Frame air pollution protection as a social responsibility that benefits not only individuals but also families and communities.
- Promote behaviour modelling by respected figures such as doctors, scientists, educators, and local community leaders.

3. Increase opportunity through structural and institutional support

To enable sustained behaviour change, environmental and systemic conditions must support the adoption of new practices. Recommended actions include:

- Integrate real-time air quality data into existing weather platforms, mobile apps and social media channels.
- Encourage employers to provide flexible working hours or remote work options on high pollution days.
- Work with municipal authorities to reduce exposure in urban environments by creating pedestrian zones, green spaces, and low-emission transport corridors.
- Equip public health institutions with evidence-based guidelines and training for advising patients about air quality risks.
- Declare the reduction of air pollution to be a priority policy goal at the national level; follow up with public updates and showcase leadership in innovation and change.

4. Leverage health professionals as change agents

Given the high levels of trust in healthcare providers, doctors and nurses should be equipped to serve as effective communicators. This could be achieved by:

- Providing training workshops on environmental health communication.

- Distributing clinical decision support tools that outline when and how to advise patients on protective behaviours.
- Developing partnerships between environmental health experts and medical institutions for knowledge-sharing.

5. Design for inclusion and accessibility

Special attention is needed for groups with limited access to information and resources. Strategies may include:

- Establishing mobile information units to reach rural and underserved communities.
- Offering subsidies or distribution of protective materials such as air purifiers to vulnerable populations.
- Ensuring that information dissemination is inclusive of people with disabilities and the elderly.

These multi-pronged interventions, if implemented in tandem, can foster a more informed, empowered and resilient public. The next section reflects on the limitations of this study and proposes areas for further investigation.

Limitations

While this study provides robust insights into air quality-related perceptions and behaviours in Georgia, several limitations should be acknowledged. Recognizing these constraints can guide both the interpretation of findings and the design of future research initiatives.

1. Cross-sectional design

The quantitative survey was cross-sectional in nature, capturing perceptions and behaviours at a single point in time. As such, the data do not allow for causal claims or examination of changes over time. Longitudinal studies would be valuable in understanding how attitudes and behaviours evolve, particularly in response to policy interventions or environmental changes.

2. Reliance on self-reported data

The study relied on self-reported behaviours, which are subject to social desirability and recall biases. While efforts were made to ensure anonymity and minimize response bias, participants may have over- or under-reported their actual behaviours. This limitation is common in behavioural studies and underscores the need for triangulating self-report data with observational or sensor-based measures where feasible.

3. Limited engagement with certain stakeholders

Despite efforts to include diverse perspectives, the study was unable to secure participation from key municipal officials and certain private sector actors, especially those involved in transportation and infrastructure. This gap limits the depth of institutional analysis and the understanding of system-level opportunities and barriers.

4. Underrepresentation of marginalized voices

Although purposive sampling helped ensure inclusion of high-risk populations, some marginalized groups - such as ethnic minorities not proficient in Georgian or Russian, and individuals without access to telecommunication - may have been underrepresented. Future studies should explore innovative methods to engage these groups more effectively.

5. Regional and seasonal constraints

Qualitative data were collected in three major cities with known pollution challenges, which may not reflect experiences in smaller towns or rural areas with different exposure patterns. Additionally, data collection occurred during specific months and may not capture seasonal variation in pollution levels and related behaviours.

Despite these limitations, the study represents a comprehensive effort to understand air quality behaviours through a behavioural science lens. The mixed methods design, theoretical grounding in the COM-B model, and integrated analysis contribute to its strength and practical relevance.

In conclusion, these findings provide a foundational evidence base for future public health initiatives aimed at mitigating the health impacts of air pollution in Georgia. They also highlight the need for continued research, cross-sectoral collaboration, and policy innovation to support adaptive, inclusive, and sustainable environmental health practices.

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