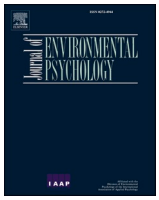
Journal of Environmental Psychology 110 (2026) 102963

Contents lists available at ScienceDirect

Journal of Environmental Psychology

journal homepage: www.sciencedirect.com/journal/journal-of-environmental-psychology



Is the public really concerned about microplastics? The importance of measuring everyday relevance and behavioral intentions as well as stated concern

Robin Janzik [a,*], Mathew P. White [b,c], Sabine Pahl [c], Severine Koch [a], Giorgia Zamariola [d], Domagoj Vrbos [d], Natalie Berger [a]

[a] Department Risk Communication, German Federal Institute for Risk Assessment (BfR), Max-Dohrn-Straße 8–10, 10589, Berlin, Germany
[b] Cognitive Science Hub, University of Vienna, Kolingasse 14–16, 1090, Vienna, Austria
[c] Environmental Psychology Group & Environment and Climate Hub, University of Vienna, Wächtergasse 1, 1010 Vienna, Austria & Augasse 2–6, 1090, Vienna, Austria
[d] Communication and Partnership Department, European Food Safety Authority (EFSA), Via Carlo Magno 1A, 43126, Parma, Italy

ARTICLE INFO

Liuna Geng

Keywords:
Microplastics
Awareness
Knowledge
Concern
Behavioral intentions
Cross-national perspective

ABSTRACT

Recent studies suggest that the European public is concerned about the impact of microplastics on environmental and human health. However, concern is usually measured by asking people relatively simple questions about their current levels (i.e., stated concern) with responses potentially inflated by immediate contextual salience, raising questions about interpretability. To explore this issue, we conducted a cross-sectional random-quota survey of German (n = 1135) and Italian (n = 1124) citizens, asking them not just about stated microplastics concern but also more indirect indicators of concern including the extent to which they think about and discuss microplastics in their everyday lives (everyday relevance) and intend to reduce their own exposure (behavioral intentions). Further, we explored the degree to which awareness and knowledge about microplastics differed across countries as well as across key demographics and how different indicators of concern were associated with these factors. Replicating earlier work, awareness was lower in Italy compared to Germany, and stated concern was high overall. In addition, most people reported thinking or talking about microplastics only rarely or sometimes, but still tended to say they were likely to engage in behaviors to reduce exposure. Moreover, stated concern and everyday relevance both mediated the degree to which microplastics knowledge predicted these behavioral intentions. The results paint a nuanced picture of public microplastics concern and support arguments for including multiple metrics including everyday relevance and behavioral intentions. They also highlight the potential of increasing public knowledge given positive associations with all three metrics. In conclusion, even if they are not particularly salient in everyday thoughts or discussions, microplastics do appear to concern many German and Italian citizens and future studies should investigate the causal chain of knowledge, awareness, concern, and action more directly.

1. Introduction

In recent years, scientists, politicians, and the public have been increasingly interested in the risks of microplastics for the environment and human health (World Health Organization (WHO), 2022). Researchers expect an accumulation of plastic particles up to a size of 5 mm in the environment, which could lead to ingestion by humans via the food chain (e.g., seafood; Toussaint et al., 2019), through breathing, or the skin (Prata et al., 2020). Despite growing research, there are unresolved questions in the risk assessment of microplastics (Science Advice for Policy by European Academies (SAPEA), 2019; WHO, 2022).

At the same time, both qualitative and quantitative studies suggest negative public attitudes towards microplastics (Henderson & Green, 2020; Menzel et al., 2021; Raab & Bogner, 2021) and a rather mixed level of knowledge about microplastics. For example, Thiele and Hudson (2021) demonstrated uncertainty about evidence for effects among both laypeople and people who have already worked on microplastics. Deng et al. (2020) also showed that people were not reliably able to identify

* Corresponding author.
E-mail addresses: robin.janzik@bfr.bund.de (R. Janzik), mathew.white@univie.ac.at (M.P. White), sabine.pahl@univie.ac.at (S. Pahl), severine.koch@bfr.bund.de (S. Koch), giorgia.zamariola@efsa.europa.eu (G. Zamariola), domagoj.vrbos@efsa.europa.eu (D. Vrbos), natalie.berger@bfr.bund.de (N. Berger).

https://doi.org/10.1016/j.jenvp.2026.102963
Received 24 July 2024; Received in revised form 8 January 2026; Accepted 18 February 2026
Available online 19 February 2026

products that are intentionally made to contain microplastics.

More importantly, there are widespread reports of public concern about the impact of both plastics in general (Davison et al., 2021) and microplastics in particular (Anderson et al., 2016; Borriello et al., 2022; Catarino et al., 2021; Felipe-Rodriguez et al., 2024; Janzik et al., 2024; Kramm et al., 2022) on humans and the environment. Recurrent population surveys such as the *Eurobarometer on Food Safety in the EU* (European Food Safety Authority (EFSA), 2019, 2022) confirm increasing levels of risk perceptions towards microplastics, but also point to differences between countries with higher (e.g., Germany, 40%) and lower concerns (e.g., Italy, 16%; EFSA, 2022).

However, surveys usually ask about stated concern. The threshold for stating concern in a survey situation may be low and depend on context (Schwarz & Strack, 1991), raising the question of the exact interpretation of such responses. Answering this requires broadening the perspective on concern, and we propose a distinction between stated concern, day-to-day relevant concern, and acting on the concern. A first issue lies in how many people are even aware of microplastics, since awareness is a prerequisite for concern (Gaskell et al., 2016; Hansla et al., 2008). Cammalleri et al. (2020) showed that Italian health professional trainees reported both low awareness and low subjective knowledge about microplastics. Another study explored concepts and mental models (i.e., internal representations of processes and functioning; Morgan et al., 2002) surrounding perceptions of microplastics among German and Italian citizens (Janzik et al., 2024). Results indicated that interviewees developed their own assumptions under uncertainty (e.g., that microplastics cause cancer) and often derived their knowledge from that of macroplastics (e.g., both contain plasticizers). There were differences in awareness of various aspects of microplastics. For example, while the German sample was more likely to make a connection between microplastics and the ubiquity of plastic packaging, Italian participants were more aware of the impact on the oceans (Janzik et al., 2024). A related question concerns the focus of concern. While plastic in relation to the natural environment has been discussed for some time (Pahl et al., 2017), plastic in relation to the human body and human health has become a growing focus only more recently (e.g., Davison et al., 2021; Grünzner et al., 2023).

A second issue relates to the question to what extent microplastics come up in people's everyday thoughts and feelings (relevance). Recent studies suggest that focusing on stated concerns is not sufficient when measuring risk perceptions; the everyday relevance of an issue in people's lives should also be factored in (Gaskell et al., 2016; Wiedemann et al., 2017). This could be particularly useful for a topic such as microplastics. As the particles are barely visible due to their size (see also Fu et al., 2023) and the effects on the environment and human health have not been fully investigated, microplastics are unlikely to be consistently relevant and salient for people. Since studies show high concerns about microplastics despite open questions in risk assessment (e.g., Kramm et al., 2022), it seems important and would constitute a novel approach to explore the significance of the topic in people's day-to-day lives further.

Thirdly, previous work shows that people with high concerns about an issue tend to take measures against it (e.g., Fujii, 2006). Looking at intentions to act as a behavioral indicator of concern seems important, as some countries are already implementing measures to reduce microplastics in the environment (Heidbreder et al., 2019). In the context of the introduction of new measures, such as the European Union's recent ban of certain cosmetic products such as loose glitter that intentionally contain added microplastics (European Commission, 2023), little research has explored people's intentions to act on microplastics and their antecedents. In a study of students in India, Dowarah et al. (2022) found behaviors regarding microplastics to be positively correlated with awareness. Yoon et al. (2021) showed risk perception to be a positive predictor for tourists' pro-environmental behavioral intentions related to microplastics in South Korea. Relatedly, risk perceptions were also positively associated with knowledge. These initial findings suggest a connection between the constructs in the context of microplastics, whereby concerns mediate the link between knowledge and intentions. However, previous studies have mostly looked at these paths in isolation (e.g., Kramm et al., 2022; Yoon et al., 2021) and tended to rely on stated concerns, disregarding the potential role of everyday relevance.

Indeed, the risk perception literature assumes that people are sometimes over-concerned (risk amplification) and sometimes under-concerned (risk attenuation) relative to what experts might expect given their technical assessment of the risks (Kasperson & Kasperson, 1996). However, only a few studies have directly looked at the link between established knowledge and concern in the context of risk (e.g., Shi et al., 2015). Although Kramm et al. (2022) showed in a representative study for Germany that knowledge was positively associated with the risk perception of microplastics, their measurement was based on the participants' own assessment of their knowledge (subjective knowledge), leaving open if this association can be found when testing for knowledge according to the current state of research (objective knowledge). Moreover, it is important to consider differences in knowledge between groups. Previous studies have shown that awareness and knowledge, just like concern, can differ according to demographic characteristics such as gender (e.g., Hayes, 2001), age (e.g., Morrison & Beer, 2017), or education (e.g., Robelia & Murphy, 2012).

Therefore, the current study aimed to fill two overarching research gaps. First, to broaden the perspective on microplastics concern and its conditions, it aimed to (1) investigate levels of awareness as well as (2) objective knowledge, and (3) take a more detailed look at stated concern, comparing the domains of environment and human health, as well as (4) concern expressed in everyday thoughts and discourse (everyday relevance). Second, to augment fragmented existing research on the development of microplastics-related intentions (as a further indirect metric of concern), the current study aimed to (5) examine the relationship between objective knowledge and behavioral intentions in a path model by considering the mediating role of different types of concern, with particular regard to the additional contribution of everyday relevance over and above the more commonly measured stated concern. In terms of overall context, the current study represents the second part of a larger research project which adopted a *Mental Models Approach to Risk Communication* (MMARC, Morgan et al., 2002) in the context of microplastics. Specifically, it builds on a qualitative study of in-depth interviews with members of the Italian and German public (Janzik et al., 2024), two populations who also showed some distinct beliefs and concerns in the qualitative work. As per the MMARC, the results of these interviews directly informed some of the thinking and items explored in this second more quantitative step. More specifically, we conducted an online survey with German and Italian citizens investigating the aforementioned constructs across different cultural contexts. We proceed by discussing the theoretical foundations of the links between knowledge, behavior, and different types of concern.

1.1. Knowledge and behavior in the environmental and health domain

Individuals' knowledge about an issue is one factor that can help explain their related actions (Boase et al., 2019; Liu et al., 2020; Shi et al., 2015). A distinction can be made between subjective and objective knowledge. Subjective knowledge refers to a personal belief regarding one's understanding of an issue. In comparison, objective knowledge refers to facts and information that can be assessed (Ellen, 1994). Some researchers have argued that rather than being distinct categories, they exist on a continuum (e.g., Pieniak et al., 2010). This can be challenging in emerging areas of knowledge where there is less certain information and research is still at an early stage (e.g., microplastics; SAPEA, 2019; WHO, 2022).

One, but by no means the only, factor to be considered in the translation of knowledge into action is the process of assessing benefits and risks (e.g., Ueland et al., 2012). While a number of studies have shown a positive relationship between subjective knowledge and

behavioral intentions (as a proxy for behavior) regarding, for example, preventing pollution (Liu et al., 2020), this link has been scarcely investigated for microplastics. This is important because microplastics can be distinguished from some other environmental and health issues in that they combine specific characteristics that make a direct assessment challenging for lay people. For instance, relative novelty and invisibility, as well as uncertainty and complexity with regards to the effects, make informed decision-making difficult due to incomplete knowledge. However, when knowledge increases, behavioral intentions may follow. For example, in one early English study, based on qualitative data, Anderson et al. (2016) found that showing participants the samples of microplastics present in beauty and personal care products led them to question their own future use of these products and express intentions to seek microplastic-free alternatives. Similarly, Deng et al. (2020) provided evidence that the willingness to reduce microplastics was positively associated with levels of environment- and health-related microplastics knowledge regarding sources, accumulation, as well as human ingestion and excretion among Chinese consumers. Finally, more recently, Borriello et al. (2022) found behavioral intentions to act on microplastics to be positively related to self-assessed knowledge in a non-representative adult sample in New South Wales, Australia.

Taken together, the results of existing studies suggest further investigation of the role of knowledge for behavior regarding microplastics is warranted, especially extending beyond subjective knowledge and using representative samples. Potential mechanisms underlying this relationship should also be explored further.

1.2. Different manifestations of concern and their mediating role in the knowledge–behavior relationship

In a general sense, concerns are understood as a component of risk perception, representing an emotional response to a potential threat (Slovic, 1987). Applied to an environmental or health-related context, concerns reflect individuals' perceived level of risk regarding issues, such as pollution or disease (e.g., Gazmararian et al., 2003; Saari et al., 2021). In questionnaires, concerns are often measured in a straightforward way, asking participants to state to what extent they feel concerned about a certain topic (Gaskell et al., 2016).

However, Wiedemann et al. (2017) argue that studies adopting this approach are likely to overestimate the extent to which participants perceive actual risk. As a survey situation is assumed to provoke a heightened focus on a questioned risk, they suggest contrasting these stated concerns with the extent to which participants manifest concern in their everyday lives. To this end, they proposed additional consideration of *thematic relevance,* which relates to "the emergence of themes in human consciousness", and *discursive relevance,* which adds a social component, describing "the communicative importance of a topic in everyday discussion" (Wiedemann et al., 2017, p. 3). Put simply, how often does the topic come up in one's thoughts and how often does one discuss it with others, with the assumption that the more one thinks and talks about the risk (i.e., everyday relevance), the more concerned one 'really' is. Including these concepts in a study of radio frequency electromagnetic field risk potentials from base stations, Wiedemann et al. (2017) found lower levels of concern using these alternative metrics, with only a third of participants saying they thought or talked about the topic in everyday life.

With respect to microplastics, considering the relevance of the topic in everyday life in addition to stated concerns is an important step forward. Despite studies having shown a high level of concern about the topic (e.g., EFSA, 2022), little is known about whether people think and talk about it in their day-to-day lives, and thus whether their stated concerns in a survey context extend to other forms of less externally cued manifestations. In addition, the question remains as to whether a differentiated consideration of thematic and discursive relevance makes sense for a less tangible topic such as microplastics, especially as there are hardly any studies to date on the extent to which the topic of microplastics is discussed beyond media coverage (e.g., Okoye et al., 2023). Thus, we argue that, in line with Wiedemann et al. (2017), thematic and discursive relevance should be examined in the context of microplastics in addition to the more traditionally assessed stated concerns when exploring population risk perceptions.

These manifestations of concerns may also help understand the relationship between knowledge and behavioral intentions if we consider their mediating role. On the one hand, studies suggest a positive relationship between environmental knowledge and environmental concerns (e.g., Saari et al., 2021; Yilmaz & Can, 2020). With knowledge forming the basis of a cognitive framework, acquiring knowledge about a subject helps shape a mental model of it. With existing knowledge structures guiding the processing of new information, the perception of related topics is also formed (Jonassen & Henning, 1999; Morgan et al., 2002). Studies have pointed to the formation of individual mental models in relation to microplastics (Felipe-Rodriguez et al., 2022; Janzik et al., 2024) and a certain level of knowledge about effects, for example, could also lead to searching for further relevant information. Accordingly, initial studies, and more recently Fian et al. (2025), were able to detect links between subjective knowledge and stated concerns about microplastics. Examining subjective knowledge among German citizens, Kramm et al. (2022) showed that respondents with higher self-assessed knowledge were more likely to say they were concerned about microplastics both in relation to the environment and health. However, the relationship became non-significant when controlling for the exposure to certain media narratives. Supporting these results, Borriello et al. (2022) found a positive link between self-assessed knowledge about microplastics and concerns about the effects on both the environment and human health among Australian participants.

On the other hand, the literature points to the importance of situationally relevant concerns for the development and implementation of behavioral intentions (Bamberg, 2003; Pahl et al., 2017). However, few studies to date have integrated this into empirical designs or looked at manifestations of concern comparatively. This neglects important precursors of action such as recurring thoughts or conversations that can promote the internalization of a problem and increase awareness, while focusing mostly on an emotional component (i.e., stated concern). Further, while there are several studies showing that concerns are, at least in part, antecedents of actions, for example related to organic farming (Toma & Mathijs, 2007) or general pro-environmental behavior (e.g., recycling; Coelho et al., 2017), few studies have explored this link in the context of microplastics. Similar to the link between knowledge and behavior, a specific investigation also appears important here in view of the unique characteristics of microplastics. Their virtual invisibility creates few situations in which direct experience can trigger behavior and microplastics are novel as an issue related to human health, so more concrete concerns may take time to form. Further, awareness of existing scientific uncertainty about impacts and also their complexity may reduce the urgency of turning concern into behavior. Interestingly, Borriello et al. (2022) investigated the relationship between concern and self-reported behavior in a structural model and showed that higher levels of concerns about the effects of microplastics on both the environment and human health predicted higher levels of behavioral intentions. Supporting this, Deng et al. (2022) found a positive relationship between environmental concerns regarding microplastics and behavioral intentions, even when controlling for attitudes, subjective norms, and perceived behavioral control (as suggested by the theory of planned behavior; Ajzen, 1991).

1.3. The current study

The current study's aim was twofold. First, it sought to explore the different manifestations of concern about microplastics discussed above, and their occurrence in different populations. Second, it aimed to widen the understanding of microplastics perceptions and behaviors by investigating the interplay of knowledge, stated concern, everyday

relevance, and behavioral intentions in a structural model. Since previous studies have found differences between countries in views on microplastics (EFSA, 2019, 2022; Janzik et al., 2024), this study further integrates a cross-national perspective. As noted above, in line with the MMARC that proposes to integrate qualitative and quantitative methodology (Morgan et al., 2002), this study is an extension of previous interview work (Janzik et al., 2024). While that earlier work used convenience samples of the public, here we wanted to know to what extent some of these themes generalized across the Italian and German adult public and thus used random-quota survey data from the two populations. These two countries lend themselves to comparison not only because of differences in the perception of microplastics found in previous studies, but also because they have different environmental policies (e.g., deposit system) and public engagement, different education systems to potentially promote environmental behavior (e.g., proportion of tertiary education), and different geographical conditions (e.g., coastline). The study's insights can help inform communicators to tailor messages, while policymakers can use this information to possibly refine policies and target education efforts.

In a first step, we explored how aware participants were of microplastics (RQ1) and which patterns of knowledge they showed (RQ2). The second step involved exploring to what extent participants were concerned about the risks of microplastics to human health and the environment (RQ3a) and if this had everyday relevance to them (RQ3b).

The last step involved testing a structural model (see Fig. 1). The first two hypotheses posited that higher microplastics knowledge would be associated with both higher stated concerns about microplastics (H1) and everyday relevance of microplastics (H2). In turn, the next two hypotheses suggested a positive relationship between stated concerns about microplastics (H3) as well as everyday relevance of microplastics (H4) and behavioral intentions. Further, it was hypothesized that the association of knowledge and behavioral intentions would be mediated by both the extent of stated concerns (H5) and everyday relevance (H6). As we expected full mediation, we did not formulate a separate hypothesis for the relationship between microplastics knowledge and microplastics-related behavioral intentions.

2. Methods

2.1. Procedure and participants

An online survey was conducted between March and May 2022 using the platform *SoSci Survey* (Leiner, 2022). Participants aged 18 years and older from Germany and Italy were recruited in cooperation with a panel provider for market and social research and reimbursed by them for their participation. Given the different objectives of our study, we did not conduct a formal power analysis; instead, to balance robustness of estimation and feasibility, we aimed for a sample size of 1200 participants per country. A random-quota procedure for gender, age, education, and region within each country was applied to increase representativeness (see Supplementary Tables S1 and S2 for educational levels and regions).The questionnaire was first constructed in English and then translated into German and Italian using the TRAPD method (Harkness et al., 2004) to ensure consistency of meaning. Participants answered the questionnaire in their respective national language.

Ethical approval was obtained by the ethics committee of the German Psychological Association (DGPs) under reference number KS2022-01-12VA. The applicability of this decision for the Italian part of the study was confirmed by the regional ethics committee of Emilia-Romagna region, where EFSA is based (Comitato etico regionale (CER), Regione Emilia-Romagna). Participants gave informed consent before participating and had the option to opt out at any stage.

A total of 1253 German and 1215 Italian citizens completed the questionnaire. After the data cleaning procedure based on attention checks, irregular durations, high numbers of missing values, and straight-lining patterns, further cases in both countries were removed from the sample (see Supplementary Table S3). This resulted in a subset of 1135 German and 1124 Italian participants.

For analyses on knowledge, concerns, relevance, and behavioral intentions, it was deemed crucial that participants were aware of microplastics to give meaningful answers. Thus, only participants confirming their awareness were included in this final subset, consisting of 1056 German and 675 Italian citizens aged between 18 and 86 years.

Table 1 shows the distributions of gender, age groups, and educational levels both within and between countries in the different analytical subsets.

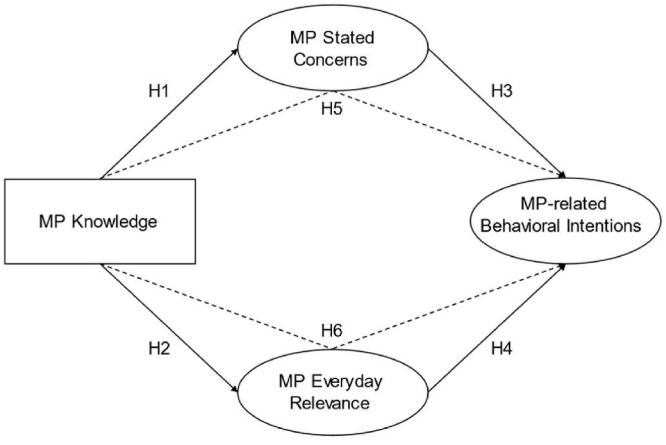


Fig. 1. Hypothesized structural model
Note. The model hypothesizes associations of microplastics knowledge, stated concerns, everyday relevance, and behavioral intentions. MP = microplastics.

2.2. Measurements

The full survey contained items on microplastics-related media use, perceived impact, sources, exposure, and responsibilities as well as informational needs. For current purposes, we focus only on the core selection of variables related to the current research questions and hypotheses: awareness, knowledge, stated concerns, everyday relevance, behavioral intentions, and a selection of demographics.[1]

2.2.1. Microplastics awareness

Awareness of microplastics was assessed by asking participants "Have you heard of microplastics before?", using the response options "yes" and "no".

2.2.2. Microplastics knowledge

Microplastics knowledge was measured using eight items developed based on findings of the previous interview study on the topic (Janzik et al., 2024). The items included statements on different domains, such as definitions (e.g., "Microplastics are intentionally added to certain products."), incidence (e.g., "Microplastics are present in the ground water."), and nutrition (e.g., "Microplastics are NOT found in organically produced foods."). The statements were selected according to whether they could be classified as true or false according to the current state of scientific knowledge. For each item, participants indicated whether they thought the statement was false (0) or true (1). After recoding two negatively worded items, a sum score indicating the number of correct answers was calculated for each participant (0–8; for a similar approach in a different context see Boase et al., 2019).

[1] These data are also referred to in a review article, listing the descriptive values for awareness and concern in the German sample as a supplement (see Janzik et al., 2025, Deutsches Ärzteblatt International, https://doi.org/10.3238/arztebl.m2025.0138).

Table 1
Participants' demographics for the full sample and the different analytical subsets.

		Full sample		Cleaned sample		Final sample (awareness of microplastics)	
		Germany (n = 1253)	Italy (n = 1215)	Germany (n = 1135)	Italy (n = 1124)	Germany (n = 1056)	Italy (n = 675)
Gender	Male (n, %)	606 (48.4%)	583 (48.0%)	543 (47.8%)	530 (47.2%)	510 (48.3%)	317 (47.0%)
	Female (n, %)	641 (51.1%)	632 (52.0%)	588 (51.8%)	594 (52.8%)	543 (51.4%)	358 (53.0%)
	Diverse (n, %)	6 (.5%)	–	4 (.4%)	–	3 (.3%)	–
Age	*M*, *SD*	48.8 (16.2)	48.9 (15.7)	49.3 (16.2)	49.0 (15.7)	49.2 (16.2)	49.3 (15.9)
	18–29 years (n, %)	208 (16.6%)	182 (15.0%)	178 (15.7%)	165 (14.7%)	169 (16.0%)	103 (15.3%)
	30–39 years (n, %)	177 (14.1%)	195 (16.1%)	158 (13.9%)	182 (16.2%)	148 (14.0%)	102 (15.1%)
	40–49 years (n, %)	249 (19.9%)	247 (20.3%)	222 (19.6%)	228 (20.3%)	204 (19.3%)	130 (19.3%)
	50–59 years (n, %)	229 (18.3%)	201 (16.5%)	209 (18.4%)	183 (16.3%)	194 (18.4%)	109 (16.2%)
	60–69 years (n, %)	256 (20.4%)	274 (22.5%)	242 (21.3%)	258 (22.9%)	225 (21.3%)	165 (24.4%)
	70–86 years (n, %)	134 (10.7%)	116 (10.6%)	126 (11.1%)	108 (9.6%)	116 (11.0%)	66 (9.7%)
Education	Lower (n, %)	537 (42.9%)	202 (16.6%)	492 (43.3%)	191 (17.0%)	441 (41.8%)	98 (14.5%)
	Medium (n, %)	360 (28.7%)	759 (62.5%)	322 (28.4%)	712 (63.3%)	310 (29.4%)	428 (63.4%)
	Higher (n, %)	356 (28.4%)	254 (20.9%)	321 (28.3%)	221 (19.7%)	305 (28.8%)	149 (22.1%)

Note. Full sample: n = 2468; cleaned sample: n = 2259; final sample (awareness of microplastics): n = 1731.

2.2.3. Microplastics stated concerns and everyday relevance

To measure stated concerns and everyday relevance, measurements proposed by Wiedemann et al. (2017) were used and adapted to the microplastics context.

Stated concerns involved two items beginning with the question: "Are you personally concerned about the effects of microplastics on (1) the environment, and (2) human health?" Items were measured on a 5-point scale ranging from 1 = "not concerned at all" to 5 = "very concerned". The items were strongly positively correlated (Germany: r = .64, p < .001; Italy: r = .62, p < .001) and collapsed into a single metric for purposes of estimation.

Individuals' overall relevance of microplastics in their everyday lives was measured using two items on thematic relevance regarding human health and the environment, respectively ("How often in your daily life do you think about the effects of microplastics on (1) the environment, and (2) human health?"), and one item on general discursive relevance ("How often in your daily life do you talk about the topic of microplastics with other people?"). Participants responded on a 5-point scale ranging from 1 = "never" to 5 = "very often". The three items also showed high internal consistency (Germany: α = .84, ω_t = .85; Italy: α = .86, ω_t = .86) and were again collapsed to form a single metric of everyday relevance.

2.2.4. Microplastics-related behavioral intentions

The measurement of behavioral intentions was constructed based on an approach proposed by Ajzen (2006). Six items reflecting measures individuals can take regarding microplastics (e.g., "In the future, I will try to reduce my personal exposure to microplastics") were developed based on qualitative data from the previous interview study (Janzik et al., 2024). Items were measured on a 5-point scale from 1 = "very unlikely" to 5 = "very likely". A mean index built from five of these items, excluding one due to overlap with everyday relevance (see Supplementary Table S4 for all items), showed high internal consistency (Germany: α = .87, ω_t = .87; Italy: α = .85, ω_t = .85).

Table 2 provides an overview of descriptive statistics, internal consistency, and intercorrelations of measurements used for modelling.

2.3. Analytical strategy

All analyses were performed using *R* (version 4.3.2; R Core Team, 2023). While analyses for RQ1 were based on the cleaned sample (n = 2259), subsequent analyses included only participants who were aware of microplastics (n = 1731). Participants indicating diverse gender were excluded from gender-based analyses due to small cell sizes (cleaned sample: n = 4; final sample: n = 3). Answering RQ1 to RQ3 on awareness, knowledge, concerns, and everyday relevance involved calculating descriptive statistics and conducting χ^2- and *t*-tests and correlations with respect to different population segments.

For H1 to H6, a structural equation model was computed using the *lavaan* package (Rosseel, 2012). Before running this model, we explored measurement invariance across the two countries and conducted multi-group analysis to ensure that it made sense to combine them in the same model (see Section 3.4 for details). Associations between variables had been demonstrated in separate regression models in advance using the whole sample (see Supplementary Table S5). Mardia's test for skewness and kurtosis showed that the data were not normally distributed (p < .001). Therefore, the model was computed using the MLR estimator with scaled test statistics and Huber-White corrected standard errors. Additionally, the provided FIML option allowed to deal with missing data (38 missing patterns; for a similar approach see Reer et al., 2022). To evaluate goodness of fit, the established criteria and thresholds of root mean square error of approximation (RMSEA; < .06), standardized root mean square residual (SRMR; < .08), comparative fit index (CFI; > .95), and Tucker-Lewis index (TLI; > .95) were used

Table 2
Descriptive statistics, internal consistency, and zero-order correlations of variables.

		Germany					Italy					Overall correlations		
	Items (Range)	*M*	*SD*	*n*	α	ω_t	*M*	*SD*	*n*	α	ω_t	1	2	3
(1) Knowledge [a]	8 (0–8)	6.14	1.40	1053	–	–	5.16	1.61	673	–	–	–		
(2) Stated concerns [b]	2 (1–5)	4.18	.78	1045	.78	.78	4.51	.66	673	.76	.76	.04	–	
(3) Everyday relevance [c]	3 (1–5)	2.77	.78	1044	.84	.85	2.89	.83	669	.86	.86	.11***	.55***	–
(4) Behavioral intentions [d]	5 (1–5)	3.93	.84	969	.87	.87	4.25	.73	635	.85	.85	.04	.56***	.54***

Note. Total: n = 1604–1726; Germany: n = 969–1053; Italy: n = 635–673. Pearson correlations based on listwise deletion. *p < .05, **p < .01, ***p < .001.
[a] 0 = no correct answers, 8 = all correct answers.
[b] 1 = not concerned at all, 5 = very concerned.
[c] 1 = never, 5 = very often.
[d] 1 = very unlikely, 5 = very likely.

(Browne & Cudeck, 1992; Hu & Bentler, 1999).

3. Results

3.1. Awareness of microplastics

In response to RQ1 on awareness of microplastics, 76.6% ($n = 1731$) of participants indicated they had heard of microplastics before, while 22.4% ($n = 505$) had not and 1.0% ($n = 23$) did not know or preferred not to say.

This proportion differed significantly by country, with German participants (93.7%) showing higher awareness than Italian participants (60.9%; $\chi^2(1) = 342.79$, $p < .001$, $\varphi = .39$).

Exploring the sample not aware of microplastics, a comparison of these participants with those indicating awareness showed no significant deviations in gender (53.6% vs. 52.1% female, $\chi^2(1) = .27$, $p = .607$, $\varphi = .01$) and age distributions ($M = 48.7$, $SD = 15.5$ vs. $M = 49.3$ years, $SD = 16.1$, $t(848.14) = .79$, $p = .432$, $d = .05$); this was upheld in both countries separately ($ps > .05$).

However, awareness differed significantly by educational level ($\chi^2(2) = 34.63$, $p < .001$, $V = .12$). Overall, participants with higher education (84.5%) were more likely to be aware than those with lower (79.9%) and medium education (72.1%). This pattern differed by country. In the German sample, those with medium education (96.3%) were slightly more likely to state awareness than respondents with higher education (95.6%), while those with lower education were lowest in awareness (90.7%). In the Italian sample, higher educated participants (68.3%) were most likely to be aware, with comparatively lower values for those with medium (61.0%) and lower education (51.9%).

3.2. Knowledge about microplastics

Table 3 summarizes responses of those participants who stated they were aware of microplastics on the different knowledge items (RQ2), ranked from highest to lowest overall accuracy. Overall, respondents tended to give the correct answer in each of the eight questions, but for each item there was at least about a tenth of participants stating false information to be true (9.0–47.2%). As an exception, responses on whether microplastics are deliberately added to products were split almost evenly between participants (52.8% [true] vs. 47.2% [false]).

When looking at countries, however, there were significant differences in six out of eight items ($ps < .001$). Participants in Germany were more likely to give the correct answer regarding added chemicals, use in cosmetics, occurrence in food, occurrence in drinks, and use in products, while Italian participants were more accurate on the breakdown of particles.

There were gender effects in three of eight items. Female participants were more likely than males to correctly connect microplastics with cosmetics (83.8% vs. 78.4%; $\chi^2(1) = 8.01$, $p = .005$, $\varphi = .07$), absorbing other substances (62.0% vs. 56.7%; $\chi^2(1) = 4.87$, $p = .027$, $\varphi = .05$), and groundwater (75.0% vs. 64.2%; $\chi^2(1) = 23.63$, $p < .001$, $\varphi = .12$).

Further, knowledge differed by age in half of the eight items ($ps < .05$). For example, 18- to 29-year-old participants were, in comparison with the other age groups, most likely to identify microplastics not being found in both glass bottles (68.4% vs. 59.9–66.7%) and organically produced foods (79.4% vs. 68.1–76.0%) as false.

Finally, educational level affected microplastics knowledge in six of eight items ($ps < .05$). Similar to awareness, there was no obvious pattern. While participants with higher education were most likely to correctly link microplastics to the degradation of plastics in the environment (93.2% vs. 88.7 and 91.5%), lower educated respondents more often correctly stated that microplastics are intentionally added to products (58.9% vs. 45.3 and 57.7%).

3.3. Stated concerns about and everyday relevance of microplastics

As can be seen in Fig. 2, stated concerns (RQ3a) about the effects of microplastics revealed a pronounced risk perception, with most participants with awareness tending towards the two top options on the 5-point scale. Overall, concerns were higher with regard to the environment ($M = 4.49$, 95% CI [4.45, 4.52], $SD = .77$) than human health ($M = 4.13$, 95% CI [4.09, 4.18], $SD = .90$), $t(1717) = -20.88$, $p < .001$, $d = -.50$.

Results showed that concerns in both domains were more pronounced among Italian participants ($ps < .001$; see Table 4).

Female participants reported to be slightly more concerned about the effects of microplastics on the environment ($M = 4.54$, $SD = .73$) than males ($M = 4.43$, $SD = .80$), $t(1674.6) = -2.73$, $p = .006$, $d = -.13$. This pattern also emerged for concerns related to human health ($M = 4.20$, $SD = .85$ [females] vs. $M = 4.06$, $SD = .94$ [males], $t(1665.2) = -3.26$, $p = .001$, $d = -.16$).

There were only weak correlations of age with human health concern ($r = .07$, $p = .002$) and environmental concern ($r = .11$, $p < .001$) and no significant correlations with education ($ps > .05$).

As for everyday relevance variables (RQ3b), means were considerably lower than for stated concerns, while the answers tended to spread around the middle of the scale (see Fig. 2). Thematic relevance was overall higher for the environment ($M = 3.20$, 95% CI [3.16, 3.25], $SD = .98$) than for human health ($M = 2.87$, 95% CI [2.83, 2.92], $SD = .90$), $t(1723) = -20.36$, $p < .001$, $d = -.49$. The extent to which participants had discussed microplastics ($M = 2.37$, 95% CI [2.33, 2.41], $SD = .85$) was significantly lower than the extent they had thought about the effects for both human health and the environment ($ps < .001$).

Exploring country effects, Italian participants had thought more about the effects of microplastics on both human health and the environment in their daily lives than German participants ($ps < .01$), whereas there was no difference between countries regarding the extent the respondents had talked about the topic ($p = .960$; see Table 4).

Gender was associated with everyday relevance of microplastics, with females reporting significantly higher values than males for thematic relevance regarding human health ($M = 2.95$, $SD = .90$ vs. $M = 2.79$, $SD = .90$) and the environment ($M = 3.30$, $SD = .97$ vs. $M = 3.10$, $SD = .99$) as well as discursive relevance ($M = 2.41$, $SD = .86$ vs. $M = 2.31$, $SD = .84$; $ps < .05$).

Age was only significantly positively correlated with thinking about the effects on human health ($r = .06$, $p = .009$), while there were no significant correlations of education with everyday relevance variables ($ps > .05$).

3.4. Structural model on knowledge, concerns, and behavioral intentions related to microplastics

After inspecting descriptive data of the reduced sample (i.e., those that were aware of microplastics), decisions were made regarding the estimation of the model. Microplastics knowledge was integrated as an observed variable (sum index) due to its formative measurement, while stated concerns, everyday relevance, and behavioral intentions were modeled as latent constructs based on their corresponding measured items. Gender (0 = male, 1 = female), age (in six groups), and education (in three levels) were integrated as predictors in the estimation of all direct paths to increase explanatory power. Due to the high correlations in the overall sample of the mean indices of stated concerns and everyday relevance ($r = .55$) as well as two pairs of individual items between them (human health concern and thematic relevance, environmental concern and thematic relevance; $rs > .50$), their error terms were allowed to covary. In addition, for two pairs of items with high intercorrelations ($rs > .65$) within the construct of behavioral intentions, their error terms were allowed to covary.

As noted above, before model estimation we also explored measurement invariance across countries and conducted multi-group

Table 3
Distribution and country-specific differences regarding microplastics knowledge.

In your opinion, are the following statements about microplastics true or false?		Total		Germany		Italy		$\chi^2(1)$	φ
		n	%	*n*	%	*n*	%		
(1) Microplastics can be about the breakdown of large plastic particles in the environment into smaller particles. [T]	False	155	9.0	117	11.1	38	5.6	14.23***	.09
	True	1576	91.0	939	88.9	637	94.4		
(2) Microplastics can have other chemicals added to them which may be dangerous for people or the environment. [T]	False	287	16.6	110	10.4	177	26.2	72.24***	.21
	True	1444	83.4	946	89.6	498	73.8		
(3) Microplastics can refer to the use of small pieces of plastics in personal care products or cosmetics. [T]	False	325	18.8	107	10.1	218	32.3	131.19***	.28
	True	1406	81.2	949	89.9	457	67.7		
(4) Microplastics are NOT found in organically produced foods. [F]	False	1274	73.7	857	81.2	417	61.9	78.52***	.21
	True	455	26.3	198	18.8	257	38.1		
(5) Microplastics are present in the ground water. [T]	False	521	30.1	312	29.6	209	31.0	.31	.02
	True	1209	69.9	743	70.4	466	69.0		
(6) Microplastics are NOT found in drinks filled in glass bottles. [F]	False	1117	64.6	748	70.8	369	54.7	45.83***	.16
	True	613	35.4	308	29.2	305	45.3		
(7) Microplastics can absorb substances from water which may be dangerous for people or the environment. [T]	False	701	40.5	447	42.3	254	37.6	3.58	.05
	True	1030	59.5	609	57.7	421	62.4		
(8) Microplastics are intentionally added to certain products. [T]	False	817	47.2	364	34.5	453	67.1	172.32***	.32
	True	913	52.8	691	65.5	222	32.9		

Note. Total: $n = 1729$–1731; Germany: $n = 1055$–1056; Italy: $n = 674$–675. Items ranked from highest to lowest overall accuracy; in the questionnaire, items were presented in random order. T = true, F = false. *$p < .05$, **$p < .01$, ***$p < .001$.

analysis. As is not uncommon when dealing with large samples of this size (e.g., Yoon & Lai, 2018), there was some variance across samples (see Supplementary Table S6). Multi-group analysis comparing a free and a constrained model (fixing intercepts and path coefficients in both countries to be the same) did not show equivalence, suggesting varying paths ($\Delta\chi^2 = 192.47$, $\Delta df = 19$, $p < .001$). However, a subsequent step-wise procedure of testing which paths varied between countries (see Supplementary Table S7) showed that several paths of the core model (H1–H6) should not be constrained. Instead, it showed constraints of paths of demographic covariates to be valid, mirroring trends based on descriptive analyses. To further explore this, we stratified the model by country and observed the coefficients separately for each country in isolation. As can be seen in Supplementary Tables S8 and S9, the set of coefficients was largely the same with only some small deviations (which we revisit below). Thus, we combined the two datasets while also adding country (0 = Germany, 1 = Italy) as a covariate to control for these small differences. The overall fit of this combined model was good: $\chi^2(63) = 263.79$, $p < .001$; RMSEA = .043, 90% CI [.038, .048]; SRMR = .022; CFI = .976; TLI = .959.

Fig. 3 shows the combined country estimated model and Table 5 summarizes path weights including confidence intervals. First exploring the role of demographics, female (β = .08, *SE* = .02, *p* = .001), younger (β = −.06, *SE* = .02, *p* = .017), more educated (β = .06, *SE* = .02, *p* = .008) and German participants (β = −.31, *SE* = .02, *p* < .001) were more likely to exhibit higher knowledge, in line with the descriptive data. In response to H1 and H2, there were significant positive associations of microplastics knowledge with stated concerns (β = .12, *SE* = .03, *p* < .001) and everyday relevance (β = .14, *SE* = .03, *p* < .001). In line with H3 and H4, both stated concerns (β = .44, *SE* = .04, *p* < .001) and everyday relevance (β = .33, *SE* = .03, *p* < .001) positively predicted behavioral intentions to act on microplastics. Supporting H5 and H6, results confirmed the mediating role of concerns. There was a significant indirect relationship of knowledge with behavioral intentions via stated concerns (*B* = .026, 95% CI [.014, .039], β = .054, 95% CI [.029, .080], *SE* = .01, *p* < .001) as well as everyday relevance (*B* = .022, 95% CI [.012, .031], β = .045, 95% CI [.025, .065], *SE* = .01, *p* < .001). Given no residual direct effect of knowledge (β = .003, *SE* = .02, *p* = .890), we can infer that these variables fully mediated the knowledge–behavioral intentions relationship (total effect: *B* = .049, 95% CI [.024, .074], β = .102, 95% CI [.051, .154], *SE* = .03, *p* < .001).

As noted above, the models for each country separately looked very similar (see Supplementary Tables S8 and S9), especially in terms of the relations between our key variables. Although the size of the coefficients varied slightly (e.g., for knowledge and concern), and confidence intervals were wider for the smaller Italian analytical sample reducing the number of significant effects, the direction of associations appeared relatively robust. Some of the covariates did differ for behavioral intentions; for instance, age and education were both positively associated with behavioral intentions in Italy (age: β = .13, 95% CI [.06, .20], *SE* = .02, *p* < .001; education: β = .11, 95% CI [.04, .18], *SE* = .04, *p* = .003) but not Germany (age: β = .04, 95% CI [.02, .09], *SE* = .03, *p* = .166; education: β = −.05, 95% CI [.11, −.002], *SE* = .03, *p* = .043).

4. Discussion

The present study contributes to the existing literature by considering different manifestations of concern to get a better understanding of the nature of public concern about microplastics. Further, it adds to a growing body of research on perceptions of microplastics in recent years by transferring the well-established relationships between knowledge, concerns, and behavioral intentions to the current and relevant context of microplastics and by testing them using samples representative of gender, age, education, and region in both Italy and Germany. This study is one of the first to examine the outlined relationships in detail using established measurement instruments and employing a country comparison. The latter seems particularly important because the occurrence of microplastics is not an isolated phenomenon in one country.

4.1. Variations in awareness, knowledge, concerns, and relevance related to microplastics

Overall, the present results stress the importance of differentiating between different manifestations of concern. In terms of awareness (RQ1), results showed a substantial level of awareness of microplastics in the whole sample, with three in four participants indicating having heard of them. However, disparities exist between countries, with German participants demonstrating significantly higher awareness

[2] Some of these variables were measured in our survey and due to space constraints will be explored in future papers.

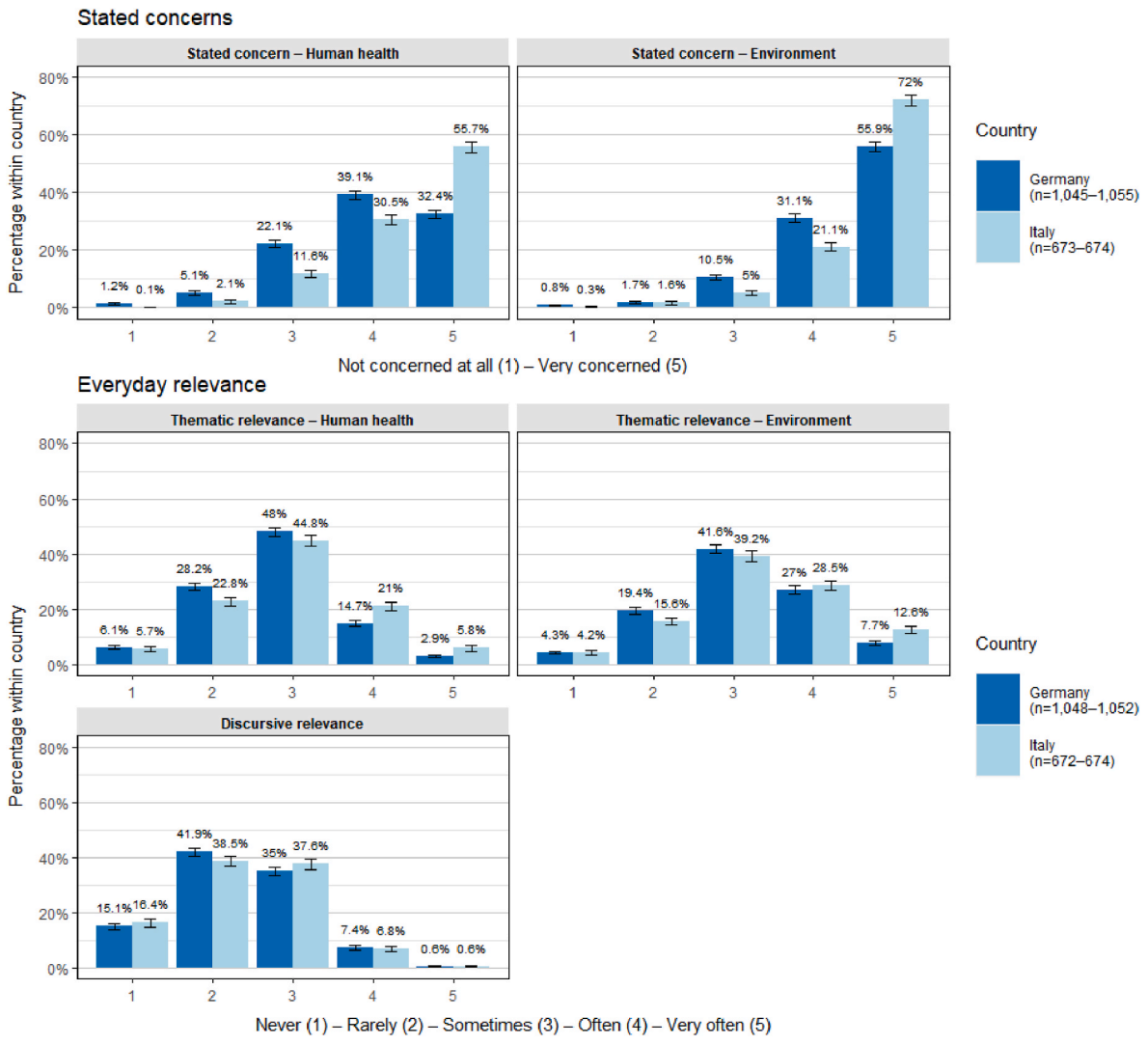


Fig. 2. Distribution of stated concerns about and everyday relevance of microplastics by country
Note. Percentages of responses for the two stated concerns (effects for human health, environment) and three everyday relevance variables (thinking about effects for human health, environment, and talking about topic) are shown for German and Italian participants. Error bars show standard errors (*SE*).

Table 4
Distribution and country-specific differences regarding microplastics concerns and relevance.

Stated concerns	Total		Germany		Italy		*t*	*d*
	M	*SD*	*M*	*SD*	*M*	*SD*		
(1) Human health	4.13	.90	3.96	.93	4.40	.78	−10.34***	−.52
(2) Environment	4.49	.77	4.40	.80	4.63	.68	−6.38***	−.32
(3) Mean index	4.31	.76	4.18	.78	4.51	.66	−9.37***	−.47
Everyday relevance	Total		Germany		Italy		*t*	*d*
	M	*SD*	*M*	*SD*	*M*	*SD*		
(1) Thematic relevance – Human health	2.87	.90	2.80	.87	2.99	.95	−4.04***	−.22
(2) Thematic relevance – Environment	3.20	.98	3.14	.96	3.30	1.01	−3.14**	−.17
(3) Discursive relevance	2.37	.85	2.37	.85	2.37	.86	−.05	−.00
(4) Mean index	2.82	.80	2.77	.78	2.89	.83	−2.83**	−.15

Note. Total: $n = 1718–1729$; Germany: $n = 1048–1055$; Italy: $n = 672–674$. For stated concerns variables, *df* of Welch's *t*-tests ranged between 1590.30 and 1598.97. For everyday relevance variables, *df* of Welch's *t*-tests ranged between 1337.63 and 1418.79. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

compared to their Italian counterparts. While this discrepancy could be attributed to various factors, including information behavior (Meagher, 2019) and cultural attitudes towards environmental issues (Sarigöllü, 2009), further exploring those participants without awareness revealed education to be an important correlate in line with existing studies (e.g., Robelia & Murphy, 2012).

Regarding knowledge (RQ2), a large proportion of the aware sample provided correct answers in the knowledge test. However, there was also a notable proportion that did not, indicating specific knowledge gaps regarding broad definitions, the relationship between microplastics and

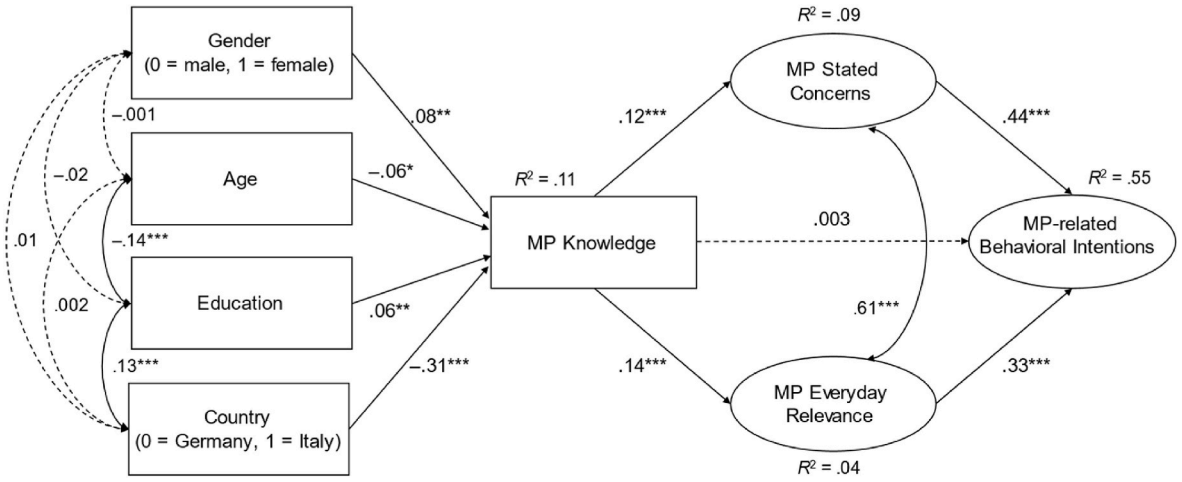


Fig. 3. Estimated structural model

Note. The model shows associations of microplastics knowledge, stated concerns, everyday relevance, and behavioral intentions. Presented are standardized regression coefficients (β). Curved lines indicate covariances between predictors. Relations of gender, age, education, and country with stated concerns, everyday relevance, and behavioral intentions were calculated, but are not shown (see Table 5). Latent constructs (circles) were modeled out of their manifest indicators. MP = microplastics. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 5
Path weights of estimated structural model.

	Knowledge	Stated concerns	Everyday relevance	Behavioral intentions
Gender (1 = female)	.08** [.03, .12]	.07** [.02, .13]	.09*** [.04, .14]	.09*** [.04, .13]
Age	−.06* [−.10, −.01]	.11*** [.06, .16]	.06* [.01, .11]	.06** [.02, .10]
Education	.06** [.02, .10]	.01 [−.05, .06]	.002 [−.05, .05]	−.01 [−.05, .03]
Country (1 = Italy)	−.31*** [−.36, −.27]	.27*** [.22, .32]	.13*** [.08, .18]	.09*** [.04, .14]
Knowledge	–	.12*** [.07, .18]	.14*** [.08, .19]	.003 [−.04, .05]
Stated concerns	–	–	–	.44*** [.36, .52]
Everyday relevance	–	–	–	.33*** [.26, .39]
R^2	.11	.09	.04	.55

Note. $n = 1728$. Presented are standardized regression coefficients (β). 95% CIs of β are shown in brackets. *$p < .05$, **$p < .01$, ***$p < .001$.

other substances, and occurrence. In terms of national differences, German participants were more likely to give correct answers than were Italian participants. For example, they had a clearer idea of the definition of primary microplastics, were more aware that other substances can be added to the particles that are discussed to pose risk for humans and the environment (e.g., bisphenol A (BPA); Liu et al., 2019), and knew about the occurrence in organic food. In addition, answers to the items stating that microplastics are intentionally added to products (e.g., Guerranti et al., 2019) and that matter from the environment can attach itself to microplastics (e.g., Gkoutselis et al., 2021) were more equally distributed in both countries. Similar to awareness, varying conditions of information availability and information seeking behavior could explain these differences (Humprecht et al., 2022; Meagher, 2019). For example, some studies found that in Germany, microplastics are discussed to a notable extent in media (e.g., Schönbauer & Müller, 2021; Völker et al., 2019), but a similar media analysis in Italy is missing. Supporting previous work, gender, age, and education showed expected patterns (Hayes, 2001; Morrison & Beer, 2017; Robelia & Murphy, 2012), which provides robustness to these findings in the context of microplastics.

Exploring stated concerns about microplastics (RQ3a), results indicate a pronounced risk perception. Overall, respondents stated to be more concerned about the impact of microplastics on the environment than on human health. This is not only in line with the results of other studies, which have shown that the topic of microplastics is currently still associated more with the environment than with human health (e.g., Kramm et al., 2022), but also in keeping with evidence that potential human health effects would be based on environmental exposure (Prata et al., 2020; WHO, 2022). Comparisons between countries showed that stated concerns among those Italians, who were aware of microplastics, were higher than concerns among German participants. On the one hand, this may reflect differences in environmental consciousness (e.g., Sarigöllü, 2009). On the other hand, against the backdrop of earlier population-wide studies, which found Italian participants to be less concerned about microplastics than German participants (EFSA, 2019, 2022), these country-related differences require further exploration. Methodological differences could be a relevant factor here. For example, in a current *Eurobarometer* questionnaire, concern is asked in a comparison of different topics ("Please tell me which of these topics you have heard about concern you most when it comes to food?"; EFSA, 2022). This approach is different to the more focused way of asking in this study.

Results on everyday relevance variables (RQ3b) suggest that participants' day-to-day thoughts and discussions with others about this topic may not fully reflect the level of stated concern. In line with studies on other risk topics such as electromagnetic fields (Wiedemann et al., 2017), the tendency to think and talk about microplastics in everyday life was lower than simply reporting concern. In a comparison of domains, a similar pattern emerged in both countries in the direction of higher extent of thinking about environmental compared to human health, underscoring the prevailing perception that microplastics pose a greater threat to the environment (Kramm et al., 2022). Despite some individuals reporting thinking often about the effects of microplastics on both human health and the environment, discussions with others about this topic were mostly reported to take place either rarely or sometimes. This suggests that stated levels of concerns tap into a different construct that does not reflect a relevance in participants' everyday lives (Gaskell et al., 2016; Wiedemann et al., 2017; see also Zwick, 2005).

Taken together, and building on the steps outlined in the MMARC, these results show that the findings uncovered in a previous interview study (Janzik et al., 2024) tend to generalize to a population level. Variations in awareness and knowledge, divergent ideas about the effect on different domains, and differences in the extent to which individuals

think and talk about the topic characterize public risk perceptions of microplastics in Germany and Italy.

4.2. Disentangling the associations of knowledge, concerns, and behavioral intentions related to microplastics

Given the confirmation of all six hypotheses, there is strong support for the proposed model based on theoretical considerations and previous empirical results. In the context of microplastics, higher knowledge was associated with higher levels of stated concerns and everyday relevance (H1, H2). In turn, both investigated types of concerns were positively related to behavioral intentions to act on microplastics (H3, H4). In view of the mediations found (H5, H6), the extent of knowledge contributes to behavioral intentions, with concerns being an intermediate step. The effects were also found when controlling for demographic characteristics (gender, age, education) and country level, strengthening the interpretation of the relationships.

These results have theoretical implications for the relationship between knowledge and behavior in the environmental and health context. While confirming the results of existing studies on the positive relationship between knowledge and concerns (e.g., Borriello et al., 2022; Kramm et al., 2022; Yilmaz & Can, 2020) and between concerns and behavioral intentions (e.g., Toma & Mathijs, 2007; Yoon et al., 2021), the results also show that knowledge by itself may only translate to behavioral intentions through stated and everyday concerns as prerequisites for individuals to form intentions to act. These results are also to some extent consistent with, but nevertheless extend those of Fian et al. (2025) in a paper published after the present data were collected. Specifically, these authors also found little support for a direct relationship between knowledge and risk perceptions, but did not explore mediating pathways as we did here. This highlights the importance of integrating potentially amplifying or limiting perceptions when examining the connection between cognition and behavior in order to have a more complete picture of the pattern of effects. In a case such as microplastics, which is characterized by invisibility, novelty, and complexity in terms of effects, individuals might not primarily rely on their available, uncertain knowledge for decision-making. This is also relevant to consider in research on perceptions of related topics with similar characteristics, such as per- and polyfluoroalkyl substances (PFAS).

The observed parallel mediating effects of stated concerns and everyday relevance suggests that it is important to collect multiple indicators of concern and use more complex models for a better understanding of human perception and behavior in relation to microplastics. Statistically, stated concerns and everyday relevance explained unique variance in intentions to act on microplastics despite controlling for both in the analyses. Looking at effect sizes, while they seem to differ in their effect on behavioral intentions in that stated concerns exert a greater influence ($\Delta\beta = .11$), the confidence intervals of these effects slightly overlapped. Similar path strengths were again observed for mediations. Theoretically, this emphasizes that concern is both socially constructed (e.g., by talking about the issue with others) and an individual cognitive or emotional issue. With behavior change being affected by social norms (e.g., Ajzen, 1991), considering everyday relevance taps into mechanisms to uncover these norms. Integrating multiple manifestations of concern as pathways to behavior takes into account that behavior does not merely have one precursor (e.g., emotions as operationalized through stated concern). In the case of microplastics, parallel mediation has been demonstrated, but in other related topics, one path may dominate (e.g., the importance of everyday relevance over stated concern in the perception of aluminium salts due to the presence in daily used antiperspirants). Consideration of multiple manifestations thus helps to highlight which specific factors are relevant in explaining behavior in each case.

We recognize that we have explored stated concerns and everyday relevance in parallel in the current study. To the extent that stated concern is affected by everyday relevance, an alternative model may have explored a serial mediation process with knowledge predicting relevance and relevance in turn predicting concern. We decided against this approach because we believe the two processes influence each other in an iterative fashion. However, future work may reveal reasons for examining the variables in a serial model.

More generally, future studies could investigate further unexplored variables, possibly adding to the explanation of effects. There could be specific moderation effects in relation to the demographic variables (e.g., a stronger influence of knowledge on concerns among women, younger individuals, and higher educated people). Given the different effects of age and education on intentions between Germany and Italy found in this study, there may be potential interactions that future studies should take into account when testing messages on microplastics in different subpopulations. Further, while the amount of variance in behavioral intentions explained by demographic variables can be described as good, these variables contributed only to a small degree to the explanation of concerns and knowledge, suggesting psychological factors might be more important (Hartley et al., 2018). For example, different dimensions of attitudes (e.g., Liu et al., 2020) regarding microplastics could be an important factor. Moreover, future studies may add variables whose influence could be considered when estimating effects. For example, studies could consider the role of past media reception (as already done by Kramm et al., 2022; Pop et al., 2023), social aspects (e.g., opinion exchange; Okoye et al., 2023), or environment-related variables such as connectedness to nature (e.g., Martin et al., 2020).[2] As an extension, actual behavior should also be taken into account, since intentions cannot fully reflect this (Sheeran, 2002).

4.3. Implications for communicators and policymakers

In line with the mental models approach to risk communication (Morgan et al., 2002), this study presents important implications for practitioners. First, the results provide starting points for improving communication strategies. Recognizing that certain demographic factors (gender, age, education) and nationality were associated with awareness and knowledge levels, communicators can tailor their messages based on this study's specific results to effectively reach different demographic groups. Since knowledge was positively associated with both stated concerns and everyday relevance, communicators should recognize that educational initiatives may be suited to not just increase awareness of microplastics in general but also concern, which, in turn, can contribute to the formation of behavioral intentions. Initiatives could involve public awareness campaigns, programs, or informational resources that highlight the mechanisms by which microplastics might have an impact on the environment and human health (see also Grünzner et al., 2023). Additionally, communicators should consider what practical steps for acting on microplastics could be included in the messages for bridging the gap between behavioral intentions and actions when crafting messages.

Second, the study's results can be used to ensure conditions under which willingness to engage with relevant initiatives will be higher and to improve future policies on microplastics. International and national policymakers need to consider that there are awareness and knowledge gaps in some parts of the population that may hinder widespread support for potential measures. For a comprehensive picture, this might involve understanding further barriers, such as individual resources (Choi & Lee, 2018; King, 2022) or consumer preferences (Borriello & Rose, 2022) that hinder the translation of given information into actions. Moreover, as knowledge is not by itself associated with intentions to act, policymakers need to design policies that not only aim to increase knowledge but also tap into concerns and everyday relevance as these are crucial in driving behavioral change.

4.4. Limitations

The limitations of the study should be taken into account when interpreting the results. First, the data are cross-sectional and do not allow for causal inferences. Although these are important insights, the effects should be examined in longitudinal or experimental studies.

Second, there was a notable reduction in sample size in Italy due to the focus on participants with an awareness of microplastics. While this remaining sample was still large enough for applying the same statistical methods and this approach was necessary to obtain meaningful and country-comparable answers on the topic, future studies should further look at this part of the population and their perceptions of microplastics.

Third, the measurement used for individual knowledge is relatively narrow due to the dichotomous response options; it would also be possible to achieve high scores on the scale by chance through guessing. Although approaches to measuring knowledge are much debated in the literature (e.g., Mondak, 2001), future studies should validate the results using other measurement methods and additional content foci (e.g., effects on human health).

Finally, it should be noted that the data were collected from two large western industrialized nations, Germany and Italy. While a random-quota procedure based on age, gender, education, and region was used to increase representativeness so that tentative inferences can be made about the respective populations, the results may not be transferable to other countries. Other environmental conditions or differences in the presence of microplastics in media coverage could be significant factors here.

5. Conclusions

Is the public really concerned about microplastics? By investigating awareness, knowledge, everyday relevance, and behavioral intentions at the same time in a diverse sample of German and Italian citizens, this study provided a more nuanced answer to this question than previous studies did. With notable differences between countries in the number of people who stated awareness of the topic, demographic variations in knowledge, higher stated concern about the effects on the environment than on human health, and comparatively lower everyday relevance of the topic, results suggest that a one-dimensional understanding of concern about microplastics may be inadequate. Shedding light on the interplay between variables, microplastics knowledge was found to be positively related to both stated concerns and everyday relevance. In turn, concerns and relevance emerged as separate predictors of behavioral intentions. Crucially, both constructs mediated the relationship between knowledge and intentions, suggesting that interventions should not only focus on knowledge transfer but also actively address concerns in line with the emerging evidence to bridge a potential intention–action gap.

To conclude, this research advances our understanding of the dynamics shaping microplastics perceptions and behavior. Implications for communication strategies and policy interventions (such as those recently implemented by the European Union) include considering demographic variations, leveraging concerns, and crafting multifaceted approaches to foster meaningful engagement and action in the ongoing challenge of mitigating the impact of microplastics on the environment and human lives.

CRediT authorship contribution statement

Robin Janzik: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Mathew P. White:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Sabine Pahl:** Writing – review & editing, Methodology, Conceptualization. **Severine Koch:** Writing – review & editing, Methodology, Conceptualization. **Giorgia Zamariola:** Writing – review & editing, Methodology, Conceptualization. **Domagoj Vrbos:** Writing – review & editing, Methodology, Conceptualization. **Natalie Berger:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization.

Funding

This work was supported by the framework partnership agreement between the German Federal Institute for Risk Assessment (BfR) and the European Food Safety Authority (EFSA), under specific agreement No. 3 of the grant GP/EFSA/AMU/2020/02. Authors GZ and DV were employed with EFSA at the time research was conducted. However, the present article is published under the sole responsibility of the authors and may not be considered as an EFSA scientific output. The positions and opinions presented in this article are those of the authors alone and do not necessarily represent the views or scientific work of EFSA.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors thank Holger Sieg for providing his valuable expertise on microplastics research during survey design. The authors also thank Mario Mazzocchi and Georgios Alaveras for their ideas on data analysis. Finally, the authors thank Bilendi for their assistance in recruiting the participants of the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2026.102963.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-t

Ajzen, I. (2006). Constructing a theory of planned behavior questionnaire: Conceptual and methodological considerations. https://citeseerx.ist.psu.edu/document?type=pdf&doi=0574b20bd58130dd5a961f1a2db10fd1fcbae95d.

Anderson, A. G., Grose, J., Pahl, S., Thompson, R. C., & Wyles, K. J. (2016). Microplastics in personal care products: Exploring perceptions of environmentalists, beauticians and students. *Marine Pollution Bulletin, 113*(1–2), 454–460. https://doi.org/10.1016/j.marpolbul.2016.10.048

Bamberg, S. (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. *Journal of Environmental Psychology, 23*(1), 21–32. https://doi.org/10.1016/s0272-4944(02)00078-6

Boase, N. J., White, M. P., Gaze, W. H., & Redshaw, C. H. (2019). Why don't the British eat locally harvested shellfish? The role of misconceptions and knowledge gaps. *Appetite, 143*, Article 104352. https://doi.org/10.1016/j.appet.2019.104352

Borriello, A., Massey, G., & Rose, J. M. (2022). Extending the theory of planned behaviour to investigate the issue of microplastics in the marine environment. *Marine Pollution Bulletin, 179*, Article 113689. https://doi.org/10.1016/j.marpolbul.2022.113689

Borriello, A., & Rose, J. M. (2022). The issue of microplastic in the oceans: Preferences and willingness to pay to tackle the issue in Australia. *Marine Policy, 135*, Article 104875. https://doi.org/10.1016/j.marpol.2021.104875

Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological Methods & Research, 21*(2), 230–258. https://doi.org/10.1177/0049124192021002005

Cammalleri, V., Marotta, D., & Antonucci, A. (2020). A survey on knowledge and awareness on the issue "microplastics": A pilot study on a sample of future public health professionals. *Annali di Igiene: Medicina Preventiva e di Comunita, 5*, 577–589. https://doi.org/10.7416/ai.2020.2377

Catarino, A. I., Kramm, J., Völker, C., Henry, T. B., & Everaert, G. (2021). Risk posed by microplastics: Scientific evidence and public perception. *Current Opinion in Green and Sustainable Chemistry, 29*, Article 100467. https://doi.org/10.1016/j.cogsc.2021.100467

Choi, E. C., & Lee, J. S. (2018). The willingness to pay for removing the microplastics in the ocean – The case of Seoul metropolitan area, South Korea. *Marine Policy, 93*, 93–100. https://doi.org/10.1016/j.marpol.2018.03.015

Coelho, F., Pereira, M. C., Cruz, L., Simões, P., & Barata, E. (2017). Affect and the adoption of pro-environmental behaviour: A structural model. *Journal of*

Environmental Psychology, 54, 127–138. https://doi.org/10.1016/j.jenvp.2017.10.008
Davison, S. M. C., White, M. P., Pahl, S., Taylor, T., Fielding, K., Roberts, B. R., Economou, T., McMeel, O., Kellett, P., & Fleming, L. E. (2021). Public concern about, and desire for research into, the human health effects of marine plastic pollution: Results from a 15-country survey across Europe and Australia. *Global Environmental Change, 69*, Article 102309. https://doi.org/10.1016/j.gloenvcha.2021.102309
Deng, L., Cai, L., Sun, F., Li, G., & Che, Y. (2020). Public attitudes towards microplastics: Perceptions, behaviors and policy implications. *Resources, Conservation and Recycling, 163*, Article 105096. https://doi.org/10.1016/j.resconrec.2020.105096
Deng, L., Li, G., Peng, S., Wu, J., & Che, Y. (2022). Microplastics in personal care products: Exploring public intention of usage by extending the theory of planned behaviour. *Science of the Total Environment, 848*, Article 157782. https://doi.org/10.1016/j.scitotenv.2022.157782
Dowarah, K., Duarah, H., & Devipriya, S. P. (2022). A preliminary survey to assess the awareness, attitudes/behaviours, and opinions pertaining to plastic and microplastic pollution among students in India. *Marine Policy, 144*, Article 105220. https://doi.org/10.1016/j.marpol.2022.105220
Ellen, P. S. (1994). Do we know what we need to know? Objective and subjective knowledge effects on pro-ecological behaviors. *Journal of Business Research, 30*(1), 43–52. https://doi.org/10.1016/0148-2963(94)90067-1
European Commission. (2023). Protecting environment and health: Commission adopts measures to restrict intentionally added microplastics. *European Commission*. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4581.
European Food Safety Authority (EFSA). (2019). Special Eurobarometer – April 2019: Food safety in the EU. *European Food Safety Authority (EFSA)*. https://doi.org/10.2805/661752
European Food Safety Authority (EFSA). (2022). Special Eurobarometer – April 2022: Food safety in the EU. *European Food Safety Authority (EFSA)*. https://doi.org/10.2805/729388
Felipe-Rodriguez, M., Böhm, G., & Doran, R. (2022). What does the public think about microplastics? Insights from an empirical analysis of mental models elicited through free associations. *Frontiers in Psychology, 13*. https://doi.org/10.3389/fpsyg.2022.920454
Felipe-Rodriguez, M., Böhm, G., & Doran, R. (2024). Who worries about microplastics? The relative importance of personal values and individual risk judgements. *Psyecology, 15*(1), 9–31. https://doi.org/10.1177/21711976241232872
Fian, L., Felt, U., Hofmann, T., White, M. P., & Pahl, S. (2025). Microplastics in food and drink: Predictors of public risk perceptions and support for plastic-reducing policies based on a climate change framework. *Journal of Environmental Psychology, 103*, Article 102583. https://doi.org/10.1016/j.jenvp.2025.102583
Fu, M., Yang, K., & Fujigaki, Y. (2023). *Introducing an "invisible enemy": A case study of knowledge construction regarding microplastics in Japanese Wikipedia*. New Media & Society. https://doi.org/10.1177/14614448221149747
Fujii, S. (2006). Environmental concern, attitude toward frugality, and ease of behavior as determinants of pro-environmental behavior intentions. *Journal of Environmental Psychology, 26*(4), 262–268. https://doi.org/10.1016/j.jenvp.2006.09.003
Gaskell, G., Hohl, K., & Gerber, M. M. (2016). Do closed survey questions overestimate public perceptions of food risks? *Journal of Risk Research, 20*(8), 1038–1052. https://doi.org/10.1080/13669877.2016.1147492
Gazmararian, J. A., Williams, M. V., Peel, J., & Baker, D. W. (2003). Health literacy and knowledge of chronic disease. *Patient Education and Counseling, 51*(3), 267–275. https://doi.org/10.1016/s0738-3991(02)00239-2
Gkoutselis, G., Rohrbach, S., Harjes, J., Obst, M., Brachmann, A., Horn, M. A., & Rambold, G. (2021). Microplastics accumulate fungal pathogens in terrestrial ecosystems. *Scientific Reports, 11*(1), Article 13214. https://doi.org/10.1038/s41598-021-92405-7
Grünzner, M., Pahl, S., White, M. P., & Thompson, R. C. (2023). Exploring expert perceptions about microplastics: From sources to potential solutions. *Microplastics and Nanoplastics, 3*, 7. https://doi.org/10.1186/s43591-023-00055-5
Guerranti, C., Martellini, T., Perra, G., Scopetani, C., & Cincinelli, A. (2019). Microplastics in cosmetics: Environmental issues and needs for global bans. *Environmental Toxicology and Pharmacology, 68*, 75–79. https://doi.org/10.1016/j.etap.2019.03.007
Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2008). The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology, 28*(1), 1–9. https://doi.org/10.1016/j.jenvp.2007.08.004
Harkness, J., Pennell, B.-E., & Schoua-Glusberg, A. (2004). Survey questionnaire translation and assessment. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin, & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* (pp. 453–473). John Wiley & Sons. https://doi.org/10.1002/0471654728.ch22.
Hartley, B. L., Pahl, S., Veiga, J., Vlachogianni, T., Vasconcelos, L., Maes, T., Doyle, T., d'Arcy Metcalfe, R., Öztürk, A. A., Di Berardo, M., & Thompson, R. C. (2018). Exploring public views on marine litter in Europe: Perceived causes, consequences and pathways to change. *Marine Pollution Bulletin, 133*, 945–955. https://doi.org/10.1016/j.marpolbul.2018.05.061
Hayes, B. C. (2001). Gender, scientific knowledge, and attitudes toward the environment: A cross-national analysis. *Political Research Quarterly, 54*(3), 657–671. https://doi.org/10.1177/106591290105400309
Heidbreder, L. M., Bablok, I., Drews, S., & Menzel, C. (2019). Tackling the plastic problem: A review on perceptions, behaviors, and interventions. *The Science of the Total Environment, 668*, 1077–1093. https://doi.org/10.1016/j.scitotenv.2019.02.437
Henderson, L., & Green, C. (2020). Making sense of microplastics? Public understandings of plastic pollution. *Marine Pollution Bulletin, 152*, Article 110908. https://doi.org/10.1016/j.marpolbul.2020.110908
Hu, L.-t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118
Humprecht, E., Castro Herrero, L., Blassnig, S., Brüggemann, M., & Engesser, S. (2022). Media systems in the digital age: An empirical comparison of 30 countries. *Journal of Communication, 72*(2), 145–164. https://doi.org/10.1093/joc/jqab054
Janzik, R., Koch, S., Zamariola, G., Vrbos, D., White, M. P., Pahl, S., & Berger, N. (2024). Exploring public risk perceptions of microplastics: Findings from a cross-national qualitative interview study among German and Italian citizens. *Risk Analysis, 44*(3), 521–535. https://doi.org/10.1111/risa.14184
Janzik, R., Sieg, H., Braeuning, A., & Böl, G.-F. (2025). Microplastics: State of the evidence on health effects and public perception. *Deutsches Ärzteblatt International, 122*(20), 546–551. https://doi.org/10.3238/arztebl.m2025.0138
Jonassen, D. H., & Henning, P. (1999). Mental models: Knowledge in the head and knowledge in the world. *Educational Technology, 39*(3), 37–42.
Kasperson, R. E., & Kasperson, J. X. (1996). The social amplification and attenuation of risk. *The Annals of the American Academy of Political and Social Science, 545*(1), 95–105. https://doi.org/10.1177/0002716296545001010
King, P. (2022). Willingness-to-pay for precautionary control of microplastics, a comparison of hybrid choice models. *Journal of Environmental Economics and Policy*, 1–24. https://doi.org/10.1080/21606544.2022.2146757
Kramm, J., Steinhoff, S., Werschmöller, S., Völker, B., & Völker, C. (2022). Explaining risk perception of microplastics: Results from a representative survey in Germany. *Global Environmental Change, 73*, Article 102485. https://doi.org/10.1016/j.gloenvcha.2022.102485
Leiner, D. J. (2022). SoSci survey (Version 3.2.50) [computer software]. https://www.soscisurvey.de/.
Liu, X., Shi, H., Xie, B., Dionysiou, D. D., & Zhao, Y. (2019). Microplastics as both a sink and a source of bisphenol A in the marine environment. *Environmental Science & Technology, 53*(17), 10188–10196. https://doi.org/10.1021/acs.est.9b02834
Liu, P., Teng, M., & Han, C. (2020). How does environmental knowledge translate into pro-environmental behaviors?: The mediating role of environmental attitudes and behavioral intentions. *Science of the Total Environment, 728*, Article 138126. https://doi.org/10.1016/j.scitotenv.2020.138126
Martin, L., White, M. P., Hunt, A., Richardson, M., Pahl, S., & Burt, J. (2020). Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours. *Journal of Environmental Psychology, 68*, Article 101389. https://doi.org/10.1016/j.jenvp.2020.101389
Meagher, K. D. (2019). Public perceptions of food-related risks: A cross-national investigation of individual and contextual influences. *Journal of Risk Research, 22*(7), 919–935. https://doi.org/10.1080/13669877.2017.1422789
Menzel, C., Brom, J., & Heidbreder, L. M. (2021). Explicitly and implicitly measured valence and risk attitudes towards plastic packaging, plastic waste, and microplastic in a German sample. *Sustainable Production and Consumption, 28*, 1422–1432. https://doi.org/10.1016/j.spc.2021.08.016
Mondak, J. J. (2001). Developing valid knowledge scales. *American Journal of Political Science, 45*(1), 224–238. https://doi.org/10.2307/2669369
Morgan, M. G., Fischhoff, B., Bostrom, A., & Atman, C. J. (2002). *Risk communication: A mental models approach*. Cambridge University Press.
Morrison, P. S., & Beer, B. (2017). Consumption and environmental awareness: Demographics of the European experience. In H. Shibusawa, K. Sakurai, T. Mizunoya, & S. Uchida (Eds.), *Socioeconomic environmental policies and evaluations in regional science. New frontiers in regional science: Asian perspectives* (pp. 81–102). Springer. https://doi.org/10.1007/978-981-10-0099-7_5.
Okoye, F., Kakar, F. L., Onyedibe, V., Hamza, R., Dhar, B. R., & Elbeshbishy, E. (2023). Social aspects of microplastics and nanoplastics. In R. D. Tyagi, A. Pandey, P. Drogui, B. Yadav, & S. Pilli (Eds.), *Microplastics and nanoplastics: Occurrence, environmental impacts and treatment processes* (pp. 447–461). Elsevier. https://doi.org/10.1016/B978-0-323-99908-3.00007-5.
Pahl, S., Wyles, K. J., & Thompson, R. C. (2017). Channelling passion for the ocean towards plastic pollution. *Nature Human Behaviour, 1*(10), 697–699. https://doi.org/10.1038/s41562-017-0204-4
Pieniak, Z., Aertsens, J., & Verbeke, W. (2010). Subjective and objective knowledge as determinants of organic vegetables consumption. *Food Quality and Preference, 21*(6), 581–588. https://doi.org/10.1016/j.foodqual.2010.03.004
Pop, V., Ozunu, A., Petrescu, D. C., Stan, A.-D., & Petrescu-Mag, R. M. (2023). The influence of media narratives on microplastics risk perception. *PeerJ, 11*, Article e16338. https://doi.org/10.7717/peerj.16338
Prata, J. C., da Costa, J. P., Lopes, I., Duarte, A. C., & Rocha-Santos, T. (2020). Environmental exposure to microplastics: An overview on possible human health effects. *Science of the Total Environment, 702*, Article 134455. https://doi.org/10.1016/j.scitotenv.2019.134455
R Core Team. (2023). *R: A language and environment for statistical computing (Version 4.3.2) [computer software]*. R Foundation for Statistical Computing. https://www.r-project.org/.
Raab, P., & Bogner, F. X. (2021). Conceptions of university students on microplastics in Germany. *PLoS One, 16*(9), Article e0257734. https://doi.org/10.1371/journal.pone.0257734
Reer, F., Wehden, L.-O., Janzik, R., & Quandt, T. (2022). Examining the interplay of smartphone use disorder, mental health, and physical symptoms. *Frontiers in Public Health, 10*. https://doi.org/10.3389/fpubh.2022.834835

Robelia, B., & Murphy, T. (2012). What do people know about key environmental issues? A review of environmental knowledge surveys. *Environmental Education Research, 18*(3), 299–321. https://doi.org/10.1080/13504622.2011.618288

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02

Saari, U. A., Damberg, S., Frömbling, L., & Ringle, C. M. (2021). Sustainable consumption behavior of Europeans: The influence of environmental knowledge and risk perception on environmental concern and behavioral intention. *Ecological Economics, 189*, Article 107155. https://doi.org/10.1016/j.ecolecon.2021.107155

Sarigöllü, E. (2009). A cross-country exploration of environmental attitudes. *Environment and Behavior, 41*(3), 365–386. https://doi.org/10.1177/0013916507313920

Schönbauer, S., & Müller, R. (2021). A risky object? How microplastics are represented in the German media. *Science Communication*, 1–27. https://doi.org/10.1177/10755470211030519

Schwarz, N., & Strack, F. (1991). Context effects in attitude surveys: Applying cognitive theory to social research. *European Review of Social Psychology, 2*(1), 31–50. https://doi.org/10.1080/14792779143000015

Science Advice for Policy by European Academies (SAPEA). (2019). A scientific perspective on microplastics in nature and society. *Science Advice for Policy by European Academies (SAPEA)*. https://doi.org/10.26356/microplastics

Sheeran, P. (2002). Intention–behavior relations: A conceptual and empirical review. *European Review of Social Psychology, 12*(1), 1–36. https://doi.org/10.1080/14792772143000003

Shi, J., Visschers, V. H. M., & Siegrist, M. (2015). Public perception of climate change: The importance of knowledge and cultural worldviews. *Risk Analysis, 35*(12), 2183–2201. https://doi.org/10.1111/risa.12406

Slovic, P. (1987). Perception of risk. *Science, 236*(4799), 280–285. https://doi.org/10.1126/science.3563507

Thiele, C. J., & Hudson, M. D. (2021). Uncertainty about the risks associated with microplastics among lay and topic-experienced respondents. *Scientific Reports, 11*(1). https://doi.org/10.1038/s41598-021-86569-5

Toma, L., & Mathijs, E. (2007). Environmental risk perception, environmental concern and propensity to participate in organic farming programmes. *Journal of Environmental Management, 83*(2), 145–157. https://doi.org/10.1016/j.jenvman.2006.02.004

Toussaint, B., Raffael, B., Angers-Loustau, A., Gilliland, D., Kestens, V., Petrillo, M., Rio-Echevarria, I. M., & Van den Eede, G. (2019). Review of micro- and nanoplastic contamination in the food chain. *Food Additives & Contaminants: Part A, 36*(5), 639–673. https://doi.org/10.1080/19440049.2019.1583381

Ueland, Ø., Gunnlaugsdottir, H., Holm, F., Kalogeras, N., Leino, O., Luteijn, J. M., Magnússon, S. H., Odekerken, G., Pohjola, M. V., Tijhuis, M. J., Tuomisto, J. T., White, B. C., & Verhagen, H. (2012). State of the art in benefit–risk analysis: Consumer perception. *Food and Chemical Toxicology, 50*(1), 67–76. https://doi.org/10.1016/j.fct.2011.06.006

Völker, C., Kramm, J., & Wagner, M. (2019). On the creation of risk: Framing of microplastics risks in science and media. *Global Challenges, 4*(6), Article 1900010. https://doi.org/10.1002/gch2.201900010

Wiedemann, P., Freudenstein, F., Böhmert, C., Wiart, J., & Croft, R. (2017). RF EMF risk perception revisited: Is the focus on concern sufficient for risk perception studies? *International Journal of Environmental Research and Public Health, 14*(6), 620. https://doi.org/10.3390/ijerph14060620

World Health Organization (WHO). (2022). Dietary and inhalation exposure to nano- and microplastic particles and potential implications for human health. *World Health Organization (WHO)*. https://www.who.int/publications/i/item/9789240054608.

Yilmaz, V., & Can, Y. (2020). Impact of knowledge, concern and awareness about global warming and global climatic change on environmental behavior. *Environment, Development and Sustainability, 22*(7), 6245–6260. https://doi.org/10.1007/s10668-019-00475-5

Yoon, A., Jeong, D., & Chon, J. (2021). The impact of the risk perception of ocean microplastics on tourists' pro-environmental behavior intention. *Science of the Total Environment, 774*, Article 144782. https://doi.org/10.1016/j.scitotenv.2020.144782

Yoon, M., & Lai, M. H. C. (2018). Testing factorial invariance with unbalanced samples. *Structural Equation Modeling, 25*(2), 201–213. https://doi.org/10.1080/10705511.2017.1387859

Zwick, M. M. (2005). Risk as perceived by the German public: Pervasive risks and "switching" risks. *Journal of Risk Research, 8*(6), 481–498. https://doi.org/10.1080/13669870500064150