HEALTH EVIDENCE NETWORK SYNTHESIS REPORT 75

How do the cultural contexts of waste practices affect health and well-being?

Julia Foellmer | Max Liboiron | Andrea Rechenburg | Thomas Kistemann

World Health Organization
REGIONAL OFFICE FOR Europe

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EVIDENCE FOR DECISION-MAKERS

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Abstract

Managing the increasing amount and complexity of municipal solid waste poses a growing challenge to the entire WHO European Region, with serious implications for human health and well-being. Addressing this requires moving beyond technical innovations to better understand and integrate a wide range of factors, including cultural contexts. By examining evidence from a broad array of disciplines in peer-reviewed and grey literature, as well as case studies from the Region, this report opens up a systematic engagement with the role of culture in waste management practices and how this fosters or undermines conditions for health and well-being. While highlighting various tensions between cultural forces at multiple scales, the evidence suggests that culturally grounded approaches to waste management can yield higher rates of public participation and cross-sectoral collaboration, be more sustainable in the long term, and lead to better health and well-being for the wider public, particularly for groups with heavier health burdens associated with waste. The evidence provides a sound basis for strengthening existing policy frameworks and identifying areas in which culture can be a driver for improved policies that are supported by all stakeholders.

Keywords

MUNICIPAL SOLID WASTE, PARTICIPATORY DECISION-MAKING, BEHAVIOUR CHANGE, LITTERING, FOOD WASTE, COMMUNITY-LED INTERVENTIONS, HEALTH PROMOTION

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ABBREVIATIONS

EU	European Union
SDG	Sustainable Development Goal

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SUMMARY

The issue

Managing the increasing amount and complexity of municipal solid waste poses a growing challenge to the entire WHO European Region, with serious implications for human health and well-being. Meaningful progress requires approaches to waste management that move beyond technical innovations to better integrate a wide range of factors, including cultural contexts. Yet the importance of culture is often overlooked in policy-making, obscuring important insights and opportunities across the waste stream. Research to date has tended to focus on the many physical harms associated with waste and, to a lesser extent, on waste's impact on well-being. A limited body of research at the intersection of culture, waste and health opens pathways for engaging with culture as a driver for improving waste management planning and policy-making and for positively impacting health and well-being.

The synthesis question

This scoping review aims to answer the question: "How do the cultural contexts of waste practices affect health and well-being?" It examines the roles that culture plays at different scales in the generation and management of municipal solid waste (as opposed to industrial waste or sewage) and how this fosters or undermines conditions for health and well-being.

Types of evidence

The review used a systematic review methodology to synthesize the global peer-reviewed and grey literature published in English between 1998 and 2021 on links between health, culture and waste from the perspectives of waste generation; waste management practices; public participation; exposure to environmental risk factors; and consumer habits, perceptions, attitudes and behaviours. The 193 selected articles included systematic reviews, nationally representative cohort studies, small-scale cross-sectional surveys, organizational reports, government papers and case studies from diverse disciplines. A search of Russian literature yielded 713 articles for further assessment after title/abstract screening but none were included in the review.

Results

While the body of research focused on culture, waste and health is still relatively small, the reviewed evidence suggests that culturally grounded approaches to

waste management can help to evaluate the deficiencies and achievements of past interventions, and make important contributions to the design and implementation of people-centred, health-promoting and sustainable waste policies. The findings also highlight the value of considering waste in the light of diverse dimensions of health. Overall, embedding policies and behaviour-change initiatives within meaningful cultural frameworks are likely to catalyse better outcomes.

A cultural approach is premised on the understanding that different groups operate using a wide range of categories, assumptions and moralities. Culture should be regarded as a complex terrain that has intersecting political, economic, ecological, legal, ethical and moral practices and values that influence behaviours and experiences related to waste and health. Culturally mediated ideologies and habits influence practices related to waste, health and well-being in fundamental but often subconscious and varied ways.

A cultural lens helps policy-makers to understand different ways of knowing, being and doing across and within regions and demographics, and to integrate these into wider commitments and frameworks. It also acknowledges diversity within seemingly shared cultures, as differences exist within ethnicities, genders, localities, religions, subcultures, ages and professional groups in any given region. Sensitivity to this diversity is particularly important given the uneven distribution of the negative impacts posed by waste production, treatment and disposal. A cultural lens can be used to understand perceptions and experiences of these inequities, and to tailor context-sensitive interventions that are more likely to succeed in reducing harm and promoting health and well-being.

This review highlights that different classes of cultural factors that prevalently operate at different social scales influence waste- and health-related practices and interventions in complex ways. Scalar mismatch (when a given problem and attempts at solving it are not occurring at commensurate scales) often takes the form of messaging that foregrounds individual or group agency (such as appeals to reduce household waste), even though overarching, systemic factors (such as pervasive infrastructure of consumption and disposability) play a more significant role in waste and health outcomes. Policy-makers can address this tension by acknowledging cultural factors operating at the micro, meso and macro scales, from local customs to national norms, and designing interventions that build on these complex relationships.

The literature did not provide a unified, instrumental theory of change whereby, for instance, a single intervention such as using culturally appropriate language paves the way for social acceptance and successful implementation. Rather, it showed that paying attention to differences between and within cultures can reveal multiple points of meaningful intervention, many of which are interrelated and synergistic. These include efforts to understand the perceptions, concerns and interests of all stakeholders; recognize the culturally specific values, concepts and norms of policy-makers and governance bodies; design transparent and participatory decision-making processes that are attentive to multilayered cultural contexts; develop equitable infrastructure; align regulations and laws with incentives and values; and include different styles and modes of communication and message framing.

Finally, this review finds that viewing waste and health through the lens of culture necessitates ongoing engagement with numerous interconnected elements. A cultural lens should, therefore, be understood as an approach, rather than a tool, in which waste is perceived as a dynamic, culturally mediated phenomenon influenced by many factors at multiple scales. This new model of engagement aspires to forge deeper understandings and moral bonds that support broader shifts towards sustainable lifestyles and circular economies.

Policy considerations

It is important for regulations, laws and incentives to consider the cultural contexts affecting the upstream generation of waste (large-scale cultures of consumption and disposability) and downstream management of waste (disposal, recuperation, recycling, etc.). While no single technique or mechanism will work across all contexts, based on the best practices and success stories identified in this scoping review, the main policy considerations to develop waste management policies with culture and health in mind are to:

- consider the motivations, values and capacities of the people and agencies involved across the waste stream to inform the planning and provision of physical and organizational infrastructure – from waste bins to landfill taxes to national policies – in a way that promotes healthy communities;
- consider how group norms, assumptions and behaviours of policy-makers impact processes and outcomes related to decision-making about waste management, and where shared understanding can be cultivated (in both directions) between professional and lay cultures;

- integrate understandings of health that include more subjective and culturally informed indicators linked to well-being into all phases of policy-making related to waste management and health;
- ensure equitable participatory processes in decision-making about waste management that consults and engages local stakeholders, including vulnerable or historically marginalized people, to effectively assess health risks and better understand, prioritize and address local concerns and perceptions of harm;
- ensure that communication about waste-related health challenges engages with cultural contexts and communities' experiences, and goes beyond one-way flows of information;
- support and scale up relevant grass-roots initiatives, such as community-led clean-ups, art projects or citizen science initiatives, to catalyse change and ensure sustainability; and
- develop synergies across disciplines and sectors to foster innovation at the intersection of culture, waste and health.

1. INTRODUCTION

1.1 Background

Almost 1.5 million deaths per year in the WHO European Region are caused by environmental factors that could be avoided or even eliminated, including excessive and improperly managed waste (1). At any point along the waste stream – from generation to collection, separation, transport, treatment, disposal, reuse and recycling – waste has the potential to adversely impact human health and well-being through both direct exposures and the contamination of air, water, soil and food. As such, waste is widely considered a key environmental determinant of poor health (2), and mitigating its negative effects has become a major global challenge (3). The United Nations 2030 Agenda for Sustainable Development sets ambitious targets related to waste and health under Sustainable Development Goal (SDG) 3 (good health and well-being), SDG 6 (clean water and sanitation), SDG 11 (sustainable cities and communities), and SDG 12 (responsible consumption and production patterns (4,5). Further, WHO and partner agencies have affirmed that effective chemical and waste management are essential to achieving all SDGs (6).

At the Sixth Ministerial Conference on Environment and Health in 2017, Member States of the WHO European Region resolved to prevent and eliminate the adverse environmental and health effects, costs, and inequalities related to waste management and contaminated sites within the context of a transition to a circular economy (1). Indeed, changing waste policies across the Region underline a general agreement that current practices of industrial production, consumption and disposal must be critically understood and adjusted to minimize harm (see Box 1).

Box 1. Waste management in the WHO European Region: variation across and within countries

The 53 Member States of the culturally diverse WHO European Region have agreed to multiple comprehensive legal frameworks that regulate waste management according to health and environmental criteria. Those within the European Union (EU) are guided by the concept of the waste hierarchy, in which reduction, reuse, recycling and recovery are prioritized over landfilling, and by the polluter-pays principle, in which producers are financially responsible for their products once they enter the waste stream (7). EU directives also set recycling targets and goals for the reduction of packaging waste at industrial,

Box 1. contd

commercial, office, service and household levels (8,9); of food waste at each stage of the supply chain (10); and of litter on beaches and in oceans (11–13).

Although more types of waste are being diverted and less waste is going to landfills in the EU-25,[1] the data show that overall waste is still increasing (14). However, these aggregated data hide significant variance between and within countries and areas. For instance, whereas 2019 statistics show that EU Member States generated 502 kg of municipal solid waste per capita (of which roughly half was recycled, composted or otherwise recovered), Denmark's figure was 844 kg while that of Kosovo (in accordance with United Nations Security Council Resolution 1244 (1999)) was just 252 kg (15). Even within states, waste generation and management can vary so enormously that thinking on a national scale is often unhelpful (16,17).

Many Member States from the eastern part of the WHO European Region recently updated their laws, legal provisions and national programmes on waste management. Some of these States now incorporate policies similar to existing EU legislation, including Extended Producer Responsibility, a strategy to add the environmental costs associated with a product throughout its life cycle to its market price (Belarus and Georgia). Others have integrated regulations on waste sorting (Georgia and Ukraine) and bans on plastic bags (Georgia) (1).

Yet efforts to reach policy targets may encounter barriers in the form of unexamined assumptions, beliefs and behaviours at all levels of society. The Russian Federation, for example, now obliges companies to recycle 10–30% of their waste, and has introduced a strategy that aims at increasing the waste processing rate from 10% in 2018 to 80% in 2030 (7). However, a tradition of recycling and waste separation and/or incineration is still lacking in the country, where 90% of waste is dumped in landfills (18).

As countries seek to accelerate progress in waste management and mitigate associated harm to health and well-being, the multifaceted cultural contexts that influence related perceptions and behaviour on multiple scales – from neighbourhoods to nations – must be better understood.

1. The composition of the European Union from 1 May 2004: Austria, Belgium, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

Yet the generation and management of waste are not merely technical problems. Some of the most significant waste-related challenges facing communities, countries and regions are complex issues such as inequitable access to infrastructure, lack of clear responsibility among authorities, noncompliance among users, uneven distribution and quality of information, and cultural and social norms such as lack of social responsibility (19). As such, waste management practices and policies are gradually expanding beyond the scope of technological innovations, and waste generation and management are being investigated as activities shaped by a range of economic, social and psychological factors and cultural practices (20,21).

1.1.1 What is the added value of a cultural lens?

In this report, culture refers to the distinct ways of knowing, being and doing held in common by different groups of people (22–24). Culturally mediated categories, assumptions and moralities influence waste-related behaviours in myriad ways – from what and how much is consumed; to how, where and why it is discarded; and to whether or not composting, recycling or upcycling are considered options (9,25). Culture also influences behaviours related to health and well-being in fundamental ways, from eating habits and physical activities to understandings of what it means to be well in the first place (26). Culture is expressed, challenged and reproduced at the micro scale (individuals, families, local organizations), meso scale (larger organizations and institutions, ethnic subcultures) and macro scale (national cultures, multinational organizations), with complex interplay between all scales.

Cultures and subcultures share common understandings of the world and how it works, but the way that these shared meanings play out in practice can vary and even conflict. Even within a small region, there are differences within seemingly shared cultures along lines of ethnicity, gender, locality, religion, subculture and age, as well as between lay and professional cultures. Additionally, one person, group or society can be part of multiple cultures and subcultures. Thus, it is important not to treat culture as a monolithic, unifying force that can simply be leveraged for coordinated end goals (27). Doing so can result in over-engineered interventions that risk exacerbating social marginalization and exclusion while accruing benefits to specific groups (27–29). This kind of "mono-causal, linear thinking" risks invoking a single factor or set of factors that, once in place, "turns the surrounding context into a backstage, a display that adds a touch of 'situational' favour, but does not really make a difference" (27). Such outcomes are neither desirable nor sustainable.

Instead, culture should be regarded as a complex terrain that is closely related to diverse but intersecting political, economic, ecological, legal, ethical and moral

practices and values that influence behaviours and experiences related to waste and health in both conscious and subconscious ways. Thus, this report advocates for using a cultural lens as an approach to discern when and under what conditions specific aspects of particular cultures can work as influential factors for waste practices that promote health and well-being and reduce health inequities in both top-down and bottom-up scenarios of policy intervention and social change.

While policy-makers are just beginning to understand the degree to which culture can influence waste- and health-related behaviours, policies and outcomes, the impetus to expand knowledge, value the experiential expertise of waste workers and develop best practices in this area is increasing. Culture-led and contextually aware interventions have the potential to create "the social and economic conditions for enabling culture to perform [...] delicate and extremely valuable roles effectively and sustainably, through a proper strategic coordination with the whole local economy and community" (27). Such an approach is in line with the WHO Regional Office for Europe's European Programme of Work 2020–2025, which includes "Behavioural and cultural insights for health" as one of its four flagship initiatives (30).

1.1.2 How does culture affect perceptions of waste?

Long after it is discarded, waste persists as visual evidence of the cultural contexts in which it was generated and managed. Waste is said to be "bound up with a whole host of habits and practices through which we cultivate particular sensibilities and sensual relations with the world" (31), and changing relations to waste reflect changing relations to self. "These shifts in habits, conscience, and self-cultivation reveal the place of waste in historically variable forms of subjectivity", or peoplehood (31). As historical politics and ideologies give rise to routines, norms and perceptions related to both consumption patterns and waste handling (32), waste also needs to be understood as a "dynamic social construction" (33).

Given that perceptions and definitions of waste are socially and culturally contingent, different terminologies of waste and waste management are used across cultures. Like other aspects of culture, these may be ambiguous or contested, and evolve in relationship to other factors. The variety of meanings associated with the concept of waste in a single language, such as English (see Box 2), illustrates its highly subjective nature spanning multiple dimensions (3). Since these subjective notions shape attitudes and behaviours towards waste generation and management at multiple scales, they can be important drivers for improving waste practices and related health and well-being outcomes within different cultural contexts (34).

Box 2. The semantics of waste in English: multiple dimensions of meaning

- Economic dimension: terms such as waste, trash, rubbish, junk and refuse reflect themes of loss and uselessness (22,35), describing unwanted, superfluous items that lack value and present an economic burden in the form of clean-up and disposal costs. At the same time, for those involved in waste handling, these terms can also be associated with a source of income. Terms such as by-product, resource and asset intentionally invoke the potential for materials to be recycled or upcycled into something useful or profitable (36,37).
- Temporal dimension: terms such as waste also refer to products of time, in that material can be traced back to specific processes and purposes in the past (31). Waste can also take on a longer-term historical perspective through its gradual accumulation or decomposition, providing valuable evidence on past settlements, societies and cultures (3).
- Spatial dimension: terms such as litter refer to material left in an inappropriate location (38,39), linking to the original meaning of waste as a desolate, ruined or neglected region. This points towards the direct and indirect burdens that litter as a spatial problem and littering as a behavioural issue place on environmental and human health and well-being (40).
- Corporal dimension: slang terms for waste such as shit and crap, as well as terms such as filth, reveal waste's long association with sanitation and the management of urban urine and excrement (22).
- Aesthetic dimension: terms such as mess and garbage highlight the ugly or repulsive nature of waste, and the perception that it belongs in dirty places (34). Yet practices such as garbage art, also known as trash art or recycling art, underline that even unwanted or discarded materials can be transformed into objects of aesthetic value, thereby prompting critical reflections on, for example, materialism and consumer culture (41).
- Behavioural dimension: while producing waste is inevitable, action-oriented terms such as to waste and to litter stress the role of human behaviour and choice in the production and improper management of waste as a choice (31).
- Moral dimension: in various contexts, to waste refers to the careless use of limited resources, for example, time or energy (42), invoking a sense of regret, loss or shame.

In the linguistically diverse WHO European Region, a consideration of the semantics of waste, uncovering both positive and negative connotations, can be an important starting point for the adoption of a cultural lens (43). For example, within certain contexts, the moral dimension invoked in the term **to waste** could be leveraged to highlight the worthiness – even the sacredness – of commonly discarded materials. An intentional transition from negative language such as trash or junk to positive language such as by-product, resource or material could draw attention to the opportunity of transforming unwanted or discarded materials deemed to lack economic value into new objects with aesthetic value (44). At the same time, these terms are also cultural and, thus, have different meanings and implications for different groups. This rhetoric needs to be framed, pursued and implemented carefully to include all stakeholders and prevent state or private actors from disproportionally profiting from "emerging waste markets" and displacing informal actors who have previously earned subsistence daily incomes from regarding waste as a resource (45).

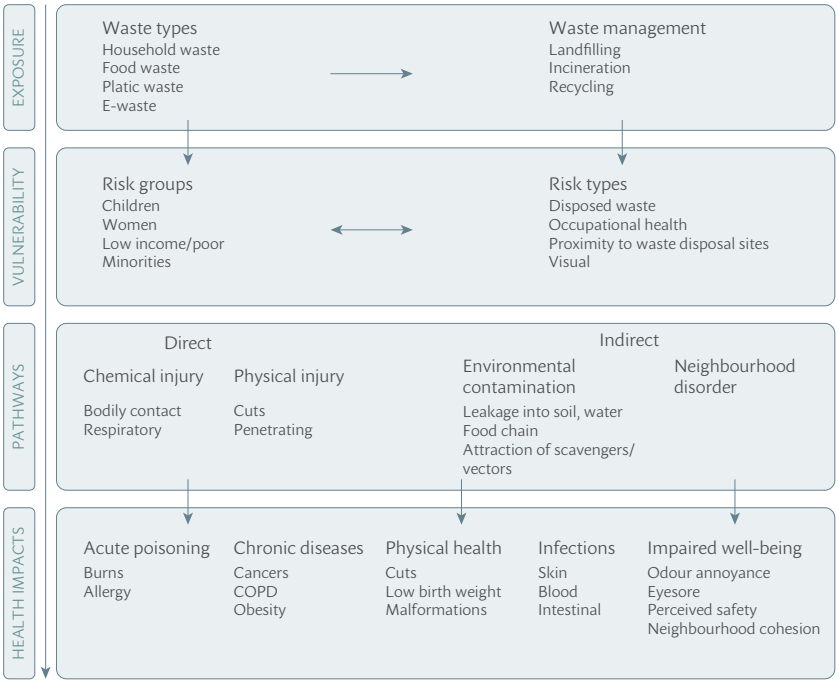
1.1.3 How does municipal solid waste affect health and well-being?

WHO defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (46). Drawing on WHO's definition and the Ottawa Charter for Health Promotion (47), this report considers the risks to health and well-being posed by municipal solid waste to encompass illness, injury and toxicological harms, but also more nuanced indicators linked to diminished personal and collective well-being. It focuses not only on the prevention of disease or impaired well-being but also on opportunities for health promotion through collective waste practices (48–50).

However, research on the links between municipal solid waste and health tends to focus on physical harms. These include toxic and infectious risks from direct contact with waste through formal and informal waste recovery/recycling work, exposure to neighbourhood litter, and the presence of vermin and odours, as well as indirect exposure through contaminated air, water, soil and food (51,52). Studies have looked at a wide range of adverse outcomes (Fig. 1) (51,53–57).

Health issues are associated with every step of the handling, treatment and disposal of waste. Although there is a rich literature on the causal effects of exposure, evidence on dose–response relationships is still inconclusive. This is mainly due to the fact that exposure to waste is a complex process influenced by

Fig 1. Potential health impacts of inexpedient waste management practices



COPD: chronic obstructive pulmonary disease.

many sources and routes of exposure, varying lengths of exposure time, and the possible interplay of inhibitory, synergistic or additive factors (such as lifestyle, income level or the coexistence of other sources of pollution) (51–53,58,59). Thus, further research is warranted.

In recent years, studies have also begun to investigate potential links between inexpedient waste management and diminished well-being, with risks including increased stress, feelings of annoyance or sadness; decreased perceptions of safety and neighbourhood cohesion; and decreased social trust (60–62). The multifaceted

ways in which perceptions of everyday environments impact well-being and quality of life merit increased attention to build a more nuanced understanding of which particular interventions in the built environment can encourage health-promoting human–environment interactions (63,64).

Evidence consistently shows that the negative impacts on health and well-being associated with municipal solid waste are unevenly distributed. For example, marginalized groups such as refugees, migrants, internally displaced people, and ethnic and racialized minorities – groups that often also experience low socioeconomic status – tend to live closer to waste treatment facilities and hazardous sites (8,65), are more exposed to emissions (65), and are disproportionately involved in informal recycling or collection work and exposed to its hazards (66). Risk of harm for these groups can be exacerbated by culturally mediated factors such as exclusion from decision-making processes related to waste facility siting (8,67), distrust in authorities, cultural isolation and language barriers (68).

Research shows that "some of the observed inequalities in exposure and health represent environmental injustice, as they are the result of social processes and may be at least partly prevented," (65,67). Such patterns of injustice point to the social determinants of health, that is, the non-medical factors that influence health outcomes. Though often treated independently in analyses, these "conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life" (69) are compounding and intersectional. Considering additional factors such as age, gender, education and employment status can account for more complexity, but disentangling possible health and well-being impacts remains difficult.

While an overemphasis on aggregated demographic categories may neglect or obscure important cultural elements that influence behaviours and choices within communities and organizations on smaller scales, demographic differences can be a way to see the effects of large-scale processes that lead to the marginalization and discrimination of specific populations. The continuous collection of demographic data by national and regional institutions can reveal trends in terms of which differences matter at the intersection of waste and health (70,71), how these processes contribute to disproportionate vulnerabilities and exposures to harm and, thus, where interventions are most needed.

A cultural approach to understanding how municipal solid waste affects health and well-being includes careful consideration of demographic trends and social

determinants, but seeks additional layers of nuance in the distinctive and dynamic "spiritual, material, intellectual and emotional features" (72) that influence perceptions, experiences and outcomes within and across these categories. Importantly, this requires that policy- and decision-makers turn the lens upon themselves to better see and understand their own group norms, assumptions and communication styles that may or may not be inclusive and effective. This can deepen understanding of both the multifaceted causes of the uneven distribution of negative impacts associated with waste, and the specific processes and policies that are most likely to make a difference.

1.1.4 Objectives of this report

While recognition of and references to the cultural contexts of waste and of health are growing, less focused attention has been paid to their significance in relation each other. This gap provided the impetus for the scoping review, but also presented a challenge: research that systematically explores the interplay of culture, waste and health is relatively limited. Thus, drawing on peer-reviewed and grey literature, as well as case studies from the WHO European Region, this report aims to describe the state of knowledge at this intersection and open up pathways for advancing related research and practices. By asking, "How do the cultural contexts of waste practices affect health and well-being?", it looks at evidence of the roles that culture plays at different scales in the generation and management of municipal solid waste (as opposed to industrial waste or sewage), and how these support or undermine conditions for health and well-being.

Other reports systematically communicate health effects from waste (73), health inequities among different demographics or cultural groups (68), and relationships between cultural participation (74) or social norms (75) and waste recycling behaviours. This report draws on such literature, synthesizing discussions and noting points of confluence, while foregrounding possibilities for leveraging culture as a driver of improved waste management. It focuses on specific areas – littering, food waste, collaborative decision-making, and the cultural contexts of waste management in Italy – to illustrate how different elements and scales interrelate. It also highlights research leading to a noticeable improvement in health and well-being. Recognizing that a cultural approach to waste and health necessitates broad engagement with diverse stakeholders, this report also seeks out participatory processes for attention and promotes a culture of policy-making that is self-reflective, consultative and deliberative.

1.2 Methodology

A scoping review of peer-reviewed literature published in English between 1998 and 2018 was conducted between September and November 2018. After removal of duplicates, a total of 6549 publications were screened by title and abstract, followed by full-text screening of the remaining 741 studies in English to identify relevant content and countries, with 40 articles selected for inclusion. Complementary snowballing searching and a search of grey literature identified a further 83 articles, with a further 70 identified through consultation with experts, making a total of 193 included in the review (1–41, 43–194).

To identify relevant articles published exclusively in Russian, a comparable search of academic literature in Russian was conducted between September and November 2018. Of these, 713 articles were selected for further assessment after title/abstract screening but none were included in the review.

Annex 1 provides further details of the review methodology, including search strings and inclusion/exclusion criteria. Annex 2 describes a network analysis of the dominant trends and relationships in 741 articles in English after title/abstract screening based on the relationships between keywords.

2. RESULTS

2.1 State of the knowledge at the interface of culture, waste and health

The vast majority of studies considered in the scoping review were focused on waste and health. These widely documented the health consequences in terms of exposure to certain waste types or waste management practices, different exposure pathways (through direct contact or environmental contamination), specific risks groups or risk types, and various health outcomes.

The published literature at the intersection of waste and culture was smaller. In a 2016 review of social factors related to waste, a search for articles on "municipal solid waste" returned 26 094 publications but, of these, only 0.69% focused on social or cultural factors (20). Within this subgroup, the papers were sorted into four groups: health (77%), economic/wage inequity (5%), environmental injustice (9%), and inequity in service provisioning (9%) (20). The results of this review mirror those of the 2016 review: although research on waste management practices has increasingly integrated a social dimension since the early 1990s, the social and cultural aspects of waste still receive a limited focus compared with technical issues (20).

This review found still fewer studies that considered all three elements – culture, waste and health – in a substantial way. A network visualization of the relationships among keywords within and across texts (Annex 2) shows how these keywords interact, including which are most influential in terms of cohering and organizing other terms. It shows that no social or cultural terms cohere the network. That is, even when social or cultural elements are mentioned as keywords, they do not appear as dominant, organizing terms. Instead, health- and waste-related keywords are the most commonly used and structure conversations in the field.

Terms such as community, mental health, neighbourhood, public opinion, consumption behaviour, risk perception and social justice appear, but play minor roles in the coherence of the discourse. This does not necessarily mean they are not mentioned often, but they are not well connected to other terms. At the same time, while food waste and health are key organizing terms, their distance from one another shows they are not often considered together. Instead, health and recycling, and health and policy, are more often explicitly linked.

Given the specialized focus of many of the studies considered in the review and the low level of coherence in the network of knowledge on culture, waste and health, more interdisciplinary collaboration and research is needed. Complementing quantitative methods by providing deeper insights into how to interpret data, qualitative and culture-centred approaches that employ methods from the health-related humanities and social sciences have an important role to play in the development of this evidence base (76).

2.2 How different scales of culture influence waste-related practices and interventions

The cultural, social and behavioural analyses considered in the review suggested that scale is one of the main tensions operating at the intersection of culture, waste and health. Here, scale refers not to smaller versus larger elements of a system, but to the ways in which certain processes and different relationships emerge at specific scales (77). Cultural factors at the micro scale (individuals, families, local organizations), meso scale (ethnic subcultures, larger organizations and institutions) and macro scale (national cultures, multinational organizations) interact in complex ways that impact waste behaviours, health and well-being outcomes, and the success or failure of related interventions.

Scalar mismatch occurs when a given problem and attempts at solving it do not occur at commensurate scales (77). A common scalar mismatch highlighted in the literature involves foregrounding the importance of micro-scale choices (for example, through appeals to personal ethics to reduce household waste) when in fact meso- and macro-scale structural factors (such as pervasive single-use plastics, excess packaging and ubiquitous waste bins) may play a more significant role in waste outcomes. Many studies showed that these structural elements are the most significant factor in shaping waste-related behaviour (20,37,78–84). Carefully considering such scales is therefore a pressing issue in waste interventions (77,85–87).

The evidence indicates that macro-scale forces such as development, urbanization and modernization (88), as well as advertising and waste management practices such as kerb-side garbage collection(84), increase waste production – even more so than population and available land area (88). This infrastructure is the result of high-level decisions about what matters, informed by national and professional views on which forms of waste generation and management are legitimate or necessary and where and how they should occur (14,89–93). Indeed, at the national scale, a 2015 paper argues that "waste generation is not only a product of the society in

which it is based, but is also profoundly affected by the level of development, rate of societal change, and the way at which the society has approached modernity" (88).

Culturally mediated meso- and macro-scale infrastructure can also play a larger role than individual behaviour in determining some health outcomes. For example, a study on the avoidance of two endocrine-disrupting chemicals found in disposable food packaging limited families' contact with all forms of canned and packaged food. While the intervention reduced the chemicals in participants' bodies by just over half, the other half of exposure came from ubiquitous exposure in everyday life (94). This points again to the limits of individual agency or lifestyle changes, particularly in contexts of significant environmental exposures (94,95). More positively, a 2020 life-cycle assessment study in Italy found that an emerging national culture of sustainability and the evolution of waste management infrastructure to incorporate methods such as recovery between 2007 and 2016 demonstrated "relevant and rising benefits" concerning reduced morbidity and mortality (96). Thus, a cultural approach is incomplete without systematic consideration of large-scale influences.

At the same time, close attention to micro-scale cultures, such as local perceptions of risk and household practices related to waste, is also essential. The review found that if large-scale infrastructure and interventions do not fit with local cultures, their likelihood of success is dramatically reduced (97,25). Issues such as widespread noncompliance, grass-roots campaigns against planned infrastructure, and distrust in authorities and decision-makers can reflect another kind of scalar mismatch, in which meso- and macro-scale professional cultures are out of sync with local values, capacities, perceptions and needs (51,98,99).

An exclusive focus on large-scale cultural factors can also miss uneven health and well-being outcomes on smaller scales. For example, handling of household waste falls disproportionately to women, increasing their exposure to toxicants from these materials (100). In some areas, women are more involved than men in waste picking, and bear a larger burden of associated risks such as contact with hazardous materials and accidents (51,101). Women also earn less money working in both formal and informal waste management (102–108). Investigating the cultural contexts that normalize and sustain these inequities within the microspheres of households and neighbourhoods could yield important insight for designing context-sensitive interventions.

Finally, the evidence suggests that cultural preferences and beliefs, even when removed from the wider environments in which they originated, continue to influence individual outcomes, but that household cultures also shift

in response to new or changing environments (109). Given these tensions, cultural factors on different scales should be considered fluidly, as intersecting and interdependent variables that influence one another in significant ways across time and place.

2.3 How culture shapes waste-related behaviours and outcomes

2.3.1 Focus on littering

Waste regulations in the EU acknowledge litter's large-scale "direct and indirect impacts on the environment, the well-being of citizens and the economy" (40). As such, a substantial number of studies considered in the review were dedicated to understanding and mitigating this issue. While few systematically framed littering in the context of both culture and health, many pointed to cultural factors on multiple scales that influence littering behaviours and responses and a significant number emphasized the impact of litter on individual and community well-being through its aesthetic, perceptual, emotional and social dimensions.

The literature frequently investigated litter as an environmental or psychological stressor, and as an indicator for disorder that diminishes the restorative value of beaches, residential neighbourhoods and urban green spaces (34,110–112). By negatively influencing people's uses and experiences of these places, litter affects mental, social and physical health and well-being in the longer term (113–116). For example, littered coastal beaches were shown to evoke feelings of sadness (117), while litter in residential neighbourhoods can lead to anxiety and depression (64), frustration and anger (118), and poorer sleep quality (119). In other studies, litter was associated with lower levels of neighbourhood cohesion (120), decreased social trust and more antisocial behaviours (121,122).

Several studies noted that litter in the environment can discourage people from engaging in health-enhancing outdoor activities (123). For example, noticing neighbourhood litter or other elements of disorder was associated with lower desirability or perceived safety of walking and other forms of outdoor exercise (124,125), particularly for older people (126,127) and women (128). Litter around schools also appeared to discourage children from using active transportation to get to classes (129,130).

At the micro scale of households and neighbourhoods, littering behaviour is highly socially and culturally patterned, actively shaped by descriptive norms (behaviour that is considered typical and accepted) and prescriptive norms (behaviour that is acceptable) in a given situation (131,132). Individuals tend to litter in previously littered and disordered environments rather than clean environments, and are less likely to litter when they see someone else picking litter up (133–137). While monetary incentives can discourage littering on the basis of extrinsic motivation in the short term, the sustained practice and visual evidence of social and cultural norms may act as longer-term deterrents to littering by appealing to a sense of conscience, autonomy, competence, social connectedness or community pride, and can ultimately have wider positive effects on perceived life meaningfulness, self-determination and well-being (118,138,139). While research from psychology and economics showed that leveraging people's intrinsic motivation can contribute to behaviour change, only a few nudge-based policy interventions have promoted intrinsic motives towards pro-environmental and prosocial behaviour compared with those building on external incentives (139).

Indeed, the literature suggested that culturally grounded anti-littering programmes emphasizing collective purpose or service to something larger than the individual self can be very effective. One study found that religious communities were more willing to engage in public street cleaning campaigns when removal of litter from streets was framed as an "act of worship" (102). Another found that being motivated to avoid negative consequences for nature or other people (altruistic/biospheric value) positively predicted a concern for reducing marine litter, whereas valuing the benefits of marine environments for oneself (egoistic value) did not (131). Moreover, evidence showed that cognitive framing such as communicating the stories of specific individuals who have been harmed by litter may be more effective in discouraging littering than providing general statistics about negative impacts (118).

At the meso and macro scales, littering behaviour is shaped by legislations, policies (111) and incentives (131) that reflect broader values and priorities. Evidence suggested that these tools are most effective when they focus on prevention (111,140). According to some research, up to two thirds of all littered items can be traced back to passive, non-deliberate littering (39,141). In this context, educational campaigns are useful for raising awareness of the presence and impact of litter, generating longer-term commitment to picking up litter or preventing littering, and encouraging the adoption of other pro-environmental behaviours (117). Research suggested

that interventions should first target people who litter only occasionally and are willing to change. Over time, this can shift social norms towards non-acceptance of littering and render heavier litterers more open to change (118).

Since the late 2000s, studies on littering have also incorporated a broader perspective focused on health rather than disease, suggesting that positive health effects are linked not only to reduced amounts of litter but also to participation in cleaning it up. Environmental stewardship activities such as litter clean-ups, marine monitoring programmes and tree planting initiatives were shown to enhance well-being by promoting physical activity, increasing place attachment and improving self-esteem (118,142). A 2017 study suggested that these activities generate the same level of positive emotions (hedonic well-being) as coastal walking and is associated with higher levels of perceived meaningfulness (eudaimonic well-being) (117). This opens up new possibilities for culturally informed anti-littering initiatives that benefit public health both directly and indirectly.

Several studies considered in the review also highlighted the potential for citizen science to increase public participation in anti-littering initiatives while integrating local knowledge systems into research and policy formation. Citizen scientists can bring important contextual insight to problem definition by identifying new issues or reframing longstanding challenges, and by contributing to theories on how to address them (142,143), particularly if they have been historically excluded from these processes. For example, different groups may identify particular waste streams as important to measure and have specific ideas of how best to do so (144). As well as complementing traditional data sources by closing gaps in data coverage and increasing spatial and temporal resolution, citizen science can tailor standardized methods to local contexts, foster literacy and numeracy, and provide a positive context for experiencing nature.

In terms of policy implementation and evaluation, citizens engaged in local science initiatives may be more likely to communicate government aims to peers, generate public understanding and support for policies, and even enforce regulations by reporting issues like fly-tipping (143) (Case study 1).

Some research argues that mobile apps are effective, low-cost tools for monitoring the amounts and types of litter and the temporal patterns of littering, and informing the design and assessment of more targeted intervention strategies. Message framing needs to be inclusive and foster public acceptance among all citizens to ensure that anti-littering campaigns are not misunderstood as class-biased programmes or platforms where self-empowered middle classes and elites can blame socially

Case study 1. Tackling fly-tipping in Croydon (London), United Kingdom

Fly-tipping, or illegal dumping of waste, is a major problem in the London borough of Croydon, with negative impacts on the health and well-being of local residents. In response, Croydon Council adopted a range of strategies aimed at changing public perceptions and behaviours related to fly-tipping and engaging citizens in creative solutions. In addition to operational and technical changes to improve the effectiveness of street-cleaning services and increase the pride and dignity of workers (such as new cleaning vehicles and solar compactor bins), the Council designed the "My Croydon" mobile app to involve citizens in monitoring. The app enables local people to map incidents of fly-tipping, report the type of waste being dumped, and include photographs or comments (145).

The "Don't Mess With Croydon" campaign also offers opportunities for community engagement, such as litter picks, clearance of overgrown alleyways and community fun days. These events seek to reduce incidents of fly-tipping and antisocial behaviour at the source by encouraging residents to identify with and take pride in their neighbourhood. Initial monitoring has confirmed a reduction in fly-tipping of 5000 incidents between 2016 and 2017 (146).

deprived people or areas for poor disposal practices. The full potential of inclusive, culturally attuned citizen science to benefit waste policies and empower communities has yet to be realized (143), and presents a promising area for further study.

2.3.2 Focus on food waste

Infused with meaning, memory and symbolism, food is a fundamental expression and experience of culture. Within the microspheres of homes and neighbourhoods, eating "effectively roots us within communities of shared tastes, common habits and collective histories" (76). On the meso and macro scales, food systems and policies reflect cultural norms and priorities related to national history and identity, the environment, development, the economy, and health, all of which have implications across the waste stream. As such, relationships to food, including food that is discarded, must be viewed within a framework of culture.

The incentive to do so is significant: research shows that vast quantities of food that is safe and nutritious for human consumption is discarded or diverted to the production of non-food commodities such as compost or bioenergy (147).

Food waste has been associated with health through increased contamination and infection risks, odours, and the attraction of animals that may carry vector-borne disease (51,52). It also detrimentally affects health and well-being through missed opportunities for redistributing nourishment in equitable ways. However, the topic of food waste, health and culture, like much of the literature, was strong in two areas instead of all three. While the health effects of food waste are not the most pressing for municipal solid waste management, the literature on food waste is particularly rich in investigations of multiple scales of cultural change.

For example, a 2013 survey found that negative attitudes towards food waste, or the intention not to waste food, do not necessarily result in less food being wasted (148). These attitude–behaviour gaps reflect the wide range of elements at different scales that mediate behaviours related to food waste (149,150), including economic concerns, food availability, supermarket infrastructure, family histories and habits, personal tastes, and beliefs about food safety and sanctity – any of which may reinforce or undermine the others in different contexts (91,151–156). A sense of guilt at wasting valuable food may conflict, for example, with structural elements such as expiration dates on packages that reinforce fears of becoming ill.

Studies also pointed to the significance of the rapid industrialization and commodification of food systems, which reflect and reify dramatic shifts in collective cultures of producing, consuming and discarding food (76). Such macro-scale factors, which commonly outsource food production and preparation to large businesses while emphasizing convenience for individuals, may influence levels of household food waste indirectly through lost knowledge about food storage and preservation, lack of sensory skills and confidence to evaluate food's suitability for consumption, and real or perceived lack of time for cooking food before it spoils (157,158). Some evidence indicates that people who grow their own food, being more aware of the effort and skill that food production requires, tend to waste less (159,160). This suggests opportunities for mitigating food waste by reviving cultures of local food production, including through community schemes such as urban orchards and community gardens.

Overall, the review revealed multiple entry points for using culturally grounded approaches to foster deeper and more conscious relationships between people and food, dismantle barriers to reducing food waste, and build a sense of shared identity around sustainable and health-enhancing behaviours (for an example, see Case study 2). Thus, culture-centred research on positive emotions and perceived meaningfulness (hedonic and eudaimonic well-being) related to food preservation and redistribution is of significant value.

Case study 2. Using religious values to reduce bread waste in Turkey

In 2013 the Turkish Grain Board [*Toprak Mahsulleri Ofisi*] carried out the one-year "Campaign for Preventing Bread Waste" in 12 major cities. The campaign, which was broadly supported by the Government of Turkey and civil society, took every opportunity to emphasize the value and sacredness of bread through conferences, exhibitions, marches, printed materials, and public service announcements on television, radio, billboards and online. For example, one widely distributed poster declared *Ekmek nimet demek. Nimete hürmet gerek* [Bread is a blessing. Show respect to the blessing].

Importantly, organizers also sought to engage citizens in conversations about food and bread waste, including through school curricula, events at mosques, and art and poetry competitions that engaged as many as 25 million children. The campaign even published a recipe book celebrating stale bread as one of the most useful ingredients in the pantry (161).

After the campaign ended, the Ministry of Food, Agriculture and Livestock reported that bread waste had decreased by 18%. These savings equated to more than 1 million loaves of bread per day, or 384 million loaves per year, worth a total of 300 million Turkish lira. The campaign was subsequently included in the country's 10th Development Plan and the projected savings were integrated into the national economic targets for 2023 (162). By situating bread within meaningful cultural contexts and emphasizing both its holiness and usefulness, the campaign dramatically increased social awareness of bread waste, along with the motivation, knowledge and skill to prevent it.

2.4 How culture shapes policy responses

2.4.1 Focus on collaborative decision-making

The legitimacy of public participation in environmental decision-making in general is laid out in the Rio Declaration on Environment and Development (163), and the European Commission's guidance note for preparing a waste management plan outlines the need for stakeholder consultation at each stage of the waste planning process (164,165). As any inclusive engagement process takes place within complex cultural contexts that present a range of specific challenges and opportunities, a cultural lens is particularly critical in this area.

Because culture refers to shared ways of knowing, being and doing, cultural perspectives tend to appear natural, as common sense or logic. Managers, policy-makers and other professionals in governance positions may sometimes be unaware that they receive and reproduce specific group cultures within the context of their work, and that these may differ from public cultures in significant ways (17). In 2017 a WHO Regional Office for Europe policy brief affirmed that when cultures of policy-making remain unexamined, those who work in these fields may "unintentionally reinforce power imbalances that deny certain groups a voice in the decision-making processes that affect their lives" (76).

The literature highlighted that lack of cultural self-awareness among policy-makers can contribute to the so-called deficit model of knowledge, in which professionals assume they know best and that the public makes poor decisions based on a lack of information. This often results in one-way flows of data and recommendations from experts to the public that rarely yield the desired behaviour changes (166). Several studies noted that this deficit model can be understood as a clash of cultures, in which both professional and lay people come to decisions that make sense for them, but that often differ or conflict with those of the other group (167–169).

It is clear that simply providing more data to fill a perceived knowledge gap does little to develop mutual understanding and increase public participation, and may increase feelings of alienation and mistrust over time (167–169). It also misses valuable opportunities to broaden the evidence base with information and insight from the lived experience. This review found that the integration of lay knowledge into planning and policy-making can complement professional or expert knowledge by translating abstract, general facts into culturally sensitive narratives that open up pathways for new perspectives and behaviours in both directions (44).

In European Union (EU) policy-making, participatory governance is increasingly applied to implement EU directives, as citizen engagement is seen as a valuable instrument to help generate local knowledge, stimulate collective learning, solve conflicts and foster approval, thus ultimately promoting effective policy delivery (170). Alongside a general shift towards conventional participatory approaches in environmental decision-making and policy-making, the nature of participation is shifting towards collective experiments by inviting citizen scientists to participate in innovation-making, for example, in so-called living labs or hackathons (171).

Adopting a cultural lens to understand different perspectives and responses is particularly important in the area of risk perception, where public and professional attitudes towards waste- and health-related issues may sharply diverge. For example,

a 2007 WHO report on population health and waste management found that "the perception of the general public was that incineration was 'unpalatable'. In contrast, informants from the industrial and commercial sector tended to demonstrate a strong belief in the current state of incineration technology as a safeguard against health impacts" (73). As technical and scientific experts tend to frame risks more narrowly than the general public, they can miss important cues from local communities about what matters and why (Case study 3).

Case study 3. Understanding risk communication on Italian websites dedicated to the impacts of waste on health

Communicating public health risks is a critical issue in the light of scientific uncertainty. Since health issues are among the most popular search terms on the web, Orizio et al. undertook a qualitative study of how Italian websites dealing with the topic of waste and health might shape risk perception (166).

The majority of websites were based in the Campania region, and the most frequently topics addressed were related to waste only. They focused on general environmental risks, waste disposal and its health effects, specific case studies about waste, environmental sustainability, environmental policies, and waste recycling. Litter in the environment, landfills and incinerators was mostly associated with messages of increased health risks, although most websites did not provide adequate references.

Only university websites reported uncertain risks, whereas institutional websites did not indicate any risks. The presence and visibility of institutional websites appeared to be very low, indicating that they fail to meet most people's information needs. Thus, people were likely to base their knowledge of the interrelations between waste and health mainly on nongovernment websites. Consequently, risk perception may be built on one-sided, incomplete messages that may not convey the latest research (166).

Participatory risk assessment, which integrates psychological, social and cultural aspects as well as local knowledge, challenges the deficit model of knowledge by engaging with local communities to understand what is risky for whom and why, not as mere feelings that might be mistaken and, thus, must be corrected by experts, but as lived experience and local knowledge. These processes can inform the development of inclusive message framing and foster public acceptance, which have been shown to augment the success of policy implementation (172,173).

The literature emphasized that participatory risk assessment must be inclusive and accessible, allow people to easily communicate their perceptions of danger and behavioural intentions (173,174), and feel meaningful, in that policy-makers are actively listening to and considering public input with the goal of finding "a compromise about what is desirable by society and what is viable in terms of technical feasibility, cultural acceptance, economic possibilities, and willingness to pay" (175).

Overall, the review found that joint decision-making processes are the basis for public understanding and appreciation of the need for waste infrastructure, for defining a shared vision, and for promoting responsible behaviour and institutional accountability (20,45,172,173,176,177), particularly in contexts of unevenly distributed harms to health and well-being. A review of 68 cases of decision-making in municipal solid waste management confirmed that collaborative or participatory decision-making is increasingly common. Yet it highlighted that while most cases considered governments/municipalities and experts to be stakeholders in decision-making, and allowed all stakeholders to assign weights to criteria, many fell short on "considering competitive relationships and hierarchy among stakeholders" (178).

Other reviewed literature detailed a range of key techniques used in multistakeholder, multicriteria decision-making (175,179–182). Several articles showed that, in general, success is more likely when significant time is given for reflecting on concerns, building relationships and developing trust before moving towards operational results and decisions (175,181); when the differential power of stakeholders is accounted for (45,177,183); when different types of lay knowledge are considered as valid (184); and when the process and final decisions are clearly influenced by all stakeholders (182).

Finally, the review found evidence for the value of diverse message framing in participatory decision-making processes related to waste and health. Less formal and more personalized messages that capture cultural contexts, such as storytelling (118,185), can engage diverse audiences and convey the nuances of lived experiences more effectively than generalized information. Therefore, willingness to engage in narrative approaches, which can involve listening to, disseminating or co-creating stories that carry shared meaning and shape new possibilities, can be an important element of collaborative and culturally grounded policy-making. Message-based interventions are cost-effective and easy to implement but need to be carefully designed. Interventions testing how messages can be framed to sustainably encourage pro-environmental and prosocial behaviours have found that intrinsic motives have a great potential to promote lasting change and engagement while

improving well-being. Whether messages that employ non-controlling language and build on autonomous choice or normative framing through descriptive social norms are more effective in creating intrinsic interest is the subject of ongoing experimentation (139).

2.4.2 Focus on the cultural contexts of waste management in Italy

Several studies identified by this review discuss various cultural contexts of waste management in Italy, including risk perception and self-reported health issues attributed to waste treatment and disposal (55,61,186), attitudes on waste generation and recycling (175,187), and participatory approaches in waste management planning (173,175). A number of these focused on the southwestern region of Campania, where the saturation of regional waste treatment facilities and illegally dumped toxic waste prompted the declaration of a state of emergency in 1994. Studies into the impacts of the decades-long waste crisis have generated important lessons on some of the complexities related to risk perception, collaborative decision-making and communication. Although the state of emergency ended in 2008 (176,188), inexpedient waste management continues to disproportionately impact health and well-being in specific geographical and socioeconomic regions and neighbourhoods (189).

The review highlighted a variety of meso- and macro-scale cultural factors that contribute to the waste crisis, including ineffective and inappropriate waste management policies and practices (19,175), the interference of organized crime in the entire waste cycle, structural inefficiencies and local maladministration, lack of diversification in disposal options, inadequate reduction or mitigation of waste generation, and local resistance to new incinerators and landfills (188–190). These interrelated issues gave rise to high levels of mistrust and concern about the management and siting of waste disposal infrastructure in Italy (175,189). Many such concerns were validated by studies proving the contamination of soil, water and air, and increased incidences of neoplasms, respiratory diseases and genetic malformations among people living in the vicinity of industrial and toxic waste landfills (176).

Although aggregated figures for the country show an overall decrease in landfilling (51,191) and increase in recycling (96,191), studies emphasized the continued impact of cultural barriers, including institutional failures, lack of public engagement, social conflict and opposition, and insufficient waste reduction. All of these have hampered the successful implementation of recent changes in management policies (176,189). Contemporary Italian waste legislation is based on the polluter-pays principle that, rather than preventing environmentally harmful behaviour, assigns liability

and compensation requirements for damage after it has occurred (188). This top-down strategy relies on and reinforces administrative power rather than involving stakeholders in earlier stages of problem definition and policy-making. A lack of established procedures for public participation led to the emergence of grass-roots movements based on the Italian cultural tradition of struggle (the so-called immanentization of antagonism, or intrinsic relation between struggle and order), which often regards conflict as the only possibility for resistance and participation (188). As such, the cultural contexts for participatory approaches to waste management in Italy are unique.

The Italian situation is further complicated by a longstanding north–south divide in terms of waste management and disposal performance, exacerbated by ongoing decentralization of environmental policies. A 2015 study on whether involvement in cultural practices such as theatre, cinema, music and reading impact recycling rates in Italy found that cultural participation, and particularly interest in diverse fields of culture, is a major determinant of waste recycling: the likelihood of recycling was increased among those who regularly read books (4.5%) and go to cinemas (3.4%) or museums (4%) (74). However, the most significant predictor of recycling behaviour was whether respondents from the almost 20 000 households lived in central or southern Italy: residence in the south correlated with a 29% decrease in the probability of recycling (74).

Inequalities between the geographical regions of Italy are even more evident when differences in socioeconomic factors are taken into account, such as income, social capital and crime intensity (189). This divide is a key example of how different waste-related cultures can coexist within the same country (192), for example, when different cultural and social norms affect the awareness and pro-environmental attitudes of citizens at neighbourhood level and, therefore, result in locally varying recycling rates (74). In the light of these systemic challenges, engaging with cultural contexts in the development of sustainable municipal solid waste strategies is both critical and complex.

The review found that an important first step is the provision of comprehensive information that meets the interests and concerns of all stakeholders and is delivered by trusted, independent bodies using accessible and clearly understandable language (Case study 3). Yet even the clearest and most comprehensive information from academics, policy-makers or practitioners will not lead to widespread engagement, acceptance and compliance if messages are not framed in such a way that people are incentivized to make use of them. Studies from Italy highlighted that inclusive, collaborative decision-making

processes are needed to define a shared vision, promote responsible behaviour and ensure institutional accountability (Case study 4) (172,173). In other words, culturally sensitive, participatory approaches are not simply a way to achieve buy-in for waste management projects or policies: in order to be successful, they must meaningfully shape both processes and outcomes.

Case study 4. Implementing a participatory health impact assessment in Arezzo, Italy

As elsewhere in Italy, the waste crisis created deep-seated mistrust towards municipal solid waste management and infrastructure among the citizens of Arezzo. In the city, a project, Participatory assessment of the health, environmental and socioeconomic impacts resulting from urban waste treatment (2011–2014), was funded by the European Commission. The project was intended to test ways of involving the local population in the establishment of guidelines for waste management strategies to reduce conflict and find common ground, particularly regarding the possible doubling of capacity of a nearby municipal solid waste incinerating plant (193).

The external funding and credible scientific methodology of the project raised public support by providing independent evidence on the challenges and possible solutions (172,173). Early and wide engagement at all stages also helped to convince citizens to participate in the project, and facilitated communication between public institutions and community groups (173,175). Specifically, several public meetings and focus group sessions were conducted to increase communication and overcome knowledge discrepancies, conflicting interests and priorities, and differential risk perception among stakeholders (173,194).

After establishing a common language and sense of shared responsibility, the consultation of local stakeholders enabled a more comprehensive baseline assessment for the next phase of the project. The consideration of local knowledge and varying levels of concern led to the inclusion of additional pathways of exposure, the establishment of an additional disease group, longer coverage of health data, and wider geographical boundaries.

The subsequent participation process revealed different perceptions not only between stakeholder groups but also among local residents. A survey on social determinants of health in the community concluded that residential proximity was associated with higher risk perception, feelings of anger and greater levels of

Case study 4. contd

concern (173). An epidemiological study found elevated risks of hospitalization and mortality related to cardiovascular and respiratory diseases among residents living near the incinerator (173), but difficulties arose when communicating these findings and their implications in policy interventions.

Political and administrative stakeholders expressed limited comprehension of the health impacts per se, and asked for suggestions for more effective interventions and public health strategies to be a translated into lay terms. The owner of the incinerating plant was keen to explore other contributory factors as a basis for future management strategies, whereas communities were interested in identifying future risks for local residents. Nearby residents asked for continued monitoring of environmental pollutants and health risks (173).

Lack of information and communication was perceived to be greatest in the area closest to the waste treatment plant, particularly around the input and output of waste flows and the quality/quantity of waste treated by category. Knowledge on the associated costs of treatment options was mainly limited to downstream economic aspects. Proposed strategies to improve the transparency of the waste cycle included the use of new communication technologies and the organization of cultural events and guided tours of the plant.

Following the participation process, awareness-raising campaigns on the waste cycle and a 3R's programme (reduce, reuse, recycle, recover) were launched at municipal level. The intensive participation process resulted in more effective waste management policies both in the short term through local interventions and in the long term through support for the establishment of the new interprovincial waste plan, including a collective agreement on limited repowering of the incinerator and ambitious new targets for separate waste collection (173).

3. DISCUSSION

3.1 Strengths and limitations of the review

This scoping review of scientific papers and grey literature identified the best available evidence as a starting point for understanding the complex interactions between culture, waste and health, and highlighted the need for more interdisciplinary research in this area. While it found that culture, waste and health were often discussed together, it drew attention to how cultural and social aspects are rarely the central or organizing forces in these discussions.

A strength of the review is its consideration of worldwide literature, although priority in the selection of relevant literature and case studies was given to those from the WHO European Region (see Annex 1). A keyword search of 744 full-text articles found data for 34 of the 53 countries in the Region and identified a range of examples of good practices with some common issues and lessons for transferability. Yet, as with any qualitative analysis that brings together studies from different geographical locations, the review does not provide a generalizable truth that is valid for all countries and cultures. Moreover, valuable lessons could be drawn from insights and experiences outside the WHO European Region, particularly by an in-depth review of studies from the Global South.

The same caution applies to the review's inclusion of research from a wide range of disciplines, which use a variety of core approaches to understand the links between culture, waste and health. While at times overlapping, these approaches are characterized by distinct scales, biases and foci. As direct comparisons between studies from different disciplines, such as psychology and sociology, are not automatically valid on methodological grounds, it was not possible to meaningfully combine all data from individual primary studies into a statistical meta-analysis. Instead, this review aimed to synthesize these studies in a way that attends to differences in method, and mainly used individual studies as examples and cases for a general overview.

Finally, although the review was conducted in English and Russian, with both languages widely spoken in the WHO European Region, there is a potential bias towards studies published in English as these constitute the majority of studies included in the analysis. The peer-reviewed literature was presented descriptively and not formally appraised for quality.

3.2 Summary of findings

Overall, the review found that sustainable approaches to waste management that positively impact health and well-being require a combination of micro-, meso- and macro-scale considerations that involve all stakeholders along the entire cycle of waste creation and disposal, while setting intervention priorities according to the waste hierarchy. Cultural approaches that account for diverse values, needs, capacities and ways of knowing tend to be more successful in terms of higher rates of use and less public noncompliance and complaint, are more sustainable in the long term, and entail better health outcomes for broader groups of people, particularly those that bear higher disease burdens associated with waste management. Successful interventions address the moral and cultural values of stakeholders, and provide technical, legal and political support to foster behaviour change.

Yet, the literature clearly showed that there is no universal approach to understanding waste and mitigating its impact. Some of these differences are linguistic, such as concepts of waste unique to different regions or subcultures (including professional cultures); some are demographic, in terms of how waste impacts the health and well-being of different groups; some are national or regional, in terms of how national cultures approach policy and infrastructure; and others are disciplinary, whereby one approach to understanding the nexus of culture, waste and health can result in different findings than another.

Through recognizing these complexities, the following insights could be gleaned from the literature.

- **Cultural approaches offer a new model of engagement.** Culture is not a stable, background variable that can be instrumentally leveraged in top-down initiatives, and treating it as such tends to result in short-term gains that are not distributed equitably. Adopting a cultural lens – an approach rather than a tool – allows policy-makers to see and understand differences in ways of knowing, being and doing across and within regions and demographics, and to integrate these into wider commitments and frameworks. As such, policy-makers can think of culture within models of engagement that seek to cultivate trust, understanding and commitment among diverse and intersectional populations, agencies and governing bodies.
- **Waste is generated, experienced and managed within cultural contexts, and impacts diverse dimensions of health and well-being.** Municipal solid waste and its unevenly distributed impacts on health are embedded in

broad cultural, social and structural systems. The review's focus on littering illuminates the many health and well-being dimensions of waste, and points to the potential of culturally sensitive, community-led interventions to increase social cohesion, while shifting perceptions and practices towards sustainability in the long term. The review's focus on food waste points to the nuanced interplay of factors that influence waste practices, and how culture can help frame positive change by promoting deeper and more conscious bonds between people and the resources they consume, as well as by building a sense of shared identity around sustainable and health-enhancing behaviours.

- **Tensions exist between different scales of culture.** As cultural contexts on micro, meso and macro scales exert different degrees and kinds of influence, careful consideration of their interrelationships is essential. Each element, from local customs to national norms, holds relevance and has impact. To avoid scalar mismatch, in which problems and attempted solutions are not operating at commensurate scales, it is critical to observe, understand and align the scales at which interventions and the issues they seek to address are operating.
- **Regulations, laws and incentives need a broader focus.** Policies and regulations tend not to address the entire waste stream, and achieve more success with diversion (recycling, composting, incineration) than overall reduction in waste. To catalyse systemic change, waste regulations, laws and incentives should more systematically address the upstream causes of waste by targeting the production and consumption norms of the throwaway culture. To begin, policy-makers can use a cultural lens to evaluate the deficiencies and achievements of past interventions, specifically in terms of uneven impacts on different stakeholders, regions, levels of the waste hierarchy, and aspects of health and well-being.
- **Inclusive and participatory decision-making processes are both crucial and complex.** Engaging diverse groups, particularly those who are marginalized or vulnerable, in decision-making processes related to waste management plans and infrastructure is crucial for incorporating local values, concerns and knowledge; generating public acceptance; and increasing accountability and success in implementation. The review's focus on participatory decision-making illustrates the importance of these transparent, collaborative and culture-sensitive processes, and emphasizes the importance of building in ample time for strengthening relationships and developing trust, creating space for reflecting on diverse concerns, accounting for power differentials, and ensuring that final decisions are clearly influenced by all stakeholders.

- **A cultural lens foregrounds interconnectedness.** Viewing waste and health through a lens of culture necessitates engagement with many interconnected systems and processes (for example, food and water, environmental protection, sanitation, migration, housing, education, and law and governance), as well as the interdependencies of individual and collective practices along the entire waste stream. The review's focus on the cultural contexts of waste management in Italy affirms both the complexity and importance of doing so. Such a lens can uncover trade-offs and synergies between sectors, and contribute to sustainability in the long term.

As discussed, knowledge gaps at the intersection of culture, waste and health are still numerous. The following research questions point to several areas where further investigation by researchers, policy-makers and citizen scientists could contribute significantly to the evidence base.

- How do the linguistics of waste in the many languages of the WHO European Region influence waste-related perceptions and behaviours, and how can these be leveraged in culture-specific initiatives?
- How do different disciplines and sectors conceptualize and investigate connections between culture, waste and health, and what synergies exist among them?
- How does culture intersect with the social determinants of health and demographics?
- How are positive emotions (hedonic well-being) and a sense of meaningful purpose (eudaimonic well-being) fostered in different cultural contexts, and where can they be leveraged as drivers for waste and health initiatives?
- What are the cultural factors that promote participation in citizen science initiatives, and how can policy-makers integrate these to empower and engage diverse populations?
- How can different knowledge systems and ways of seeing be included in policy processes?
- How does culture influence risk perception and risk communication?
- How can narrative approaches be mainstreamed in waste and health initiatives?

3.3 Policy considerations

It is important for regulations, laws and incentives to consider the cultural contexts affecting the upstream generation of waste (large-scale cultures of consumption and disposability) and downstream management of waste (disposal, recuperation, recycling, etc.). While no single technique or mechanism will work across all contexts, based on the best practices and success stories identified in this scoping review, the main policy considerations to develop waste management policies with culture and health in mind are to:

- consider the motivations, values and capacities of the people and agencies involved across the waste stream to inform the planning and provision of physical and organizational infrastructure – from waste bins to landfill taxes to national policies in a way that promotes healthy communities;
- consider how group norms, assumptions and behaviours of policy-makers impact processes and outcomes related to decision-making about waste management, and where shared understanding can be cultivated (in both directions) between professional and lay cultures;
- integrate understandings of health that include more subjective and culturally informed indicators linked to well-being into all phases of policy-making related to waste management and health;
- ensure equitable participatory processes in decision-making about waste management that consults and engages local stakeholders, including vulnerable or historically marginalized people, to effectively assess health risks and better understand, prioritize and address local concerns and perceptions of harm;
- ensure that communication about waste-related health challenges engage with cultural contexts and communities' experiences, and goes beyond one-way flows of information.
- support and scale up relevant grass-roots initiatives, such as community-led clean-ups, art projects or citizen science initiatives to catalyse change and ensure sustainability; and
- develop synergies across disciplines and sectors to foster innovation at the intersection of culture, waste and health.

4. CONCLUSIONS

Drawing on evidence from a wide range of disciplines, this report opens up a systematic engagement with the role of culture in waste management practices and how it impacts health and well-being. Although it found that the social and cultural aspects of municipal solid waste still receive a limited focus compared with technical and economic issues, it affirmed their critical importance. On multiple scales, such factors influence perceptions of what waste is and how it can be prevented; how, where and by whom waste should be treated; how related burdens of harm are (disproportionately) distributed; and what policies are needed in response. Being attentive to these elements and their interrelationships can help policy-makers more sensitively and effectively intervene in the complex interplay of culture, waste and health. Rather than prescribing specific measures, a cultural approach provides a framework for reflecting on and reshaping assumptions and behaviours in both public and professional spheres through consultation, collaboration and flexible communication strategies. Such an approach can impact policies, and policy-makers, in meaningful ways.

In the light of these findings, the review presents a list of considerations for those seeking a more strongly participatory, culturally grounded approach to addressing waste and health issues. With research in this area still in its infancy, plentiful opportunities are available for systematically expanding knowledge and best practices within unique, local contexts. Doing so will be key to achieving the ambitious waste- and health-related goals set out in multiple agendas and declarations within the culturally diverse WHO European Region.

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ANNEX 1. SEARCH STRATEGY

Databases, websites and other sources

PubMed and Web of Science were searched for academic peer-reviewed literature in English between September and November 2018. The strategy was kept broad to ensure all relevant documents were identified. Additional documents were identified through expert consultations, snowballing searching and a search of grey literature, including organizational reports (for example, in WHO and Organisation for Economic Co-operation and Development websites), government papers, and monitoring and evaluation reports to identify case studies. Almost 222 million people in 16 countries in the WHO European Region speak Russian either as their native language or on a regular basis, and research originating from these regions is often published exclusively in Russian (1). Therefore, using the English-language search strategy, a literature search in Russian of two Russian language databases (Elibrary and CyberLeninka) was carried out by a Russian-speaking expert.

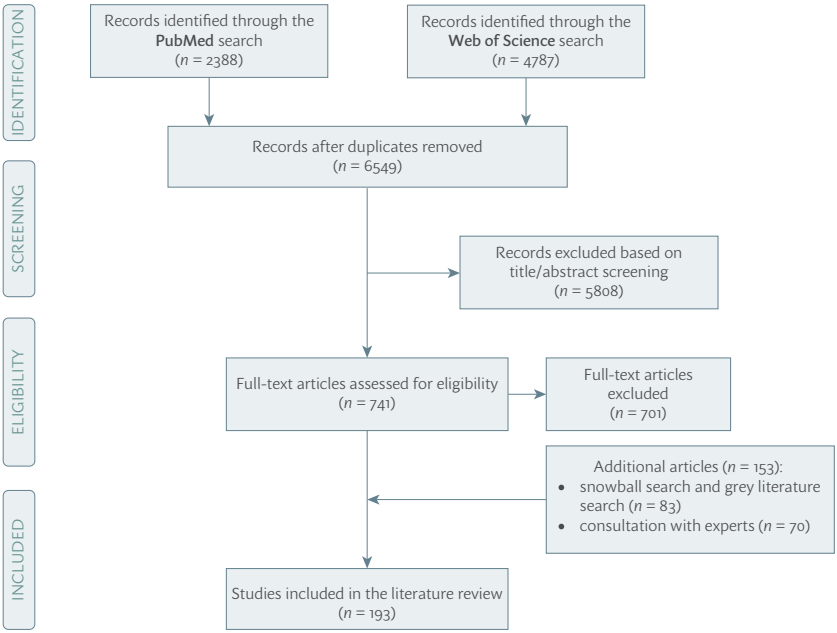
Study selection

Studies were selected according to PRISMA guidelines (Fig. A1.1) (2). The results of all database searches were downloaded and combined into a single database. After duplicate removal, the titles and abstracts were screened for eligibility using inclusion and exclusion criteria and then reviewed by three researchers to identify papers for final inclusion. Any areas of disagreement were resolved by discussion.

Inclusion criteria were:

- peer-reviewed articles, grey literature and case studies;
- a focus on waste in the context of culture and/or health, particularly waste generation; waste management practices; public participation; exposure to environmental risk factors; and consumer habits, perceptions, attitudes and behaviours;
- published between 1998 and 2021; and
- published in English or Russian.

Fig. A1.1. PRISMA flowchart: selection of studies in English



Articles were screened and excluded if their main focus was on one of the following topics:

- animals and veterinary health
- dental medicine
- medical waste
- urology
- diet and nutrition
- prenatal health
- non-infectious diseases
- environmental health
- sanitation
- heavy metals
- biotechnology/molecular biology.

The review focused on articles that gave insights for the WHO European Region, but included some relevant articles from outside the Region. Table A1.1 shows the numbers of records in English included and excluded in title/abstract screening, by topic.

Table A1.1. Title/abstract screening of articles in English

Topic	Records screened	Records excluded
Animals and veterinary health	2 897	2 596
Dental medicine	112	81
Medical waste	550	525
Medical care	399	255
Urology	186	168
Diet and nutrition	169	110
Prenatal health	42	39
Infectious diseases	439	390
Non-infectious diseases	574	533
Environmental health	455	371
Sanitation	146	78
Heavy metals	240	134
Biotechnology/molecular biology	267	195
Outside the WHO European Region	164	111
Others	321	222
Total	**6 961**	**5 808**

Table A1.2 shows the number of records in English and Russian after duplicate removal and applying the exclusion criteria.

Table A1.2. Full-text records in English and Russian assessed for eligibility, by topic

Topic	Records in English	Records in Russian
Exposure to disposal sites/environmental hazards	72	52
Neighbourhood environmental quality/ environmental risk factors	67	49
Occupational health risks	58	29
Knowledge/attitude/awareness/ public support/education	54	24
Reuse/recover/recycling/urban metabolism	49	36
(Municipal solid) waste management	45	74
Electronic waste	45	21
Risk perception/risk assessment	36	18
Food waste	35	34
Participatory waste management	35	10
Household waste/recycling behaviour	33	42
Marine litter/littering behaviour	33	28
Industrial waste/hazardous waste	31	82
Household medical waste disposal	28	22
Landfills/solid waste disposal sites	26	108
Facility siting/location factors	19	12
Guidelines/policies	15	38
Sanitation and hygiene	13	9
Minority communities	13	3

Table A1.2. contd

Topic	Records in English	Records in Russian
Waste prevention/minimization	12	8
Waste management and climate change/disaster response	9	6
Consumption	7	5
Definitions of waste/waste management	6	3
Total	**741**	**713**

Full-text screening of 6549 records in English after removal of duplicates, 5850 were excluded based on title/abstract screening and full-text screening of the remaining 741 studies in English identified 40 articles eligible for inclusion. Complementary snowballing searching and a search of grey literature identified a further 83 articles, with a further 70 identified through consultation with experts, making a total of 193 included in the review. Of the 713 articles in Russian obtained after title/abstract screening, none were included in the review after further assessment.

Search terms

The following terms were used for the PubMed and Web of Science search strategy:

(((((cultural OR culture-driven OR culture-led OR belief OR believes OR value OR attitude OR norm OR identity OR tradition OR convention OR awareness OR practice OR behavio* OR habit OR "community lifestyle" OR "social determinant" OR "social system" OR "social context" OR "social interaction" OR "social pressure" OR perception OR policy OR policies)))

AND

((garbage OR trash OR litter OR rubbish OR "waste management" OR "waste production" OR "waste recycl*" OR "waste reuse'" OR "waste dispersal" OR "waste disposal" OR "waste reduction" OR "waste segregation" OR "waste separation" OR "waste upcycle" OR "waste guideline" OR "waste target" OR "waste program" OR "waste education" OR "waste knowledge" OR "waste practice" OR "environmental practice" OR "waste behavio*" OR "recycling behavio*" OR "waste prevention

behavio*" OR overproduction OR overconsumption OR "waste technology" OR "waste infrastructure" OR "waste facilit*" OR "household waste" OR landfill)))

AND

((health OR mortality OR morbidity OR disease OR well-being OR ill-health OR pathogen*))) NOT cancer

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3. All references were accessed 31 August 2021.

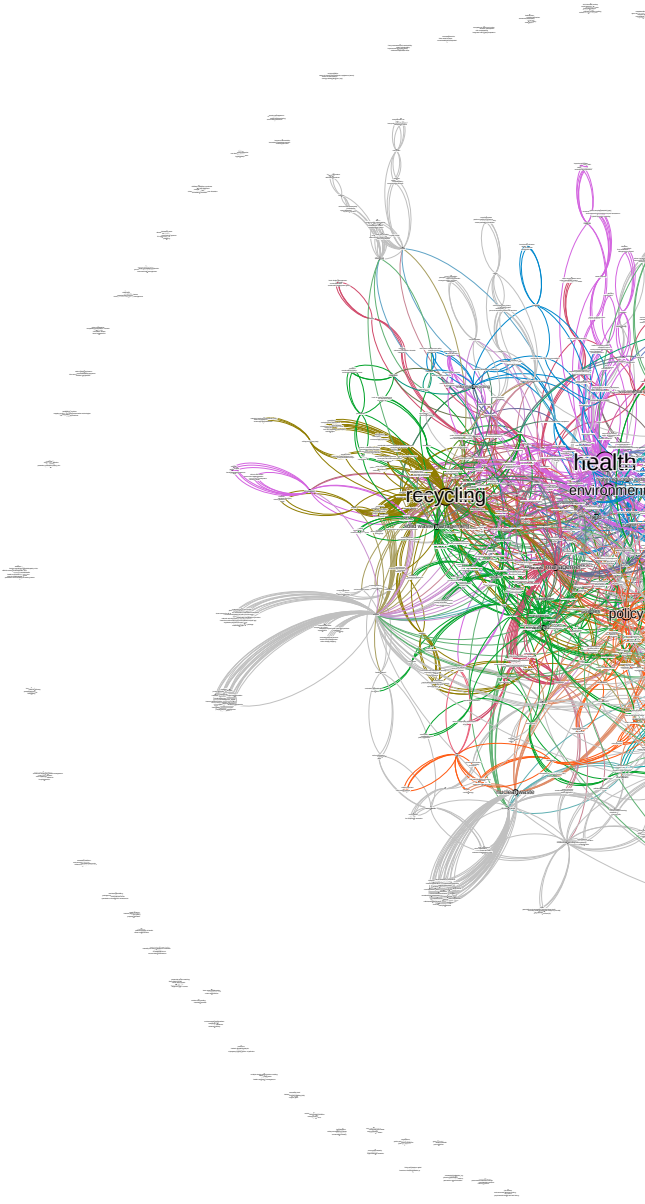
ANNEX 2. DATA VISUALIZATION OF KEYWORDS IN PEER-REVIEWED ARTICLES ON CULTURE, WASTE AND HEALTH

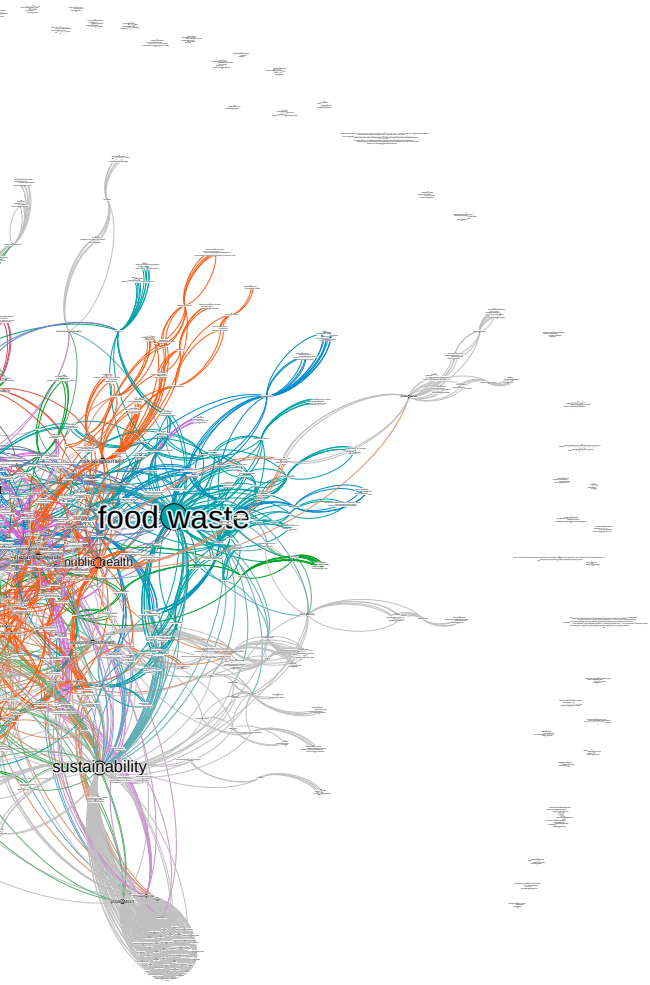
Fig. A2.1 shows the relationships between keywords in peer-reviewed articles on waste, health, and culture before the eligibility stage of screening (741 articles) based on a discourse analysis of the complete textual corpus to investigate the dominant trends and relationships. The size of nodes and the accompanying text indicates the influence of each keyword, as measured by betweenness centrality (how "close" it is to other keywords) and modularity (the most densely connected keywords) to specifically highlight interdisciplinary connections and conversations to supplement textual analysis. Larger nodes indicate keywords that are more similar to all other keywords. The closeness of nodes indicates how often the keywords appear together in the same articles. Small clusters of nodes that are not attached to the main network represent papers that use one of the keywords but are not connected to any other keywords in the corpus (for example, one of the clusters in the centre left of the outer ring is a discussion around the use of waste grains and offal as livestock feed and its impacts on human health). These would have been removed in the final screening.

The seven colours indicate the most densely connected keywords, or community conversations among keywords.

- The **pink cluster** contains keywords related to health, environment, higher education, community and innovation.
- The **turquoise cluster** contains keywords related to food waste, responsibility and citizen science.
- The **orange cluster** contains keywords related to risk assessment, risk perception, risk communication, public health, policy, garbage, radioactive waste, hazardous waste and stakeholder participation.
- The **green cluster** contains keywords related to solid waste management, water quality, wastewater and policies.
- The **red cluster** contains keywords related to waste management, poverty and incentives.

Fig. A2.1 Relationships between keywords in 720 selected articles[4]





4. This network diagram is provided for general visualization only. A fully expandable/zoomable version is available in How do the cultural contexts of waste practices affect health and well-being? Data visualization of keywords in peer-reviewed articles on culture, waste and health: relationships between keywords in 720 selected articles (web-version) (3), where it is possible to zoom in to 1200% in order to read the smallest text.

- The **blue cluster** contains keywords related to circular economy, waste, human health and electronic waste.
- The **mustard yellow** cluster contains keywords related to recycling, plastic and capacity-building.

Grey areas have lower community cohesion and are less central to the main discussions in the identified literature. For example, the **grey cluster** in the lower right is around various forms of disorder in neighbourhoods, and is distantly related to the main corpus through the single keyword "litter".

The network visualization was produced using ScienceScape **(1)** and Gephi 0.9 **(2)**. No filters were applied to eliminate nodes or articles.

References[5]

1. ScienceScape [website]. Paris: SciencesPo Médialab; 2022 (https://medialab.github.io/sciencescape/).
2. The Open Graph Viz Platform. In: Gephi [website]. San Francisco (CA): GitHub; 2022 (https://gephi.org/).
3. How do the cultural contexts of waste practices affect health and well-being? Data visualization of keywords in peer-reviewed articles on culture, waste and health: relationships between keywords in 720 selected articles (web-version). Copenhagen: WHO Regional Office for Europe; 2022 (https://apps.who.int/iris/handle/10665/354583).

5. All references were accessed 31 August 2022.

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