

# Drinking Water from the Tap for Individual and Planetary Health: A Call for Action for Behavioural and Public Health Scientists

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Drinking-water is a human right and it should be available, accessible, affordable, acceptable and safe for all at all times (United Nations General Assembly, 2010). Tap water is widely accessible in many countries in the WHO European Region and the European Union, and it can be a healthy, cheap, and climate-friendly option for hydration. Despite the availability of tap water, the intake of packaged water and sugar-sweetened beverages remains high in Europe (Malik & Hu, 2022; Tosun et al., 2020). Surveys conducted in the European Union showed that between 2012 and 2015 59% of the respondents used tap

water for drinking at least occasionally (ECORYS, 2015), and 49% reported this to be their usual choice for drinking (TNS Political & Social, 2012). However, tap water use varies greatly across countries. While in some of the countries in the north of the WHO European Region (e.g., Estonia, The Netherlands, Sweden, Finland) tap water consumption was reported as very high, many countries remain where consumption is reported to be rather low (e.g., Bulgaria, Cyprus, Ireland, Latvia, and Malta).

In the context of the current climatic crisis, in which a significant human influence has been established (IPCC report, Masson et al., 2021), the high consumption of packaged beverages is of concern due to its high ecological footprint. Moreover, a high intake of sugar-sweetened beverages is of concern due to its proven association with weight gain and obesity, among others. Therefore, the promotion of tap water consumption lies directly at the interface of a number of UN Sustainable Development Goals: Good Health and Wellbeing, Clean Water and Sanitation, Cleaner Production and Consumption, and Climate Change, while being of relevance also for targets related to quality education and reduced inequalities. In the pan-European Region, the UNECE/WHO Europe Protocol on Water and Health (United Nations Economic Commission for Europe, 1992) – an international legal agreement linking sustainable water management and the prevention, control and reduction of water-related diseases – stipulates that "equitable access to water, adequate in terms both of quantity and quality, should be

<sup>1</sup>The author affiliated with the World Health Organization (WHO) is alone responsible for the views expressed in this publication and they do not necessarily represent the decisions or policies of the WHO.

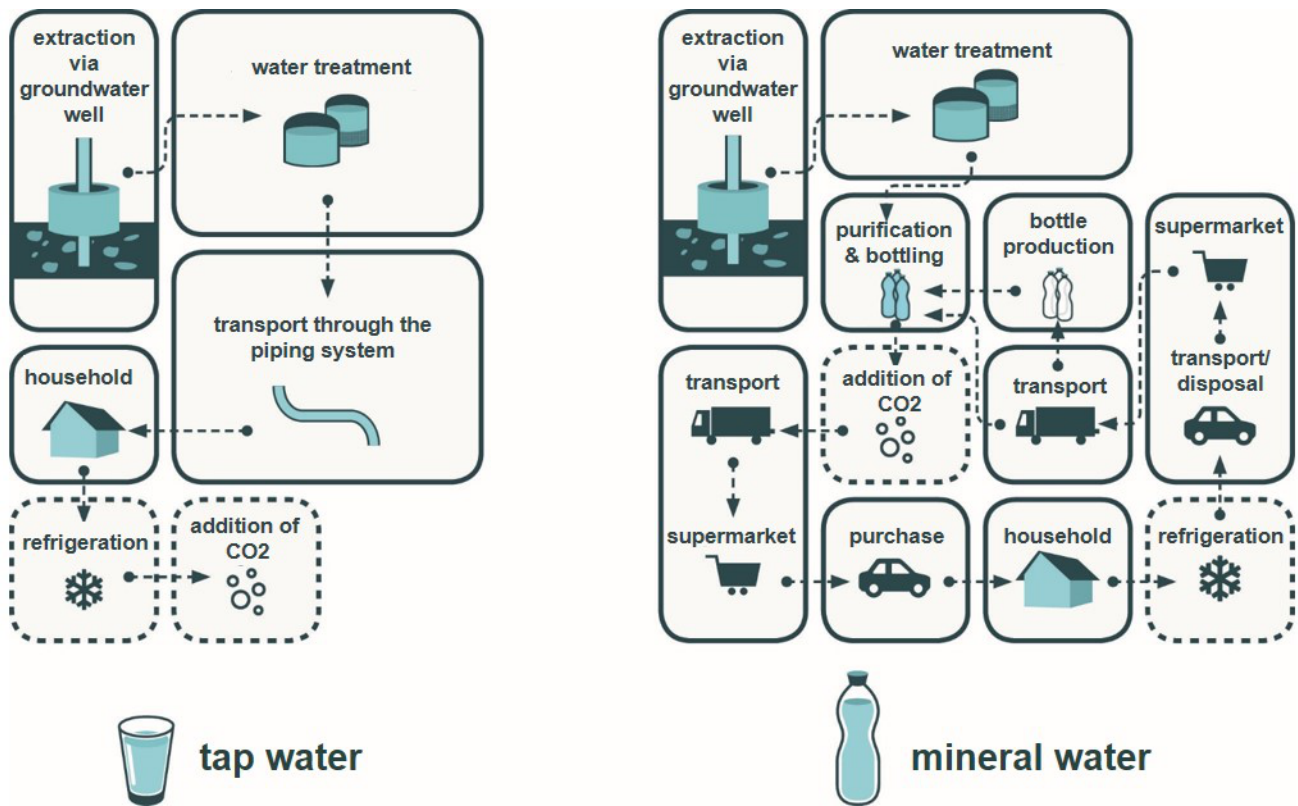


Figure 1: Comparison of Life Cycle of Tap vs. Bottled Water (source: *a tip:tap*)

provided for all members of the population, especially those who suffer a disadvantage or social exclusion". These principles have been reflected also in the revised EU Drinking Water Directive (European Commission, 2020), which states that the Member States should tackle the issue of access to water for all, by increasing relevant infrastructure in public spaces where technically feasible, and by promoting the use of tap water.

Promoting tap water consumption should be made a priority target for improving public and planetary health. In this commentary, we will highlight the significance of choosing tap over bottled water as well as other packaged beverages and discuss avenues for action and behavioural interventions.

## Tap Water Drinking & Planetary Health

Drinking water from the tap has several environmental advantages over bottled water. This becomes most apparent when looking at the lifecycle of one bottle of water as shown in Figure 1. The starting point is the exploitation of oil or gas as feedstock for plastic bottle production or silicate to produce glass bottles. Energy is needed to form and produce the bottle, transport it to the water source, and pump water into it. Long transport routes of filled bottles across countries or continents into stores and from there to consumers' homes use further energy and emit CO<sub>2</sub> (Botto, 2009; Fantin et al., 2014). After consumption, glass bottles have to be transported back and

cleaned to be reused and plastic bottles have to be recycled. However, only around 60% of plastic bottles are being recycled in the European Union, whereas the remaining plastic waste is going to landfills or polluting land, rivers, and oceans (van Calcar, & van Emmerik, 2019; Eunomia, 2020). Various steps in this life cycle also require water, and it has been estimated that, on average, it takes about 5.3 liters of regular water to produce a single 1-liter plastic bottle for water or soda (Ercin et al., 2011; Olson-Sawyer & Madel, 2020). Taking this whole life cycle into consideration, drinking water from the tap has been modelled to have a 1400–3500 times lower detrimental impact on the environment than bottled water, with the exact number depending on the respective setting and context (Villanueva et al., 2021).

The consumption of bottled water contributes to water wastage, air and land pollution (e.g. through uncontrolled disposal of plastic waste, transport and incineration), and climate change due to the higher CO<sub>2</sub> emissions during production and transport.

## Tap Water Drinking & Individual Health

Due to the previously presented effects on environmental aspects and climate change, the consumption of packaged beverages thus indirectly contributes to negative effects on the health of the population (World Health Organization; 2021a). Packaged beverages also include sugar-sweetened beverages, which add to the global burden of non-communicable, cardio-metabolic diseases (Malik & Hu, 2022, Malik et al., 2015). Consumption of sugar-sweetened beverages is associated with increased body weight and obesity (also among children; Williams et al., 2020; von Philipsborn et al., 2020), which also pose a risk factor for type 2 diabetes (Wu, 2019) and liver diseases (Charles-Messance, 2020). Individuals consuming 1-2 sugar-

sweetened drinks (of the size of a can) per day were found to have a 26% increase in their risk of developing type 2 diabetes over individuals who rarely consume such beverages (Malik et al., 2010). Furthermore, sugar-sweetened beverages are associated with dental caries and loss of teeth (Bleich et al., 2018). A 17-year follow-up study found the risk for caries to be around 42% higher in children and adolescents with high sugar-sweetened beverage intake compared to those with low intake (Marshall, 2020). Switching to less energy-dense and ideally to sugar-free drinks is thus considered a priority for promoting health at all ages.

While prices for tap water differ significantly across countries and even within countries (International Water Association, 2019), and there is not yet a standardized method to evaluate its affordability, the price of tap water is generally more affordable than bottled beverages. The National Institute of Statistics in Italy, for example, calculated that in terms of unit cost (Euro per liter), household monthly expenditure on bottled mineral water was about 6,000 times higher than water billed for domestic use in 2018 (Istituto Nazionale di Statistica, 2019). Improving access to and consumption of tap water in households and public spaces – for individuals to be able to choose it as the preferred option for drinking – may thus contribute to the reduction of inequalities and social disparities for the well-being of all, including the poor population and marginalized groups.

Water is already one of the most popular – and healthiest – substitutes for sugar-sweetened beverages (Zheng et al., 2015). While bottled and tap water do not differ in terms of their benefits to human health, tap water is free or at a low charge and readily available at home and, in some countries, in public spaces. Still, many people are reluctant to consume tap water for different reasons. We, therefore, need interventions that specifically target the promotion of tap water consumption. In the following, we will discuss

barriers to tap water consumption and showcase interventions that have been designed to overcome these barriers with the goal to promote human and planetary health.

## Perceived Barriers to Drinking Tap Water in WHO European Region

“The packaging and selling of something that is already [...] available” is one of marketing’s greatest achievements (Queiroz et al., 2012, p. 328). Past marketing strategies for bottled water and water filters have shaped our perception of what safe and healthy water looks and tastes like and what type of water or packaging expresses a certain lifestyle (Brei, 2017). When taking action on promoting tap water, behavioral scientists need to consider influencing factors affecting perceptions about tap water, as described below.

Tap water is one of the best-controlled aliments in Europe, with few country- or context-specific exceptions. In many countries of the WHO European Region national legal standards exist that regulate health-relevant thresholds for contaminants, and surveillance is in place to ensure the safety of the drinking-water (United Nations and WHO, 2018). WHO/UNICEF data (2022) for the WHO European Region show that 95.10% of households have access to water free from fecal and priority chemical contamination (96.91% in the SDG Region of Europe and North America). Nevertheless, surveys from countries in Europe where drinking-water quality is monitored, revealed that perceived issues with safety and quality of the tap water are among the most reported reasons for avoidance. Respondents are mostly concerned about the presence of hormones, drug residues, nitrates, or pesticides in drinking water (ECORYS, 2015). In 2021, almost one household in three (28.5%) in Italy did not trust to drink tap water, stable compared to 2020, although this share has gradually decreased over time

(40.1% in 2002; Istituto Nazionale di Statistica, 2022). This distrust showed a marked geographical variability: from 2% in some regions in the North and higher in the South with up to 60% on the Islands (Istituto Nazionale di Statistica, 2022). It is important to note that some areas where distrust was highest were also observed with the highest frequency of irregularities in the water supply (especially in the South). In addition, bottled water advertising strategies may have strengthened consumers’ beliefs that tap water as compared to bottled mineral water would be of lower quality. For example, one advertising campaign showing a dirty water pipeline along the slogan “Our water stands everywhere except in the pipe” was admonished by the Centre for Protection against Unfair Competition in Germany in 2021. Other advertisements may imply a lack of essential micronutrients, e.g., by emphasizing “natural sources” or branding their product as “sports” waters, while claiming to increase concentration and performance. Micronutrients such as calcium and magnesium are indeed important for health, but they are commonly found in water (except for desalinated water) (WHO, 2009). On the contrary, hardness caused by the amount of calcium and magnesium in tap water may be even perceived as a negative attribute (as it may affect taste and turbidity) rather than a nutritional benefit, though calcium and magnesium may have a protective effect against cardiovascular mortality (World Health Organization, 2017).

Germany is one example of a country with high percentages of compliance for the quality of piped drinking-water (99% according to the German Environment Agency in 2019) and, at the same time, with high rates of bottled water consumption in Europe, underlining that research on tap water has to take regional and cultural differences into account. For instance, most consumers in Germany prefer carbonated water (Elmadfa & Meyer, 2015). Bottled water still is the most common source of carbonated water in Germany, however, more than



one quarter of consumers use a water carbonator to carbonate tap water at home (Statista, 2021).

Another prevalent misconception is that tap water does not taste as good as bottled water, though people were unable to distinguish between bottled and tap water in various taste tests (e.g., Debbeler et al., 2018; Jhuang et al., 2020). It is important to note that chlorine (used to disinfect water in some countries in Europe) as well as desalination, may indeed impact taste and odor. This may reduce consumers' preference for tap water and impede acceptance and effectiveness of water consumption interventions (Doria, 2010; Francis et al., 2015).

Finally, a barrier to choosing tap water exclusively over packaged beverages (at least at home) is the common belief that recycling eliminates the environmental impact of bottled water, showing that compensatory beliefs, as well as moral licensing, might be at play (e.g., "It is ok to drink bottled water as long as the bottles are being recycled"; Saylor et al., 2011).

## How to overcome barriers to tap water consumption

While improving access to safe water remains an important issue – especially in those areas where the quality of drinking-water is not yet ensured at all times or where tap water is not accessible out of the home – it is evident that work remains to increase consumption in the many countries and regions where safe tap water is already accessible and safe to drink. Overcoming barriers at the individual level requires behavioural and cultural insights. Recent studies have focused on consumers' reasons and positive outcome expectancies regarding tap water consumption. Research suggests that individuals choose tap water because it is inexpensive, convenient, and good for the environment (Etale, et al., 2018; Geerts et al., 2020). In order to spread knowledge

about the benefits of tap water, reduce preconceptions and promote tap water accessibility and use, interventions can be implemented on at least three different levels (von Philipsborn et al., 2020): International, national and regional *policies* (e.g., production, marketing, taxes), setting-based interventions in communities to change local food *environments* (e.g., pricing of sugar-sweetened beverages in cafeterias, installing drinking-water points), and behavioural interventions on the *individual level* (e.g., education, risk perception, social norms, and skills for self-regulation).

One factor on a policy level is *affordability*. This implies that the price of water should not present a barrier to access or prevent people from meeting their basic human needs. While continued efforts to ensure equitable tariffs are important, sharing information on the cost that is easy to understand, including the comparisons of bottled and tap water prices, through invoices or smartphone applications could also increase awareness about tap water affordability.

In 2021, an expert workshop by WHO Regional Office for Europe discussed barriers and facilitators for the promotion of drinking-water in general, with tap water being the preferred source of choice, identifying feasible actions for improvements in the Region and applicable at the national and local level (WHO, 2021b). The meeting collected a number of initiatives that were reported as well-received by the population. In the following, we will showcase four initiatives promoting tap water consumption in Europe. These represent also examples of measures suggested in the EU Drinking Water Directive (European Commission, 2020). We will focus on the active ingredients of each campaign in terms of pre-established labels for behaviour change techniques (BCTs; Michie et al., 2013). However, it is important to note, that local characteristics (e.g. water quality, infrastructure) and cultural differences need to be taken into consideration when planning interventions as well.

*Estonia: Call for catering facilities to offer tap instead of bottled water (<https://www.tallinn.ee/en/news/campaign-calls-companies-provide-tap-water-instead-bottled-water>)*

This campaign was launched by the City of Tallinn, the Estonian Hotel and Restaurant Association, and Talinna Vesi, the city's tap water provider, to promote eco-friendly catering. Local hotels, food outlets, and catering companies could join the initiative and show their support through badges displayed in their shops and on their websites. In return, they were also listed on the initiative's website, where interested customers could search the database to identify eco-friendly options (unfortunately the campaign is concluded, so the website is no longer available). This system builds on the following BCTs: introduction of environmental stimulus to "cue" tap water consumption, "material incentive", "non-specific incentive", "non-specific reward", "social reward", "social incentive". Indirectly, this also enables a "demonstration of the [desired] behaviour", i.e. offering tap water to customers, models behaviour that can be repeated at home. Moreover, participating restaurants can "[identify themselves] as role model[s]". For customers that choose to eat at participating restaurants for other reasons, the initiative may have an indirect effect on the awareness of consumers via "exposure" to easily available, good quality and behavioural friendly tap water. On the initiative's website, additional information on the safety of tap water was provided to address potential concerns of restaurants and customers alike ("information about health consequences").

*Germany: Water Revolution and a tip:tap (<https://atiptap.org/en/>)*

This initiative is financed by the German Federal Ministry for the Environment and targets various local stakeholders all over Germany. The intervention components are 1) information and campaigns on the benefits of drinking water at the local level (e.g., "water days" and promotional

activities at fairs and markets), 2) education for citizens and workplaces to increase the demand and consumption for drinking water (education in schools, expert advice for private and public workplaces), and 3) the creation and promotion of access points to drinking water in public and private areas (planning, building and promoting water fountains in school and public spaces). With its diverse efforts, the non-profit organisation *a tip:tap* uses a number of effective BCTs, in particular "restructuring the physical environment" and "restructuring the social environment". The organization targets both individuals as well as private and public structures. The organization supports companies, schools, and kindergartens in testing their tap water to prove safety, installing tap water wells and consulting on how to swap bottled for tap water in cafeterias and business meetings. By implementing water projects and online seminars, *a tip:tap* intervenes on the BCTs "social and environmental consequences" of tap water consumption, "comparative imagining of future outcomes" and increases awareness on the "salience of consequences" for human and planetary health. As means of incentive, certificates for *tap-water-friendly schools* or *water districts* (town districts with tap water points) are issued for participating institutions. Figure 2 is an example of how *a tip:tap* builds a positive narrative on the "identity associated with changed behaviour" by highlighting the benefits of tap water consumption. In *tap water challenges*, the organization also aims to promote "self-monitoring of behaviour", (where individuals or companies track their tap water consumption).

*Iceland: Kranavatn (<https://kranavatn.inspiredbyiceland.com/>)*

"Kranavatn" is a social campaign consisting of a website accompanied by a series of advertisement videos focused on providing information on the benefits of tap water. The initiative makes use of cultural insights related to the close relationship of Iceland with nature highlighting the close

connection of tap water with natural resources and thus addressing the BCT "identity associated with changed behaviour". The commercials focus on education by providing "instruction on how to perform [the] behaviour" and showcasing the advantages of consuming tap water ("pros and cons", i.e. being free). Moreover, the commercials highlight the connection of tap water and the Icelandic nature, underlining the "identity associated with changed behaviour". Finally, consumers can show their commitment to mainly drinking tap water from reusable bottles by taking a pledge on the campaign's website.

*United Kingdom: A map of water refill stations and water fountains (<http://www.refill.org.uk>)*

The app Refill points users towards free water refill stations and water fountains. With the help of the app, users can find nearby food outlets where they can bring their containers or cups as well as shops that are suitable for plastic-free shopping. The app uses the following BCTs: "restructuring the physical environment" and "restructuring the social environment" as well as "changing exposure to cues for the behaviour" by increasing users' accessibility to cues in the environment through the information on where individuals can refill their bottles (provided both in the app and via stickers on shop windows and doors). The app also provides "feedback on behavior" by tracking the number of refills. In addition, the initiative's website offers information materials, which contribute to raising awareness and increasing the "salience of consequences" of plastic use with a specific focus on "social and environmental consequences" by making use of the water refill points.

## Future Role of Behavioural Scientists in Tap Water Promotion

To better understand water consumption habits and socio-cultural influences, to design, and most

importantly to evaluate promotion programs, we will need sound theoretical foundations. Behaviour change models for promoting the consumption of tap water on an individual level will have to include both health and environmental cognitions that shape individual motivation and beverage choice as well as take setting-based variables facilitating or hindering the behaviour into account. There are a number of promising theoretical approaches in health and environmental psychology, which may be used and adapted for the development and evaluation of tap water promotion programs. Such approaches need to be adaptable and should accommodate the following aspects:

- Consideration of individual-level, modifiable social-cognitive factors related to health and environmental concerns (e.g., health-related and environment-related outcome expectancies in social-cognitive theory, Bandura, 1998)
- Consideration of the social context of tap water consumption in the local context (e.g., social norms, van der Linden, 2013)
- Identification of potential variables for tailoring interventions (e.g., accessibility of tap water, educational status, gender, age, stage of change, Health Action Process Approach, Schwarzer, 2008)
- Putting tap water consumption (behaviour A) in context with other risk behaviours (behaviour B; sweetened beverage consumption; RANAS Model, Mosler et al., 2012)
- Consideration of cross-behavioural cognitions at the intersection between health and environmental psychology (e.g., compensatory health beliefs, transfer beliefs)

Most of the public campaigns and initiatives showcased above target motivational factors, such as knowledge on safety and benefits as well as cue-accessibility to prompt tap water consumption from an individual and local perspective. In order to change long-acquired habits, these strategies are a first step, but will need to be complemented by

BCTs to increase post-motivational (volitional) processes such as planning, self-monitoring of progress, healthy habit formation, and coping strategies (instead of focusing on the pre-motivational phase). Long-term behaviour change should be facilitated by establishing local and national policies and regulations for ensuring the accessibility and promotion of the consumption of safe tap water. Finally, behavioural research has repeatedly shown the importance of the physical environment for consumption behaviours (e.g., Hollands et al., 2017). Accordingly, interventions need to implement accessibility of safe tap water in households and in public spaces (squares, commercial areas, restaurants, schools, and workplaces). This may require changes to the physical environment, including adequate treatment devices, water fountains, or labels for outlets with safe tap water. Water should be accessible and affordable for all, including marginalized groups and people with disabilities.

The illustrated initiatives are examples of innovative programs and were reported as being well-received by the public (contributing to the feasibility), but they usually did not include a fine-grained evaluation of programme efficacy (e.g., in terms of change in water consumption, change in individual, regional, or planetary health), nor an evaluation of psychosocial factors explaining why a program was successful. Initiatives to promote tap water consumption should not only be theory- and

evidence-based, but also, whenever possible, be accompanied by high-quality evaluations based on behaviour change theory using well-controlled study designs. Most importantly, future tap water interventions should be evaluated in terms of behavior and health outcomes, as well as in terms of changes in modifiable, psychosocial predictors of tap water consumption. It is these theory-based beliefs and perceptions that we can specifically target with behaviour change techniques.

We advocate the use of established frameworks to guide the development of informed interventions and policies (e.g., Behaviour Change Wheel, Michie et al., 2011; Medical Research Council framework for development and evaluation of complex interventions, Craig et al., 2008; Intervention Mapping, Bartholomew, et al., 1998; Guide to evaluating behaviourally and culturally informed health interventions in complex settings, WHO Regional Office for Europe, 2022). Adopting one of these structured approaches for the development of future tap water interventions will help establish a stronger evidence base as to whether, for whom, and why programs promoting the consumption of tap water work.

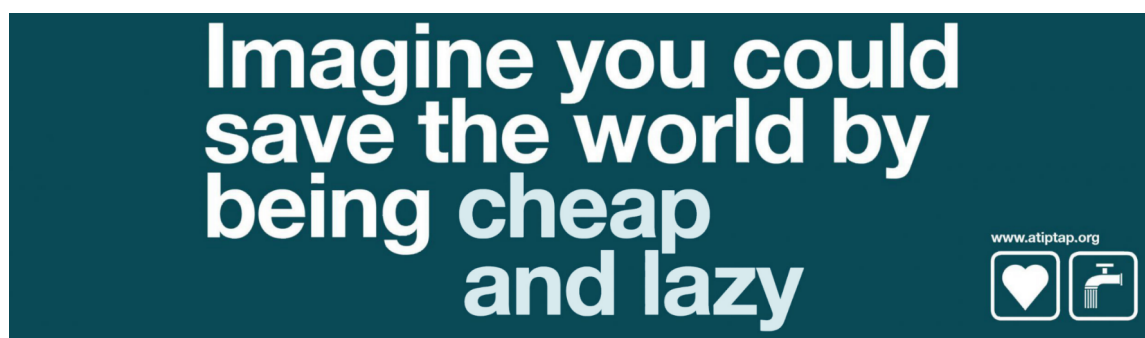


Figure 2 (source: *a tip:tap*)



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