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A survey on hydration and use of plastic water bottles among Italian health sector workers

Camilla Lugli[1], Lucia Palandri[1,2], Simona Pedretti[3], Romana Bacchi[4], Daniela Altariva[5], Giulia Guerzoni[3], Alessia Sala[3], Claudia Vaccari[3], Tommaso Filippini[6,7], Elena Righi[1], Marco Vinceti[6,8], Gabriele Romani[9]

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Abstract

Background. *Modena's Local Health Authority (AUSL) is a public service with more than 5,000 employees. In its facilities, drinking water is available as tap water. However, disposable plastic bottles are also widely used, thus increasing plastic waste.*
Study design and methods. *In the present study, we aimed to investigate employees' drinking habits through an ad hoc 10-item online questionnaire, which was administered in spring 2023.*
Results. *Of the 584 participants (10.8% response rate), 75% of workers reported drinking less than 1.5 liters of water per day. In addition, 74% of workers brought water from home, while 62% used disposable plastic containers bought in the workplace or outside. When asked if they would appreciate a water refilling station in the workplace, whether that would induce them to consume less plastic and to drink more water, 91%, 82%, and 72% of workers said "yes", respectively. By installing water coolers, the estimated mean number of plastic bottles spared every day at the AUSL would be about 6,000.*
Conclusions. *Our data shed light on most employees' perceived need for alternative sources of drinking water, not only in order to drink more for health benefits, but also to reduce plastic usage in favor of reusable, more environmentally friendly materials.*

[1] *Section of Public Health, Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy*
[2] *Clinical and Experimental Medicine PhD Program, University of Modena and Reggio Emilia, Modena, Italy*
[3] *Occupational Health Service, AUSL Modena, Modena, Italy*
[4] *Management Board Office, AUSL Modena, Modena, Italy*
[5] *Nursing Management Staff, AUSL Modena, Modena, Italy*
[6] *CREAGEN - Environmental, Genetic and Nutritional Epidemiology Research Center, Section of Public Health, Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy*
[7] *School of Public Health, University of California Berkeley, Berkeley, CA, USA*
[8] *Department of Epidemiology, Boston University School of Public Health, Boston, MA, USA*
[9] *Clinical Management Staff, AUSL Modena, Modena, Italy*

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Introduction

As the primary component of the human body, water plays an essential role in every physiological function. It constitutes around 60% of body weight in adult males and 50-55% in females, with individual requirements influenced by behavioral and environmental factors. Recognized as vital for optimal health, maintaining adequate hydration is primarily achieved through water intake, supporting body functions, thermoregulation and cognitive performance (1–3). Adequate intake represents the amount of water necessary to meet the needs of most healthy individuals within a specific life-stage group, assuming an average diet and moderate physical activity levels. Despite numerous attempts (1,4,5), establishing universally accepted guidelines for optimal water intake is challenging given the intricate dynamics of the body's water regulation mechanisms and individual variations (6). Hydration, however, plays an essential role in promoting workplace health. Individuals dedicate a substantial share of their time to work, and prioritizing physical and mental well-being in the workplace is paramount. Programs designed to improve lifestyle choices not only bolster employee health, but also boost workplace productivity and decrease absenteeism, nurturing a culture of wellness (7). Increasing awareness of the health advantages of adequate water intake and advocating for proper hydration at work are key components of these initiatives (3,8,9). Additionally, integrating internal green policies and practices is crucial to the pursuit of sustainability objectives (10,11). On the other hand, water may also be a major source of exposure to chemicals of concern, including lead (12,13), selenium (14), fluoride (15,16), and more generally inorganic and organic chemicals (17–20).

Nowadays, supporting water intake may increase plastic waste considerably due to an extremely large use of disposable bottles. In fact, water can be sourced from various outlets, including tap and bottled water. EU Member States implement strict policies ensuring the safety of drinking water (21), with Italy updating its legislation according to EU directives (22). However, distrust in tap water persists in Italy, with nearly one-third of households declining to consume it (23). Consequently, disposable water bottles constitute a significant portion of plastic waste. This contributes to Italy's status as the leading consumer of bottled water in Europe, with recycling rates below 50% (24). The environmental impact of plastic bottles (mainly polyethylene terephthalate (PET) bottles), lies both in plastic waste and the average production of CO_2 emissions through plastic bottles production phases (25–27). The production of a 0.5 L PET bottle of water approximately generates approximately 82-178 g of CO_2 equivalent emissions, including those associated with the entire lifecycle of the bottle, from raw material extraction to disposal (28). In addition, disposable plastic bottle usage raises the risk of exposure to plasticizers, such as phthalates or phthalate substitutes (29,30), and microplastic pollution of water for human consumption. This a current issue currently of considerable public health relevance (31–33), which adds to the more general issue of chemical contamination of drinking water.

Related to plastic bottle production CO_2 emissions are the carbon footprint of healthcare facilities and settings. Healthcare systems worldwide are at fault for 4% of the global CO_2 emissions and consequently for climate change (34–36). Therefore, interventions on healthcare system emissions were a topic of the COP27 and COP28 global negotiations but also a World Health Organization target (37,38).

The purpose of this study is to assess the water habits and intake in an Italian community of health workers. More specifically, our focus is on disposable plastic usage associated with the use of plastic water bottles.

Methods

We conducted an observational study involving employees of the National Health Service's Local Health Authority (AUSL) of Modena, a city of the Emilia Romagna region, Northern Italy, with around 700,000 inhabitants. Modena's AUSL includes 5 hospitals and 7 public health districts with a network of territorial and primary health care services and more than 5,000 employees overall.

We uploaded a structured, self-administered questionnaire including 10 questions via the AUSL intranet platform. An email communication was sent to all employees (N=5,394), notifying them of the availability of the survey for completion. Data were collected between April and May 2023.

The questionnaire included a first section focusing on general information such as age, gender, and job position. A second section investigated water drinking habits, asking workers about the amount of water drunk during an average workday and during the overall day, along with the containers used to carry water to work. A third section investigated the appreciation for a

water refilling stations in the workplace. Survey data were collected and analyzed in an anonymized format. Due to the entirely anonymous collection of data, Ethical Committee approval was waived according Italian and European legislations.

We computed the median and the interquantile range (IQR) for continuous data as well as the absolute and relative frequencies for categorical variables.

Results

Demographics

Overall, 584 respondents from the total workforce (N=5,394) completed the survey, with a response rate of 10.8%. Socio-demographic information can be found in Table 1. Most respondents (80%) were female, and the median age was 49 years (IQR 37-56). The sample is representative of the whole workforce for age and gender. Respondents' occupations spanned from healthcare positions (82%) to other support jobs, including nurses (40%), administrative workers (14%), physicians (11%) and auxiliary nurses (7%).

Water drinking habits

Survey data revealed that, during the entire day, 229 (39%) and 207 (35%) of the participants drink between 1 and 1.5 L and more than 1.5 L of water, respectively, while 128 (22%) participants drink between 0.5 and 1 L. The remaining 3% drink less than 0.5 L per day. During working hours, 281 (48%) and 164 (28%) of the participants drink between 0.5 and 1 L and less than 0.5 L of water, respectively, while 114 (20%) drink between 1 and 1.5 L. The remaining 4% drink more than 1.5 L per day. Percentages for the interval of water drunk are outlined in Figure 1.

Of those who drink less than 0.5 L/day, 95% drink less than 0.5 L during the workhours. Of those who drink more than 1.5 L/day, 43% drink 0.5-1 L during the workhours. Moreover, 72% of the sample prefers still water and off those who drink sparkling water, 48% drink less than 0.5 L during the workdays.

Of the respondents, 151 (26%) buy water in the workplace from the vending machines or the onsite coffee bar or canteen. Most of them (433, 74%) therefore bring to work water containers purchased elsewhere. Of these 443 workers, 220 (51%) reported using reusable bottles as water containers and 181 (82%) declared they fill them at home. Other filling stations include tap water in the workplace and public fountains.

As shown in Figure 2, 364 of the total 584 participants (62%) use disposable bottles to drink water. Of those who drink 1-1.5 L during the workdays, 64% use disposable bottles. Of those who use reusable bottles, 50% drink 0.5-1 L during the workday.

Water refilling stations

As many as 531 participants (91%) declared that they would have appreciated a water-cooling refilling station in the workplace. Interestingly, 82% and 72% declared that a water refilling station would encourage them to use fewer disposable plastic bottles and drink more, respectively (Figure 3).

Estimated plastic waste and carbon footprint

According to respondents' answers, we calculated that the consumption through 0.5 L disposable plastic bottles during a typical workday amounted to 725 bottles. The number of disposable plastic bottles spared daily by study participants, should an alternative source of drinking water be available at work, would be 637 bottles per day. Applying respondents' answer rate to the total workforce such a figure would correspond to a daily spare of 6,370 bottles in the entire Modena AUSL, i.e., over 2 million a year. Furthermore, we quantified that the CO_2 emissions spared by downsizing production by 6,370 PET bottles (0.5 L) would range from 522 to 1134 kg CO_2 equivalents.

Table 1 - Demographic characteristics of the study sample (n=584); *category including technician, physical therapist, midwife, healthcare assistant, prevention technician, biologist, pharmacist, dietician, educator, ambulance driver.

Variable		N	%
Age			
	<29	53	9%
	30-39	117	20%
	40-49	138	24%
	50-59	212	36%
	>60	64	11%
Gender			
	Female	465	80%
	Male	117	20%
Occupation			
	Nurse	231	40%
	Clerk	81	14%
	Physician	62	11%
	Auxiliary nurses	40	7%
	*Other	170	29%

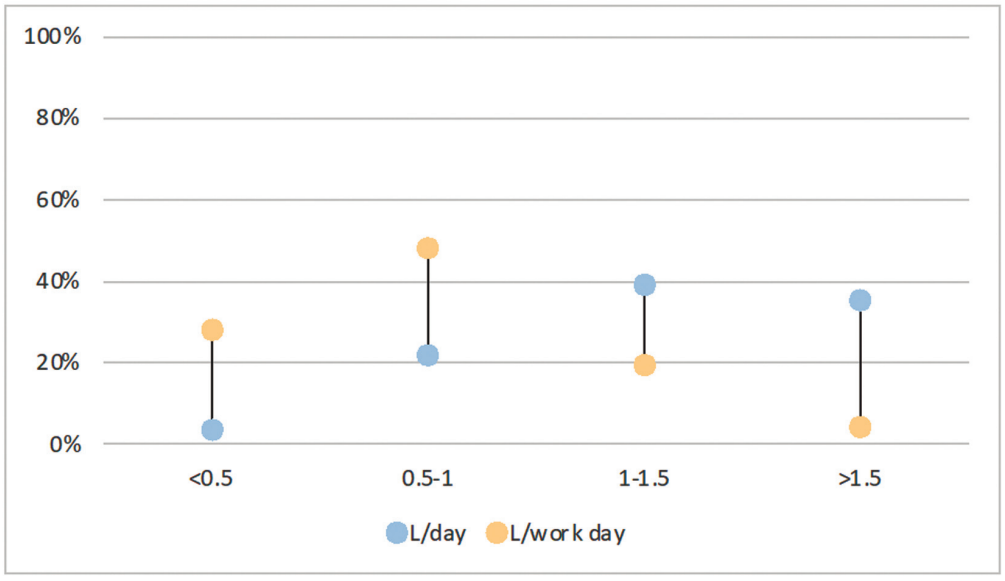

Figure 1 - Average range of water drunk during the work hours compared to the amount of water drunk during the entire day.

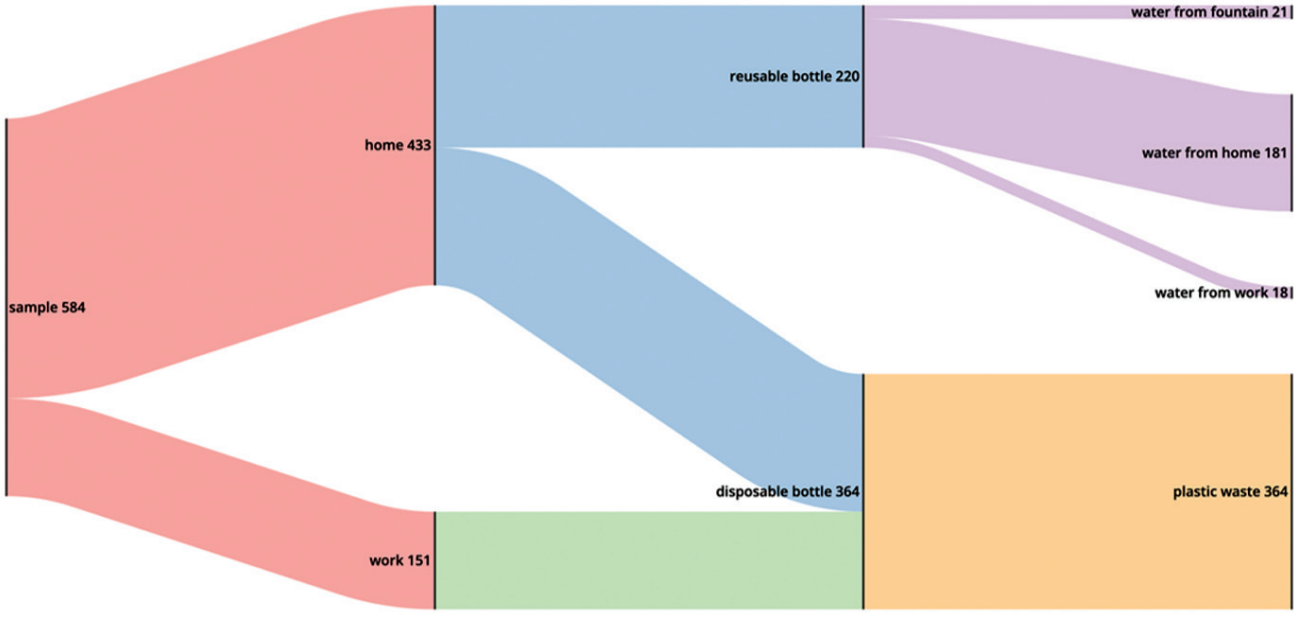

Figure 2 - Sankey diagram of water and water containers use.

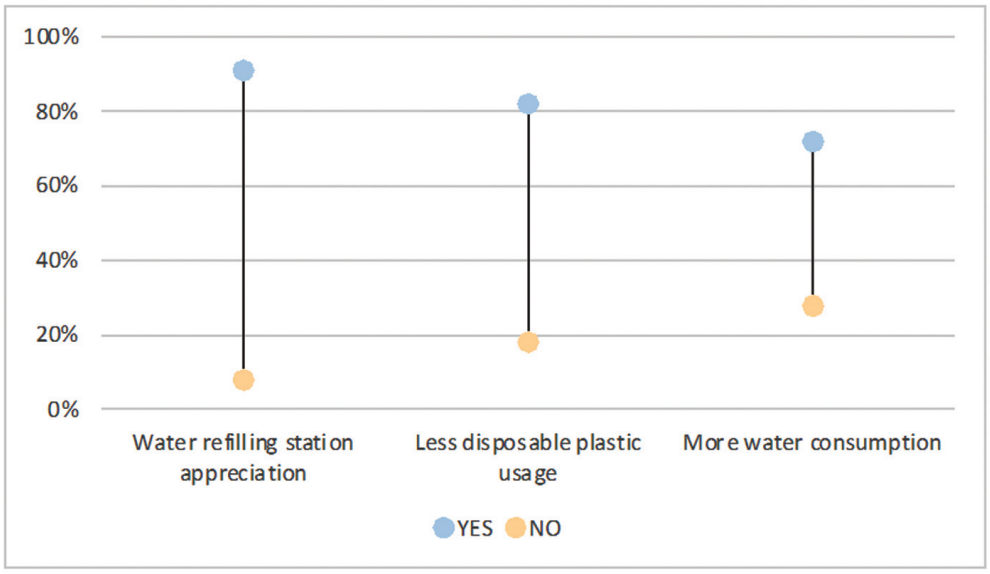

Figure 3 - Workers' opinion (blue "yes" favorable, yellow "no" against) a) over the appreciation of a water refilling station installation, b) over the possibility of using less disposable plastic in the event of a water refilling station installation, c) over the possibility of drinking in the event of a water refilling station installation.

Discussion

The aim of this study was to assess employees' water intake habits in the workplace and the consequent impact in terms of plastic consumption in Italy. We found that most employees reported water intake levels below guidelines. Moreover, data showed that the main source of water was disposable plastic bottles.

We observed that less than 40% of the sample drink daily more than 1.5 L/day of water, a percentage that decreased to less than 10% during workhours. Even though there are no universally accepted cutoffs for optimal water intake, leading authorities like the European Food Safety Authority and the US National Academy of Medicine agree that daily water intake should be around 2.5 L for men and 2.0 L for women (1,5,6). In our population, more than half of the participants reported drinking less than 1.5 L/day. A workplace health promotion program geared towards enhancing lifestyle choices and raising awareness of the importance of adequate hydration at work appears to be warranted.

In the population investigated in the present study, disposable plastic bottle usage was very high, confirming an overall excess of plastic use in daily life. Similar results were found in other countries and different study populations (39).

In addition to the environmental and health issues of plastic waste management, the safety and quality of drinking water within plastic bottles are of concern and currently under scrutiny, particularly for the possible leaching of contaminants into drinking water as well as the environment. High storage temperatures have also been implicated in the degradation of PET in plastic bottles, causing apprehensions over the safety of drinking water stored under unfavorable conditions (40). Such concerns underscore the importance of ensuring proper storage and handling practices to reduce the use of plastic bottles and counteract associated health risks. Of particular concern is the release of plasticizers or microplastics and nanoplastics, with the latter posing heightened toxicity risks due to their smaller size and greater potential for human ingestion (11). In the last decades, we have witnessed a steady surge in the consumption of bottled water, a prevalent source of microplastics. This has been driven by factors ranging from dissatisfaction with tap water quality to perceived organoleptic preferences and the lightness of bottles (41). Dissatisfaction with tap water could explain as well why only 8% of the workers in our survey used tap water as a source of drinking water at work. In light of the detrimental effects on the environment and human health posed by the usage of disposable plastic bottles, a workplace health promotion program

should be implemented. This should include specific education and develop heightened awareness of the health risks posed by inappropriate usage of plastic containers.

Among study participants, we found a great interest for the implementation of a water refilling stations in the workplace. Not only would this have a tangible impact on a more sustainable environment, but it would also incentivize people to abandon disposable plastic usage.

As regards study limitations, we cannot entirely exclude the occurrence of a degree of selection bias, especially recruitment of subjects using non-disposable bottles who are likely more sensitive to the plastic waste topic. If this is the case, the number of potentially daily-sparing plastic bottles would be even higher if the availability of alternative water dispensers and effective promotion interventions were increased. Among study strengths, this is the first study assessing this type of drinking habit in the healthcare workplace in Italy, to the best of our knowledge (42). Our findings underline the high amount of disposable plastic bottles that would be spared by promoting alternative water sources in the workplace, and the related reduction of CO_2 emissions. Considering the adverse effects of climate change on human health (43) and the culpability of healthcare systems to climate change (34–36), this study shows the willingness of healthcare workers to be part of the change to build a more climate resilient healthcare system.

Conclusions

Overall, the findings of the present study indicate that an effort should be made to offer alternatives to plastic bottles and improve health literacy on the importance of proper hydration. This would enhance workers' health and overcome plastic waste problems in occupational environments.

Conflict of interest: The authors declare no conflict of interest.
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Riassunto

Indagine sull'idratazione e l'utilizzo di bottiglie di plastica usa e getta tra i lavoratori del settore sanitario italiano

Introduzione. L'Azienda Unità Sanitaria Locale (AUSL) di Modena è un servizio pubblico con più di 5.000 dipendenti. Nei suoi stabilimenti, l'acqua da rubinetto è potabile e dunque disponibile al consumo. Tuttavia, anche l'acqua in bottiglia di plastica usa e getta è ampiamente consumata, aumentando così i rifiuti di plastica.

Disegno dello studio e metodi. Nel presente studio, abbiamo cercato di indagare le abitudini dei dipendenti al consumo di acqua tramite un questionario somministrato online nella primavera del 2023 e composto da 10 domande.

Risultati. Dei 584 partecipanti (10,8% di risposta), il 75% dei lavoratori ha dichiarato di bere meno di 1,5 L di acqua die. Inoltre, il 74% dei lavoratori ha affermato di portare l'acqua da casa, mentre il 62% ha affermato di utilizzare contenitori di plastica monouso acquistati sul posto di lavoro o all'esterno. All'interno del questionario è stato domandato ai lavoratori se avrebbero apprezzato l'installazione di un distributore di acqua e se questo li avrebbe indotti a consumare meno plastica e bere di più: rispettivamente, il 91%, l'82% e il 72% ha risposto "sì". Con l'installazione di distributori di acqua, è stato stimato che il numero medio di bottiglie di plastica usa e getta risparmiate ogni giorno all'AUSL sarebbe circa 6.000.

Conclusioni. Alla luce dei dati raccolti, emerge il bisogno percepito dalla maggior parte dei dipendenti di fonti di acqua potabile alternative rispetto a quelle già a disposizione. Inoltre, si è osservata la volontà dei dipendenti all'abbandono di contenitori di plastica monouso in favore di materiali riutilizzabili e più ecologici.

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Corresponding author: Camilla Lugli, Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Via Campi 287, 41125 Modena, Italy
e-mail: camilla.lugli@unimore.it