Options for measuring fluid-intake in the daily life

Guillaume Chevance

Tools and Technologies for Drinking Water Quality Assessment

Advancing the Science for Drinking Water Chemical Exposure Assessment and Health Research

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CLASSIC ISSUES WHEN MEASURING BEHAVIORS

Within-person "day-to-day" variance is high

(one assessment day isn't sufficient)

https://doi.org/10.1093/tbm/ibaa026

"Automatic" behaviors are subject to recall bias

(it's difficult to self-report fluid-intake)

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Different methods -both self-reported and more objective ones- have to be combined

BIG PICTURE OF THE DIFFERENT OPTIONS

1

Self-reported

- Paper and pencil
- Smartphone-based

2

“Objective” measures

- Wearables
- Smart containers

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- Most commonly used method in epidemiological studies / part of 24 hour-food recalls

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- Significant under-estimation compared to fluid-specific 7 days record https://doi.org/10.1007/s00394-015-0945-7

- App-based 7 days records capture higher intake and seems to be the preferred option compared to paper-based ones https://doi.org/10.1007/s00394-015-0954-6

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Outcome = quantity

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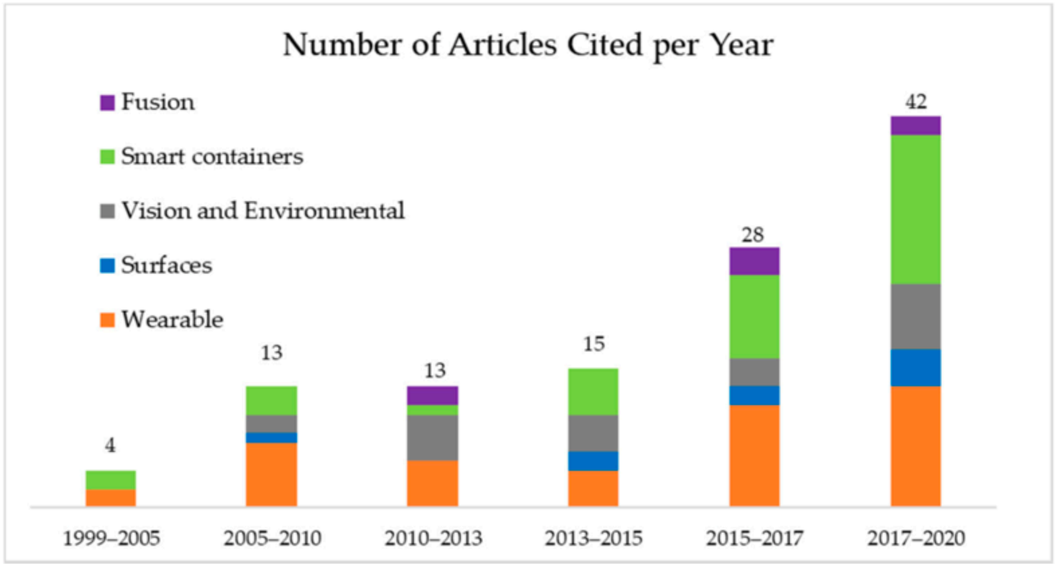
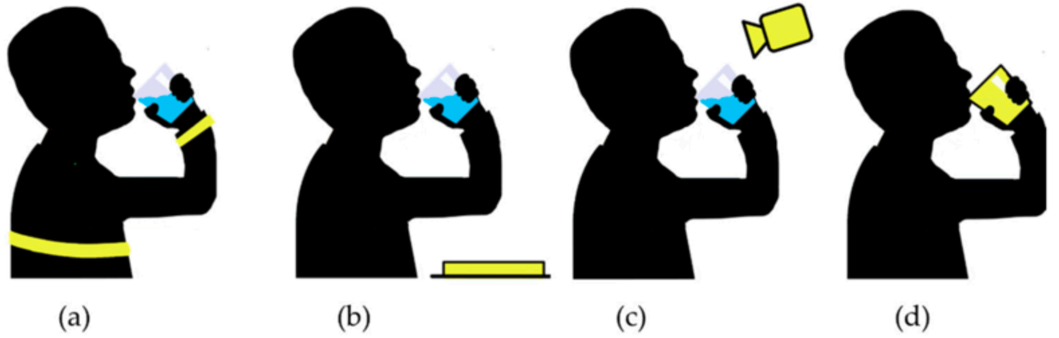


Figure 1. Number of articles reviewed per year.



https://doi.org/10.3390/nu13062092

WEARABLES

Activity monitors
smartwatches

Smart textiles

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SHORT-PAPER

Towards a generalizable method for detecting fluid intake with wrist-mounted sensors and adaptive segmentation

Authors: Keum San Chun, Ashley B. Sanders, Rebecca Adaimi, Necole Streeper, David E. Conroy, Edison Thomaz Authors Info & Claims

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90% accuracy in detecting drinking episodes

Pro = passive measure / only required to wear a smartwatch

Cons = works for only one wrist and not for specific movements (straws)

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Outcome = number of intakes

Figure 5. Images of analyzed commercial bottles: (**a**) HidrateSpark 3 [153], (**b**) Hidrate Spark Steel [154], (**c**) H2OPal [132], (**d**) Thermos Smart Lid [155], (**e**) Ozmo Active [156], (**f**) DrinkUp [158], (**g**) HydraCoach [159], and (**h**) Droplet Tumbler [160].

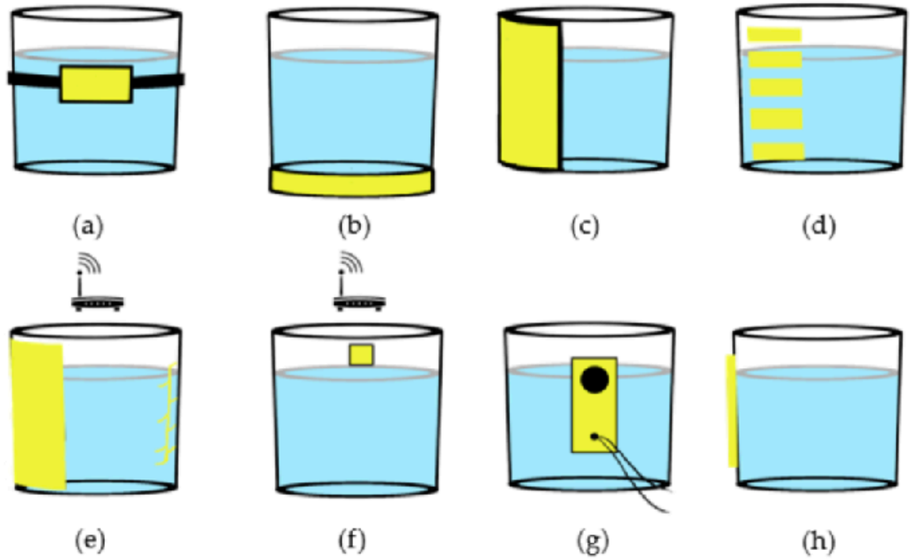

Figure 4. Schematic diagram of various sensor layouts for each smart container category, namely (**a**) inertial [120–124], (**b**) load and pressure [125], (**c**) capacitive [126], (**d**) conductive [127], (**e**) Wi-Fi [128], (**f**) vibration [129], (**g**) acoustic [130], (**h**) and other level sensor [131].

SMART CONTAINERS

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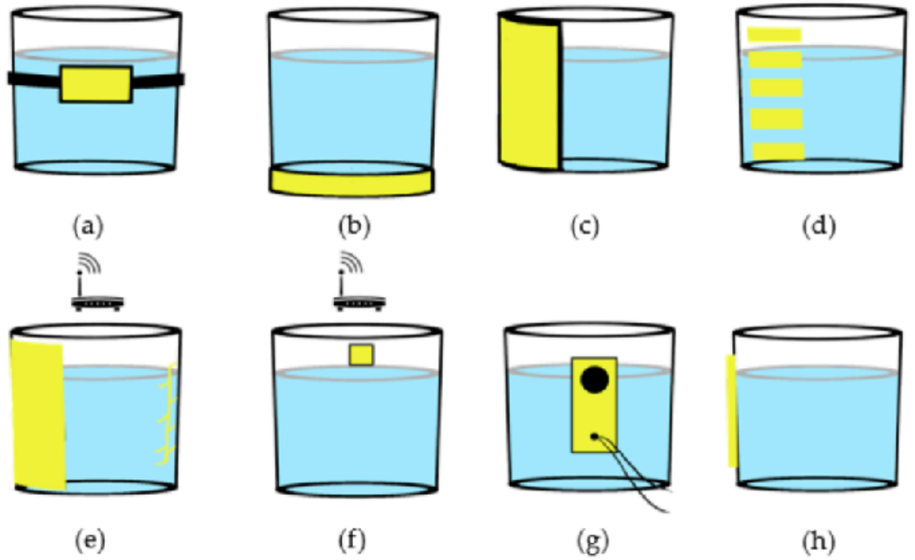
Monitoring fluid intake by commercially available smart water bottles

Rachel Cohen[1,2]✉, Geoff Fernie[1,2,3] & Atena Roshan Fekr[1,2]

Fluid intake is important to prevent dehydration and reduce recurrent kidney stones. There has been a trend in recent years to develop tools to monitor fluid intake using "smart" products such as smart bottles. Several commercial smart bottles are available, mainly targeting health-conscious adults. To the best of our knowledge, these bottles have not been validated in the literature. This study compares four commercially available smart bottles in terms of both performance and functionality.



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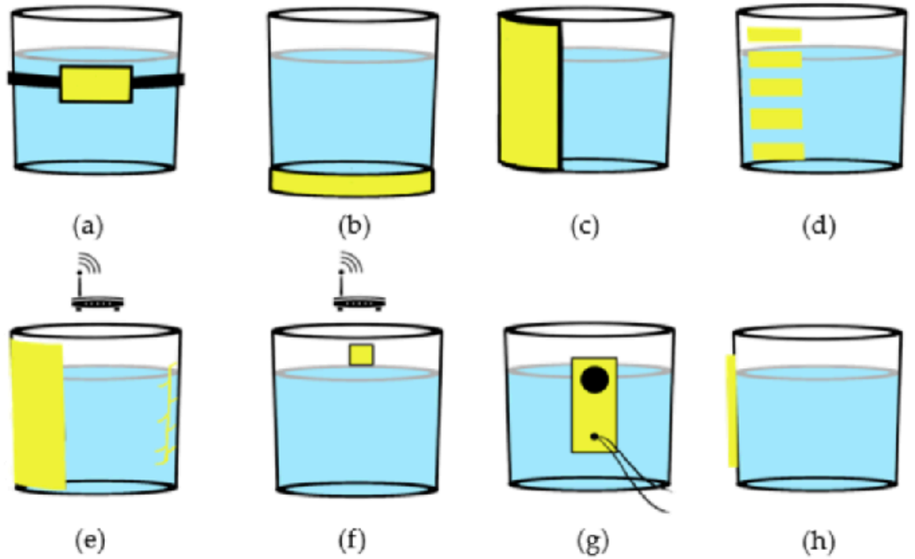
Price ranged between
30 and 100 USD



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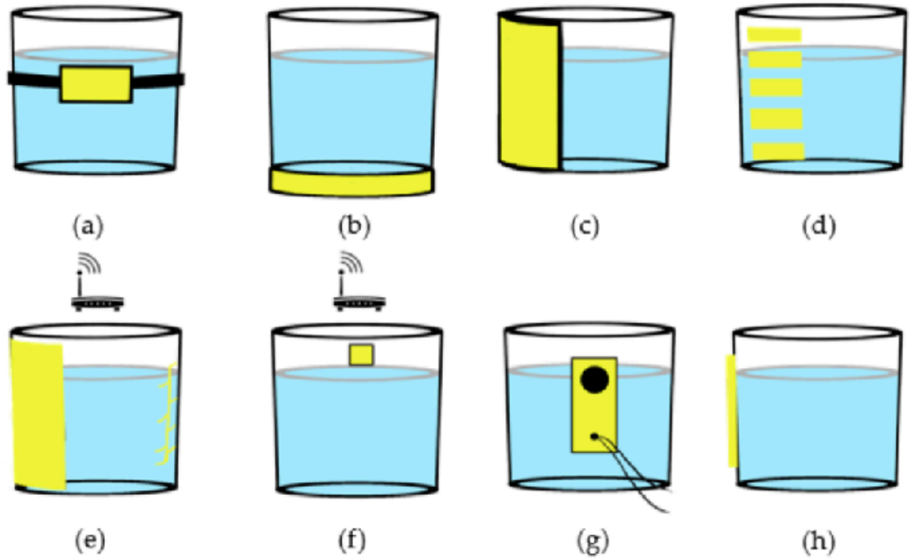
Cons = do not capture specific drinking episodes (coffee/tea mug)



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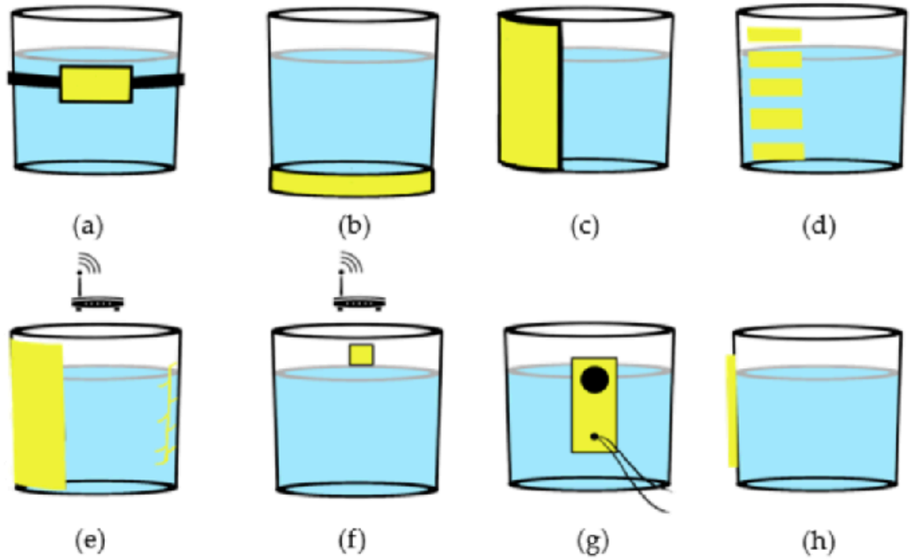
Outcome = number of intakes AND volume



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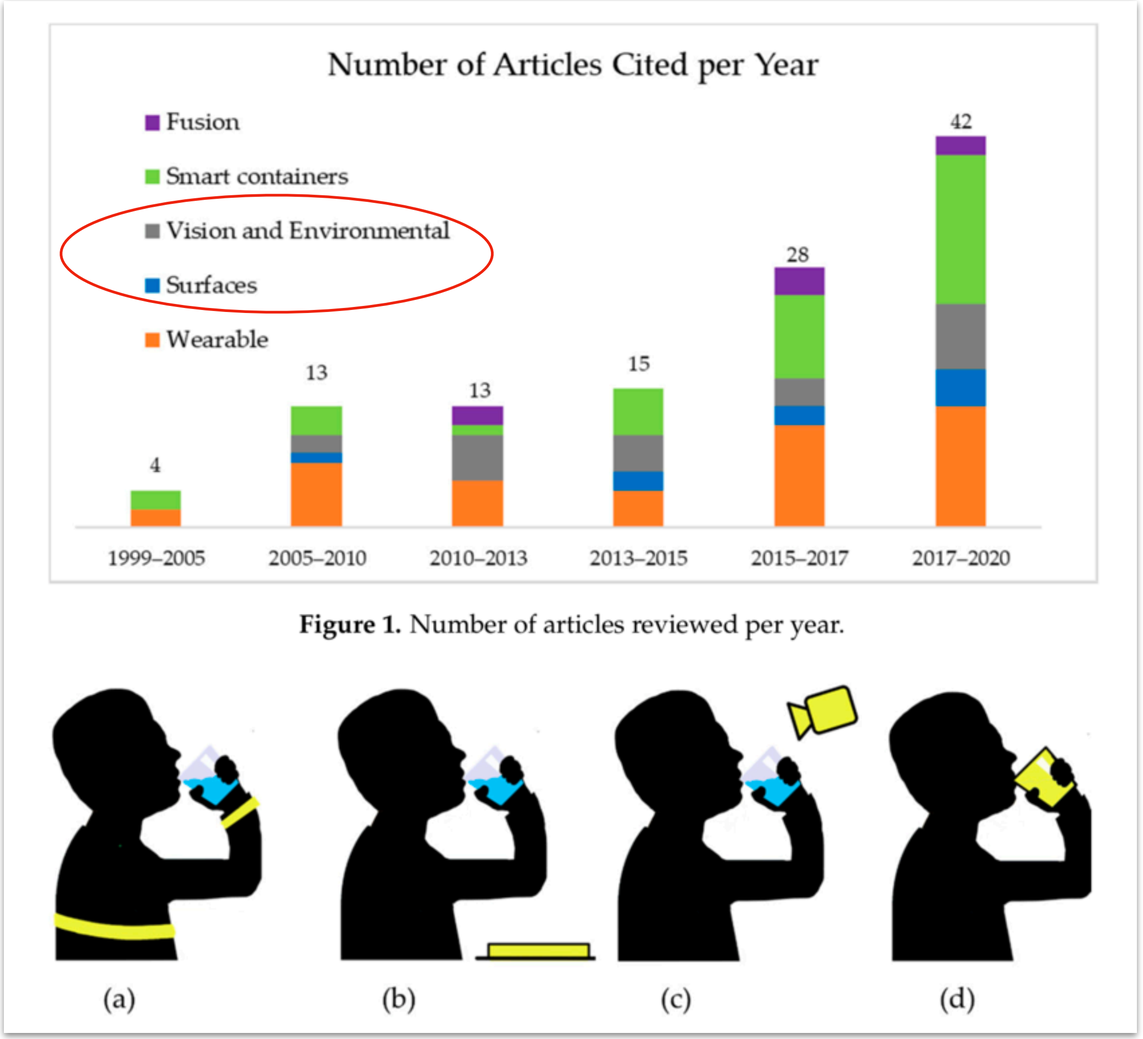

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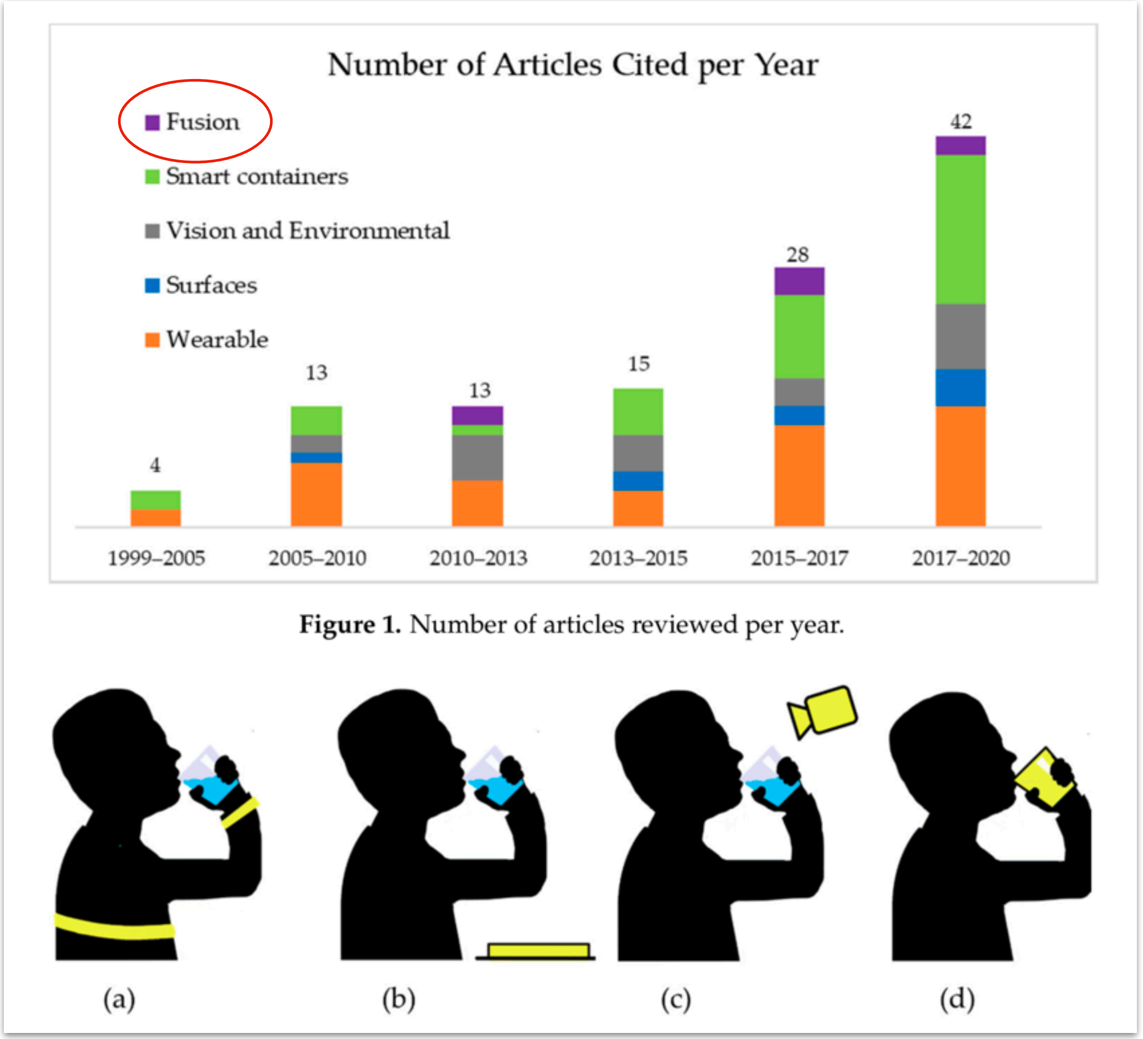

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COMBINATION OF METHODS

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Just-in-time adaptive intervention to promote fluid consumption in patients with kidney stones

David E Conroy [1], Ashley B West [1], Deborah Brunke-Reese [1], Edison Thomaz [2], Necole M Streeper [3]

Activity monitor + Smartphone App + Connected bottle

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Use the whole data flow for sending automatic reminders (notifications)

COMBINATION OF METHODS

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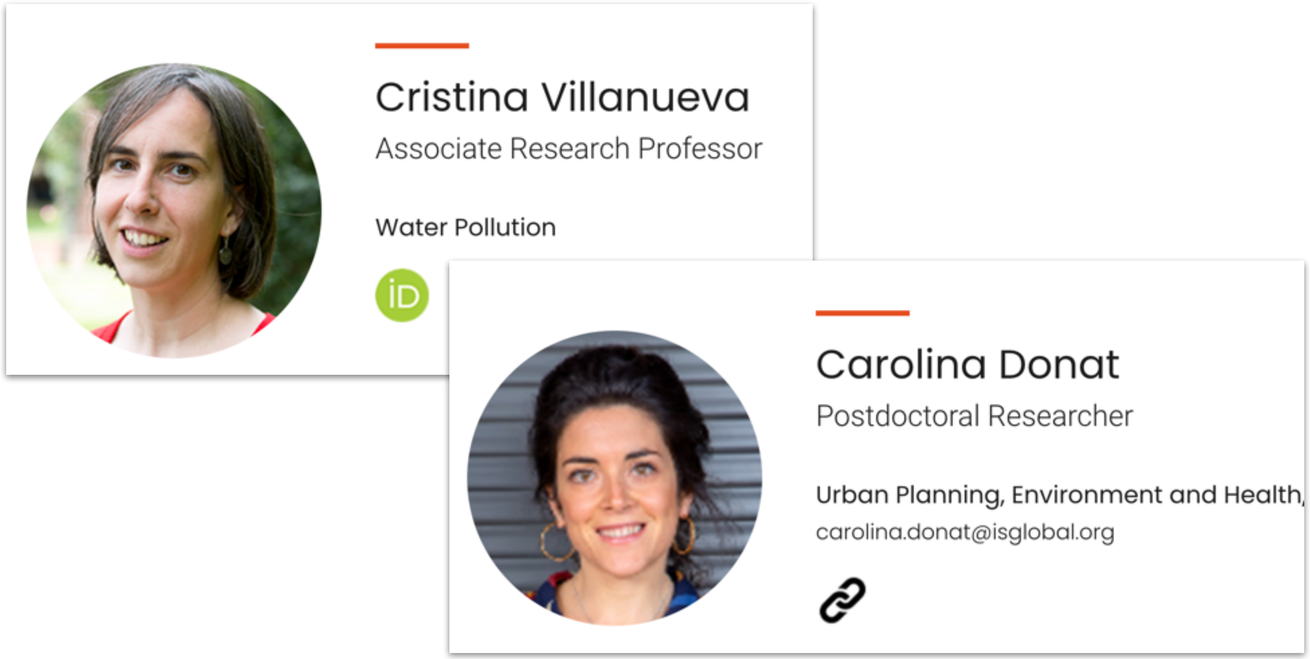
Retention rate good at 3-month



3 times per days
Brief food diary and questions about food packaging

Exposure to Nano- Microplastics and Plastic Additives through Drinking Water

CONCLUSION

- All assessment methods come with pros and cons
- Combination of methods can be an option
- Outcomes differ from one method to another (intakes *versus* volume)
- Accuracy of new technologies looks acceptable (high false positive rate for wearables)
- For self-reported methods, implementation via smartphone and over several days should be preferred