Increasing Water Intake of Children and Parents in the Family Setting: A Randomized, Controlled Intervention Using Installation Theory

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Key Words

Drink · Installation · Social influence · Information · Experiment · Poland · Behavior change · Family · Home · Child · Nudge · Sweet beverage · Obesity · Prevention

Abstract

On average, children and adults in developed countries consume too little water, which can lead to negative health consequences. In a one-year longitudinal field experiment in Poland, we compared the impact of three home-based interventions on helping children and their parents/caregivers to develop sustainable increased plain water consumption habits. Fluid consumption of 334 children and their caregivers were recorded over one year using an online specific fluid dietary record. They were initially randomly allocated to one of the three following conditions: Control, Information (child and carer received information on the health benefits of water), or Placement (in addition to information, free small bottles of still water for a limited time period were delivered at home). After three months, half of the non-controls were randomly assigned to Community (child and caregiver engaged in an online community forum providing support on water consumption). All conditions significantly increased the water consumption of children (by 21.9–56.7%) and of adults (by 22–89%). Placement + Community generated the largest effects. Community enhanced the impact of Placement for children and parents, as well as the impact of Information for parents but not children. The

results suggest that the family setting offers considerable scope for successful installation of interventions encouraging children and caregivers to develop healthier consumption habits, in mutually reinforcing ways. Combining information, affordances, and social influence gives the best, and most sustainable, results.

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Introduction

Adequate water intake contributes to the overall health and well-being, enabling the body to maintain its mental and physical capabilities, and it helps in reducing energy intake and consequent risks of obesity [1]. However, in Europe, the water intake of children and adults remains below recommended levels [2]. There is, therefore, a public health issue of establishing healthy intake patterns in adult and children (whose habits may continue into adulthood).

This research assessed, over 12 months, the impact of home interventions on the water intake of children and parents. Home setting interventions are rare [3]; we identified only two such interventions on hydration habits [4, 5], and these focused on adolescents but did not involve parents. To the best of our knowledge, ours is the first research conducted on families at home, specifically designed to involve parents and to evaluate the impact on young children's fluid intake.

Interventions targeting children's fluid intake frequently focus on the school environment [1, 6–8]. However, there is evidence that home environment significantly influences eating patterns in young children [9]. Parents are crucial as role models [10] and as sources of imitation whose food preferences influence children's preferences [11]. Such effects are strongest for children aged 3–5 [12].

We aimed at identifying which of three interventions had the greatest impact on the water consumption of children. During the first intervention, as in traditional health belief studies [13], we provided information, relayed by parents, about the health benefits of water drinking. In the second, small 'kid size' bottles of water were delivered at the participants' home in order to increase the visibility and availability of water, after ideas of affordances from ecological psychology [14, 15] and echoing 'nudge' in behavioral psychology [16]. During the third, parents had access to an online discussion forum that provided norms of consumption and tips for change, after studies on the social influence of community for lasting behavioral changes [15, 17].

Installation Theory [18, 19] states that behavior is channelled by the combination of three layers of determinants: embodied knowledge, contextual affordances, and social influence. Therefore, we hypothesized that the greatest behavior change (e.g., the largest increase in water intake) would involve a combination of all three interventions, reflecting the three 'layers' of the 'installation' within the household.

Methods

Participants. 439 households in eight cities in Poland were involved. Eligible children were 3 to 6 years old, who drank a maximum 250 ml/day of plain water of all kinds, consumed a minimum of 800 ml/day of sweet hot or cold beverages, and failed to meet the EFSA adequate intake for total water intake of children.

Study Design and Intervention

The experimental design reflects the three layers of installation theory. Initially, participants were randomly allocated to one of three conditions (see figure 1): *Control*, receiving no intervention at all; *Information*, offered information and advice about water consumption; and *Placement*, offered information plus free water bottles at home. Three months later, half of the members of the *Information* and *Placement* groups were randomly allocated to the *Community* condition: an online community forum to exchange support. The study was conducted from May 2012 to May 2013.

The Research Ethics Committee of the Social Psychology Department at London School of Economics and the Bioethics Committee at the Institute of Food and Nutrition in Warsaw approved the protocol. Parents provided written informed consent.

Measures. The parents participating in this research completed a fluid-specific dietary record of the intake of all fluids for children and themselves, over 7 consecutive days [20], in each of six 'waves' (each intervention was assessed for short term effects immediately after; longer term effects were measured 3 weeks and 6 months after interventions – see fig. 1) the present analysis focuses on baseline (wave 1) and final results (wave 6). For in-depth analysis and methodological control, a subsample of five mothers recorded two full days of interaction with their child, using wearable miniature video-cameras, and participated in 'replay interviews' [21] of those recordings.

Data Analysis. We analyzed volumes of water intake, using analysis of variance carried out on SPSS (18.0) commercial software.

Results

At baseline, water consumption was well below the recommended adequate intake level [2] for children; the mean intake was below 55 ml/day and that of parents was below 280 ml/day.

Water intake significantly increased during and after the intervention, for parents and children in all conditions (table 1); all intervention groups significantly increased more than the control group. The largest increases in water intake were observed in the conditions with product placement (placement + community, 56.7% for children; and placement only, 88.6% for parents).

All conditions showed large effect sizes for children (η^2_p varied between 0.34 for the *Control* group and 0.54 for *Placement + Community*), whereas for parents the *Placement Only* ($\eta^2_p = 0.32$) and *Placement + Community* ($\eta^2_p = 0.26$) conditions showed large effect sizes. For children, *Community* increased intake for *Placement* (i.e., *Placement + Community > Placement Only*), but not for *Information* (i.e., *Information + Community < Information Only*). For parents, *Community* increased intake for *Placement* and (to a lesser degree) for *Information*. For children, *Control* increased the effect for approximately 50% of the interventions; for parents, the effect was 20% or less.

Discussion

These findings suggest that the habit of drinking water can be changed among both children and parents; indeed, combining the layers of installation led to the greater increase of daily water intake. The changes of water intake

Fig. 1. Twelve-month study protocol.

Table 1. Evolution of total water intake for all groups at baseline (wave 1) and 12 months follow-up (wave 6)

Children						Parents				
conditions	baseline	12 months	mean change (ml)	% change	p-value and η^2_p *	baseline	12 months	mean change (ml)	% change	p-value and η^2_p *
Control	53.7 (83.4)	171.4 (156.5)	117.7	219.2	0.00 0.34	277.2 (277.4)	338.6 (244.3)	61.4	22.1	0.02 0.08
Information Only	44.0 (67.3)	265.9 (315.0)	221.9	504.3	0.00 0.36	262.8 (315.1)	477.4 (518.8)	214.6	81.6	0.00 0.23
Information + Community	45.9 (67.0)	244.3 (275.5)	198.4	432.2	0.00 0.34	277.8 (287.9)	491.9 (486.7)	214.1	77.1	0.00 0.18
Placement Only	39.6 (57.4)	197.5 (195.8)	157.9	400	0.00 0.41	181.1 (229.3)	341.5 (293.5)	160.4	88.6	0.00 0.32
Placement + Community	38.1 (79.4)	254.4 (219.5)	216.3	567	0.00 0.54	250.4 (256.9)	419.6 (318.1)	169.2	67.5	0.00 0.26

* Mean and standard deviation (in parentheses) of plain water intake (in ml) and % change. By convention, a partial eta-squared (η^2_p) value of 0 to 0.02 is a weak effect, 0.02 to 0.13 is a modest effect, 0.13 to 0.26 is a moderate effect, and >0.26 is a large (practically significant) effect.

observed in the control group over the 12 months suggest that adults are less susceptible to social desirability and/or Hawthorne effects [22] than children. Parents intervened in the children's water consumption, varying by treatment and acting as gatekeepers of children's consumption. Analysis of video replay interviews illustrated this variation. Following *Information* recommendations, they offer children water, also drinking it themselves as role models. Following *Placement*, the visible presence of water bottles triggered water intake by children, by parents, and reminded parents to encourage children's drinking. The effect of *Placement* was even greater when the affordances (here small water bottles) were actually present (at month 3, 80.1% increase for children and 11.8% increase for parents in *Placement* + *Community*); these effects decreased when the affordance was discontinued (water bottles were no longer made available to the household after month 3), before being stabilized at the final measure [20].

The impact of *Placement* on parents was also striking (i.e., resulting in the parents' only large effect size $\eta^2_p > 0.26$); being a gatekeeper (i.e., organizing the choice of available drinks) for others influenced that person. The free water was placed in child-sized bottles for children's use, but taking concrete steps to make this choice available – directing the child's affordances for water drinking – increased both the child's consumption and the parents' own consumption. An important implication is that installation interventions develop feedback loops; specifically, nudging or influencing someone else's choices may also influence one's own choices. Both parent and child changes toward more healthy consumption were mutually reinforcing. This provides strong vindication for implementing healthy changes in family settings.

Conclusion

Increasing water consumption by children and parents is an important matter of public health policy, and our interventions show that this is possible. Informing parents and children about the health benefits of water can increase their water consumption. Combining this with the right affordances (e.g., an increased availability of water), the effect is greater and even more if combined with social influence (e.g., a community). Addressing the complete home 'installation' therefore appears a good ecological strategy for behavioral change.

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Disclosure Statement

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