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Improving hydration of care home residents by increasing choice and opportunity to drink: a quality improvement study

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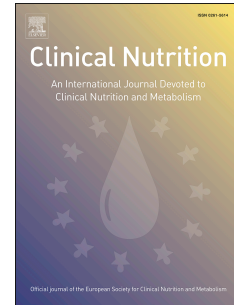
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Improving hydration of care home residents by increasing choice and opportunity to drink: a quality improvement study

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Title page**Improving hydration of care homes residents: a quality improvement project to increase choice and opportunity to drink****Jennie Wilson**

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1 **Improving hydration of care home residents by increasing choice and opportunity to drink:**
2 **a quality improvement study**

3 **Abstract**

4 *Background & Aims:* Dehydration is recognised as an important problem among care home
5 residents and can be associated with severe consequences. Insufficient provision of fluids to
6 meet resident preferences and lack of assistance to drink have been identified as key factors
7 driving under-hydration of care home residents. Using targeted interventions, this study
8 aimed to optimise hydration care for frail older people in a care home setting.

9 *Methods:* The study used quality improvement methods to develop and test interventions to
10 extend drinking opportunities and choice in two care homes. Changes were made and
11 evaluated using Plan-Do-Study-Act (PDSA) cycles. Data were captured on the amount of
12 fluids served and consumed, and staff and resident feedback. The long-term impact of the
13 interventions was assessed by measuring daily laxative and antibiotic consumption, weekly
14 incidence of adverse health events, and average fluid intake of a random sample of six
15 residents captured monthly.

16 *Results:* The interventions were associated with an increase in the amount and range of
17 fluids consumed, in one home mean fluid intakes exceeded 1500ml for three consecutive
18 months. Laxative use decreased significantly in both homes. A number of practical and
19 organisational barriers affected the sustainability of interventions.

20 *Conclusions:* Interventions to optimise the hydration of care home residents can be
21 effective. Plan-Do-Study-Act cycles provide an effective methodology to implement new
22 interventions into existing practice in care homes. Sustainable change requires strong
23 leadership, organisational support and teamwork.

24 **Keywords:** care homes, fluid intakes, hydration, older people, quality improvement

25 Introduction

26 Older people are vulnerable to dehydration due to physiological changes occurring with age,
27 such as loss of thirst reflex, muscle tissue and kidney function.^{1,2} Both, physical and cognitive
28 impairments may also affect their access and ability to consume fluids.³ The consequences
29 of dehydration in older people are severe and include delirium, falls, urinary and respiratory
30 tract infection and constipation.^{4,5} Dehydration is also associated with increased hospital
31 admissions and poor clinical outcomes.⁶ Under-hydration has been recognised as a
32 particular problem for residents in long-term care settings dependent on care staff for their
33 hydration needs, especially those needing active assistance, or prompting, to drink.⁷⁻¹⁰

34 A recent study in the United Kingdom found that 12% of those admitted to hospital from
35 care homes were dehydrated and that the condition is significantly more prevalent in this
36 population compared to patients admitted to hospital from their own homes.⁶ In order to
37 maintain health and prevent dehydration, adults, including older people are recommended
38 to consume a minimum of 1500ml of fluids day.¹¹ Studies have identified that a significant
39 proportion of care home residents have signs of dehydration or impending dehydration.^{1,2}
40 Our work exploring patterns of fluid provision and consumption⁷ suggested that few care
41 home residents consumed the recommended minimum.

42 There is a paucity of studies that have designed or tested interventions to improve the
43 hydration of older people in care homes.¹² Moreover, little is known about the sustainability
44 of such interventions as many studies relied on supernumerary staff to undertake tasks
45 within the intervention protocols.¹³⁻¹⁶ Practicality and acceptability of these interventions
46 need to be tested in the care home environment, and systems developed that enable
47 evidence to be embedded into everyday practice.

48 Detection of dehydration in non-acute settings is not easy. Clinical signs and symptoms and
49 urinary indices are not specific and sensitive enough to be used in this population.¹⁷
50 Conversely, the more reliable blood osmolality is not appropriate, and not routinely
51 available in a care home setting. Therefore, in this study we used a pragmatic approach to
52 measure the efficacy of fluid provision by observing changes in fluid intake. Preliminary
53 work, reported separately⁷ identified a range of difficulties experienced by staff in meeting
54 this fundamental care need for frail older care home residents. This study reports the use of
55 improvement science methods to design, implement and measure the effect of
56 interventions aimed at increasing fluid provision and optimising hydration of care home
57 residents. The paper was written using SQUIRE guidelines for reporting improvement
58 projects.¹⁸

59 **Materials and methods**

60 *Setting*

61 The study was undertaken in two privately operated care homes in West London. Both
62 homes had a mix of residential and nursing care beds, Home A had 160 individual rooms and
63 Home B 146 rooms. The study unit in Home A comprised 25 rooms arranged in two corridors
64 of seven and 18 beds with a separate lounge, dining room and a small kitchenette. In Home
65 B, the study unit comprised 34 rooms arranged in two corridors of 12 and 22 rooms, a
66 combined lounge and dining area and a kitchenette. Both study units provided care for frail
67 older people, some with mild or moderate cognitive impairment. Both homes operated a 12
68 hour shift system with a day shift staffing ratio of one healthcare assistant (HCA) to five
69 residents. In Home A, one registered nurse managed the unit and a clinical nurse manager
70 worked across the entire home between 8am and 5pm weekdays. In Home B, a registered
71 nurse manager worked on the unit between 8am and 5pm weekdays, with an additional
72 registered nurse on duty. At night Home A unit was staffed by one registered nurse and two
73 HCA and at Home B, one registered nurse and three HCA.

74 *Planning the interventions*

75 At each home a dedicated project team, comprising the unit manager, HCA and university
76 researchers, co-designed strategies to improve resident hydration. The respective teams,
77 met once a week to plan and organise testing of interventions and review measurement
78 data. Analysis and review of the data then informed the design and implementation at the
79 next step of improvement activity.

80 *Rationale for the interventions*

81 Previous observations had identified that resident hydration was not prioritised by staff.
82 There were few points in the day when fluids were offered however they were not
83 consistently given to all residents at these times, especially to those who needed assistance
84 to drink. Systems were not in place for serving drinks before or after meals and residents
85 were rarely offered more than one drink at each opportunity. This meant that the majority
86 of residents would rarely be able to consume the minimum recommended daily amount of
87 1500ml. In addition, residents were not routinely asked what they preferred to drink and
88 the full selection of drinks available was not communicated to them. The most commonly
89 given drinks were tea, water and squash. Interventions were therefore needed to increase
90 the number of opportunities and support for residents to obtain fluids and enable them to
91 choose from a range of drinks.

92 An Action Effect Diagram (AED)¹⁹ was developed to connect the overall aim of the study
93 (optimising hydration), with the factors that contributed to effective hydration care and the
94 interventions designed to target these factors (Figure 1). The AED was used to help guide the
95 improvement activities and communicate with relevant stakeholders.

96 The design and implementation of the interventions varied according to each home's
97 circumstances and systems of care. Interventions were tested using Plan-Do-Study-Act

98 (PDSA) cycles.²⁰ This improvement methodology emanates from the work of Edward Deming
99 and has been widely used in UK healthcare for testing changes in real-world settings.^{19,21}

100 *Description of improvement activity*

101 1) Extending drinking opportunities comprised three interventions:

- 102 • Pre-breakfast drinks: a structured approach to providing drinks to residents moved
103 to the dining room prior to breakfast was introduced at Home A.
- 104 • Drinks after meals: systems were established to ensure that residents were offered
105 hot drinks after lunch and dinner at Home B.
- 106 • Protected Drinks Time (PDT): a structured approach to ensuring that all residents
107 were served a drink and where needed, provided with assistance to drink during the
108 mid-afternoon drinks round at Home A and B.

109 2) Supporting and extending residents' choice of fluids was achieved through developing a
110 Drinks Menu, which provided a communication tool to support resident decision making
111 when choosing a drink and encourage staff to offer more than one drink. The drinks
112 menu was also used in conjunction with PDT and was introduced in both homes (Figure
113 2).

114 The project team in each home decided on the priority of the interventions, hence the
115 differences in order and execution were anticipated. In Home A, the project team decided to
116 introduce and test PDT first, the drinks menu was introduced three months later and the
117 drinks before breakfast were the last intervention tested. At Home B, the project team
118 decided to start with some small scale testing of the drinks menu and incorporated this into
119 PDT at the later stage. Drinks after meals were introduced after the menu and PDT were
120 implemented. Details on the length of the testing of each intervention are provided in Table
121 1.

122 *Measurement of the effect of interventions*

1231) Specific data were collected for each PDSA cycle. The effect of interventions were assessed
124 by recording the number, type and volume of drinks served to, and consumed by, the
125 residents. Some cycles focused on feasibility issues and therefore did not include an
126 estimated measurement of fluid consumption. Field notes and staff feedback were collected
127 immediately following each cycle.

1282) Individual fluid intakes were captured every 4 weeks between February 2016 and January
129 2017 by observing the volume of fluids consumed by six randomly selected residents on
130 each unit between 6am – 9pm. The mean volume and standard deviation (SD) consumed at
131 each observation was plotted on a run chart with the median line calculated prospectively
132 from the first ten observations.

1333) Adverse health events (AHE) associated with dehydration (urinary tract infection (UTI),
134 pneumonia/chest infection, falls, incidence of dehydration and hospital admission) were
135 collected weekly from January 2016 to February 2017.

1364) The number of laxative doses and courses of antimicrobial therapy were captured from
137 prescription charts four-weekly from November 2015 to February 2017. Laxative data were
138 aggregated weekly and a statistical process control XmR chart was created for mean laxative
139 doses/resident/day. The mean and the control limits were recalculated if any special cause
140 variations occurred.²² The rationale for using these measures was that if fluid intakes
141 increased, the incidence and/or severity of constipation and infections should decrease with
142 concomitant reduction of laxative and antibiotic use.

143 *Funding and ethical approval*

144 This project was funded by the National Institute for Health Research North West London
145 Collaboration for Leadership in Applied Health Research and Care (NIHR NWL CLAHRC).

146 The study was considered to be 'service evaluation' and did not require submission to the
147 Health Research Authority, but approval was obtained from the College of Nursing,
148 Midwifery & Healthcare research university ethics panel at the University of West London.

149 **Results**

150 *Drinks before breakfast/with meals*

151 At Home A, the offer of a drink before breakfast for residents in the dining room resulted in
152 average fluid consumption ranging between 158-170ml (Table 2) for all cycles except the
153 second, where staff were not briefed before the activity. By the final cycle, all residents
154 present in the dining room received a drink with a maximum fluid intake of 380ml in the
155 period before breakfast. Receiving a pre-breakfast drink had no adverse effect on the
156 amount of fluid a resident subsequently consumed at breakfast. Modifications made during
157 the test cycles included briefing of HCA and preparing flasks of hot drinks for use by HCA in
158 the dining room (final format is presented in Table 3). Staff reported that offering residents a
159 drink before breakfast had minimal impact on their workload and that it could be
160 incorporated within the daily routine. Verbal feedback from residents was encouraging, one
161 resident commented that having a drink at this time gave them "something to do" as they
162 waited for breakfast to be served.

163 At Home B, the offer of a drink after meals for residents in the dining room/lounge resulted
164 in average fluid intakes ranging from 124-158ml with more than half of residents accepting
165 the offer of a drink following their meal. Although every resident was offered a drink during
166 the first cycle, this did not occur during subsequent cycles. All residents who accepted the
167 offer of a drink after lunch also accepted a drink at the next drinking opportunity, mid-
168 afternoon PDT (data not shown). Modifications made during the test cycles included the
169 catering assistant preparing flasks of hot drinks for HCA to use in the dining room. Staff
170 reported they had enough time to offer and provide drinks to residents as part of their

171 routine. Nonetheless, data on fluid intakes indicate that some residents did not receive the
172 assistance they needed to drink (Appendix 1).

173 *Protected Drinks Time & Drinks Menu*

174 In Home A, across the five cycles where data was collected, the proportion of residents
175 receiving a drink at PDT was 80-100% with a mean fluid intake ranging from 142-182ml. By
176 the final cycle, 39% of residents received more than one drink, although some residents
177 (26%) were still consuming little (less than 50ml) at PDT (Appendix 2). Across the cycles,
178 modifications were made to allocate staff to activities, ensure the cups and trolley used to
179 serve drinks were returned to the unit after lunch, and that staff returned from their breaks
180 on time. Modifications were supported by staff briefings in order to inform and reinforce
181 practice. Verbal feedback from staff and residents indicated that PDT was an effective way
182 of providing drinks to residents. However, sustaining PDT was problematic. Within two
183 months of implementation, monthly observations of fluid intake indicated a reduction in
184 both the number of drinks provided, and the percentage of residents given a drink. This was
185 corroborated by specific data captured on PDT approximately a month after
186 implementation, which showed a reduction in both, the number of drinks provided (0.43 per
187 resident) and the percentage of residents given a drink (43%).

188 In Home B, across the seven cycles where data was collected, the proportion of residents
189 receiving a drink in the mid-afternoon was 80-100% with mean fluid intake ranging from
190 149-246ml (Appendix 3). By cycle seven, 60% of residents received more than one drink,
191 with just 10% (3/30) residents consuming less than 50ml. Modifications included
192 introduction of a second drinks trolley and staff allocation sheet, staff briefings, designating
193 staff to record resident fluid intake, use of a simpler pictorial drinks menu and skills
194 modelling for HCA in using the drinks menu. HCA reported that the clear allocation of roles
195 and responsibilities encouraged a greater sense of team work. Verbal feedback obtained

196 from residents during PDSAs was positive, many said they were happy to have both a hot
197 and a cold drink. However, in practice, HCA did not always devote time to assisting residents
198 with drinking or offer drinks refills.

199 At both homes, staff were observed to use the drinks menu inconsistently. Some HCA
200 reported that it was time consuming to offer residents a choice or that residents were
201 unable to make a choice due to cognitive impairment. Implementation of the drinks menu
202 was also compromised when drink stock was not available on the unit. Inconsistent
203 communication as to who was responsible for ensuring a sufficient stock of the full range of
204 drinks on the unit contributed to this problem.

205 *Impact of interventions on fluid intakes*

206 In Home A, fluid intake increased when the interventions worked successfully (Figure 3).
207 However, the improvement was difficult to sustain and mean fluid intakes of 1500ml or
208 more were not achieved. In Home B, the PDT and drinks menu were successfully embedded
209 in routine practice, however this took several months to take effect. With both trolleys
210 available to support PDT, fluid intakes increased above 1500ml and were sustained for three
211 consecutive months. The standard deviation (SD) for each sample provided an indication of
212 the variation in fluid intakes between the different residents included in the sample. Wide
213 SD indicated that the fluid intakes of residents in the observed sample were highly variable;
214 narrow SD indicated that the fluid intakes were similar across the residents in the sample. In
215 Home A, the SD suggest that the initial increase in fluid intakes benefited only some
216 residents (probably independent drinkers). By the end of the study narrower SD indicated
217 that fluid intakes were more consistent across the sample, but the mean intake was still less
218 than 1500ml. In Home B, the mean fluid intake increased to more than 1500ml by the eight
219 month and was sustained at this level. Compared to Home A the SD were relatively narrow

220 over the period of study indicating less variation in fluid intakes between residents in the
221 sample.

222 *Impact of interventions on Adverse Health Events and medication use*

223 There was no change in the incidence of Adverse Health Events (AHE) and throughout the
224 project there was no significant relationship between monthly fluid intake and incidence of
225 AHE (data not presented). However, this is not unexpected given the small sample size,
226 modest increase in fluid intakes and the relatively low incidence of these events.

227 Dehydration proved difficult for staff to identify and was rarely reported (four events in
228 Home A and eight in Home B over the study period).

229 There was a significant decrease in the average daily laxative consumption at both homes
230 after six months of improvement activity (Figure 4). There was no change in the use of
231 antibiotic therapy observed throughout the project (data not presented).

232 **Discussion**

233 Our study has demonstrated that interventions aimed at increasing both choice and
234 opportunity to drink were effective in increasing fluid consumption in care home residents.

235 Our earlier work had demonstrated that residents are at risk of under hydration because
236 they are not routinely offered sufficient drinks during the day or assisted to consume fluids

237 where necessary. The interventions were therefore designed to address problems by

238 integrating new drinking opportunities with existing staff activity and guiding staff to

239 address resident needs and preferences. In addition, given that we had previously

240 demonstrated that the majority of residents were not offered enough to drink, our

241 interventions aimed to increase drinking opportunities for all residents rather than solely

242 targeting individuals perceived to be at risk of dehydration.

243 Although other authors have suggested that older people's fluid intakes are governed by
244 their reluctance to drink,^{1,2} this study found that when given the opportunity, choice and
245 assistance, residents accept more drinks and will have drinks before, with, and after meals.
246 Concerns raised by staff that providing extra drinks would reduce the amount residents
247 consumed at the next drinking opportunity were shown to be unfounded. Providing
248 additional structured drinking opportunities supported an increase in the number of
249 residents receiving drinks and resulted in more fluids being consumed. Whilst PDT benefited
250 most residents, including those who needed assistance, the additional drinking
251 opportunities (before breakfast and after meals) primarily targeted those who were
252 independent as they tended to be only offered to those in the dining room/lounge. Further
253 work is required to extend this intervention to residents in their own rooms, including
254 ensuring adequate support to drink is provided.

255 Other studies reported that residents often restricted the fluids they consumed to avoid
256 incontinence,¹ this was also reported in our previous work where the residents mentioned
257 toileting issues prevented them from drinking adequate amounts.⁷ However, during this
258 study, we did not observe the residents refusing the drinks or limiting the amounts
259 consumed due to this reason. In fact, where preferable fluids and appropriate assistance
260 were given, residents tended to consume entire drinks and sometimes requested refills.

261 A number of key factors influenced the success with which change was embedded into
262 practice and subsequent sustainability of the interventions. These included allocation of
263 staff to activities, availability of stock/equipment, communication systems and leadership of
264 the care team.

265 The development and utilisation of a staff allocation sheet was central to embedding PDT
266 into the care routines. In both homes, prior to the introduction of PDT, one or two HCA
267 prepared and delivered drinks to all residents. However, two or three drink choices were

268 prepared and no staff were allocated to doing this. There was also no structure for
269 supporting residents to consume the drinks given. Assigning each HCA a specific role during
270 PDT encouraged teamwork and directed HCA time to actively helping in drink distribution
271 and supporting residents to drink. Furthermore, clear role allocation helped avoid confusion
272 as to which residents had or had not been given a drink.

273 The consistent availability of supplies and equipment to effectively deliver PDT and the
274 drinks menu was problematic in both homes. Problems were context specific with the
275 logistics of having cups, drinks and trolley available in time for 3pm being key issues in Home
276 A, and issues with availability of the full selection of drinks to equip two trolleys in Home B.
277 These barriers could be avoided by addressing the interaction between HCA and catering
278 staff and developing processes to assign clear responsibility for ensuring equipment is
279 available when required.

280 Communication between HCA about residents care needs and preferences was observed to
281 be predominantly verbal with residents' care plans rarely accessed by HCA. New staff were
282 more likely to ask established staff about residents' fluid preferences rather than ask
283 residents directly. This was the norm on both units and partly explained the reluctance of
284 HCA to use the drinks menu; they assumed they knew their residents preferences. Reliance
285 on assumed preferences resulted in a lack of opportunities at which residents were enabled
286 to exercise autonomy. Assumption of decision-making rather than facilitation is an issue
287 across the long-term care sector.²³ In addition, some HCA demonstrated a lack of confidence
288 in communicating with residents to support decision-making, suggesting specific training is
289 required. The nature and quality of communication and relational networks have been
290 considered as important influences on the implementation of an intervention.²⁴ Thus,
291 communication issues are likely to have impacted upon the consistent implementation of
292 the interventions.

293 Neither home had a formal process for identifying residents with low fluid consumption. The
294 relay of information between qualified and unqualified staff about residents' hydration care
295 needs was informal and ad hoc. This, combined with a lack of defined responsibilities for
296 specific residents in relation to hydration, meant that poor intakes went both unnoticed and
297 unaddressed by both HCA and qualified staff. These problems have significant implications
298 for quality of care and have been highlighted in other research.^{25,26} This lack of information
299 contributes to the low priority given to hydration in the routine of care delivery and the
300 difficulty in achieving and sustaining optimal fluid intakes. In our study, monthly data on
301 daily fluid intakes was captured by research staff but it was not feasible for one person to
302 capture this data for more than 6 residents at any one time. Simple, accurate methods of
303 monitoring fluid intakes of care home residents are required to support efforts to optimise
304 hydration.

305 To embed and sustain practice that supports resident hydration, the role of the unit leader is
306 critical. They need to be actively engaged with the HCA to assign, promote, supervise and
307 monitor the relevant tasks to ensure effective hydration care. Role modelling good practice,
308 for example demonstrating how to use the drinks menu and supporting the drinks round
309 contributed to an effective PDT. Tyler and Parker²⁷ also found that teamwork was sustained
310 where managers consistently modelled positive behaviours and attitudes. Presence of a unit
311 manager facilitated the adoption of improvement initiatives as routine practice in Home B.
312 In contrast at Home A, several changes in nurse leadership led to unclear communication of
313 expectations and consequently interventions were not embedded into routine practice.
314 Initiatives are rarely sustained if leadership at both a strategic and operational level is
315 lacking.²⁸ Our study upholds the findings of previous work which suggests that good
316 leadership at nurse manager level is key to service improvement.^{29,30}

317 Turnover of staff was a particular challenge in both units and maintaining a project team
318 within each home required a significant contribution by the academic members of the
319 project team to both execute PDSA cycles and collect data on outcomes. We identified other
320 potential interventions, e.g. more accurate systems for monitoring fluid intake and
321 triggering appropriate carer response together with practical approaches to training that
322 address the knowledge and skills required to support residents' needs and preferences,
323 however, we were not able to fully test these in the current study.

324 A limitation to this study was the measurement of hydration status of the residents. Since
325 using blood biochemistry to assess dehydration would not be practical or ethical for an
326 implementation study, we used fluid intakes as an indication of hydration status. We also
327 attempted to collect data on the incidence of dehydration, but this was not reported
328 accurately by the staff. Increased external temperature (e.g. summer time) could have been
329 a potential confounder for increasing fluid intake of the residents. However, we found no
330 evidence of the consistent relationship between climatic conditions and increase in fluid
331 intakes. In fact, the highest intakes were observed at end of the project (October-
332 December), which suggests that the increase was due to interventions rather than
333 temperature changes. As this was a small scale study, the results may not be readily
334 generalizable to other care homes or settings. Nonetheless, with local adaptation we were
335 able to introduce, these three interventions in two different care homes. Whilst we
336 identified some factors that explained the success of the adoption, it was beyond the scope
337 of this study to identify all possible factors. However, from previous research, it is evident
338 that care homes with similar resources and demand can provide vastly different experiences
339 of care.³¹ We were unable to monitor long-term compliance with the interventions beyond
340 the study period, and thus observed improvements may weaken over time. Other
341 researchers suggest that 'periodic audit and feedback might be necessary for some years to
342 get a practice change established'.²⁹

343 This study is a rare example of the application of improvement science in care homes and
344 indicates the flexibility required to design and deliver interventions in such settings.
345 Interventions to optimise hydration that focus on extending opportunities and choice can be
346 effective in increasing resident fluid intake to above the minimum recommended amount of
347 1500ml per day. Although changes to standard approaches to care delivery are required to
348 optimise resident fluid consumption, embedding what appear to be simple, essential care
349 activities into routine practice is not easy. Using PDSA cycles to test small changes is an
350 effective methodology to implement new interventions into existing practice. Sustainable
351 change requires strong and effective leadership, with role modelling and mentoring of junior
352 staff, as well as organisational support and teamwork. Our study demonstrates that
353 systematic implementations of simple, inexpensive measures such as at least one PDT a day
354 and Drinks Menu, provide a pragmatic approach to optimising fluid intakes of care home
355 residents without a significant increase in staff workload. In our analysis of the interventions
356 in the Action Effect Diagram there are also a number of areas needing further research, in
357 particular optimising the design of drinking vessels and monitoring residents at risk.

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361 **Statement of Authorship**

362 Conception and design of study: AB, ATi, HL, JW, RM

363 Acquisition of data: AB, ATi, ATs, CG, DC, JW, HL

364 Analysis and/or interpretation of data: AB, ATi, CG, JW, HL

365 Drafting the manuscript: ATi, CG, JW

366 Revising the manuscript critically for important intellectual content: AB, ATi, ATs, CG, DC,

367 JW, HL, RM

368 Approval of the version of the manuscript to be published (the names of all authors must be
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370 **Conflict of Interest Statement**

371 Authors declare no conflict of interest

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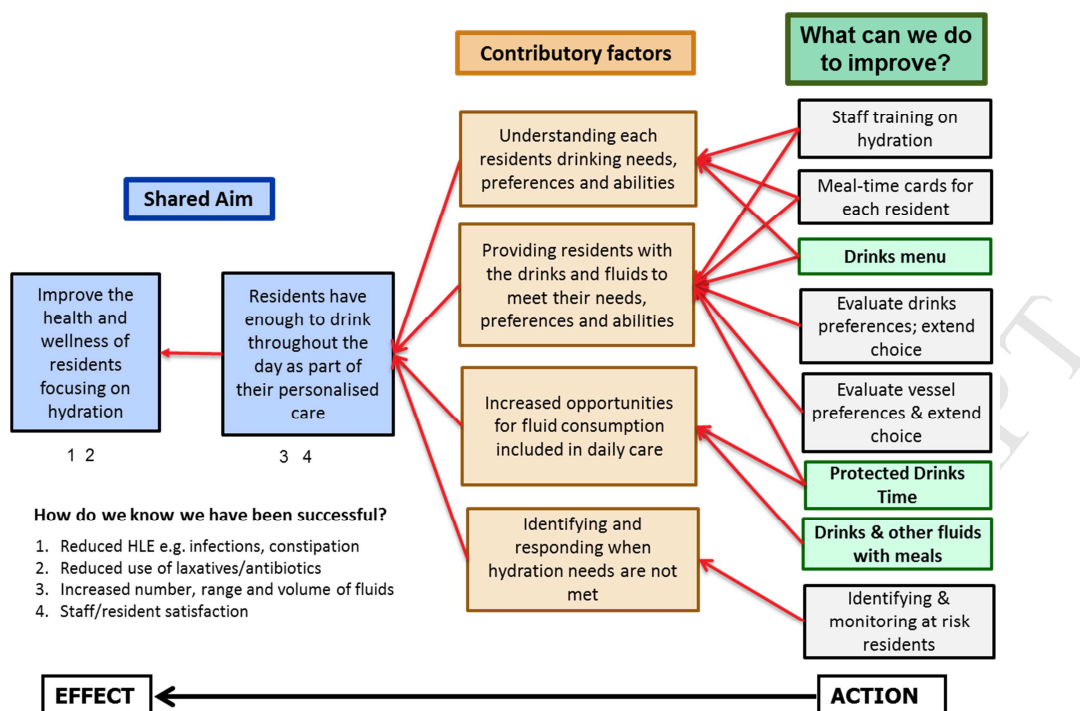
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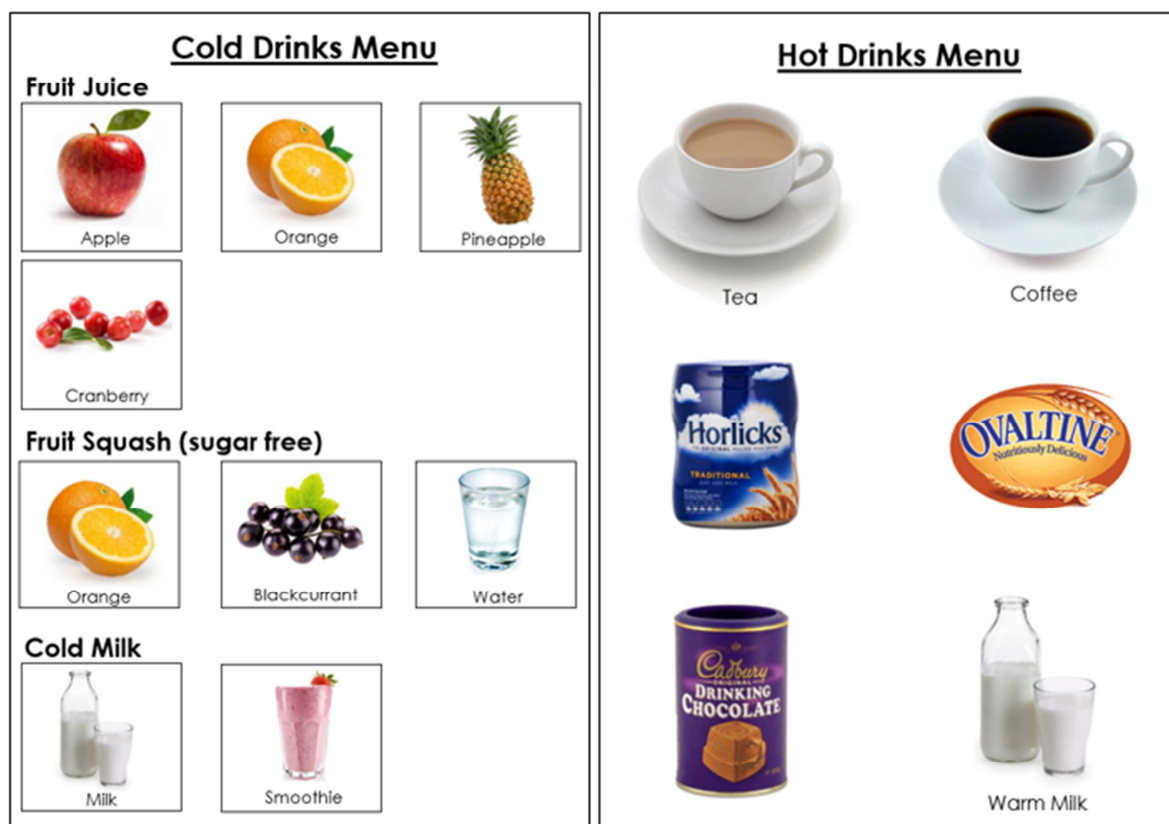
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467 **Figure and Table Legends**



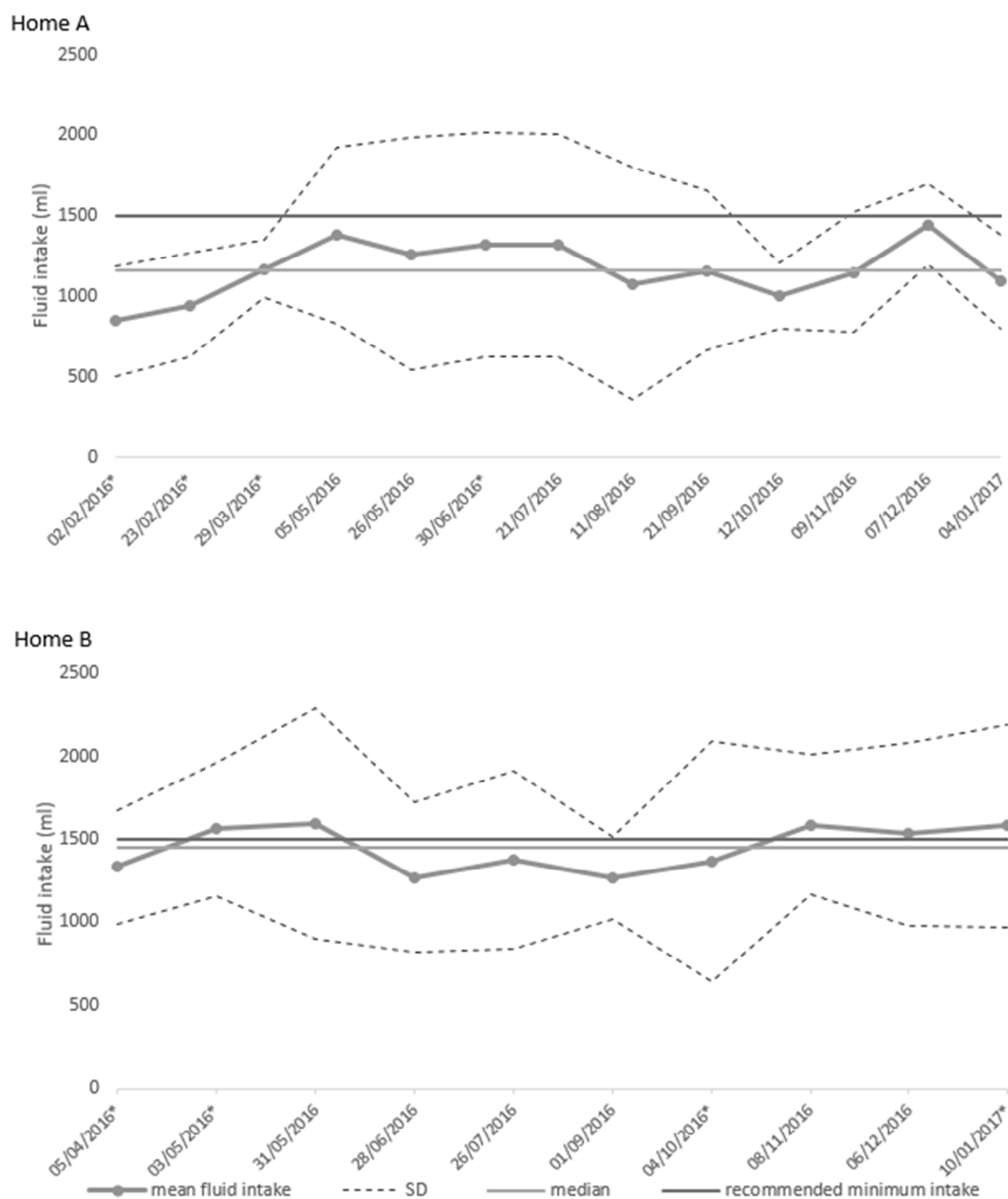
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469 **Figure 1: Action Effect Diagram for improving hydration of care home residents.**
 470 **Highlighted in bold are the interventions reported in this paper.**



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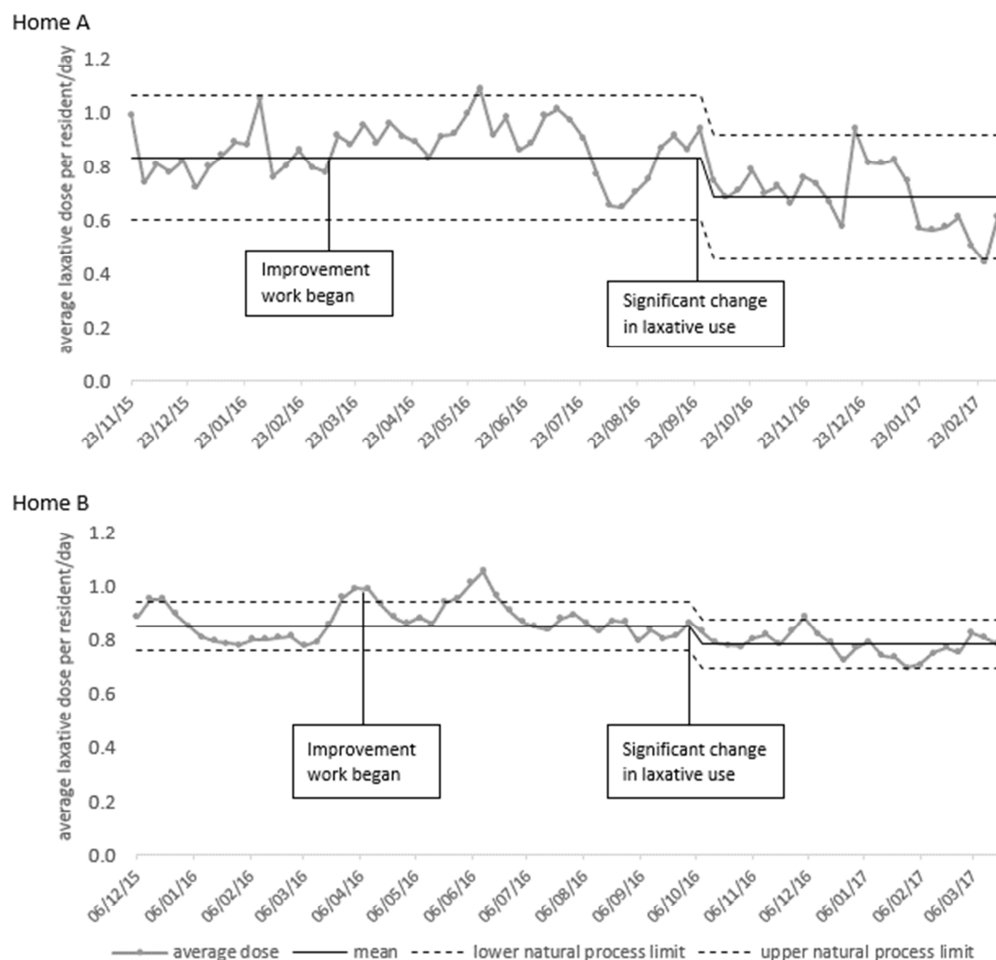
Figure 2: Drinks Menu used by staff to encourage residents to select their preferred drinks and consume more fluids.



474

475 **Figure 3: Run charts illustrating mean fluid intake data from routine observations where**
 476 **four-six randomly selected residents were observed from 6am to 9pm. Median was**
 477 **calculated prospectively from the first ten data points. *Observations of less than six**
 478 **residents, this occurred when a resident was taken absent after observations were**
 479 **underway.**

480



481

482 **Figure 4: An XmR chart illustrating average laxative dose per resident per day. Data**
 483 **aggregated weekly as mean daily dose per resident per day.**

484 **Table 1: The number of cycles and the duration for testing the interventions. (Duration**
 485 **was defined as the time from the first to the last PDSA cycle)**

Intervention	Number of PDSA cycles	Duration
<i>Home A</i>		
Drinks before breakfast	4	4 days
PDT + Drinks Menu	8	8 weeks
<i>PDT</i>	4	
<i>PDT + Drinks Menu</i>	4	

<i>Home B</i>		
Drinks after meals	3	
Drinks Menu + PDT	7	9 weeks
<i>Drinks Menu</i>	5	
<i>Drinks Menu + PDT</i>	2	

486

487 **Table 2: Drinks before breakfast PDSA cycles (Home A)**

	<i>Cycle</i>			
	1	2	3	4
No. residents observed (no receiving a drink)	7 (7; 100%)	9 (5; 56%)	10 (7; 70%)	7 (5; 71%)
No. drinks given	12	6	14	8
% of residents given more than one drink (of those who were given one)	57%	11%	50%	29%
Fluids served (% consumed)	2000 (55%)	1200 (45%)	2660 (44%)	2300 (37%)
Mean consumed for those receiving a drink (ml)	158	108	169	170
Median fluid intake (min-max)	200 (0-300)	100 (20-220)	180 (30-360)	150 (0-380)
No (%) of residents who consumed less than 50ml	14%	56%	40%	57%

488

489 **Table 3: Final format of the interventions to enhance hydration of care home residents**

1) Extending drinking opportunities	
Drinks before breakfast (Home A)	Drinks after meals (Home B)
<ul style="list-style-type: none"> The HCA who brings the resident to the dining room prior to breakfast asks what 	<ul style="list-style-type: none"> Two HCA who are assigned to serve and feed residents in the lounge, offer hot

<p>they want to drink, prepares and serves the drink.</p> <ul style="list-style-type: none"> Flasks of tea/hot water pre-prepared by HCA and placed in dining room <p>Team leaders remind the HCA and provide assistance if necessary</p>	<p>drinks to the residents when clearing the plates after meals.</p> <ul style="list-style-type: none"> Flasks of tea/hot water pre-prepared by catering assistant and placed in dining room by HCA
<p>Protected Drinks Time (Home A)</p>	<p>Protected Drinks Time (Home B)</p>
<p>Distribution of drinks to all residents from a trolley and HCA allocated to specific roles:</p> <ul style="list-style-type: none"> 1 HCA serves residents in lounge, assists and encourages them to drink and offers additional drinks. HCA encouraged to make themselves a drink to model social aspect of drinking. 2 HCA distribute drinks to residents in own rooms using a trolley. Deliver drinks to those who can drink independently first and provide assistance to those who need it. Offer additional drinks. <p>The team leader briefs staff in the morning, allocates responsibilities and reminds staff to commence PDT shortly before 3pm.</p>	<p>Two drinks trollies introduced to enable drinks to be served by two teams and focus HCA time on assisting residents. Staff allocation sheet used to assign HCA to specific roles:</p> <ul style="list-style-type: none"> 1 HCA serves residents in lounge, assists and encourages them to drink. HCA encouraged to make themselves a drink to model social aspect of drinking. 3 HCA assigned to each trolley; serve drinks and assist residents in own rooms 1 HCA allocated to answer resident bells during PDT if required and 1 to document fluid intake. <p>The unit manager briefs staff in the morning, completes the allocation sheet and reminds staff to commence PDT shortly before 3pm.</p>
<p>2) Extending choice</p>	
<p>Drinks Menu (Home A & B)</p>	

- A simple pictorial menu showing the hot and cold drinks available is placed in the dining room, lounge and in resident rooms and used with formal drink activity
- Catering staff to ensure sufficient supplies of all items on the menu are held on the unit
- Menu used after lunch and dinner and during the afternoon PDT and before breakfast
- Residents encouraged to choose **both** a hot and cold drink

490 *HCA = healthcare assistant; PDT = Protected Drinks Time*

491

ACCEPTED MANUSCRIPT