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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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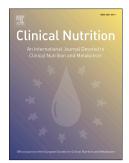
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Title page

Improving hydration of care homes residents: a quality improvement project to increase choice and opportunity to drink

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Revision no 2

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 impeding dehydration. ^{1,2}
40	Our work exploring patterns of fluid provision and consumption ⁷ suggested that few care
41	home residents consumed the recommended minimum.

There is a paucity of studies that have designed or tested interventions to improve the hydration of older people in care homes.¹² Moreover, little is known about the sustainability of such interventions as many studies relied on supernumerary staff to undertake tasks within the intervention protocols.¹³⁻¹⁶ Practicality and acceptability of these interventions need to be tested in the care home environment, and systems developed that enable 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 separately ⁷ 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

At each home a dedicated project team, comprising the unit manager, HCA and university researchers, co-designed strategies to improve resident hydration. The respective teams, met once a week to plan and organise testing of interventions and review measurement data. Analysis and review of the data then informed the design and implementation at the 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 choose from a range of drinks. 91

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

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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

1221)	Specific data war	a collected for eac		The effect of in	terventions were assessed
1231)	Specific uata wei	e conecteu foi eac	I PDSA LYLIE.	The effect of it	itel ventions 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
- 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

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 Heath 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 the dining room (final format is presented in Table 3). Staff reported that offering residents a 158 159 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

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routine. Nonetheless, data on fluid intakes indicate that some residents did not receive theassistance 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

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

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
- 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
- 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
- after six months of improvement activity (Figure 4). There was no change in the use of
- 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
- 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
- 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
- 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	toileting issues prevented them from drinking adequate amounts. ⁷ However, during this study, we did not observe the residents refusing the drinks or limiting the amounts
258 259	
	study, we did not observe the residents refusing the drinks or limiting the amounts
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259 260 261	study, we did not observe the residents refusing the drinks or limiting the amounts consumed due to this reason. In fact, where preferable fluids and appropriate assistance were given, residents tended to consume entire drinks and sometimes requested refills. A number of key factors influenced the success with which change was embedded into

the care team.

The development and utilisation of a staff allocation sheet was central to embedding PDT into the care routines. In both homes, prior to the introduction of PDT, one or two HCA 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 logistics of having cups, drinks and trolley available in time for 3pm being key issues in Home 275 276 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 across the long-term care sector.²³ In addition, some HCA demonstrated a lack of confidence 287 288 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 for quality of care and have been highlighted in other research.^{25,26} This lack of information 298 299 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 critical. They need to be actively engaged with the HCA to assign, promote, supervise and 306 307 monitor the relevant tasks to ensure effective hydration care. Role modelling good practice, for example demonstrating how to use the drinks menu and supporting the drinks round 308 contributed to an effective PDT. Tyler and Parker²⁷ also found that teamwork was sustained 309 310 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 expectations and consequently interventions were not embedded into routine practice. 313 314 Initiatives are rarely sustained if leadership at both a strategic and operational level is lacking.²⁸ Our study upholds the findings of previous work which suggests that good 315 leadership at nurse manager level is key to service improvement.^{29,30} 316

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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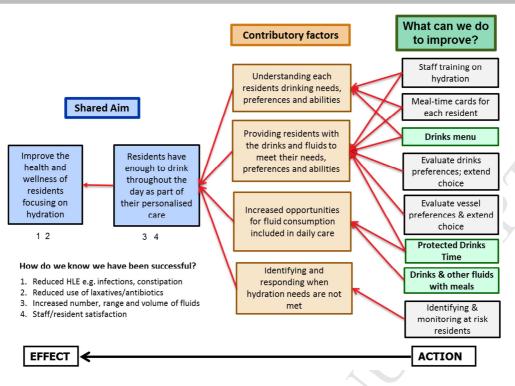
378 References

- 379 1. Hooper, L., Bunn, D.K., Downing, A., Jimoh, F.O., Groves, J., Free, C., Cowap, V., 380 Potter, J.F., Hunter, P.R. and Shepstone, L. Which Frail Older People Are 381 Dehydrated? The UK DRIE Study. J Gerontol A Biol Sci Med Sci. 2016; 71: 1341-382 1347. 2. Marra, M.V., Simmons, S.F., Shotwell, M.S., Hudson, A., Hollingsworth, E.K., Long, 383 E., Kuertz, B. and Silver, H.J. Elevated Serum Osmolality and Total Water Deficit 384 385 Indicate Impaired Hydration Status in Residents of Long-Term Care Facilities 386 Regardless of Low or High Body Mass Index. J Acad Nutr Diet. 2016; 116: 836.e2. 387 3. Schols, J.M., De Groot, C.P., van der Cammen, T.J., Olde Rikkert, M.G. Preventing
- and treating dehydration in the elderly during periods of illness and warm
 weather. J Nutr Health Aging. 2009; 13: 150-157.
- 390
 4. Benelam, B., Wyness, L., 2010. Hydration and health: a review. Nutr
 391
 Bull.;35(1):3-25.

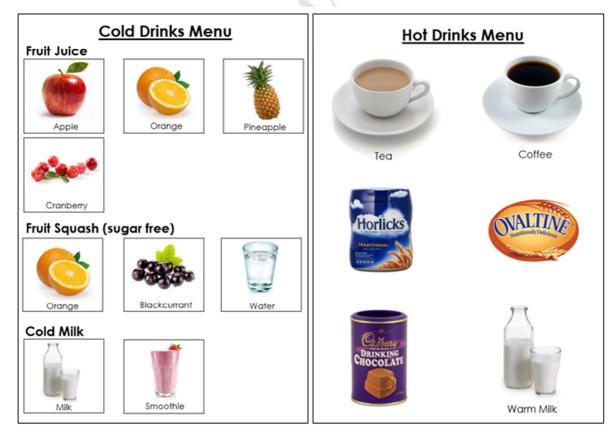
5.	Szafara, K.L., Kruse, R.L., Mehr, D.R., Ribbe, M.W., van der Steen, J.T. Mortality
	following nursing home-acquired lower respiratory infection: LRI severity,
	antibiotic treatment, and water intake. J Am Med Dir Assoc. 2012; 13: 376-83.
6.	Wolff, A., Stuckler, D., McKee, M. Are patients admitted to hospitals from care
	homes dehydrated? A retrospective analysis of hypernatraemia and in-hospital
	mortality. J R Soc Med. 2015; 108: 259-265
7.	Bak, A., Wilson, J., Tingle, A., Greene, C., Tsiami, A., Canning, D., Loveday, H.
	Under-hydration of residents in nursing care homes: defining the problem and
	contributory factors. Age and Ageing. 2018; 47 (suppl 2): Pages ii12–ii13.
8.	Kayser-Jones, J., Schell, E., Porter, C., Barbaccia, J., Shaw, H. Factors Contributing
	to Dehydration in Nursing Homes: Inadequate Staffing and Lack of Professional
	Supervision. J Am Geriatr Soc. 1999; 47: 1187-94.
9.	Kayser-Jones, J. Malnutrition, dehydration, and starvation in the midst of plenty:
	the political impact of qualitative inquiry. Qual Health Res. 2002; 12: 1391-405.
10	. Kayser-Jones, J. Nursing homes: a health-promoting or dependency-promoting
	environment? Fam Community Health. 2009; 32: S66.
11	. Ferry, M., Dal Canton, A., Manz, F., Armstrong, L., Sawka, M., Ritz, P., et al. 2005.
	Strategies for ensuring good hydration in the elderly. Nutr Rev. 2005 63: S22-29.
12	. Bunn, D., Jimoh, F., Wilsher, S., Hooper, L. Increasing Fluid Intake and Reducing
	Dehydration Risk in Older People Living in Long-Term Care: A Systematic
	Review. J Am Med Dir Assoc. 2015 16: 101-113.
13	S. Spangler, P.F., Risley, T.R., Bilyew, D.D. The management of dehydration and
	incontinence in nonambulatory geriatric patients. J Appl Behav Anal. 1984; 17:
	397-401.
14	Simmons, S.F., Alessi, C., Schnelle, J.F. An intervention to increase fluid intake in
	nursing home residents: prompting and preference compliance. J Am Geriatr
	Soc. 2001; 49: 926-933.
	 6. 7. 8. 9. 10 11 12 13

419	15. Robinson, S.B., Rosher, R.B., 2002. Can a beverage cart help improve hydration?
420	Geriatr Nurs. 2002; 23: 208-211.
421	16. Mentes, J.C., Culp. K. Reducing hydration-linked events in nursing home
422	residents. Clin Nurs Res. 2003; 12: 210-225.
423	17. Hooper L, Attreed NJ, Campbell WW, Channell AM, Chassagne P, Culp KR, et al.
424	Clinical and physical signs for identification of impending and current water-loss
425	dehydration in older people. Cochrane Database of Systematic Reviews. 2012; 2.
426	18. Ogrinc, G., Davies, L., Goodman, D., Batalden, P., Davidoff, F. & Stevens, D. SQUIRE
427	2.0 (Standards for QUality Improvement Reporting Excellence): revised
428	publication guidelines from a detailed consensus process. J. Contin. Educ. Nurs.
429	2015; 46: 501.
430	19. Reed, J.E., McNicholas, C., Woodcock, T., Issen, L., Bell, D. Designing quality
431	improvement initiatives: the action effect method, a structured approach to
432	identifying and articulating programme theory. BMJ Qual Saf. 2014; 23: 1040-
433	1048.
434	20. Taylor, M.J., McNicholas, C., Nicolay, C., Darzi, A., Bell, D., Reed, J.E. Systematic
435	review of the application of the plan-do-study-act method to improve quality in
436	healthcare. BMJ Qual Saf. 2014; 23: 290-298.
437	21. Ham, C., Berwick, D., Dixon, J. Improving Quality in the English NHS: A strategy
438	for action. The King's Fund. 2016.
439	22. Mohammed, M., Worthington, P. Why traditional statistical process control
440	charts for attribute data should be viewed alongside an xmr-chart. BMJ Qual Saf.
441	2013; 22: 263-269.
442	23. Boyle, G. Autonomy in long-term care: a need, a right or a luxury? Disabil Soc.
443	2008; 23: 299-310

444	24. Damschroder, L.J., Hagedorn, H.J. A Guiding Framework and Approach for
445	Implementation Research in Substance Use Disorders Treatment. Psychol Addict
446	Behav. 2011; 25: 194-205.
447	25. André, B., Sjøvold, E., Rannestad, T., Ringdal, G.I. The impact of work culture on
448	quality of care in nursing homes – a review study. Scand J Caring Sci. 2014; 28:
449	449-57.
450	26. Spilsbury, K. Making claims on nursing work: Exploring the work of healthcare
451	assistants and the implications for registered nurses roles. J Res Nurs. 2005; 10:
452	65-83.
453	27. Tyler, D.A., Parker, V.A. Nursing home culture, teamwork, and culture change. J
454	Res Nurs. 2011; 16: 37-49.
455	28. Health Foundation. Quality Improvement Made Simple: What Every Board
456	Should Know About Healthcare Quality Improvement. London: Health
457	Foundation. 2013.
458	29. Bowers, L., Pithouse, A., Hooton, S. How to establish evidence-based change in
459	acute care settings. Ment Health Pract. 2012; 16: 22-25.
460	30. Gage, W., Heywood, S. Measuring quality in nursing and midwifery practice.
461	Nursing Stand. 2012; 26: 35-40.
462	31. Killett, A., Bowes, A., Brooker, D., Burns, D., Kelly, F., La Fontaine, J., et al. What
463	makes a real difference to resident experience? Digging deep into care home
464	culture: The CHOICE (Care Home Organisations Implementing Cultures of
465	Excellence) research report. University of Worcester. 2013.
466	Y
467	Figure and Table Legends



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



471

472 Figure 2: Drinks Menu used by staff to encourage residents to select their preferred drinks

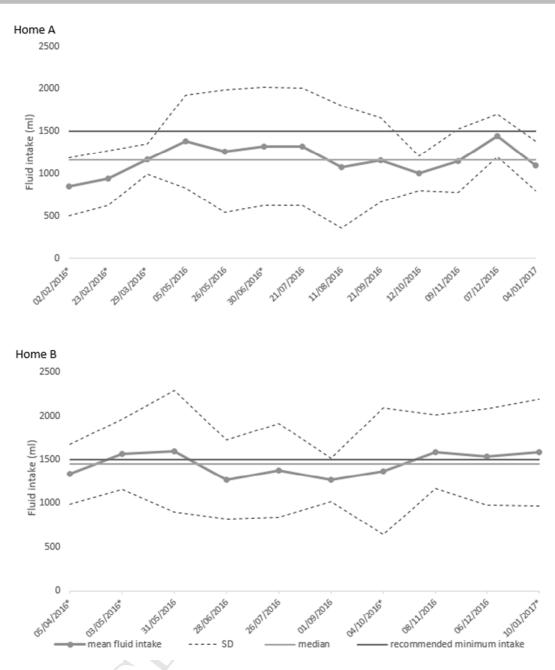
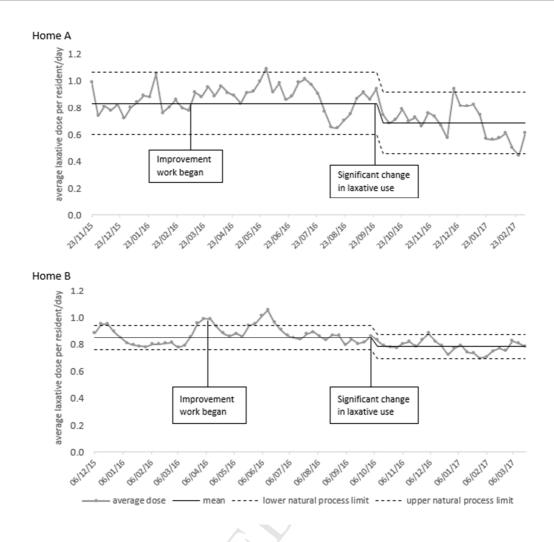


Figure 3: Run charts illustrating mean fluid intake data from routine observations where
four-six randomly selected residents were observed from 6am to 9pm. Median was
calculated prospectively from the first ten data points. *Observations of less than six
residents, this occurred when a resident was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

480



- 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			
Home A					
Drinks before breakfast	4	4 days			
PDT + Drinks Menu	8	8 weeks			
PDT	4				
PDT + Drinks Menu	4				

Ноте В		
Drinks after meals	3	
Drinks Menu + PDT	7	9 weeks
Drinks Menu	5	
Drinks Menu + PDT	2	

486

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

	Cycle			
	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	57%	11%	50%	29%
who were given one)				
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)	1) Extending drinking opportunities				
Dri	inks before breakfast (Home A)	Dri	nks after meals (Home B)		
•	The HCA who brings the resident to the	•	Two HCA who are assigned to serve and		
	dining room prior to breakfast asks what		feed residents in the lounge, offer hot		

they want to drink, prepares and serves	drinks to the residents when clearing the		
the drink.	plates after meals.		
• Flasks of tea/hot water pre-prepared by	 Flasks of tea/hot water pre-prepared by 		
HCA and placed in dining room	catering assistant and placed in dining		
Team leaders remind the HCA and provide	room by HCA		
assistance if necessary			
Protected Drinks Time (Home A)	Protected Drinks Time (Home B)		
Distribution of drinks to all residents from a	Two drinks trollies introduced to enable		
trolley and HCA allocated to specific roles:	drinks to be served by two teams and focus		
• 1 HCA serves residents in lounge, assists	HCA time on assisting residents. Staff		
and encourages them to drink and offers	allocation sheet used to assign HCA to		
additional drinks. HCA encouraged to	specific roles:		
make themselves a drink to model social	• 1 HCA serves residents in lounge, assists		
aspect of drinking.	and encourages them to drink. HCA		
• 2 HCA distribute drinks to residents in	encouraged to make themselves a drink		
own rooms using a trolley. Deliver drinks	to model social aspect of drinking.		
to those who can drink independently	• 3 HCA assigned to each trolley; serve		
first and provide assistance to those who	drinks and assist residents in own rooms		
need it. Offer additional drinks.	• 1 HCA allocated to answer resident bells		
	during PDT if required and 1 to document		
The team leader briefs staff in the morning,	fluid intake.		
allocates responsibilities and reminds staff to	The unit manager briefs staff in the morning,		
commence PDT shortly before 3pm.	completes the allocation sheet and reminds		
	staff to commence PDT shortly before 3pm.		
2) Extending choice			
Drinks Menu (Home A & B)			

• 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