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**Identifying behavior change techniques for inclusion in a complex
intervention targeting antipsychotic prescribing to nursing home residents
with dementia.**

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Human Rights: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study, formal consent is not required.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Welfare of Animals: This article does not contain any studies with animals performed by any of the authors.

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Implications

Practice: Sixteen behavior change techniques have been identified, that may be used as the basis for behavior change and quality improvement interventions by clinicians targeting inappropriate antipsychotic prescribing to nursing home residents with dementia.

Policy: Policymakers should consider developing suitable systems to enable prescribers to compare their own antipsychotic prescribing practices, to that of their peers, in a meaningful manner.

Research: The systematic and detailed approach undertaken to identify appropriate BCTs in this study, could be used as an example for other interventions.

1 **Identifying behavior change techniques for**
2 **inclusion in a complex intervention targeting**
3 **antipsychotic prescribing to nursing**
home residents with dementia.

5 **Abstract**

6 **Background:**

7 Nursing home residents with dementia are commonly prescribed antipsychotics despite the
8 associated increased risk of harms. Interventions to optimize prescribing practice have been
9 found to be effective in the short-term, but there is a lack of evidence to support sustainability
10 of effects, along with a lack of theory, public involvement and transparency in the 11
intervention development process.

12 **Purpose:**

13 Using theory has been advocated as a means of improving intervention sustainability. The
aim
14 of this study was therefore to identify behavior change techniques (BCTs) for inclusion in a
complex intervention targeting antipsychotic prescribing to nursing home residents with
dementia.

17 **Methods:**

18 A comprehensive approach to identifying a long list of all potential BCTs from three different
19 sources was undertaken. The most appropriate BCTs were then selected through a two-round
20 Delphi consensus survey with a broad range of experts (n=18 panellists). Advisory groups of
21 people with dementia, family carers, and professional stakeholders provided feedback on the
22 final BCTs included.

23 **Results:**

24 After two Delphi survey rounds, agreement was reached on 22 BCTs. Further refinement of
25 the selected BCTs based on advisory group and panellists' feedback, along with use of the
26 APEASE criteria (Affordability, Practicability, Effectiveness, Acceptability, Side effects/safety
27 and Equity) resulted in a final list of 16 BCTs.

28 **Conclusion:**

29 The next step in intervention development will be to identify the most appropriate mode of
30 delivery of the 16 BCTs identified for inclusion. The study provides a case-example of a
31 systematic approach to incorporating evidence with stakeholder views in the identification of
32 appropriate BCTs.

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39 **Introduction**

40 Antipsychotics are commonly prescribed to nursing home residents with dementia for the
41 management of behavioral and psychological symptoms of dementia (BPSD) [1-4]. However,
42 antipsychotics have limited effectiveness for treating BPSD and are associated with an
43 increased risk of mortality, stroke and other serious side effects [5, 6]. Non-pharmacologic
44 interventions are recommended as the first line treatment for BPSD, with antipsychotics only
45 recommended for severe symptoms, where there is significant patient distress or risk of harm,
46 or when non-pharmacologic interventions have failed [7-9].

47 A 2014 systematic review determined that many types of interventions were effective at
48 reducing inappropriate antipsychotic prescribing to nursing home residents with dementia in
49 the short-term [10]. These interventions were categorized as educational programs (n=11
50 studies), outreach services, where specialists visited the nursing homes (n=2 studies),
51 medication reviews (n=4 studies) and multicomponent interventions (n=5 studies) [10].
52 However, the review authors noted that there was a lack of evidence to support sustainability
53 of effects. In addition, we identified a distinct lack of theory, patient and public involvement
54 (PPI) and transparency in the intervention development processes in the included studies
55 [10].

56 It has been argued that interventions aimed at changing healthcare professional behaviors
57 may not have had the desired long-term effects due to the lack of theory in the development
58 of the intervention [11]. Evidence suggests that interventions that make extensive use of
59 theory may have larger effects on behavior than those that use less or no theory [12]. The
60 explicit use of theory can help us to better understand the key elements of the intervention,
61 the participants and the context. Moreover, it can provide a generalizable framework, inform

62 the development, delivery and evaluation processes, and permit an exploration of potential
63 causal mechanisms [13].

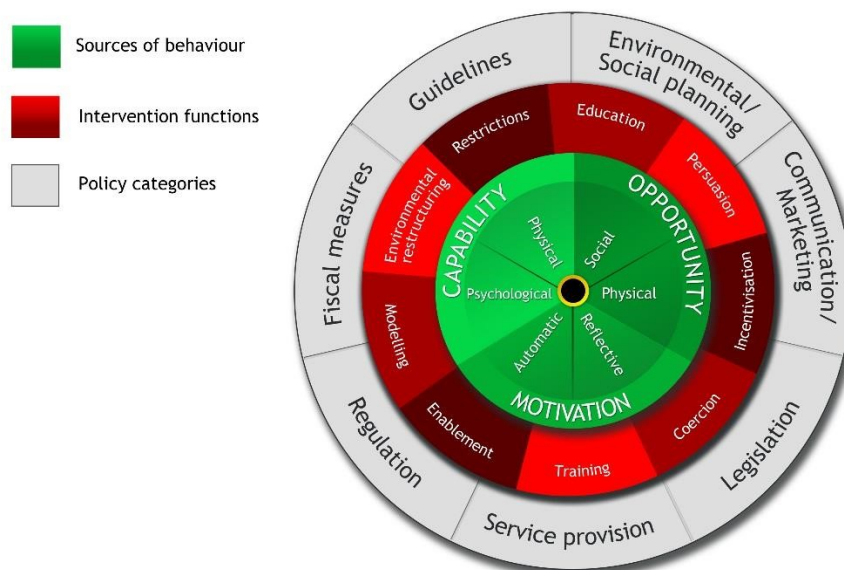
64 There is an increasing evidence base to suggest that PPI and the incorporation of stakeholder
65 views can enhance the quality and appropriateness of research [14]. Furthermore, from an
66 ethical perspective, involving those who might potentially be affected by the findings in
67 research has been strongly advocated [15].

68 In terms of research transparency, there has been a concerted effort in recent times to
69 improve the reliability, utility and impact of health research, while reducing research waste,
70 through more transparent and accurate reporting [16]. Inadequate reporting of interventions
71 may have serious consequences for clinical practice, research replication, policy making and
72 patients, if readers cannot determine how an intervention was developed and implemented
73 [17].

74 Taken together, these research issues suggest the need for a systematic, transparent
75 approach, incorporating PPI and stakeholder input in the intervention development process.
76 The Behavior Change Wheel (BCW) is one systematic approach for applying behavioral theory
77 to complex intervention development [18]. The BCW guidance on developing behavior change
78 interventions was developed by synthesizing existing frameworks for intervention
79 development according to three criteria: comprehensiveness, coherence, and a clear link to
80 an overarching model of behavior (Figure 1).

81

Figure 1: The behavior change wheel [19]



82

83 Essentially the BCW provides the intervention designer with theory-informed tools and
84 techniques to help understand and change behavior in a step-by-step and transparent manner
85 [18]. There are three main stages to the BCW. The first stage involves understanding the
86 behavior through the conduct of a thorough analysis of the behavior and the context in which
87 it occurs. Once a target behavior has been identified, the BCW provides guidance on
88 identifying what needs to shift to bring about change (i.e. a 'behavioral diagnosis' is
89 conducted) and mapping these determinants to intervention functions, the broad categories
90 of ways an intervention can change behavior, and policy options. The final stage involves
91 identifying content and implementation options. A core component of the final stage is to
92 identify the most appropriate behavior change techniques (BCTs) for the planned intervention.
93 BCTs are defined as the active component of an intervention designed to change behavior,
94 and are essential for intervention transparency and future replication of interventions [20]. A
95 comprehensive list of 93 BCTs and associated definitions exists as a standardized language
96 known as the BCT Taxonomy version 1 (BCTTv1) [20]. By providing a standardized language to

97 describe intervention content, BCTs facilitate the translation of interventions into practice at
98 scale.

99 Identifying appropriate BCTs requires the incorporation of an understanding of influences on
100 behavior and existing literature, with the views of key stakeholders, to ensure the intervention
101 is context-appropriate, evidence-based, and can be translated into practice. Various methods
102 to identify the most appropriate BCTs have been described [21]. Although there is currently
103 no clear guidance on the optimal method, using expert consensus groups (such as Delphi
104 surveys) and/or guidance materials matching BCTs to behavioral determinants feature
105 prominently throughout the literature [22-26].

106 A Delphi survey is defined as a *“group facilitation technique that seeks to obtain consensus*
107 *on the opinions of experts through a series of structured questionnaires (or rounds)”* [27].

108 Previous studies have used Delphi surveys to achieve consensus from stakeholders, on which
109 BCTs are potentially suitable for inclusion in behavior change interventions [26, 28, 29].

110 However, the approaches used differed significantly across studies, even for the same
111 behavior. For example, with regards to smoking behaviors, one study retrieved 55 BCTs linked

112 to the determinants of waterpipe smoking from the literature, divided these 55 BCTs into
113 three broad intervention groups, and then 14 panellists ranked each BCT in order of perceived

114 importance, within each of the three intervention groups [28]. Another study took a very
115 different approach at identifying suitable BCTs for inclusion in an intervention to reduce

116 smoking during pregnancy, through a three-round Delphi survey with 44 panellists [29].
117 Round-one asked panellists to rate the ‘influence’ and ‘difficulty’ of 34 pre-identified barriers

118 and facilitators using a 5-point Likert scale, and gathered panellists’ suggestions on ways to
119 address these. Rounds two and three sought further consensus on the barriers and facilitators

120 and on ‘appropriateness’ of the panellists’ suggestions. The suggestions were then coded for
121 BCTs by the research team after the Delphi study was completed [29]. Hence even within
122 similar behavior change contexts, there are significant differences in the approaches
123 undertaken to identify BCTs. Therefore, there is a need to better standardize, and report, the
124 approach to BCT identification so that future researchers can replicate and improve upon this
125 process.

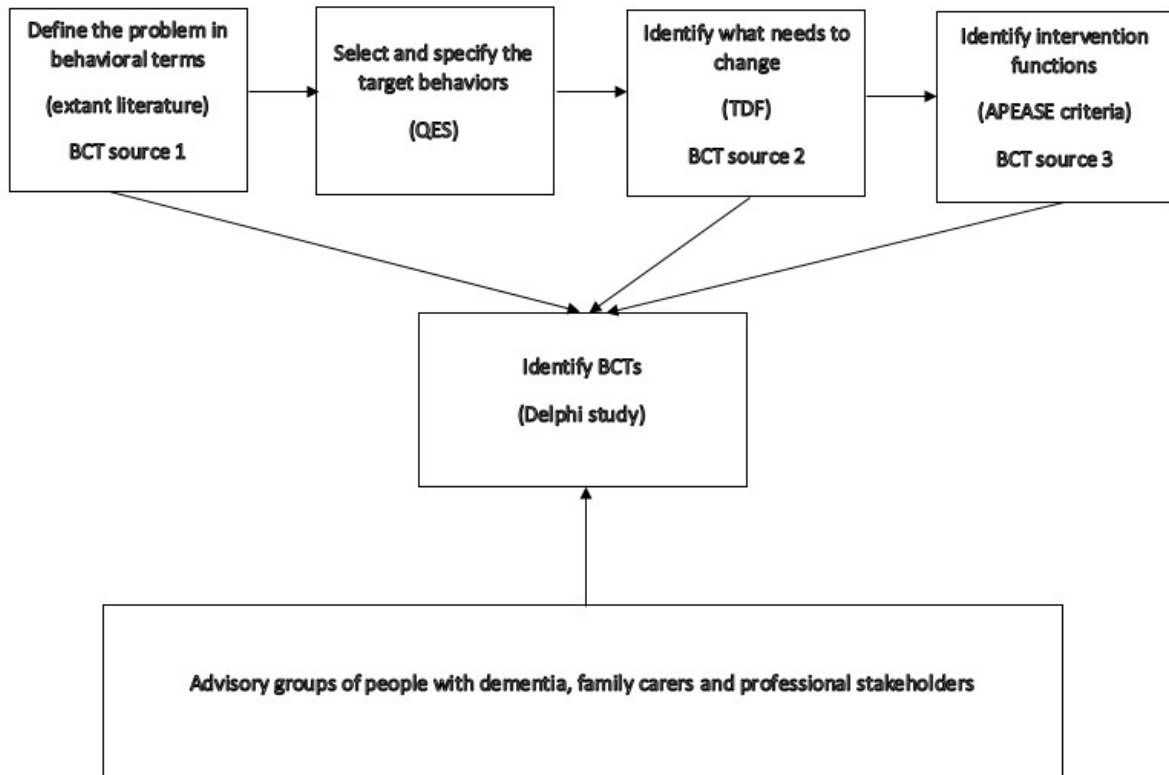
126 The aim of this study was to identify BCTs for inclusion in a complex intervention targeting
127 antipsychotic prescribing behaviors (appropriate requesting by nurses and prescribing by
128 general practitioners [GPs]). The study is part of a larger project which aims to develop an
129 evidence-based, theoretically informed complex intervention to sustainably improve the
130 appropriateness of antipsychotic prescribing to nursing home residents with dementia, using
131 the BCW approach, with stakeholder engagement, and PPI throughout. The study also
132 provides a case-example of a systematic approach to incorporating evidence with stakeholder
133 views in the identification of appropriate BCTs which may be of use to the development of
134 interventions across behaviors and contexts.

135 **Methods**

136 The current study focused on the process of identifying BCTs for inclusion in a complex
137 intervention targeting appropriate requesting and prescribing of antipsychotics to nursing
138 home residents with dementia, in Ireland (Figure 2). To provide context for this process, an
139 overview of the development of this complex intervention is described, followed by the
140 detailed methods of the current study.

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Figure 2: The steps (and sources/methods) involved in identifying behavior change techniques for inclusion in a complex intervention



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APEASE = Affordability, Practicability, Effectiveness, Acceptability, Side effects/ safety, Equity; BCT = Behavior Change Technique; QES = Qualitative Evidence Synthesis; TDF = Theoretical Domains Framework

148 **Overview of development of complex intervention**

149 We broadly followed the BCW approach [18] to intervention development as operationalized
150 by Sinnott *et al.* [23]. These researchers conducted a qualitative evidence synthesis (QES) and
151 semi-structured interviews in order to gain a deeper understanding of the behavior, prior to
152 identifying BCTs through an expert panel consensus meeting. Sinnott *et al.* argued that the
153 conduct of these qualitative studies generated much needed data on the research problem
154 and was a strength of the approach undertaken [23].

155 Intervention development began by conducting a QES exploring the complex influences on
156 decision-making regarding antipsychotic prescribing to nursing home residents with dementia,

157 using meta-ethnography (Figure 2)[30]. One of our key findings was the need to target both
158 the main requesters (i.e. nursing staff) and prescribers (i.e. GPs) of antipsychotics when
159 designing any intervention. A follow-on qualitative study using the Theoretical Domains
160 Framework (TDF), an integrative framework of influences on behavior developed by
161 synthesizing multiple behavior change theories, explored the determinants of appropriate
162 requesting and prescribing behaviors across the 14 TDF domains [31]. From this study, the
163 predominant TDF domains were identified, highlighting what needs to change for the desired
164 behaviors to occur, and indicating some potential intervention options (Figure 2). The largely
165 deductive approach used for the qualitative study complemented the inductive approach of
166 the QES. The next step in developing an intervention was to identify appropriate BCTs and this
167 leads us onto our current study.

168 **Current study**

169 The current study targeted the Irish nursing home setting, where most of the care is provided
170 by on-site nurses and healthcare assistants, with regular visits from physicians (GPs and/or
171 specialists) who are generally based off-site. We undertook a comprehensive approach to
172 identifying all potential BCTs ('long list') from three sources (Figure 2) and then selected the
173 most appropriate BCTs for our intervention using a Delphi consensus survey with a broad
174 range of experts. The QES was not considered a source of BCTs due to its bottom-up,
175 metaethnographic approach, but rather it informed the TDF-based qualitative interview study.
176 Designing an intervention with the best possible potential for future implementation was a
177 key part of the process, and we aimed to engage and catalyze dialogue between the
178 researchers, practitioners and members of the public in identifying the intervention content.
179 Therefore, as a core component of our intervention development process for the project, we

180 established PPI advisory groups, one with people with dementia, and one with family carers,
181 with whom we consulted on an ongoing basis.

182 The PPI advisory group meetings with people with dementia were co-facilitated by the primary
183 author and a member of the Alzheimer Society of Ireland and used participatory approaches
184 to support members to get involved, including flipcharts, coloured cards and assistance with
185 writing. Four sessions occurred in total. The meetings with family members were less
186 structured, and although three face-to-face group meetings took place, most of the
187 interactions were via phone, email or letters. Alongside our PPI advisory groups, we separately
188 consulted with professional stakeholders (three GPs, one consultant geriatrician, two
189 consultant psychiatrists of old age, three nurses and two pharmacists) who were involved in
190 providing care to nursing home residents with dementia. These consultations tended to be
191 less structured than that of the PPI groups and occurred throughout the intervention
192 development process. For example, these consultations took place in-person (as a small group
193 or one-to-one), or else via phone or email. Ethics approval was provided by the local research
194 ethics committee (ECM 4X 19/01/16).

195 **Generation of 'Long List' of BCTs**

196 Three sources were used to create a 'long list' of BCTs (Figure 2):

197 **Source 1: BCT intervention content of the 22 studies [32-54] included in a 2014 systematic**
198 **review** [10]. This systematic review examined interventions to reduce inappropriate
199 prescribing of antipsychotics to nursing homes with dementia and was selected as we
200 considered it to be the most comprehensive and highest quality review in this area. BCTs from
201 each intervention study directed at our target behaviors (appropriate requesting and
202 prescribing of antipsychotics) were coded by the primary author using the BCTTv1 [20]. The

203 primary author had completed online and face-to-face training in BCTTv1. All BCTs that were
204 coded in at least two studies were added to the 'long list'. This requirement of two prior uses
205 aimed to minimize inclusion of erroneous one-off BCTs due to the often-suboptimal nature of
206 intervention reporting, and to account for the inherent interpretive nature of BCT coding.

207 **Source 2: Mapping of predominant TDF domains to the BCTs** [31]. The TDF consists of 14
208 domains and provides a comprehensive, theory-informed approach to identifying the
209 determinants which influence behaviors [55]. The TDF also aligns with the first stage of the
210 BCW [18]. In our previous qualitative study with local healthcare providers and family carers,
211 we used the TDF to identify what factors need to change in order to achieve the desired change
212 in antipsychotic prescribing behaviors i.e. a 'behavioral diagnosis' was undertaken. For this
213 qualitative study, the predominant TDF domains and determinants influencing these complex
214 prescribing behaviors were identified [31]. Nine predominant TDF domains were identified:
215 *Behavioral regulation; Beliefs about capabilities; Beliefs about consequences; Emotion;*
216 *Environmental context and resources; Knowledge; Memory, attention, and decision processes;*
217 *Social influences; and Social/professional role and identity* [31]. These TDF domains were then
218 mapped to the relevant BCTs from the BCTTv1 guided by methods described by Cadogan *et al.*
219 [56, 57].

220 A mapping tool developed by Cane *et al.* [58] was used as the primary guiding document and
221 provided clear links between 12 (of the 14) TDF domains and the BCTs from BCTTv1. Notable
222 omissions are with regard to the *Memory, attention and decision-processes* and
223 *Social/professional role and identity* TDF domains which are not mapped to any BCTs using this
224 tool. This is because in the original mapping study by Cane *et al.*, experts did not consistently
225 allocate any BCT to these two domains [58]. To circumvent this problem, an older mapping

226 matrix developed by Michie *et al.* [59] was used to map these two TDF domains to the BCTs.
227 This particular matrix [59] was developed prior to the establishment of the BCTTv1 [20], hence
228 there are differences in terms of the BCT labels and definitions between these two matrices
229 [58, 59]. However, there is also substantial overlap between these different versions of BCTs.
230 Hence for the purpose of clarity, the few BCTs that were identified using the older matrix were
231 converted to their nearest BCTTv1 equivalent.

232 **Source 3: Mapping of intervention functions to the BCTs.** Intervention functions are defined
233 as “*broad categories of means by which an intervention can change behavior*” [18]. The
234 ‘behavioral diagnosis’ from our qualitative study, [31] helped us to specify what exactly
235 needed to change in order to bring about the desired behavior, and using BCW matrices we
236 were able to identify the range of intervention functions most likely to be effective in achieving
237 this change [18]. To help us select the most appropriate intervention functions, our research
238 team (the five authors of this paper) used the APEASE criteria (affordability, practicability,
239 effectiveness, acceptability, side effects and equity) to identify the functions relevant to this
240 intervention. Sustainability issues were also discussed by the research team, for example, we
241 considered whether the intervention sites could or would continue to engage with the
242 proposed intervention functions after we had completed our research.

243 The primary author also used the APEASE criteria with a range of professional stakeholders,
244 and in a less formal manner with the PPI advisory group members, for example asking, “*What*
245 *type of intervention would you like to see, and why?*” Specifically, we intentionally did not go
246 through the APEASE criteria systematically with PPI advisory group members, as we felt that
247 the questions might be too academic for some members. Instead potential interventions
248 options were described, and this would prompt a broader discussion between members. The

249 recordings from these sessions were used to inform the ongoing intervention development
250 process at all stages. Points raised by the PPI advisory groups were discussed with the
251 professional stakeholders at a later stage, and vice versa. Using BCW guidance [18], we then
252 mapped our selected intervention functions to the most frequently used BCTs for each
253 relevant intervention function.

254 At the end of this process, BCTs from all three sources were collated into a 'long list' alongside
255 their definitions and operationalized examples within the context of antipsychotic prescribing
256 to nursing home residents with dementia. Two of the research team members generated this
257 list to ensure that all BCTs could be operationalized for the purpose of our intervention, and
258 that the examples remained true to their respective BCT definition.

259 **Consensus-approach to identifying BCTs**

260 Using the approach reported by Millar *et al.* as a guide [60], we conducted an online tworound
261 Delphi survey with a range of experts to reach consensus on the most appropriate BCTs for
262 our planned intervention. This approach was selected due to the clear and transparent
263 methods described for gaining consensus on interventions in a similar care setting (i.e. nursing
264 homes).

265 Notably, our Delphi survey was distinct from the PPI process, as the former sought to achieve
266 a level of consensus specifically for identifying BCTs, whereas the latter sought to inform the
267 intervention development process as a whole, via involvement and engagement, and occurred
268 over a much longer period of time (Figure 2). Panellists were recruited, both internally from
269 within PPI and stakeholder advisory groups and externally, based on meeting at least one of
270 the following criteria:

- 271 • knowledge or experience of antipsychotic prescribing in
- 272 dementia
- 273 • expertise in behavior change or implementation science
- 274 carer of a person with dementia.

275 All panellists that agreed to participate were emailed a link to the survey and given a deadline
 276 of 3-4 weeks to complete each round, with a reminder email sent as necessary. Only the
 277 panellists who completed the first round were invited to the second round.

278 From our previous research, we concluded that the intervention should target both the
 279 prescriber (GP) and requester (nurse), and this was outlined in the Delphi survey instructions
 280 (Figure 3) [30]. However, we did not explicitly anchor the panellists towards GPs or nurses, as
 281 we were open to broadening our targets based on the feedback from panellists. Furthermore,
 282 this feedback informed discussions with the research team to consider important system level
 283 barriers and facilitators, and whether different BCTs may be required for different intervention
 284 targets.

285 **Figure 3: Example screenshot from an item in the first round**

286

* 3. How would you rate the **importance** of the below mentioned intervention component (BCT) with respect to its unique contribution to an intervention targeting **appropriate antipsychotic requesting and prescribing** for nursing home residents with dementia?

Label	BCT Definition	Operationalised Example
Problem Solving	Analyse, or prompt the person to analyse, factors influencing the behaviour and generate or select strategies that include overcoming barriers and/or increasing facilitators	Identify factors (e.g. behavioural symptoms in residents) that may lead to an inappropriate request for an antipsychotic, and develop non-drug strategies to use in these situations

Neither
unimportant
nor important

Not important (1) (2) (3) (4) (5) (6) (7) (8) (9) Critically important Unable to score

Any comments (please specify)

287

288 Each of the two rounds were sent to the panellists using an online survey tool

289 (SurveyMonkey®, California, US). Panellists were asked to rate how important they perceived

290 each BCT with respect to its unique contribution to an intervention targeting appropriate
291 antipsychotic requesting and prescribing, for nursing home residents with dementia. Panellists
292 were provided with the BCT label, definition and an operationalized example.

293 Panellists were instructed to score the importance of each BCT on a Likert scale ranging from
294 1 (*not important*) to 9 (*critically important*). Panellists were also able to select '*unable to score*'
295 if they felt they could not offer any opinion on that particular BCT [61] (Figure 3). Panellists
296 were also provided with room for additional comments after every BCT and were invited at
297 the end of the first round to suggest additional BCTs which they considered to be important.
298 These suggested BCTs were collated at the end of the first round and added into the second
299 round.

300 Consensus for a BCT being included in the intervention was defined as $\geq 70\%$ of panellists
301 scoring 7-9 and $< 15\%$ scoring 1-3. Exclusion was defined as $\geq 70\%$ scoring 1-3 and $< 15\%$
302 scoring 7-9, in line with the methods described by Millar *et al.* [60]. This scoring system
303 originated from the recommendations of the *Grading of Recommendations Assessment,*
304 *Development and Evaluation* (GRADE) Working Group [61]. The second-round survey only
305 contained BCTs for which no consensus had been reached, along with some additional new
306 BCTs which had been suggested by panellists. Anonymized group scores from round-one were
307 presented beside the BCTs, and panellists were asked to consider this feedback when
308 rescored. At the end of round-two, BCTs that still did not meet consensus were excluded. Data
309 were analyzed descriptively using Microsoft Excel 2013 (WA, USA).

310 Qualitative feedback provided by the panellists was analyzed thematically and informed the
311 second round of the Delphi study. Following the consensus step, to ensure the selected BCTs
312 were appropriate for the Irish context and feasible within the limited resources of the planned

313 intervention, the research team applied the APEASE criteria and considered sustainability
314 issues, one last time, to determine the final set of BCTs.

315 The qualitative feedback provided by the panellists, along with input from the PPI and
316 stakeholder groups also informed the intervention development more broadly.

317 **Results**

318 **Generation of ‘Long List’ of BCTs**

319 **Source 1 (systematic review):** Twenty-three unique BCTs were identified by coding the
320 intervention content of the 22 studies included in the 2014 systematic review [10]. Of these
321 23 BCTs, 18 were coded in at least two studies, and hence were added to the ‘long list’
322 (Supplementary Table S.1). The three most prevalent BCTs among included studies were #4.1
323 *Instruction on how to perform a behavior* in 15 studies [32, 34, 36-40, 42, 44, 46, 49-51, 53,
324 54], #1.4 *Action planning* in 14 studies [32, 34-36, 40, 41, 44-48, 52-54] and #1.2 *Problem*
325 *solving* in 13 studies [32, 36-39, 41, 44-46, 48, 50, 53, 54].

326 **Source 2 (qualitative study):** Mapping of our nine predominant TDF domains (as identified
327 from our qualitative study [31]) to the BCTs using the Cane matrix [58] resulted in the
328 identification of 32 BCTs. The Michie matrix [59] identified four BCTs (*Planning,*
329 *Implementation; Self-monitoring; Social processes of encouragement, pressure, support; and*
330 *Prompts, triggers, cues*). These four BCTs were converted to their nearest BCTTv1 equivalents
331 of #1.4 *Action planning*, #2.3 *Self-monitoring of behavior*, #3.1 *Social support (unspecified)* and
332 #7.1 *Prompts/cues* respectively.

333 **Source 3 (mapping intervention functions to the BCTs):** Linking our nine predominant TDF
334 domains to BCW intervention functions [18], all nine intervention functions were determined

335 to be potentially relevant. Using the APEASE criteria among our research group, with PPI and
336 stakeholder input and considering sustainability issues, we included the following five
337 intervention functions; *Education, Persuasion, Training, Environmental restructuring* and
338 *Modelling* (Supplementary Table S.2). When asked, our PPI advisory group felt strongly that
339 education was key to changing behaviors, and hence should be a central part of any
340 intervention. Using BCW guidance [18], we mapped these five selected intervention functions
341 to the most frequently used BCTs for each respective intervention function, thereby
342 identifying 12 BCTs.

343 In total, 42 unique BCTs across 15 BCT clusters were identified from the three different sources
344 and were included in our 'long list', after removal of 24 duplicate BCTs (Supplementary Table
345 S.3). Initial screening of these 42 BCTs resulted in one BCT being removed (#2.6 *Biofeedback*),
346 as it was agreed that this BCT was inoperable within the context of any possible intervention.
347 Hence 41 BCTs were included in our finalized 'long list' and were operationalized with
348 examples for the purpose of the Delphi survey (Supplementary Table
349 S.4).

350 **Consensus-approach to identifying BCTs**

351 A broad range of stakeholders (n=19) from three countries (Ireland, United Kingdom and
352 Canada) were invited to participate in the Delphi survey; 18 agreed to participate and 16
353 completed both rounds. The 18 panellists included implementation scientists or behavior
354 change experts (n=3), GPs (n=3), nurses (n=3), pharmacists (n=3), consultant psychiatrists of
355 old age (n=2), psychologists with health services research expertise (n=2), a consultant
356 geriatrician (n=1), and a carer (n=1). The carer and one nurse did not complete the second
357 round. Panellists were advised that the examples provided were not necessarily indicative of

358 any planned intervention, nor were we necessarily advocating them. Rather the examples
359 served the purpose of understanding the meaning of these BCTs in the context of a
360 hypothetical intervention.

361 At the end of the first round of the Delphi study, 12 of the 41 BCTs met the inclusion criteria
362 and none met the exclusion criteria. Five new BCTs were included in round 2 based on
363 panellists' suggestions (#1.5 *Review behavior goal(s)*, #1.6 *Discrepancy between current*
364 *behavior and goal*, #8.3 *Habit formation*, #13.2 *Framing/re-framing* and #13.3 *Incompatible*
365 *beliefs*). These were added to the 29 BCTs for which consensus was not reached.

366 BCTs that focused on positive attitudes and working together as a team, such as #1.2 *Problem*
367 *solving*, #1.4 *Action planning*, #12.2 *Restructuring the social environment* and #13.1
368 *Identification of self as role model* were viewed favorably by panellists. Regarding BCT #12.2,
369 one panellist commented:

370 *"An important point as the social influence on prescribing is likely to be significant and*
371 *change will require that all involved are in agreement with a resident's care plan."*

372 Conversely BCTs that had negative connotations such as #5.5. *Anticipated regret* and #16.1
373 *Imaginary punishment*, were considered highly inappropriate, unacceptable and potentially
374 unethical:

375 *"This form of punishment will likely not be acceptable in the health system."*

376 Hence 34 BCTs were circulated in round-two, of which 10 then met the inclusion criteria and
377 two met the exclusion criteria. Therefore, at the end of both rounds, 22 BCTs met the inclusion
378 criteria and two BCTs met the exclusion criteria (Table 1).

379 **Table 1: BCTs meeting inclusion and exclusion criteria after two Delphi rounds**

Included BCT Label	Mean Delphi score	Median Delphi Score	Respondents scoring 'critically important' (%)	Respondents scoring 'not important' (%)
1.1 Goal setting (behavior)†	6.64	7	78.6	14.3
1.2 Problem Solving†	8.56	9	93.75	0
1.4 Action Planning†	8.19	9	93.75	0
1.5 Review behavior goal(s)	7.14	7	85.7	0
1.6 Discrepancy between current behavior and goal	7.36	7	78.6	0
2.2 Feedback on behavior†	7	7	81.25	6.25
4.1 Instruction on how to perform a behavior†	7.29	7.5	78.58	7.14
4.2 Information about antecedents†	7.27	7	73.33	0
5.1 Information about health consequences	7.64	9	78.6	7.1
6.1 Demonstration of the behavior†	7.64	8	78.6	7.1
6.2 Social Comparison†	7.46	8	76.9	0
7.1 Prompts/cues†	7.5	7	78.6	0
8.1 Behavioral practice/rehearsal	7.29	8	71.4	0
8.2 Behavior Substitution†	7.8	8	86.7	0
8.3 Habit formation	7.5	8	85.7	0
9.1 Credible Source†	7.47	8	73.3	0
12.1 Restructuring the physical environment	7.21	7.5	78.6	7.1
12.2 Restructuring the social environment	7.14	7	78.6	0
12.5 Adding objects to the environment†	7.73	8	86.7	0
13.1 Identification of self as a role model	6.93	7	71.4	0
13.2 Framing/re-framing	6.86	7	71.4	14.3
15.3 Focus on past success	7.29	7.5	71.4	0
Excluded BCT Label	Mean Delphi score	Median Delphi Score	Respondents scoring 'critically important' (%)	Respondents scoring 'not important' (%)
12.3 Avoidance/reducing exposure to cues for the behavior	2.21	1	7.1	78.6
16.1 Imaginary punishment	2.5	2	7.1	71.4

Applying the APEASE criteria as a research team to these 22 BCTs and considering 380 sustainability issues, resulted in a finalized list of 16 BCTs from 10 BCT clusters (Table 2).

381

Table 2: Use of APEASE criteria to finalize behavior change techniques

382

BCT	Label	Affordability	Practicability	Effectiveness and cost effectiveness	Acceptability	Side effects/safety	Equity	Decision Yes/No	Reasons for exclusion
1.1	Goal setting (behavior)	✓	✗	✓	✗	✗	✓	No	Feedback from panellists was generally skeptical. National or regional data on antipsychotic prescribing patterns in nursing home residents with dementia is not readily available in Ireland, hence this BCT is not practicable. Furthermore, there may be some safety concerns about indiscriminately reducing antipsychotic prescribing levels.
1.2	Problem Solving	✓	✓	✓	✓	✓	✓	Yes	
1.4	Action Planning	✓	✓	✓	✓	✓	✓	Yes	
1.5	Review behavior goal(s)	✓	✗	✓	✗	✗	✓	No	As 1.1
1.6	Discrepancy between current behavior and goal	✓	✗	✓	✗	✗	✓	No	As 1.1
2.2	Feedback on behavior	✓	✗	✓	✗	✗	✓	No	As 1.1
4.1	Instruction on how to perform a behavior	✓	✓	✓	✓	✓	✓	Yes	
4.2	Information about antecedents	✓	✓	✓	✓	✓	✓	Yes	
5.1	Information about health consequences	✓	✓	✓	✓	✓	✓	Yes	
6.1	Demonstration of the behavior	✓	✓	✓	✓	✓	✓	Yes	

6.2	Social Comparisons	✓	✗	✓	✗	✗	✓	No	As 1.1 In addition, feedback suggested that comparator data needs to be matched for each individual prescriber in order to be useful (which is not feasible)
7.1	Prompts/cues	✓	✓	✓	✓	✓	✓	Yes	
8.1	Behavioral practice/rehearsal	✓	✓	✓	✓	✓	✓	Yes	
8.2	Behavior Substitution	✓	✓	✓	✓	✓	✓	Yes	
8.3	Habit formation	✓	✓	✓	✓	✓	✓	Yes	
9.1	Credible Source	✓	✓	✓	✓	✓	✓	Yes	
12.1	Restructuring the physical environment	✗	✗	✓	✓	✓	✓	No	Restructuring the physical environment for the purpose of this time and budget-constrained intervention, would not be affordable or practicable.
12.2	Restructuring the social environment	✓	✓	✓	✓	✓	✓	Yes	
12.5	Adding objects to the environment	✓	✓	✓	✓	✓	✓	Yes	

13.1	Identification of self as a role model	✓	✓	✓	✓	✓	✓	Yes	
13.2	Framing/reframing	✓	✓	✓	✓	✓	✓	Yes	
15.3	Focus on past success	✓	✓	✓	✓	✓	✓	Yes	

BCT = Behavior Change Technique

0

1 Qualitative feedback from the panellists influenced our decision-making. Generally, feedback
2 towards all goal setting BCTs was met with skepticism. Specifically, in relation to the BCT #1.1
3 *Goal setting (behavior)*, some panellists felt that setting targets for antipsychotic prescribing
4 reductions may not have the intended consequence:

5 *“This is not helpful - prescribing needs to be appropriate, not necessarily reduced. You*
6 *might have no reduction, after a goal of 10% reduction, and staff would become*
7 *demoralized, even though a good process (exists).”*

8 Although the BCT #6.2 *Social comparison* was rated relatively highly in terms of importance
9 for changing prescribing behaviors (Table 1), several panellists expressed concerns that unless
10 the prescribing data were matched to each physician’s local patient population, then
11 comparing their prescribing to that of their peers was not necessarily beneficial. Currently,
12 there are no such systems in place at a regional or national level in Ireland to allow prescribers
13 to compare their antipsychotic prescribing practices to their peers. Moreover, there were
14 some concerns that the prescribers may be potentially identifiable from any de-novo local
15 dataset, and hence there was some reluctance to engage in audit and feedback:

16 *“Importance depends on comparator selected: physicians may be more likely to*
17 *identify with local comparators than national (although may be feasibility issues with*
18 *local comparators).”*

19 Therefore, goal setting and social comparison BCTs were judged to have acceptability,
20 practicability and safety issues according to the APEASE criteria, and were excluded by the
21 research team (Table 2). The reasons for exclusion of all six BCTs at this stage are outlined in
22 Table 2.

23 **Discussion**

24 This paper describes the process of identifying BCTs for inclusion in a complex intervention
25 aimed at sustainably reducing inappropriate antipsychotic prescribing to nursing home
26 residents with dementia. By using the BCW approach, and detailing our process, we have
27 identified BCTs in a transparent manner and have thus enabled replication of our process by
28 other researchers. Hence, the method described here to identify appropriate BCTs could be
29 used as an example for other interventions. Our findings also have implications for practice,
30 as the BCTs identified may be used as the basis for behavior change and quality improvement
31 interventions by GPs and nurses working in the nursing home setting.

32 A systematic review and meta-analysis of BCTs in deprescribing interventions across contexts
33 was published in 2018 by Hansen *et al.* [62]. Of 1,561 articles identified by the authors, 25
34 studies were included in this review, identifying 28 BCTs and 13 BCT clusters targeting
35 deprescribing behaviors. The most frequently coded BCTs among included studies were #4.1
36 *Instruction on how to perform a behavior* (n=16), #9.1 *Credible source* (n=16) and #2.2
37 *Feedback on behavior* (n=14). There was a large overlap between the BCTs we identified
38 through coding the systematic review by Thompson-Coon *et al.* (n=18 BCTs) [10] and those
39 identified in the systematic review by Hansen *et al.* (n=28 BCTs) [62], despite the lack of
40 overlapping studies between the two systematic reviews. For example, of the 10 BCTs
41 identified by Hansen *et al.* and not initially identified by us, five of these were later identified

42 through other sources of BCTs. The five remaining BCTs that were not identified by us through
43 this process were unlikely to be included in the final intervention for various reasons. For
44 example, panellists' responses suggested that some BCTs from the *goals and planning*,
45 *feedback and monitoring* or *comparison of behavior* clusters would not be feasible in an Irish
46 nursing home setting, due to the lack of routine feedback on antipsychotic prescribing
47 practices. However, due to evidence to support the effectiveness of audit and feedback
48 strategies [63], policymakers should consider developing suitable systems to enable
49 prescribers to compare their own antipsychotic prescribing levels to that of their peers, in a
50 meaningful manner.

51 Although previous studies have used Delphi surveys to identify BCTs for inclusion in behavior
52 change interventions [26, 28, 29], key questions remain with regards to how best to select
53 the most appropriate BCTs for a planned intervention. A standardized approach to selecting
54 BCTs (such as the one undertaken in the current study) should be developed and agreed upon,
55 to provide guidance for intervention developers and researchers. Additionally, more research
56 is required to determine the most efficient approach to identifying and testing which BCTs
57 lead to sustainable behavior change and ultimately better patient outcomes. One of the key
58 strengths of this study was the transparent use of innovative methods to identify BCTs. By
59 using this systematic and transparent approach we believe that we have contributed to the
60 evolving science of complex intervention development. By retrieving potential BCTs from
61 three different sources informed by previous research [10, 30, 31], and by involving a wide
62 range of individuals in this process, we believe that we have used a comprehensive approach
63 to identify the most appropriate BCTs for our planned intervention. Of particular benefit to
64 further developing our intervention was the elicitation of stakeholders' views on certain BCTs,

65 through the Delphi survey, PPI and stakeholder advisory groups. These views have helped to
66 contextualize some of the key issues relevant to the Irish nursing home setting and have
67 reinforced the importance of education and teamwork.

68 We argue that the precise qualitative methodologies adopted by intervention developers
69 should suit the research questions rather than follow any strict protocol. For example, we
70 used a deductive, TDF-based approach for our interview study [31]. Whereas Sinnott *et al.*
71 (who also used the BCW [23]) used an inductive, grounded theory approach for their
72 interview study [64]. Both approaches informed our respective intervention development
73 processes, thereby indicating that either approach may be appropriate depending on the
74 research questions asked.

75 One of the limitations of our study was the constrained involvement of people with dementia
76 and carers in our Delphi survey. The carer who attempted the Delphi survey (along with some
77 of the participating healthcare professionals) found the language of BCTs excessively
78 academic. We had considered involving more PPI advisory group members in the Delphi
79 survey; however, it is likely that the same situation would have arisen and may have resulted
80 in undue stress in those individuals. In hindsight, their involvement in this particularly
81 academic BCT identification process may not have been appropriate. Although we held
82 several participatory meetings with PPI advisory group members, even more face-to-face time
83 describing the possible intervention options and using participatory techniques such as card
84 sorting and direct ranking may have been a more appropriate method of co-creating an
85 intervention [65]. Alternatively, the approach used by Fergie *et al.* may have been more
86 accommodating as it enables panellists to rank the importance of various options and to
87 discuss potential solutions, in plain English, and only after consensus is reached are the

88 findings coded by the researchers using BCTs [29]. However, time constraints prevented us
89 from attempting these alternative approaches. Though we may have unsuccessfully involved
90 PPI advisory group members in commenting on the precise components of a provider-facing
91 intervention, the members created a rich narrative around their values and preferences that
92 will be crucial in implementing the complex intervention. The challenge of meaningfully
93 involving patients and public in research is an important issue to address as there are unique
94 insights and mutual benefits that can only be gained by truly involving people directly affected
95 by a condition [15, 66]. More evidence is required to help researchers understand how best
96 to meaningfully involve people with dementia and carers in the development of
97 theoryinformed interventions.

98 The next step in our project involves identifying the mode of delivery for our intervention, in
99 addition to the sequencing and packaging of our selected intervention functions and BCTs.
100 Inappropriate antipsychotic prescribing to nursing home residents with dementia has become
101 a topical subject in recent times due to increased media scrutiny [67]. Many different
102 interventions and strategies have been developed recently in an attempt to curb this
103 inappropriate prescribing, both at local and national levels, including a repeat prescribing tool
104 for GPs [68], a program combining staff training, social interaction, and antipsychotic
105 prescribing guidance [69] and public reporting of antipsychotic prescribing levels in nursing
106 homes [70].

107 While the focus of the current research was at the behavioral level, the successful
108 implementation of the intervention will also require a consideration of the systems level and
109 wider context. The issue of appropriate prescribing could also benefit from drawing more
110 broadly from the implementation science literature, for example exploring the issue as an

111 example of the ‘de-implementation’ of harmful practice [71]. From our previous qualitative
112 research [30, 31], it was evident that multifaceted approaches are needed in order to achieve
113 sustainable improvements. It is therefore important to consider the full range of potential
114 modes of delivering our intervention, including the suitability of various theoretical
115 approaches used in implementation science, before deciding on the most appropriate for our
116 particular target behaviors, population groups and setting [18]. For example, though we have
117 identified education should be a core component of our intervention, we need to determine
118 how best to deliver educational interventions, using which theory, and alongside what, to
119 achieve sustainable results.

120 **Conclusion**

121 Sixteen BCTs were identified for inclusion in a complex intervention targeting GP and nursing
122 antipsychotic prescribing and requesting behaviors to nursing home residents with dementia,
123 through an expert consensus process. More research is required to help researchers
124 understand how best to meaningfully involve people with dementia and carers in the
125 development of a theory-informed intervention, and how best to select BCTs for complex
126 interventions. The systematic and detailed approach undertaken to identify appropriate BCTs
127 in this study, could be used as an example for other interventions.

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Table S.1: Behavior Change Techniques identified in the 22 interventional studies included in the systematic review by Thompson-Coon et al.

Study (year)	1.1	1.2	1.3	1.4	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.3	6.1	6.2	7.1	8.1	8.2	9.1	12.1	12.2	12.5	
Ray (1987)		✓		✓							✓		✓	✓					✓	✓				
Schultz (1991)									✓													✓	✓	
Avorn (1992)				✓							✓		✓						✓	✓				
Rovner (1992)				✓	✓									✓							✓			
Ray (1993)	✓	✓	✓	✓					✓		✓		✓		✓			✓		✓				
Meador (1997)	✓	✓							✓		✓		✓	✓	✓						✓			
Heal (1998)		✓				✓	✓				✓		✓		✓									
Schmidt (1998)		✓						✓			✓			✓									✓	
Earthy (2000)				✓	✓						✓		✓	✓				✓						✓
Ballard (2002)		✓		✓					✓			✓											✓	
Hagen (2005)											✓			✓				✓			✓			

Fossey (2006)	✓	✓		✓	✓				✓		✓	✓		✓	✓				✓		✓		
Study (year)	1.1	1.2	1.3	1.4	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.3	6.1	6.2	7.1	8.1	8.2	9.1	12.1	12.2	12.5
Dahl (2008)		✓	✓	✓		✓											✓					✓	✓
Monette (2008)		✓	✓	✓	✓				✓		✓		✓	✓			✓			✓		✓	
Morrisson (2009)	✓			✓		✓											✓						✓
Patterson (2010)		✓		✓	✓														✓			✓	
Westbury (2010)		✓			✓						✓		✓			✓	✓			✓		✓	
Testad (2010)								✓			✓			✓									
Khan (2011)	✓								✓	✓	✓	✓	✓		✓					✓		✓	
Chakraborty (2012)	✓			✓		✓																✓	
Vida (2012)		✓		✓	✓						✓	✓	✓	✓						✓			
Monette (2013)		✓	✓	✓	✓				✓		✓		✓	✓			✓			✓		✓	
Total no. of BCTs	6	13	4	14	8	4	1	2	8	1	15	4	11	11	5	1	7	1	3	12	1	11	3

1.1 = Goal setting (behavior); 1.2 = Problem solving; 1.3 = Goal setting (outcome); 1.4 = Action planning; 2.2 = Feedback on behavior; 2.3 = Self-monitoring of behavior; 2.4 = Self-monitoring of outcome(s) of behavior; 3.1 = Social support (unspecified); 3.2 = Social support (practical); 3.3 = Social support (emotional); 4.1 =

Instruction on how to perform the behavior; 4.2 = Information about antecedents; 5.1 = Information about health consequences; 5.3 = Information about social and environmental consequences; 6.1 = Demonstration of the behavior; 6.2 = Social comparison; 7.1 = Prompts/cues; 8.1 = Behavioral practice/rehearsal; 8.2 = Behavior substitution; 9.1 = Credible source; 12.1 = Restructuring the physical environment; 12.2 = Restructuring the social environment; 12.5 = Adding objects to the environment

Persuasion (using communication to induce	✓	✓	✓	✓	✓	✓	Yes	
positive or negative feelings or stimulate action)								
Restriction (Using rules to reduce the opportunity to engage in the target behavior)	✓	✗	✓	✗	✗	✓	No	Restriction was not acceptable to any stakeholder as it would 'limit agency on the part of the target group'. There were also concerns regarding the practicability of implementing such an intervention and also regarding the potential safety issues regarding not prescribing antipsychotics.
Training (imparting skills)	✓	✓	✓	✓	✓	✓	Yes	

BCW = Behavior Change Wheel; APEASE = Affordability, Practicability, Effectiveness, Acceptability, Side effects/safety, Equity

Table S.3: The ‘Long List’ of BCTs and source(s)

The ‘Long List’ of BCTs (label)	1. Intervention Content (systematic review)	2(a). TDF domains via Cane matrix (qualitative study)	2(b). TDF domains via Michie matrix (qualitative study)	3. Intervention Functions: BCW guidance (APEASE criteria)
1.1 Goal setting (behavior)	✓			
1.2 Problem solving	✓			
1.3 Goal setting (outcome)	✓			
1.4 Action planning	✓		✓	
2.2 Feedback on behavior	✓	✓		✓
2.3 Self-monitoring of behavior	✓	✓	✓	✓
2.6 Biofeedback		✓		
2.7 Feedback on outcome(s) of behavior				✓
3.1 Social support (unspecified)	✓	✓	✓	
3.2 Social support (practical)	✓	✓		
3.3 Social support (emotional)		✓		
4.1 Instruction on how to perform a behavior	✓			✓
4.2 Information about antecedents	✓	✓		
5.1 Information about health consequences	✓	✓		✓
5.2 Salience of consequences		✓		
5.3 Information about social and environmental consequences	✓	✓		✓
5.4 Monitoring of emotional consequences		✓		
5.5 Anticipated regret		✓		
5.6 Information about emotional consequences		✓		
6.1 Demonstration of the behavior	✓	✓		✓
6.2 Social comparison		✓		
6.3 Information about others’ approval		✓		
7.1 Prompts/cues	✓	✓	✓	✓
7.2 Cue signalling reward		✓		

8.1 Behavioral practice/ rehearsal				✓
8.2 Behavior substitution	✓			
9.1 Credible source	✓			✓
9.2 Pros and cons		✓		
9.3 Comparative imagining of future outcomes		✓		
10.4 Social reward		✓		
10.11 Future punishment		✓		
11.2 Reduce negative emotions		✓		
12.1 Restructuring the physical environment		✓		✓
12.2 Restructuring the social environment	✓	✓		
12.3 Avoidance/reducing exposure to cues for the behavior		✓		
12.5 Adding objects to the environment	✓			✓
13.1 Identification of self as role model		✓		
15.1 Verbal persuasion about capability		✓		
15.3 Focus on past success		✓		
16.1 Imaginary punishment		✓		
16.2 Imaginary reward		✓		
16.3 Vicarious consequences		✓		
Total number of BCTs identified*	18	32	4	12

*Total number of BCTs identified = 66. After removal of duplicate BCTs (n=24), this resulted in 42 unique BCTs.

Table S4: Operationalized BCT examples for the purpose of online Delphi study

Label	BCT Definition	Operationalised Example
1.1 Goal setting (behavior)	Set or agree on a goal defined in terms of the behavior to be achieved	Nursing home staff/GPs set a goal to reduce the total number of residents who are prescribed an antipsychotic over 3 months
1.2 Problem Solving	Analyze, or prompt the person to analyze, factors influencing the behavior and generate or select strategies that include overcoming barriers and/or increasing facilitators	Identify factors (e.g. behavioral symptoms in residents) that may lead to an inappropriate request for an antipsychotic, and develop non-drug strategies to use in these situations
1.3 Goal setting (outcome)	Set or agree on a goal defined in terms of a positive outcome of wanted behavior	Nursing home staff/GPs set a goal to reduce the number of falls in residents, as a result of reduced antipsychotic usage
1.4 Action Planning	Prompt detailed planning of performance of the behavior (must include at least one of context, frequency, duration and intensity).	Encourage nursing home staff to develop a plan of how and when non-drug intervention will be attempted first-line
2.2 Feedback on behavior	Monitor and provide informative or evaluative feedback on performance of the behavior	Inform nursing home staff/GPs of how many residents with dementia, under their care, are prescribed antipsychotics monthly
2.3 Self-monitoring of behavior	Establish a method for the person to monitor and record their behavior(s) as part of a behavior change strategy	Ask nursing home staff to document every time they request an antipsychotic medication for a resident
2.7 Feedback on outcome of behavior	Monitor and provide feedback on the outcome of performance of the behavior	Inform GPs of how many residents with dementia under their care who are prescribed antipsychotics, had a fall, monthly
3.1 Social Support (unspecified)	Advise on, arrange or provide social support (e.g. from friends, relatives, colleagues, 'buddies' or staff) or non-contingent praise or reward for performance of the behavior. It includes encouragement and counselling, but only when it is directed at the behavior	Ask GPs to reinforce/praise nursing staff for completing the assessment tool, before requesting an antipsychotic

3.2 Social Support (practical)	Advise on, arrange, or provide practical help (e.g. from friends, relatives, colleagues, 'buddies' or staff) for performance of the behavior	Advise nursing home staff to identify a colleague who they can seek help from when completing an assessment tool for residents with behavioral symptoms
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Label	BCT Definition	Operationalised Example
3.3 Social Support (emotional)	Advise on, arrange, or provide emotional social support (e.g. from friends, relatives, colleagues, 'buddies' or staff) for performance of the behavior	Advise nursing home staff to identify a colleague who they can seek emotional support from if a particularly distressing behavior occurs/reoccurs as a result of not requesting or prescribing an antipsychotic
4.1 Instruction on how to perform a behavior	Advise or agree on how to perform the behavior (includes 'Skills training')	Provide written information to GPs on how to deprescribe an antipsychotic, in the form of an algorithm
4.2 Information about antecedents	Provide information about antecedents (e.g. social and environmental situations and events, emotions, cognitions) that reliably predict performance of the behavior	Advise nursing staff to record on the assessment tool, details of situations or events that occurred leading to antipsychotic prescriptions
5.1 Information about health consequences	Provide information (e.g. written, verbal, visual) about health consequences of performing the behavior	Provide written and oral information to GPs and Nursing home staff regarding the side effects of antipsychotics
5.2 Salience of consequences	Use methods specifically designed to emphasize the consequences of performing the behavior with the aim of making them more memorable (goes beyond informing about consequences)	Provide nursing home staff with a sensationalized newspaper headline depicting the negative consequences of antipsychotic prescribing in residents with dementia
5.3 Information about the social and environmental consequences	Provide information (e.g. written, verbal, visual) about social and environmental consequences of performing the behavior Note: consequences can be for any target, not just the recipient(s) of the intervention;	Provide written information to GPs and Nursing home staff regarding the costs of antipsychotics
5.4 Monitoring of emotional consequences	Prompt assessment of feelings after attempts at performing the behavior	Advise nursing home staff to record how they feel after requesting (or not requesting) an antipsychotic for a resident with behavioral symptoms
5.5 Anticipated Regret	Induce or raise awareness of expectations of future regret about performance of the unwanted behavior	Ask nursing staff/GPs to assess the degree of regret they will feel if they request/prescribe antipsychotics inappropriately

5.6 Information about emotional consequences	Provide information (e.g. written, verbal, visual) about emotional consequences of performing the behavior	Provide visual information on the positive emotions experienced by nursing home staff when non-pharmacological interventions were used successfully
6.1 Demonstration of the behavior	Provide an observable sample of the performance of the behavior, directly in person or indirectly e.g. via film, pictures, for the person to aspire to or imitate	Demonstrate to nursing staff how to use the assessment form using a pre-recorded video
6.2 Social Comparison	Draw attention to others' performance to allow comparison with the person's own performance	Show the GPs the proportion of nursing home residents with dementia nationally who were prescribed antipsychotics, and compare with their own data

Label	BCT Definition	Operationalised Example
6.3 Information about others' approval	Provide information about what other people think about the behavior. The information clarifies whether others will like, approve or disapprove of what the person is doing or will do	Tell the Nursing home staff that people with dementia and family carers strongly disapprove of the use of antipsychotics, except in certain situations
7.1 Prompts/cues	Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behavior. The prompt or cue would normally occur at the time or place of performance	Place an assessment tool in the residents care plan as a reminder to complete, every time the resident exhibits behavioral symptoms
7.2 Cue signalling reward	Identify an environmental stimulus that reliably predicts that reward will follow the behavior	Advise nursing home staff that they will be rewarded for completing the assessment tool for residents with dementia, but will receive no reward for completing the tool in residents without dementia
8.1 Behavioral practice/rehearsal	Prompt practice or rehearsal of the performance of the behavior one or more times in a context or at a time when the performance may not be necessary, in order to increase habit and skill	Prompt nursing home staff to practice using the assessment tool based on a case study in a classroom setting
8.2 Behavior substitution	Prompt substitution of the unwanted behavior with a wanted or neutral behavior	Prompt nursing home staff to suggest non-drug alternatives instead of prescribing antipsychotics
9.1 Credible Source	Present verbal or visual communication from a credible source in favour of or against the behavior	Delivery of an educational session on appropriate antipsychotic prescribing from a pharmacist who is an expert in this area

9.2 Pros and Cons	Advise the person to identify and compare reasons for wanting (pros) and not wanting to (cons) change the behavior	Ask nursing home staff to list and compare the advantages and disadvantages of antipsychotic prescribing in people with dementia
9.3 Comparative imagining of future outcomes	Prompt or advise the imagining and comparing of future outcomes of changed versus unchanged behavior	Prompt GPs to imagine and compare likely or possible outcomes in the future, should current levels of inappropriate antipsychotic prescribing continue versus reduced levels of inappropriate prescribing
10.4 Social Reward	Arrange verbal or non-verbal reward if and only if there has been effort and/or progress in performing the behavior	Congratulate nursing home staff every time they complete the assessment tool
10.11 Future punishment	Inform that future punishment or removal of reward will be a consequence of performance of an unwanted behavior (may include fear arousal) (includes 'Threat')	Inform nursing staff/GPs that inappropriate requesting/prescribing of antipsychotics may result in public shaming/censuring by HIQA and/or the media
11.2 Reduce negative emotions	Advise on ways of reducing negative emotions to facilitate performance of the behavior (includes 'Stress Management')	Advise nursing home staff on the use of stress management skills to reduce anxiety associated with not using antipsychotics in residents
Label	BCT Definition	Operationalised Example
12.1 Restructuring the physical environment	Change, or advise to change the physical environment in order to facilitate performance of the wanted behavior or create barriers to the unwanted behavior (other than prompts/cues, rewards and punishments)	Advise to paint the doors of the wards to prevent wandering/exitseeking behaviors in residents and hence reduce the need for antipsychotics
12.2 Restructuring the social environment	Change, or advise to change the social environment in order to facilitate performance of the wanted behavior or create barriers to the unwanted behavior (other than prompts/cues, rewards and punishments)	Advise nurses to complete the assessment tool in conjunction with healthcare assistants, family members, GPs and residents (where appropriate)
12.3 Avoiding/reducing exposure to cues for the behavior	Advise on how to avoid exposure to specific social and contextual/physical cues for the behavior, including changing daily or weekly routines	Advise GPs to limit ward rounds to once weekly to reduce face-to-face time with nursing home staff, and hence restrict the amount of inappropriate requests for antipsychotics
12.5 Adding objects to the environment	Add objects to the environment in order to facilitate performance of the behavior	Provide assessment tools to the wards to enable appropriate requesting of antipsychotics

13.1 Identification of self as role model	Inform that one's own behavior may be an example to others	Inform nursing home staff that if they complete the assessment tool every time a resident exhibits a behavior, this may encourage other staff to start using the tool
15.1 Verbal persuasion about capability	Tell the person that they can successfully perform the wanted behavior, arguing against self-doubts and asserting that they can and will succeed	Tell the GP that they can successfully improve the appropriateness of their antipsychotic prescribing despite the challenges that exist
15.3 Focus on past success	Advise to think about or list previous successes in performing the behavior (or parts of it)	Advise the nursing home staff to describe occasions where nondrug strategies worked and antipsychotics were not needed
16.1 Imaginary punishment	Advise to imagine performing the unwanted behavior in a real-life situation followed by imagining an unpleasant consequence (includes 'Covert sensitisation')	Advise nursing home staff/GP to imagine inappropriate requesting/prescribing of antipsychotics followed by public shaming and censuring by the media and HIQA
16.2 Imaginary reward	Advise to imagine performing the wanted behavior in a real-life situation followed by imagining a pleasant consequence (includes 'Covert conditioning')	Advise nursing home staff/GP to imagine not prescribing antipsychotics followed by an improvement in residents behavioral symptoms and their quality of life
16.3 Vicarious consequences	Prompt observation of the consequences (including rewards and punishments) for others when they perform the behavior	Draw attention to the negative media attention other GPs have received for prescribing antipsychotics inappropriately