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**Sensory devices for older adults with behavioural disturbance in the emergency department: a descriptive study**  
--Manuscript Draft--

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| <b>Full Title:</b>                             | Sensory devices for older adults with behavioural disturbance in the emergency department: a descriptive study   |
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| <b>Order of Authors Secondary Information:</b> |  |
| <b>Abstract:</b>                               | Non-pharmacological strategies are advocated for the management of behavioural disturbance in older adults due to the risk of harm from pharmacological therapy; however, there is limited evidence supporting their use in emergency departments (EDs). A descriptive study was conducted to present uses of: sensory devices as non-pharmacological management of behavioural disturbance and their perceived impact. Data were collected from the sensory device registry, electronic medical records, and survey. Patient-level data (N=33) showed that sensory devices, such as tactile blankets or toys and music, can be used in ED to alleviate behavioural disturbance amongst older adults. Staff (N=22) expressed their interest to increase device supply. A patient and carer (N=2) suggested that the devices should be initiated earlier in the ED care. There are limitations to descriptive study designs, thus further research is required to strengthen the evidence on the impact of these devices on patient outcomes. |
| <b>Author Comments:</b>                        |  |
| <b>Response to Reviewers:</b>                  | Thank you for accepting our contribution to the care of older adults in the emergency department. Reviewers' feedback and our detailed responses span 11 pages so they have been uploaded as a Word document in this revision.   |

**TITLE** Sensory devices for older adults with behavioural disturbance  
in the emergency department: a descriptive study

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1    **Abstract**

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3    disturbance in older adults due to the risk of harm from pharmacological therapy; however,  
4    there is limited evidence supporting their use in emergency departments (EDs). A descriptive  
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7    the sensory device registry, electronic medical records, and survey. Patient-level data (N=33)  
8    showed that sensory devices, such as tactile blankets or toys and music, can be used in ED  
9    to alleviate behavioural disturbance amongst older adults. Staff (N=22) expressed their  
10   interest to increase device supply. A patient and carer (N=2) suggested that the devices should  
11   be initiated earlier in the ED care. There are limitations to descriptive study designs, thus  
12   further research is required to strengthen the evidence on the impact of these devices on  
13   patient outcomes.

14

15   **Keywords** dementia, cognitive impairment, therapeutic activity kit, non-pharmacological  
16   interventions, emergency nursing, agitation

17 **BACKGROUND**

18 The number of older adults ( $\geq 65$  years old) seeking care in emergency departments (ED) is  
19 expected to continue to rise due to the ageing population, poor access to primary care and  
20 social support, and poor self-efficacy (Lowthian et al., 2011). It is common for older adults to  
21 present with behavioural and psychological disturbance related to dementia or delirium  
22 (Samaras, Chevalley, Samaras, & Gold, 2010). For example, in one study 72% of elderly  
23 patients referred to a behavioural emergency response team had history of dementia  
24 (Simpkins, Peisah, & Boyatzis, 2016). Delirium is challenging to quantify due to suboptimal  
25 screening methods (Barron & Holmes, 2013). However, there is a broad agreement that  
26 hyperactive delirium, a subtype of delirium, is commonly detected due to its clinical features  
27 (Nagaraj, Burkett, Hullick, Carpenter, & Arendts, 2016). Symptoms of behavioural and  
28 psychological disturbance of dementia and hyperactive delirium generally overlap, and can  
29 include restlessness, anxiety, agitation, aggression, combative, confusion, and delusions (Han  
30 & Wilber, 2013; Kales, Gitlin, & Lyketsos, 2015). For the purpose of this study, these  
31 symptoms are referred to as behavioural disturbance.

32

33 Detection and treatment of underlying physiological causes of behavioural disturbance are a  
34 priority in EDs (McCabe & Kennelly, 2015), but it is also imperative to manage the symptoms  
35 that pose a risk to patients and staff (Gottlieb, Long, & Koyfman, 2018). Consequent on the  
36 harm and poor efficacy from pharmacological restraints (i.e. sedatives, antipsychotics,  
37 benzodiazepines) (Gustafsson, Sandman, Karlsson, Gustafson, & Lovheim, 2013; Yap et al.,  
38 2019), the first line of management should be non-pharmacologic measures (Gottlieb et al.,  
39 2018; McCabe & Kennelly, 2015; Nagaraj et al., 2016). However, in practice, pharmacological  
40 management is more prevalent (Silwanowicz et al., 2017) perhaps because EDs are not well-  
41 equipped to support non-pharmacological strategies to manage behavioural disturbance in  
42 older adults (Boltz, Parke, Shuluk, Capezuti, & Galvin, 2013).

43

44 Broadly, non-pharmacological strategies can be sensory (i.e. music, distraction aids),  
45 psychosocial (i.e. socially-assistive devices, pet therapy, and meaningful activities), or a care  
46 protocol (i.e. communication strategy) (Scales, Zimmerman, & Miller, 2018). Research has  
47 largely focused on sensory and psychosocial devices as evidenced by their success in  
48 communities or residential aged care facilities (Abdi, Al-Hindawi, Ng, & Vizcaychipi, 2018;  
49 Konno, Kang, & Makimoto, 2014; Leng et al., 2019; van der Steen et al., 2018). Systematic  
50 reviews show that amongst community-dwelling older adults with dementia, music  
51 interventions improved quality of life, and reduced anxiety and resistance-to-care behaviours  
52 (i.e. pulling away, grabbing objects) (Konno et al., 2014; van der Steen et al., 2018). Socially-  
53 assistive robots resulted in positive impacts on agitation, depression, and social interaction  
54 (Abdi et al., 2018; Leng et al., 2019). Sensory and psychosocial devices are not as widely  
55 studied in the ED (Lee et al., 2020), perhaps owing to the presumption that they may be difficult  
56 to implement due to inherent time constraints, environmental stimuli in, or physical design of,  
57 the ED (Clevenger, Chu, Yang, & Hepburn, 2012).

58

59 Nevertheless, although mainly anecdotal, it is encouraging that there is a small body of  
60 literature on the use of sensory devices to manage behavioural disturbance (Higgs et al., 2020;  
61 James & Hodnett, 2009; Ricker & Mulligan, 2017). Furthermore, the protocol for an empirical  
62 study investigating the feasibility and effectiveness of sensory devices on one-on-one nursing  
63 care requirement, chemical, and physical restraint has recently been proposed (Higgs et al.,  
64 2020).

65

66 In the context of the scarcity of evidence supporting the use of sensory strategies for  
67 behavioural disturbance amongst older adults, this study was undertaken over a six-month  
68 period in one ED. The aim of this study was to describe uses of sensory devices, patient  
69 characteristics, and perceived impact on patient outcomes. Study findings will contribute to  
70 the evidence of the value of non-pharmacological strategies in the form of sensory devices in  
71 the management of older adults with behavioural and psychological disturbance in the ED.

72 **METHODS**

73 **Ethics**

74 The study was approved as low risk research by the Metro South Human Research Ethics  
75 Committee.

76 **Study design**

77 This was a descriptive study design utilising information from routinely collected patient data  
78 and a brief survey of **end-users** (patients, their carers and staff) to inform the indications and  
79 types of devices used, perceived efficacy and operational challenges of using the devices in  
80 the ED.

81 **Setting**

82 The study ED is part of a public, metropolitan, adult tertiary referral hospital in Brisbane,  
83 Australia and has over 65,000 presentations annually. During the study period, 23% of ED  
84 presentations were made by older adults seeking care for varying conditions, similar to the  
85 national average of 22% (Australian Institute of Health and Welfare, 2018). The ED has  
86 dedicated clinical nurses who conduct comprehensive nursing assessment for community-  
87 dwelling older adults presenting to the ED. Their aim is to improve the care trajectory of older  
88 adults as they are cared for in the ED.

89 **Description of sensory devices and their use**

90 In this study, the sensory devices were three smart tablets loaded with games and music, with  
91 noise-cancelling headphones for the tablets; tactile devices that included five sensory  
92 blankets, two stuffed toy animals or dolls, and several colouring books and pencils. Devices  
93 were available in the department from September 2019. Any staff could use, if indicated, the  
94 devices for older adults who present with agitation, anxiety, irritability, restlessness or to  
95 improve comfort or their overall experience in the ED. They were asked to record their use of

96 the devices in a logbook to monitor usage and ensure their return. For ease of access they  
97 were kept in a trolley outside the medication room (Supplement 1).

98

99 Multifaceted strategies were used to implement the devices. Staff were first notified via email  
100 that the devices were available, along with the 'Guidelines for the use of sensory devices'  
101 (Supplement 1) and the survey. Ten volunteer nurse champions capitalised on shift  
102 handovers, departmental meetings, or informal conversations between colleagues to:  
103 encourage the use and recording of sensory devices and complete the survey. In addition,  
104 posters that contained pictures and advice of the availability of sensory devices were put up  
105 in frequented areas.

106 ***Sampling and data collection***

107 **Patient data**

108 Convenience sampling was used to obtain the study population. Patients' names, unique  
109 identifiers, and devices were extracted from the sensory device logbook for all entries from  
110 September 2019 to March 2020. Subsequently, age, sex, presenting problem, triage category,  
111 date/time of arrival in ED, date/time discharged from ED, documented signs of behavioural  
112 disturbance in the nursing notes, PRN chemical restraints (anxiolytics, benzodiazepines, anti-  
113 psychotics) and time administered in the ED, and one-on-one care requirement were collected  
114 from the ED electronic medical records system (FirstNet); then, input to a Microsoft Excel  
115 worksheet.

116

117 **Survey**

118 Information about the study and a QR (**quick response**) code link to the Microsoft Forms  
119 electronic survey was printed on a poster next to the logbook. Survey questions (Supplement  
120 2) were framed to generate responses of perceived efficacy and operational challenges in the  
121 use of the devices, and to gather other feedback from staff and patients or their carers. To

122 obtain responses from patients and carers, we relied on staff to encourage them to provide  
123 feedback. Data from Microsoft Forms were converted to Microsoft Excel.

124 **Data analysis**

125 Patient data and survey information were separately analysed. Descriptive statistics were  
126 used for patient data including demographics, clinical characteristics, documented behaviours  
127 and devices used.

128

129 Qualitative content analysis technique (Hsieh & Shannon, 2005) was used to analyse survey  
130 data to dictate the perceived efficacy and difficulties of using the sensory devices in the ED.  
131 Initial keywords (i.e. agitation, anxiety) for perceived efficacy were pre-determined based on  
132 previous evidence (Abdi et al., 2018; Konno et al., 2014; Leng et al., 2019; van der Steen et  
133 al., 2018). The number of times the keywords were selected in the survey (Supplement 2)  
134 were summated and presented as counts. Free text data were used as quotes to support the  
135 pre-determined keywords.

136 **RESULTS**

137 **Sensory devices used**

138 During the study period, there were 44 recorded uses of sensory devices in the logbook. Of  
139 which, 75% (n=33) were utilised for older adults, aged 68-95 years.

140

141 Of the study patient cohort (N=33), the male to female ratio was approximately 1:1. The older  
142 persons' presenting complaints varied, and included falls, mood disturbance, or pain (Table  
143 1). Two-thirds of the sensory devices used were tactile devices (n=22, 67%). Commonly  
144 documented indications for sensory devices were agitation, confusion, resistance to care (i.e.  
145 getting out of bed, pulling intravenous lines or monitoring equipment), and distress.

146

147 [Insert Table 1 about here]

148

149 About 40% of the study cohort had chemical restraint (Table 1). Sensory devices were first  
150 initiated for the one in three of those who received chemical restraint. Similarly, one in three  
151 required one-on-one monitoring by an assistant-in-nursing.

152

153 ***Perceived Impact***

154 Twenty-two nurses, a patient, and a carer responded to the survey. Of those who responded,  
155 12 nurses used tactile devices and 10 used smart tablets. Both the patient and carer provided  
156 a response for each of the device they used. Therefore, perceived impact below is subdivided  
157 into the types of devices used.

158

159 **Tactile devices**

160 Nurses believed that tactile devices gave patients something to do (n=7) and had an impact  
161 on agitation (n=6), anxiety (n=5), stress (n=3), and pain (n=1):

162 “*Nice to have these items to utilise as a distraction*”. -Nurse 3

163

164 “*Very effective for this patient. Reduced agitation, stopped her from climbing out of*  
165 *bed, seemed very content when touching blanket*” -Nurse 6

166

167 A carer of a patient who received a tactile device rated 4 of 5 (1=very poor to 5=very  
168 good) that the device contributed to the patient’s overall experience in the ED. The carer  
169 noted that earlier implementation would have been beneficial:

170

171 “*This was initiated on pts arrival to short stay, could have been initiated much earlier*  
172 *to provide a distraction to IVC [from intravenous cannula]*”. -Patient/carer 2

173

174 Two main issues were highlighted. First, the size of the accessories for the tactile devices  
175 hindered engagement for some patients. Second, there was a limited supply of sensory  
176 devices in the department:

177

178 *"Needs to be more of them. I took the last one and it takes time to replenish the stock.*

179 *We have dementia patients all the time". -Nurse 9*

180

181 Smart tablets

182 The nurses reported using the smart tablets to play pre-loaded or live streamed classical music  
183 or popular genre music thought to be familiar to the patient. Similar to tactile devices, nurses  
184 suggested that tablets alleviated patients' agitation (n=9), stress (n=6), anxiety (n=5), and pain  
185 (n=1). In addition, the devices provided patients something to do (N=4) or distraction (n=2):

186

187 *"Settled down almost straight away, brought back pleasant memories for the patient,*  
188 *freed staff to fulfil other duties". -Nurse 4*

189

190 *"It was a trial, and it worked for the patient. Stopped him from getting out of bed". -Nurse*  
191 *10*

192

193 The patient, rated 5 of 5 that the device contributed to his overall experience in the ED,  
194 noting:

195

196 *"The music was lovely, liked choice of songs". -Patient 1*

197

198 As with the tactile devices, nurses were frustrated that there were not enough of the smart  
199 tablets available to be used when needed. Further, sources of frustration were flat batteries  
200 (n=3) or internet access (n=2):

201

202 "I tried to use the iPad for a patient, I was unable to connect to the internet and it took me  
203 10+ minutes with multiple people trying to assist with nil success". -Nurse 8

204

205 **DISCUSSION**

206 The aim of this study was to describe uses of sensory devices, patient characteristics, and  
207 perceived impact on patient outcomes in the ED. Our findings indicate that sensory devices,  
208 tablets with music and tactile devices were used for older adults who exhibit agitation,  
209 confusion, resistance to care or distress. Devices were well received because they alleviated  
210 these behavioural symptoms.

211

212 The Sensoristasis Imbalance Model (SIM) (Kovach, 2000) could explain the underlying  
213 mechanism of action of sensory devices. The SIM posits that people with dementia experience  
214 disruptions in sensoristasis (equilibrium of sensory state) as a result of underlying illnesses or  
215 changes in their environment. For example, high stimulus exceeds stress threshold;  
216 conversely, low stimulus leads to sensory deprivation. Either, high or low stimulus, produces  
217 affective discomfort that can translate into behaviours such as agitation (Kovach, 2000).

218 Sensory-calming activities, such as those provided by tactile devices and music, restores  
219 sensoristasis; thus, settle agitation (Kovach, 2000). Certainly, the physiological basis for using  
220 music therapy amongst older adults with dementia has been established as evidenced by  
221 increases in melatonin and reductions of stress hormone salivary chromogranin A  
222 (McDermott, Crellin, Ridder, & Orrell, 2013). In community settings, a series of music therapy  
223 sessions led to improvements in anxiety, depression, and quality of life, but its impact on  
224 agitation or aggression is inconsistent (van der Steen et al., 2018). This may be due to  
225 fluctuating levels of stimuli and agitation or minimal levels of agitation in the study population  
226 (Blackburn & Bradshaw, 2014). It remains unclear if a single, brief exposure to music would  
227 yield similar benefits, but based on our findings it is plausible.

228

229 There is limited evidence associating sensory devices with a reduction of pharmacological  
230 restraints, but we acknowledge that a study has been proposed (Higgs et al., 2020). In effect,  
231 if sensory devices can manage behavioural disturbance then pharmacological restraints could  
232 decrease. In our study cohort 40% received pharmacological restraint, which is higher than  
233 previously reported at 19% (Silwanowicz et al., 2017). Of note, of those who received  
234 pharmacological restraint one-third were being managed with sensory devices first. Staff were  
235 not specifically instructed to consider sensory devices first, so this was a promising finding  
236 and could be indicative that sensory devices were used appropriately as first-line management  
237 of behavioural disturbance.

238

239 Those challenges experienced here in the use of sensory devices related to the availability of  
240 stock and the internet and power for the tablets. Tactile devices are sent away to the hospital's  
241 laundry service, with turnarounds taking up to three weeks at times. Also, when patients are  
242 admitted, the devices are taken and could be used during their entire stay limiting device  
243 availability. Internet access for the tablets is through the hospital's free wi-fi and have to be  
244 connected every time the tablets are used. If staff are not familiar with this process, connection  
245 can be an issue. Tablets are not connected to chargers all the time, so if idle, they can  
246 discharge. Tablets could still be used to play music while charging. Solutions to issues raised  
247 are currently being considered i.e. fast-track the cleaning of tactile devices, request a  
248 permanent wi-fi connection for tablets, and using power banks to charge the tablets.

249

## 250 ***Limitations***

251 Data from the logbook and survey were independent. The authors recognise that in some  
252 instances uses were not recorded although the survey was completed, or users were  
253 recorded, but the survey was not completed. Based on this, we believe that over the six-month  
254 period the devices were used more than the number recorded or reported.

255

256 One could argue about the specific impact of devices or whether one is superior than the other  
257 (i.e. music versus tactile devices). There is no universal approach to the management of  
258 behavioural disturbance in older adults in the ED. For example, music, when not desired, could  
259 worsen such agitation, so the choice of device should be appropriate for the patient.

260

261 Patient or carer participation was poor, so this can hinder generalisability of findings. In future  
262 studies, investigators need to consider appropriate methods to enhance consumer  
263 participation in their setting.

264

265 This was a descriptive study – the indication for the use of devices was based on behavioural  
266 symptoms rather than diagnosis of dementia or delirium and outcomes were not measured  
267 objectively, so findings herein need to be interpreted considering selection, detection, and  
268 performance biases. Although the study is descriptive, it has merit because it is evidence that  
269 sensory devices can be used in the emergency setting consistent with previous anecdotal  
270 evidence (James & Hodnett, 2009; Ricker & Mulligan, 2017).

271

## 272 CONCLUSION

273 This descriptive study demonstrates that sensory devices, such as music and tactile devices,  
274 can be used in the ED to allay behavioural disturbance in older adults such as agitation,  
275 confusion, resistance to care or distress.

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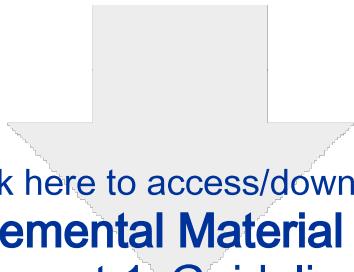
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**Table 1. Characteristics of the study population (N=33).**

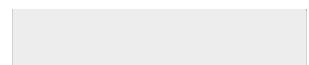
| Age (range)   |   | 68-95 years |     |
|---|---|-------------|-----|
|   |   | n           | %   |
| Sex   | Female                                      | 16          | 48% |
|   | Male  | 17          | 52% |
| Australasian Triage Scores                            | 1   | 1           | 1%  |
|   | 2   | 7           | 14% |
|   | 3   | 17          | 52% |
|   | 4&5   | 8           | 33% |
| Presenting problem                                    | Fall  | 10          | 30% |
|   | Mood disturbance                            | 6           | 18% |
|   | Pain  | 6           | 18% |
|   | Altered level of consciousness              | 3           | 9%  |
|   | Requesting investigation                    | 2           | 6%  |
|   | Other                                       | 6           | 18% |
| Documented behaviours (not mutually exclusive) (N=26) | Agitation                                   | 12          | 46% |
|   | Resistance to care:                         |             |     |
|   | Getting out of bed                          | 7           | 27% |
|   | Pulling out tubes, monitoring equipment     | 5           | 19% |
|   | Pulling off clothing, sheets                | 4           | 15% |
|   | Aggressive (i.e. hitting, verbally hostile) | 6           | 23% |
|   | Confusion                                   | 5           | 19% |
|   | Distress                                    | 2           | 8%  |
| Chemical restraints in ED                             | Nil   | 20          | 61% |
|   | Droperidol                                  | 7           | 21% |
|   | Haloperidol                                 | 3           | 9%  |
|   | Other                                       | 3           | 9%  |
| Comforting product used                               | Tactile devices                             | 22          | 67% |
|   | Smart tablets                               | 7           | 21% |
|   | Unknown                                     | 4           | 31% |
| Initiated first (N=13):                               | Pharmacological management                  | 7           | 54% |
|   | Sensory devices                             | 4           | 31% |
|   | Unknown                                     | 2           | 15% |

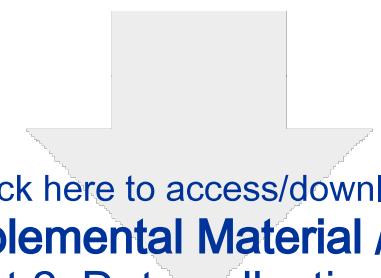
|                           |     |    |                |
|---------------------------|-----|----|----------------|
| Required one-on-one care  | Yes | 11 | 33%            |
|                           | No  | 22 | 67%            |
| ED length of stay (range) |     |    | 3.6-23.4 hours |

**Legend:** ED, emergency department



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