1 **AN EVIDENCE-BASED PROGRAM TO IMPROVE ANALGESIC PRACTICE AND**

2 **PAIN OUTCOMES IN RESIDENTIAL AGED CARE FACILITIES**

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22 Running head:

23 Effect of a Pain Management Program in RACFs

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25   **ABSTRACT**

26   Pain is common in those living in residential aged care facilities (RACFs) and a number of

27   obstacles have been identified as recurring barriers of adequate pain management. To address

28   this, the Australian Pain Society developed 27 recommendations for comprehensive good

29   practice in the identification, assessment and management of pain. This study reviewed pre-

30   existing pain management practice at five Australian RACFs and identified changes needed

31   to implement the recommendations, and then implemented an evidence based program that

32   aimed to facilitate improved pain management. The program involved staff training and

33   education, and revised in-house pain-management procedures. Reviews occurred pre- and

34   post-program, and included the assessment of 282 residents for analgesic utilisation and pain

35   status. Results showed that analgesic use improved post-program (p <.001), with a decrease

36   in residents receiving no analgesics (from 15% to 6%) and an increase in residents receiving

37   Around-The-Clock plus Pro Re Nata (ATC+PRN) analgesics (from 24% to 43%). There were

38   improvements in pain relief for residents with scores indicative of pain, with ABBEY

39   (p=.005), PAINAD (p=.001), and NOPPAIN (p<.001) scores all improving. Although

40   physical function declined as expected, SF-36 bodily pain scores (p=.001) also showed

41   improvement. The results demonstrate that improved evidence based practice and outcomes

42   in RACFs can be achieved with appropriate training and education. Investing resources in the

43   aged care workforce via this program has improved analgesic practice and pain relief in

44   participating sites. Further attention to the continued targeted pain management training of

45   aged care staff is likely to improve pain-focused care for residents.

46   **KEY WORDS:** pain, pain management, residential aged care, training, program

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INTRODUCTION

Those in Australia aged over 65 years with care needs that include 24 hour nursing care are eligible to receive 'high level' care in Residential Aged Care facilities (RACFs). For some residents in RACFs, 'low level' care of 24 hours personal care and intermittent nursing care is sufficient. Overall, residents' care needs are substantial - over 40% of residents have circulatory system and/or musculoskeletal and connective tissue related diseases listed as their first medical condition (excluding mental and behavioural disorders). Also 50% of residents have dementia and 26% have a mental illness without dementia[1]. Pain is common in these settings, affecting up to 80% of residents, although international research findings demonstrate that the absolute prevalence of pain can vary substantially between facilities[2,3]. Obstacles have been recognised as potential barriers to adequate pain management in aged care. Under-prescription of opioids for pain relief in residential aged care is a problem, with some practitioners fearful of patients becoming addicted to prescription opioids or experiencing adverse side effects[4]. This practice is changing as research findings show that the risk of opioid dependency is low when these medications are used for medical reasons[5,6], and as new drug formulations are introduced with fewer side effects[7]. However, other factors remain that are detrimental to good pain management in residential aged care[8] - including non-standardised approaches to pain assessment[9], insufficient pain management knowledge base for staff[9], inconsistent care due to high staff turnover or staff shortage[4], and poor multidisciplinary pain management structures[8].

A number of international studies have implemented programs to improve pain management practice in residential aged care. These programs have involved strategies to improve the staff's education in pain assessment and management[10,11,12], typically administered to all levels of nursing staff and sometimes combined with changing pain management practice at an institutional level[12,13,14]. Results invariably show improvement on some aspect of pain

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73 management practice, though pain relief outcomes may be mixed. Stevenson et al 2006[15]

74 showed improvements in some areas relating to pain management in long term care facilities,

75 as well as reduced self-reported pain of any severity and of at least moderate pain. Baier et al

76 2004[16] implemented a pain management program in nursing homes that showed

77 improvements in pain assessment but not analgesic use or prevalence of pain. A similar

78 program implemented by Horner et al 2005[14] showed improvements in pain assessment but

79 failed to show a difference in pain treatment of residents with at least moderate daily pain. A

80 program implemented in long term care facilities by Kaasalainen et al 2012[12] showed

81 comparatively more increased pain in a control group compared to an pain protocol

82 intervention group, though both groups had increased pain scores over the intervention

83 period.

84 To address the complexity of pain management in residential aged care, the Australian Pain

85 Society (APS) developed a framework comprising 27 key recommendations[17,18]. Based on

86 best available evidence, these recommendations outlined best practice in the identification,

87 assessment and management of pain in RACFs. These recommendations were also supported

88 with a toolkit provided to all Australian RACFs by the Australian Government[17,18] that could

89 be used as the basis of an evidence based training and education program to be deployed in

90 RACFs. However, prior to this study, no implementation and evaluation program had been

91 developed to embed the toolkit and recommendations into routine care. Also, although there

92 are a number of pain management programs that have been developed and tested

93 internationally, the authors were (and remain) unaware of any pain management program

94 specifically designed for Australian RACFs that utilises a comprehensive framework such as

95 the APS key recommendations. This project aimed to address implementation of the 27

96 recommendations and evaluate outcomes.

97

98   **METHODS**

99   Conducted in 2008-9, this study used a pre-test / post-test design. Five facilities in three

100   Australian states (QLD, VIC, WA) were selected to partner in this study, representing a

101   spectrum of RACFs (high, low or dementia-specific care, large or small bed capacity,

102   culturally diverse, and in metropolitan or regional settings). A pre-test (baseline) review of

103   pre-existing pain management practices and outcomes in these RACFs identified gaps in

104   training and organisational changes needed to implement the recommendations. A

105   comprehensive program (including staff education and training, pain assessment procedures,

106   broadening staff roles, and pain management resources) was then conducted to address gaps

107   in pain management practice. A post-implementation (post-program) review evaluated the

108   success of the program in practice and outcomes.

109   Ethical approval for the study was obtained from the Alfred Hospital Ethics Committee

110   (VIC), Curtin University Ethics Committee (WA), Edith Cowan University Ethics Committee

111   (WA), and Queensland University of Technology Ethics Committee (QLD).

112   **Subjects**

113   An exhaustive sample of all residents participated in the reviews, with a minority of residents

114   refusing to participate. Next of kin consented on behalf of residents without the capacity to

115   consent themselves (unless there was no provision for proxy consent, in which case the

116   relevant ethics committee granted waiver of consent).

117   **Assessment tools**

118   Residents were individually assessed using a comprehensive battery of pain and

119   psychometric tools. The Resident's Verbal Brief Pain Inventory (RVBPI)[20], ABBEY pain

120   scale[21], Pain Assessment in Advanced Dementia Scale (PAINAD)[22], Non-communicative

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121 Patient's Pain Assessment Instrument scale (NOPPAIN)[23] and Short Form 36 Health

122 Survey[24] were used to assess pain. The RVBPI was adapted from the Brief Pain Inventory[25]

123 and is an abbreviated self-report verbal pain scale. It consists of a number of questions,

124 including 'pain today', 'worst pain', 'average pain, 'least pain', and 'pain now'. ABBEY (0

125 to 18 scale), PAINAD (0 to 10 scale), and NOPPAIN (0 to 30 scale) are pain scales designed

126 to be used in patients that cannot self-report or with cognitive impairment. These three scales

127 differ slightly in the items they endorse as indicative of pain. The Short Form 36 Health

128 Survey [SF-36] is a general health self-report questionnaire with subscales including physical

129 (0 to 100 scale) and bodily pain assessment (0 to 100 scale). Resident prescription medication

130 charts were also reviewed to determine analgesic utilisation and to complete the Medication

131 Quantification Scale (MQS)[26]. Only analgesics prescribed and signed as given were included.

132 Residents were also assessed on a number of well-established psychometric tools – the

133 Geriatric Depression Scale (GDS)[27], Cohen-Mansfield Agitation Inventory (CMAI)[28], and

134 Barthel Index[29].

135 **Procedure**

136 All eligible residents were assessed at baseline and post-program. The observational tools

137 were used for every resident and tools requiring self-report were administered when

138 achievable. The baseline review also included:

139 • expert assessment of current practice after observation undertaken over a four week

140 period (including the evaluation of existing structured pain identification and

141 assessment procedures, pain management policies and quality improvement

142 processes, and the integration of multidisciplinary collaborations and treatment

143 protocols)

144   • the compilation of summaries of pharmacological and non-pharmacological

145   interventions,

146   • focus groups with residents, family and staff to describe existing practice and

147   outcomes (including administration of a Pain Management Staff Survey)

148 In this way, the baseline review identified any evidence based practice gaps. These gaps were

149 prioritised and the implementation program tailored at each individual facility to ensure that

150 all key areas were covered but also to implement strategies that addressed prioritised areas.

151 Program delivery was also adapted to the learning needs at each facility (variable due to

152 differences in staff cultural background, English language proficiency, etc).

153 Each RACF then underwent the implementation program designed to address identified

154 practice deficits. This program aimed to improve pain management in accordance with the 27

155 APS recommendations and encompassed four main categories of activities: staff education

156 and training (eg training in verbal / non-verbal pain tools and the use of mobilisation

157 protocols; importance of around the clock analgesics), the establishment of a regular

158 evidence-based pain assessment procedure (eg regularly asking about pain and regular re-

159 assessment; structured procedures to identify the causes of pain; structures to identify pain in

160 those unable to report it), the appointment of pain champions / pain team (eg systems to

161 improve multidisciplinary collaboration between physician, staff and allied health; referral to

162 pain clinics for those that fail to respond to treatment; demonstration of a pain vigilant

163 culture), and the co-ordination of available resources for pain management (eg structured

164 staff procedures to document pain-related behaviour; availability of both pharmacological

165 and non-pharmacological pain treatment therapies; pain management quality improvement

166 processes).

167   Staff attended lectures, workshops (four x three-hour sessions) and one-on-one 'on the job'

168   training (two x half-day sessions), though this varied depending on nursing staff capacity.

169   Training was also tailored in response to staff roles at each RACF. Nursing staff received

170   additional training on analgesics and behaviour assessment, support staff received additional

171   training on noticing and reporting resident behaviours, and managerial staff received

172   additional training on systems such as linking pain assessment with government funding

173   structures. Educational content included an overview of pain and ageing and dementia,

174   current evidence and APS guidelines, usage of pain assessment tools and their practical

175   application, pain management practice and treatment options, and a summary of changes to

176   pain management practice and staff roles. The RVBPI (and either ABBEY or PAINAD for

177   non-verbal residents) were recommended to facility staff as appropriate tools in pain

178   assessment and were encouraged to be completed at least every three months, or more

179   regularly when appropriate. Facilities changed policy and procedures to reflect these new

180   practices.

181   Pain Champions were also appointed at each facility and most established 'pain teams',

182   staffed by a combination of clinical managers, pain champions, nurse unit managers, and

183   allied health staff. Co-ordination of available pain management resources included collating

184   resources, developing external pain management contacts, commissioning pain specialists for

185   some residents with intractable pain, and making available a multidisciplinary pain clinic for

186   individual treatments.

187   The post-program review was conducted approximately one year after the initial one.

188   Assessments were done blind to any treatment changes between reviews.

189   **Data Analysis**

190 Residents were classified with cognitive impairment when scoring < 24 on the Mini-Mental

191 State Examination (MMSE)[30] or 4+ on the Psychogeriatric Assessment Scales - Cognitive

192 Impairment Scale (PAS-Cog)[31]. Analgesic use was defined as the protocol of drug

193 administration [None (NIL), Pro-Re-Nata (PRN), Around-The-Clock (ATC), Around the

194 Clock plus Pro-Re-Nata (ATC+PRN)]. The impact of the program on analgesic use at the

195 RACFs was assessed using chi-square analysis.

196 Separate MANOVA repeated measures multivariate tests were used on non-verbal pain

197 measures (ABBEY, PAINAD, NOPPAIN), RVBPI measures (worst pain, least pain, average

198 pain, pain now), and physical components of the SF-36 (Physical Function, Role-physical,

199 bodily pain, General Health) to determine between-subject cognitive status effects, within-

200 subject program effects, and cognitive status x program interaction effects. For non-verbal

201 pain assessment tests, only residents with baseline scores indicative of likely pain were

202 included (cut-offs of ABBEY > 3.5, PAINAD > 3.5, NOPPAIN > 4.5[32]). Though cut-offs

203 here were higher than recommended for 'daily practice', they correspond reasonably well

204 with those recommendations, and were based on ROC curve cut-off points from previous

205 work[32]. For RVBPI tests, only residents that answered 'Yes' to the item 'Do you feel pain

206 today?' were included. Wilk's Lambda was used for all multivariate tests. Univariate analysis

207 used Greenhouse-Geiser with Bonferroni correction. All analyses were conducted using

208 SPSS Statistics for Windows, version 17.0 (Chicago: SPSS Inc).

209

210 **RESULTS**

211 **Participation Rates**

212 The project achieved a very high 92% recruitment rate with 365 residents assessed at

213 baseline, and 330 residents assessed post-program. A sub-sample of 282 residents was used

214 for analysis in this paper, restricted to residents assessed at both reviews. Table 1 shows the

215 demographic and clinical characteristics of the sample at baseline. The sample was primarily

216 female (77%), average age 85 years, and with 29% of residents with a PAS-Cog or MMSE

217 indicating no cognitive impairment, 25% with mild cognitive impairment, and 46% with

218 moderate or severe cognitive impairment.

219

220 [Table 1 around here]

221

222 **Non-Pharmacological Pain Management**

223 The use of non-pharmacological pain management treatments at baseline and post-program

224 were compared. For residents reporting pain on the day of testing (n=83), 34% (n=28)

225 reported using any form of non-pharmacological treatment at baseline review compared with

226 42% (n=35) at post-review (n=83, $\chi^2 = 0.928$).

227

228 **Analgesic Utilisation Practice**

229 The impact of the program on current analgesic use was assessed by comparing the

230 prevalence of analgesic prescription type (NIL, PRN, ATC, or ATC+PRN) at baseline and

231 post-program. Though the program could also be assessed in relation to changes in dosage or

232 analgesic class, the timing of analgesic use (NIL, PRN, etc) is also an important benchmark,

233 especially useful for evaluating pain management systems. The results showed significant

234   changes in analgesic utilisation practice after the program. This was evident for all residents

235   (Fig 1), those cognitively intact (Fig 2A), those with any level of cognitive impairment (Fig

236   2B), and residents identified with at least moderate to severe cognitive impairment (results

237   not shown).

238   Figure 1 shows the effect of the program on all participating residents. Analgesic prescription

239   rates at baseline were 15% (NIL), 17% (PRN), 44% (ATC), and 24% (ATC+PRN). Post-

240   program rates were 6% (NIL), 21% (PRN), 30% (ATC), and 43% (ATC+PRN). Chi-square

241   analysis confirmed changes in analgesic practice (χ^2 = 116.43, df = 9, p < .001). 75% (n = 30)

242   of residents without analgesics were prescribed at least PRN post-program, with 53% (n =

243   16) of those prescribed at least ATC. Though 62% (n = 28) on PRN analgesics at baseline

244   remained on PRN, 33% (n = 15) were on analgesics with an ATC component post-program.

245   ATC prescription rates also shifted, with 48% (n = 56) previously on ATC prescribed an

246   additional PRN analgesic post-program. It should be noted that a supplementary analysis of

247   all participating residents (including those not assessed at both time points) yielded a similar

248   pattern of analgesic use (results not shown).

249

250   [Figure 1 about here]

251

252   Figure 2 shows the effect of the program on analgesic use for the cognitively intact (A) and

253   the cognitively impaired (B). For the cognitively intact at baseline (Figure 2A), rates were

254   25% (NIL), 16% (PRN), 32% (ATC), and 27% (ATC+PRN). Post-program rates were 6%

255   (NIL), 25% (PRN), 32% (ATC), and 37% (ATC+PRN). Chi square analysis showed

256   differences in analgesic use for the cognitively intact (χ^2 = 34.33, df = 9, p < .001), with 44%

257 prescribed PRN from previously none, and 35% prescribed ATC+PRN from previously ATC

258 only. Figure 2B shows the effect of the program on residents with any level of cognitive

259 impairment. Baseline rates were 10% (NIL), 17% (PRN), 47% (ATC) and 26% (ATC+PRN).

260 Post-program rates were 5% (NIL), 16% (PRN), 36% (ATC) and 44% (ATC+PRN). Chi-

261 square analysis confirmed changes in analgesic use (χ^2 = 63.17, df = 9, p < .001). 67%

262 without analgesics at baseline were prescribed at least PRN post-program. 44% on ATC at

263 baseline were changed to ATC+PRN post-program. When stratifying the group by only those

264 with moderate to severe cognitive impairment, the pattern of analgesic practice was also

265 similar (results not shown).

266

267 [Figure 2 about here]

268

269 **Pain Measurement Scores**

270 Multivariate repeated measures MANOVA (see Table 2) were performed on non-verbal pain

271 assessments (ABBEY, PAINAD, NOPPAIN), RVBPI subscales (Worst pain, Least pain,

272 Average pain, pain Now), and the physical domain of the SF-36 (Physical Function, Role

273 physical, Bodily Pain, General Health). Sample sizes were smaller for non-verbal measures

274 and RVBPI subscales due to fewer residents meeting the pain cut-off criteria or indicating

275 pain on the day of assessment, respectively. For non-verbal pain measures, there were

276 significant within-subject program effects [$F(3,121)$ = 7.06, p < .001], with significant

277 univariate effects for ABBEY (p = .005), PAINAD (p = .001), and NOPPAIN (p < .001). For

278 RVBPI measures, there were no significant within-subject program effects [$F(4,81)$ = 2.08, p

279 = .091], though the univariate effect for Least pain was significant (p = .046). For the

12

280 physical components of the SF-36, there were significant within-subject program effects [$F_{(4,}$

281 $_{202)} = 6.22$, $p < .001$], with univariate effects significant for physical function ($p = .001$) and

282 bodily pain ($p = .001$).

283

284 [Table 2 about here]

285

286 Table 3 shows the change in pain score (for ABBEY, PAINAD, NOPPAIN) from baseline to

287 post-program, for residents meeting the non-verbal pain score cut-offs. Pain score worsened

288 in 29% of residents. Pain score was unchanged for 11% to 21% of residents. Pain score

289 improved in 50% to 60% of residents.

290

291 [Table 3 about here]

292

293 **DISCUSSION**

294 Pain management in residential aged care can be difficult due to obstacles such as non-

295 standardised approaches to pain, insufficient staff knowledge and support, high staff turn-

296 over, and poor multidisciplinary pain management integration. The APS key

297 recommendations and associated toolkit endeavour to address these barriers, and this project

298 aimed to improve pain management in a number of Australian RACFs by implementing and

299 evaluating a comprehensive program that incorporated such guidelines.

300 The results suggest that a program aiming to incorporate a best available evidence approach

301 to pain management in RACFs can improve both practice and pain-related outcomes. After

13

302 the program, analgesic use had shown considerable improvement. The number of residents

303 with no analgesic prescription diminished post-program, particularly in the cognitively intact

304 group. Likewise, the number of residents prescribed ATC + PRN increased post-program,

305 with the largest gains seen in the cognitively impaired.

306 As well as significant improvements in adherence to APS guidelines in analgesic practice,

307 there were improvements in pain scores after the program. For residents with pain scores

308 exceeding the cut-offs, non-verbal pain measures (ABBEY, PAINAD, NOPPAIN) were all

309 lower after the program. As previous work has shown that non-verbal pain assessments are

310 sensitive to pain severity in people with dementia[32], it supports the notion that this

311 intervention program was successful in improving pain relief. The distribution of change in

312 pain score during the study showed that approximately 30% of residents had pain scores that

313 had worsened post-program, whilst 10% to 20% had unchanged pain scores. However, the

314 majority (50% to 60%) had pain scores that improved at least 1 point, with up to 20% of

315 those improving by considerably more (4+ points on the ABBEY / PAINAD, or 7+ on the

316 NOPPAIN). An improvement of this magnitude would potentially have a significant impact

317 on a resident experiencing pain.

318 There were also changes in the physical component of the SF-36, with the bodily pain

319 subscale from the Short Form-36 health survey improving post-program. This suggests that

320 reports of recent bodily pain and interference with activity due to that pain were less severe

321 after the program. The post-program bodily pain scores (69.85 ± 25.28) were consistent with

322 normative scores of the general population over 75 years old (69.3 ± 23.84) whilst the

323 baselines scores (63.99 ± 25.68) were consistent with scores of the general population of any

324 age and with arthritis or osteoporosis conditions [33]. The results suggest an implementation

325 program can be particularly successful at relieving bodily pain conditions and improving

326 related function.

327   The results from our study showed that pain scores improved in residents in pain at baseline,

328   and together with evidence showing improved compliance with APS pain management

329   guidelines and improved staff self-efficacy (reported in a second paper by the same

330   authors[34]), suggests that the program was successful in embedding evidence-based pain

331   management recommendations into routine care. However, though overall pain scores after

332   the program improved for residents with likely pain, still 40% to 50% either had unchanged

333   or worsened pain scores. It is unclear whether these residents had difficult to treat or

334   intractable pain, whether acute pain between baseline and post-program had inflated pain

335   scores, whether disease had progressed with accompanying increases in pain, or that the

336   program was insufficiently targeted to improve certain painful conditions. Likewise, other

337   factors could instead be responsible for the improvements seen in analgesic use and pain

338   scores. Unrelated management policies or turnover in aged care staff may have inadvertently

339   impacted pain management. It is however reasonable to assume that any improvements seen

340   post-program were due to the implementation program.

341   Comparisons with other international research on the efficacy of programs to improve pain

342   management practice in aged care have shown mixed outcomes. Stevenson et al 2006[15]

343   outlined a large scale program implemented in a variety of health care organisations. Though

344   not specifically tailored to long-term care, the program demonstrated significant reductions in

345   the average prevalence of pain in the past 24 hours for residents that could self-report in 26

346   long-term care facilities, when measured using a one-minute verbal pain questionnaire.

347   Unlike our study, only a small sample (ten residents) at each facility was assessed pre and

348   post-program. Nonetheless they showed that the number of residents receiving analgesics

349   improved post-program. Our study showed a similar finding with an increase in the

350   prevalence of analgesic use for residents without cognitive impairment post-implementation

351   program. A program designed for long-term nursing homes by Horner et al 2005[14] showed

352 improvements in pain assessment but no difference in pain treatment of residents with

353 moderate or excruciating pain. Unlike our study, they did show an increase in the use of non-

354 pharmacological pain treatments post-program. A pain management program for long-term

355 care by Kaasalainen et al 2012 [12] showed that after a one year period, the control group had

356 higher non-verbal pain scores than the intervention group. However the intervention group

357 was still shown to have higher non-verbal pain scores post-intervention program. This

358 compares to our study also showing that pain worsened for 29% of residents that met non-

359 verbal pain score cut-offs. Overall however, all non-verbal pain measures were lower after

360 our implementation program. A recent study by Tse et al 2013 showed that an integrated pain

361 management program can improve a number of outcomes for the elderly in nursing homes[35].

362 This short program (eight weeks) was implemented only for cognitive residents in a nursing

363 home. Not only did pain scores improve, but also measures of happiness, geriatric depression,

364 and life satisfaction.

365 There are a number of limitations with this study. The inclusion of a control group would

366 have strengthened the design of the study and allowed for more direct comparisons of the

367 effectiveness of the implementation program at each facility. A second limitation is that this

368 study does not report on the impact of the side effects of analgesic medications, an important

369 issue in pain management. Although nursing staff was educated on the potential side effects

370 of analgesic medication, adverse events associated with its use (such as constipation with

371 opioids) were not documented for study purposes. As such, the implementation program

372 could not be assessed in this regard.

373

374 **CONCLUSION**

375   This study demonstrates that for the RACFs that participated in the program, best evidence

376   based practice can be achieved with additional training and education, and appropriate

377   changes to institutional pain management practice. The results show that the implementation

378   program can demonstrate improvements in pain-related outcomes, such as better analgesic

379   utilisation and improved pain relief. Investing directed resources in the aged care workforce

380   may therefore improve care for residents.

393   **Conflict of Interest:**

Elements of Financial/Personal Conflicts	S Savvas		C Toye		E Beattie		S Gibson	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X
Grants/Funds		X		X		X		X
Honoraria		X		X		X	X	
Speaker Forum		X		X		X		X
Consultant		X		X		X		X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X		X
Patents		X		X		X		X
Personal Relationship		X		X		X		X

394   *Authors can be listed by abbreviations of their names.
395   For all "Yes" responses, provide a brief explanation here:

407

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GRAPHICS

Table 1: Clinical Characteristics of the Sample (n=282) at Baseline.

	Total n	(%)	Mean ± SD
Age (years)	282		85.3 ± 7.7
Sex: Total	282	(100%)	
Male	66	(23%)	
Female	216	(77%)	
MMSE Score	51		19.1 ± 12.1
PAS-Cog Score	183		9.7 ± 6.9
Cog Impairment: Total	230	(100%)	
No impairment	67	(29%)	
Mild impairment	58	(25%)	
Moderate or Severe	105	(46%)	
SF-36 Total Score	222		61.5 ± 19.5
Abbreviated GDS	217		3.8 ± 3.1
MQS	282		13.6 ± 9.4
CMAI	281		34.9 ± 11.8
Barthel Index	280		53.9 ± 31.8

SD, Standard Deviation; MMSE, Mini-Mental State Examination (range 0-30); PAS-Cog, Psychogeriatric Assessment Scale - Cognitive Impairment Scale (range 0-21); SF-36, Short Form (36) Health Survey (range 0-100), GDS, Geriatric Depression Scale; MQS, Medication Quantitative Scale, CMAI, Cohen-Mansfield Agitation Inventory.

Table 2: *Change in Pain Score.* Mean pain scores at baseline and <u>one year </u>post-program.

	N	Baseline Mean (SD)	Post-program Mean (SD)	df	MeanSq	F	p
				Pairwise comparisons		
Non-Verbal Pain Assessments							
ABBEY	124[a]	5.97 (2.63)	5.08 (3.19)	1	48.79	7.99	.005**
PAINAD	124[a]	3.90 (1.80)	3.19 (1.79)	1	31.23	12.48	.001**
NOPPAIN	124[a]	9.33 (4.87)	7.13 (4.74)	1	300.52	17.77	<.001**
Resident Verbal Brief Pain Inventory Subscales							
RVBPI worst pain	84[b]	2.39 (0.83)	2.35 (0.88)	1	0.05	0.09	.760
RVBPI least pain	84[b]	0.78 (0.68)	0.99 (0.99)	1	1.91	4.10	.046*
RVBPI average pain	84[b]	1.61 (0.62)	1.76 (0.73)	1	0.99	3.41	.068
RVBPI pain now	84[b]	1.15 (0.89)	1.14 (0.93)	1	0.01	0.01	.924
Physical domain of the SF-36							
SF-36 Physical Function	206	30.73 (27.07)	26.97 (25.49)	1	1457.83	10.53	.001**
SF-36 Role physical	206	60.07 (41.82)	63.64 (41.95)	1	1307.66	1.06	.304
SF-36 Bodily Pain	206	63.99 (25.68)	69.85 (25.28)	1	3541.90	12.06	.001**
SF-36 General Health	206	59.87 (20.48)	60.79 (23.72)	1	86.70	0.46	.498

*p < .05; **p < .01; SD, Standard Deviation; RVBPI, Resident Verbal Brief Pain Inventory; SF-36, Short Form 36 Health Survey.

[a]Residents with baseline scores meeting pain cut-off scores.

[b]Residents that answered 'Yes' to 'Do you feel pain today?'.

Table 3: Percentage of Residents Showing Improvement in Pain Score

	n	(%)
ABBEY		
Score worsened	36	29%
Score unchanged	20	16%
Score improved 1 to 3 points	45	36%
Score improved 4+ points	23	19%
PAINAD		
Score worsened	36	29%
Score unchanged	26	21%
Score improved 1 to 3 points	46	37%
Score improved 4+ points	16	13%
NOPPAIN		
Score worsened	36	29%
Score unchanged	14	11%
Score improved 1 to 6 points	49	39%
Score improved 7+ points	27	21%

Figure 1: Analgesic Use for All Residents. The figure shows the prevalence of analgesic use for all residents, at baseline and <u>one year</u> post-program. Note the significant changes in residents with no analgesic prescription (NIL) and Around-The-Clock and Pro-Re-Nata (ATC+PRN) prescription.
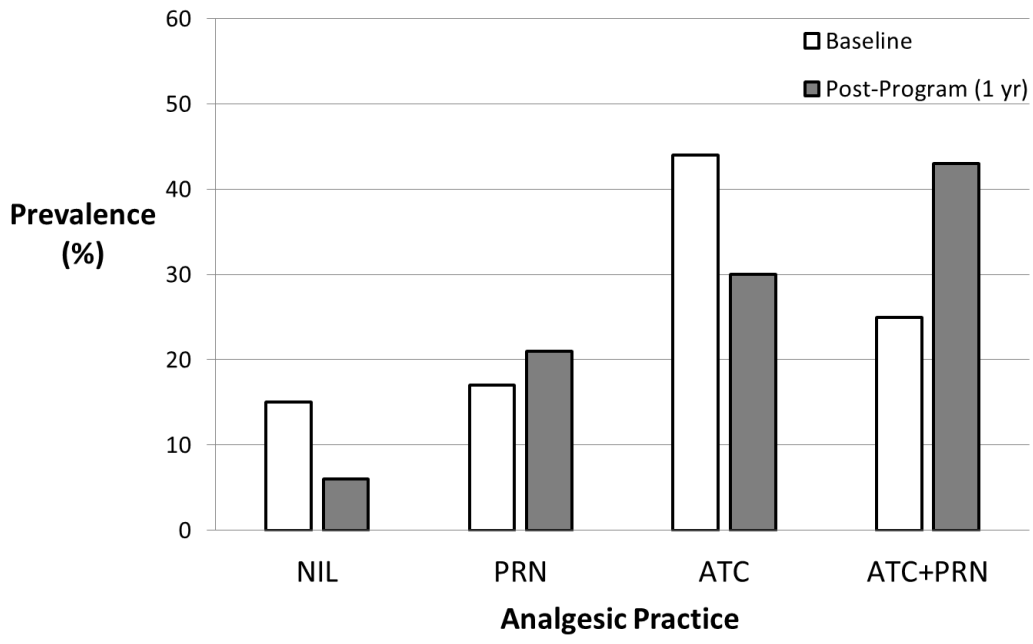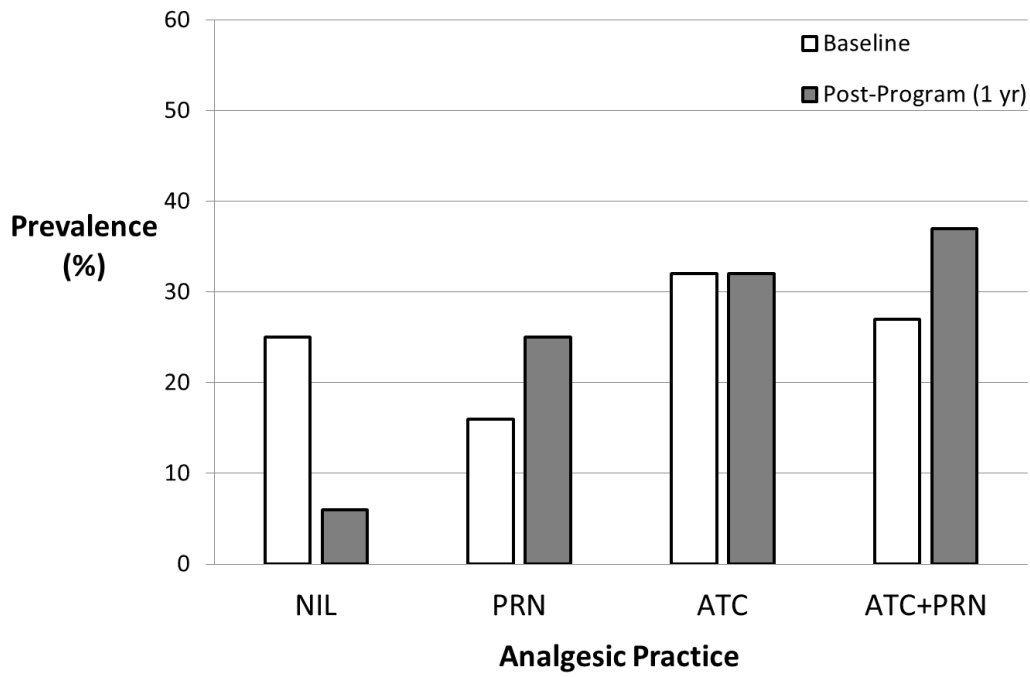
Figure 2: Analgesic Use in the Cognitively Intact and Impaired. The figures show the prevalence of analgesic use for residents with / without cognitive impairment, at baseline and <u>one year</u> post-program. A: Analgesic use in the cognitively intact. B: Analgesic use in the cognitively impaired.

A: Cognitively Intact

B: Cognitively Impaired