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The effectiveness of a nurse practitioner-led pain management team in long-term care: A mixed methods study

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1 THE EFFECTIVENESS OF A NURSE PRACTITIONER-LED PAIN MANAGEMENT TEAM
2 IN LONG-TERM CARE: A MIXED METHODS STUDY
3

4 Sharon Kaasalainen, RN, PhD^{1,2}; Abigail Wickson-Griffiths, RN, PhD³; Noori Akhtar-Danesh^{1,4}; Kevin
5 Brazil, PhD^{4,5}; Faith Donald, RN(EC), PhD⁶; Ruth Martin-Misener, RN-NP, PhD⁷; Alba DiCenso, RN,
6 PhD^{1,4}; Thomas Hadjistavropoulos, PhD⁸; Lisa Dolovich, BScPhm, PharmD, MSc ^{4,9}
7

8 ¹School of Nursing, McMaster University; ²Department of Family Medicine, McMaster University;
9 ³Faculty of Nursing, University of Regina; ⁴Department of Clinical Epidemiology and Biostatistics,
10 McMaster University; ⁵School of Midwifery, Queens University Belfast; ⁶Daphne Cockwell School of
11 Nursing, Ryerson University; ⁷School of Nursing, Dalhousie University; ⁸Psychology Department,
12 University of Regina; ⁹Department of Family Medicine
13

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ABSTRACT

Background: Considering the high rates of pain as well as its under-management in long-term care (LTC) settings, research is needed to explore innovations in pain management that take into account limited resource realities. It has been suggested that nurse practitioners, working within an inter-professional model, could potentially address the under-management of pain in LTC.

Objectives: This study evaluated the effectiveness of implementing a nurse practitioner-led, inter-professional pain management team in LTC in improving (a) pain-related resident outcomes; (b) clinical practice behaviours (e.g., documentation of pain assessments, use of non-pharmacological and pharmacological interventions); and, (c) quality of pain medication prescribing practices.

Methods: A mixed method design was used to evaluate a nurse practitioner-led pain management team, including both a quantitative and qualitative component. Using a controlled before-after study, six LTC homes were allocated to one of three groups: 1) a nurse practitioner-led pain team (full intervention); 2) nurse practitioner but no pain management team (partial intervention); or, 3) no nurse practitioner, no pain management team (control group). In total, 345 LTC residents were recruited to participate in the study; 139 residents for the full intervention group, 108 for the partial intervention group, and 98 residents for the control group. Data was collected in Canada from 2010-2012.

Results: Implementing a nurse practitioner-led pain team in LTC significantly reduced residents' pain and improved functional status compared to usual care without access to a nurse practitioner. Positive changes in clinical practice behaviours (e.g., assessing pain, developing care plans related to pain management, documenting effectiveness of pain interventions) occurred over the intervention period for both the nurse practitioner-led pain team and nurse practitioner-only groups; these changes did not occur to the same extent, if at all, in the control group. Qualitative analysis highlighted the perceived benefits of LTC staff about having access to a nurse practitioner and benefits of the pain team, along with barriers to managing pain in LTC.

1 Conclusions: The findings from this study showed that implementing a nurse practitioner-led pain team can
2 significantly improve resident pain and functional status as well as clinical practice behaviours of LTC staff.
3 LTC homes should employ a nurse practitioner, ideally located onsite as opposed to an offsite consultative
4 role, to enhance inter-professional collaboration and facilitate more consistent and timely access to pain
5 management.

6 Key Words: pain management, long-term care, nurse practitioner, implementation science

10 INTRODUCTION

11 Pain management in long-term care (LTC) has been recognized as a serious challenge worldwide with
12 approximately 40-83% of older adults experiencing pain (Moulin et al, 2002; Proctor & Hirdes, 2001;
13 Zwakhalen et al., 2009). Older adults in LTC often have numerous medical conditions, such as osteoarthritis,
14 musculoskeletal conditions, cancer, post stroke, diabetic neuropathy; that require complex medical care and
15 contribute to pain (Swafford et al., 2009). Despite these high rates of pain in older adults, pain is frequently
16 undertreated (Kaasalainen et al., 1998; Won et al., 2004). Unresolved pain has both physical and
17 psychological consequences, including: weight loss, sleep disturbance, decreased functional abilities,
18 impaired mobility, depression, anxiety, behavioural disturbance, and decreased quality of life (Mezinskis et
19 al., 2004). Hence, the problem of untreated pain warrants attention.

20 A variety of barriers to effective pain management in LTC have been identified in the literature,
21 including lack of assessment tools, poor documentation, lack of interdisciplinary collaboration, poor
22 nurse/physician communication, poor knowledge transfer, limited time, and resident and family knowledge
23 and attitudes (Tarzian & Hoffman, 2004; Jones et al., 2004; Stevenson et al., 2006). In addition to these,
24 assessing and managing pain of non-verbal residents, such as those with cognitive impairment, is also a
25 major barrier to effective pain management (Mentes, Teer, & Cadogan, 2004). Kaasalainen et al. (1998)

1 demonstrated that residents with dementia in LTC are prescribed and administered significantly less pain
2 medication than are residents without dementia.

3 Limited physician services in many North American LTC homes and other resource limitations (e.g.,
4 limited registered nurses, lower skill mix care models) are considered to be responsible, at least in part, for
5 the under-management of pain in this setting (Hadjistavropoulos et al., 2009). A recent model that took into
6 account both resource realities and high clinical standards proposed that the nurse practitioner (NP) was an
7 untapped resource that could help address pain under-management in LTC, especially in homes where on-site
8 physician services are relatively limited (Hadjistavropoulos et al., 2009). NPs are in an optimal position to
9 improve pain management for LTC residents given their scope of practice and advanced skill level. Within
10 their scope of practice, NPs can obtain medical histories, perform physical examinations, diagnose and treat
11 health problems, order and interpret laboratory tests and x-rays, prescribe medications and treatments,
12 provide education, and case manage and coordinate services, all of which are important tasks in pain
13 management (College of Nurses of Ontario, 2008). In Canada, Federal legislation has recently changed to
14 allow NPs to prescribe many controlled substances. Each province and territory is in the process of deciding
15 which substances can be prescribed by an NP.

16 NPs have the potential to address barriers to pain management including lack of: knowledge, physician
17 onsite coverage, appropriate assessment tools, prescribing of effective pain medications, interprofessional
18 collaboration and continuity of care, and physician trust in LTC nurses, that have been identified in previous
19 research (Kaasalainen et al., 2007a; Martin et al., 2005). In light of the current inadequacies of the LTC
20 system and the potential for the NP to improve resident care, pilot work was conducted to help delineate the
21 NP role in LTC around pain management (Kaasalainen et al., 2007b, 2010). All NPs within a large Canadian
22 province were surveyed and they reported that they spent 79% of their time engaged in clinical activities and
23 most of them (80%) reported using pain assessment tools (Kaasalainen et al., 2007b). McAiney et al. (2008)
24 found that one of the most common reasons for NP referral was for medical care (32%), which included pain
25 management among other issues.

1 Perceptions of the NP role by health care team members (i.e., licensed nurses, personal support
2 workers, physiotherapists, pharmacists, physicians) and administrators appear to be quite positive
3 (Kaasalainen et al., 2010). That is, team members viewed NPs as being beneficial in providing thorough
4 assessments, consistent care, more time with residents, efficient ordering of pain medications and tests, and
5 timely follow-up with resident pain concerns (Kaasalainen et al., 2010). Musclove, Sawhney and Watt-
6 Watson (2002) identified both interprofessional (IP) collaboration and the presence of an NP on the team as
7 methods of improving pain management in acute care. Similarly, we argue here that improving IP
8 collaboration within a care model that is led by an NP would address barriers to effective pain management
9 and build organizational capacity. Hence, a rigorous evaluation of this NP care model is needed to examine
10 its effectiveness in improving the quality and efficiency of pain management services in LTC.

11 **STUDY PURPOSE**

12 The purpose of this study was to evaluate an NP-led, IP pain management team in LTC. In addition to
13 the NP, the team included onsite pharmacists, physicians, licensed nurses, personal support workers, social
14 workers, and physiotherapists. The NP worked with each intervention facility to help build capacity among
15 the team and other staff by facilitating the implementation of pain protocols and assessment tools, and
16 provide case management and service coordination for residents when needed. Specifically, we sought to
17 evaluate the effectiveness of the implementation of the NP-led pain management team in improving resident
18 outcomes (i.e., pain, functional status, depression, agitation) and health care provider outcomes (i.e.,
19 documentation of pain assessments, use of non-pharmacological and pharmacological interventions, quality
20 of pain medication prescribing). We also explored staff perceptions of the implementation of the NP-led pain
21 management team.

22 **METHODS**

23 **Design**

24 Due to the complexity of evaluating health services interventions, such as the implementation of an
25 NP-led pain management team in LTC, a mixed method design was used to examine the interplay among the

1 LTC context, implementation of the NP-led pain management team, and outcomes (DiCenso et al., 2005). A
2 mixed method design is appropriate for this study to address the mix of research questions that address the
3 same overriding study goal (Morse, 2006). A controlled before-after design was used to evaluate the
4 effectiveness of the NP-led pain management team over a 12-month period. A qualitative component was
5 used to capture other information related to the evaluation of the intervention, specifically related to the
6 “how” and “why” of the intervention at the completion of the study (Yin, 2009). The study included two
7 intervention groups; a full intervention (NP-led Pain Team) and a partial intervention (NP only). The partial
8 intervention group was included so we could examine the added benefit of a Pain Team, compared to the
9 addition of an NP only. The third group (standard care) was used as a control. Each of these three study
10 groups included two LTC homes to reach our sample size requirements. Data was collected from 2010-2012,
11 with baseline and post-intervention data being collected over a 3-month period. Ethical approval for the study
12 was obtained from a university research ethics board as well as from each of the participating LTC homes.

13 **Description of the Intervention**

14 **The full intervention** (NP-led Pain Team) was guided by a two-tiered NP intervention model: (a) NPs
15 led educational initiatives on pain management with their IP teams and facilitated the implementation of
16 evidence-based pain assessment tools and protocols; and (b) NPs participated in organizational-level
17 interventions (i.e., IP team, development of policy and procedures for pain, participation in quality
18 improvement initiatives) (Krichbaum et al., 2005). We used a multifaceted approach to implement the
19 intervention including:

- 20 (a) two, 2- hour “Train-the-Trainer” sessions with the NPs only, led by study staff, and based on existing
21 tools and resources that have been evaluated in a previous project (Kaasalainen et al., 2012);
- 22 (b) the development of an interprofessional pain management team at each of the two intervention sites, led
23 by the NP, met monthly or every other month;
- 24 (c) an educational workshop which was based on the curriculum that was developed by the Medical College
25 of Wisconsin (2000) and was updated with more current literature;

1 (d) reminders or study posters that were posted periodically at each nursing station.

2 To ensure fidelity of the intervention, we asked the NPs to document their activities related to
3 implementing the Pain Team on a weekly basis, which we reviewed with them monthly. In addition, a
4 research assistant attended each of the Pain Team meetings, recorded minutes, and documented attendance.
5 Two NPs were hired (one at each site), and agreed to help implement a Pain Team at the LTC home at their
6 respective homes. Both NPs had a Masters degree and were female; one had three years of NP experience
7 and the second one had over 10 years of experience.

8 **In the partial intervention sites (NP only)**, the NP engaged in normal activities, which included pain
9 management, as outlined in their employment contract with the regional health authority and was contacted
10 by the LTC home on a consultative basis without the added support of an IP pain management team. The two
11 NPs who worked at the partial intervention homes had on average about 8 homes in their portfolio. One NP
12 was male and one was female. Both had a Masters degree and had been working in LTC for over 5 years.

13 For both NP intervention groups (NP-led Pain Team and NP only), the NPs did not have prescribing
14 authority for controlled substances due to provincial legislation restrictions but they were able to prescribe
15 other types of pain medications (e.g., non-opioid analgesics, non-steroidal analgesics).

16 **The control group** (no NP, no pain team) continued with their usual in-house services with no access
17 to an NP or a pain management team.

18 **Recruitment and Sampling**

19 All LTC homes in a designated area in a mid-sized metropolitan area in Canada were screened for three
20 *primary* characteristics: medium to large sized facility (over 120 beds to meet our sample size requirements),
21 employment of an NP and use of a pain management team. From a potential pool of 41 homes, 15 were
22 screened eligible to participate in this study since they were medium to large sized, did **not** currently employ
23 an NP nor have an onsite pain management team. These eligible LTC homes were matched to two *secondary*
24 characteristics: quality indicators (obtained using publicly-reported Ministry data), and funding status (profit
25 vs not-for-profit) to create two well-matched or similar clusters of homes. Within each cluster, we recruited

1 one LTC home to participate in the full intervention (NP-led pain team), one for the partial intervention (NP
2 only), and one for the control group (no NP, no pain team). To do this, the Principal Investigator approached
3 the administrators of these eligible homes to inform them about the study and ask them to participate. Once
4 we obtained two homes for each group (full intervention, partial intervention, control) to meet our sample
5 size requirements, our recruitment ended. Informed consent was obtained from all resident participants or
6 their proxy. We excluded residents who could not speak English; otherwise, all residents were invited to
7 participate.

8 **Sample Size**

9 Our sample size calculations were based on our primary outcome variable – pain measured by the
10 PACSLAC pain scale (Fuchs-Lacelle et al., 2004). Based on our previous study (Kaasalainen et al., 2012) the
11 standard deviation (SD) for the PACSLAC is about 1.7 and a mean difference of 1.0 from pre to post
12 intervention seems to be practically significant. Based on these criteria and power of 0.80 a sample size of
13 57 we anticipated we needed for each group. Our previous study showed that the intra-class correlation
14 (ICC) for PACSLAC within LTC facilities is about 0.003. Taking this ICC into account, the final sample
15 size would be about 62 in each group (31 in each LTC facility). To account for a maximum of 35% dropout
16 rate over the study period (which is consistent with previous work that has followed LTC residents over the
17 course of a one-year intervention period) we anticipated we needed a sample size of approximately 89 in
18 each group (about 45 in each LTC facility).

19 **Data Collection**

20 Data were collected using a number of assessment tools and residents' chart information at three
21 separate times in 6-month intervals: before the intervention had been implemented (Time 1) and 6 months
22 (Time 2) and 12 months (Time 3) into the intervention period. For each of the measurement times, data were
23 collected in the same manner as described below.

1 **Resident Outcomes**

2 The **primary outcome** was resident pain, which was assessed using a standardized procedure that has
3 been used in other evaluation studies to accommodate for the abilities of residents who have cognitive
4 impairments (Kaasalainen & Crook, 2004). Pain was assessed for each resident using four different tools,
5 two that assessed verbal reports and two that assessed behavioural responses to pain. Verbal reports were
6 measured using the numerical rating scale (NRS), an 11-point tool that ranges from 0 (no pain) to 10 (worst
7 possible pain) and the PPI scale (PPI), a subscale of the McGill Pain Questionnaire (Melzack, 1975), a self-
8 report six-point word-number scale used to assess pain intensity at the moment ranging from 0 (no pain) to 5
9 (excruciating pain). Both have been shown to produce reliable responses for pain sensation intensity in older
10 adults (Kaasalainen & Crook, 2003). This scale was enlarged and bolded to promote ease of use by older
11 adults (NIH, 2008).

12 Two tools assessed behavioural responses. The Pain Assessment in the Communicatively Impaired
13 Elderly (PACI) is a 7-item tool that measures facial expressions, body movements, and words that have been
14 associated with pain. Convergent validity of the PACI is acceptable (Kappa = 0.74 - 0.85); it was assessed
15 using a set of videotaped segments of LTC residents in potentially painful situations (Kaasalainen et al.,
16 2011). The reliability of the PACI has been examined in LTC, with inter-rater coefficients ranging from 0.82
17 - 0.88 and test-retest coefficients ranging from 0.62 - 0.78 across levels of cognitive impairment (none, mild,
18 moderate, extreme) (Kaasalainen & Crook, 2003). The Pain Assessment Checklist for Seniors with Limited
19 Ability to Communicate (PACSLAC) is a longer, more comprehensive tool and includes items related to
20 facial expressions, activity/body movement, social/personality/mood, physiological indicators, eating and
21 sleeping changes, and vocal behaviours, with a possible score ranging from 0-60 (Fuchs-Lacelle et al., 2004).
22 The validity of the PACSLAC is very good with an inter-rater reliability of 0.97 and internal consistency of
23 0.86 (Fuchs-Lacelle et al., 2004; Lints-Martindale et al., 2012).

24 Over a 2-week period during each data collection point, pain was assessed two times for each resident
25 by research staff: (a) once during a potential painful naturally-occurring event (e.g., transfer from bed to

1 chair, range of motion exercises), and (b) once at rest in the afternoon. The behavioural observation tools
2 were completed first in order to blind the raters to the verbal report scores for pain. Approximately 10% of all
3 the behavioural pain assessments, using both the PACI and PACSLAC, were completed by two raters to
4 assess inter-rater reliability, or consistency between the raters. Next, the residents were asked to rate their
5 pain using the PPI and NRS, using self report; hence no inter-rater reliability assessment was needed for
6 these tools.

7 **Secondary outcomes** at the resident level included variables that have been associated with pain
8 including functional status, depression and agitation. *Functional status* was measured using the Older
9 Americans Resources and Services (OARS) questionnaire to assess basic and instrumental activities of daily
10 living (OARS-ADL; Fillenbaum, 1988). Validity and reliability of the OARS-ADL is acceptable for use in
11 clinical settings (Fillenbaum, 1988). *Depression* was measured using the Cornell Scale for Depression in
12 Dementia (CSDD; Alexopoulos et al., 1988) and involves the assessment of signs and symptoms of major
13 depression in patients with or without dementia. It has strong psychometric properties and has been used
14 widely with the LTC population (Alexopoulos et al., 1988). *Agitation* was measured using the Cohen-
15 Mansfield Agitation Inventory - Short Form (CMAI-SF; Cohen-Mansfield, 1995). The CMAI-SF is a short
16 version of the Cohen-Mansfield Agitation Inventory. The secondary outcomes were assessed by LTC staff
17 (i.e., licensed nurses) in a standardized manner during the data collection points at all six sites.

18 ***Health Care Provider Clinical Practice Behaviours and Outcomes***

19 Undergraduate students were trained as independent chart extractors and were blinded to the study
20 purpose and the allocation of sites to the intervention and comparison groups. They were instructed to only
21 retrieve the necessary data from residents' charts. To assess ***clinical practice behaviours*** (e.g.,
22 documentation of pain assessments, use of pharmacological and non-pharmacological pain interventions),
23 chart reviews were conducted for the same consenting residents as above. Their charts were reviewed three
24 times - once during the pre-implementation period and at 6 and 12 months post-implementation. They
25 extracted data on a number of indicators including a) use of a standardized pain assessment tool; (b) use of an

1 admission pain assessment form; (c) evidence that characteristics of pain were identified; (d) exploration of
2 causes of pain; (e) identification of goals related to pain; (f) development of a care plan; (g) use of non-
3 pharmacological interventions; (f) ordering of pain medications; and (g) documentation of the effectiveness
4 of pain interventions. Using these chart data, the *quality of pain medication prescribing practices*, or Pain
5 Management Index (PMI) scores, were calculated using the Pain Medication Appropriateness Scale (PMAS;
6 Hutt et al., 2006). Using this tool, each resident's pain assessment scores (intensity) were compared with their
7 prescribed pain medication (classification). This index ranges from -3 to +3 with negative values indicating
8 “inappropriate” and positive values “appropriate” pain management. The PMI was calculated for each
9 resident at baseline, interim, and post-intervention (final).

10

11 *Qualitative Outcomes*

12 At the end of the implementation phase, focus groups were held with the IP pain management team,
13 other health care providers and members of administration to (a) explore their perceptions about the NP role
14 in facilitating pain management for residents and the Pain Team itself; (b) identify any barriers to the
15 implementation of the NP-led IP pain management team; and, (c) gather suggestions for implementing future
16 NP interventions in the practice setting. At each of the full intervention sites, two focus groups were held;
17 one with personal support workers (care aides) and one with licensed nurses. NPs were also interviewed and
18 asked to give specific feedback around the interdisciplinary nature of the intervention strategy and ways to
19 improve collaboration within the health care team in order to strengthen pain management interventions in
20 LTC.

21 *Analysis*

22 A multilevel modeling analysis was used to compare *resident outcomes* (pain, functional status,
23 depression, agitation) in the three groups at time points 2-3 while adjusting for the baseline measurements
24 (time point 1). We did not include residents who had died in the final analysis, rather we used a ‘per
25 protocol’ approach whereby only those who were still receiving the intervention were included in the

1 analysis. We also included the interaction term between time and groups in the model to capture unparalleled
2 changes over time. In this case, the difference between groups was significant if either group difference or
3 interaction term was significant. Correlations were calculated between raters for the behavioural observation
4 pain ratings (PACI, PACSLAC) for 10% of the sample at each time point, during both rest and activity
5 episodes.

6 For each of the *clinical practice behaviours* or process indicators, change over the intervention period
7 was determined using the following calculation: Time 3 (T3, one year after the intervention began) minus
8 Time 1 (T1, before the intervention began) so that three possibilities existed: ‘negative change’ (T3-T1 = -1,
9 met the criteria at T1 but not T3), ‘no change’ (T3-T1 = 0, met the criteria at both times or did not meet the
10 criteria at either time), or ‘positive change’ (T3-T1 = 1, met the criteria at T3 but not T1. A Chi-square test
11 was calculated to determine differences between: (a) the intervention and control groups and, (b) the partial
12 intervention and control groups for ‘positive change’ only, since this assessed the effectiveness of the
13 intervention, an objective of this study.

14 The *quality of pain medication prescribing practices* was calculated according to the following
15 process outlined by Hutt et al. (2006).

16 **Pain sub-score:** Using the pain assessment scores that were collected from each of the participating
17 residents in this study, pain sub-scores were calculated using a decision-tree (based on consensus reached
18 between investigators SK and LD). This decision-tree indicates that the highest NRS and PPI rating should
19 be used unless the patient could not communicate pain, or in situations where a diagnosis of dementia was
20 present. In such cases, the PACI scores were used, again using the highest available rating. We could not use
21 the PACSLAC in this analysis given its scoring ranges from 0-60 and it does not lend itself to collapsing
22 scores in the manner used by Hutt et al. (2006). Once the scale and highest pain score were determined, a
23 pain rating of mild, moderate or severe was assigned (Hutt et al., 2006).

24 **Medication sub-score:** Medication sub-scores were calculated by two graduate students (nursing,
25 pharmacy) using the medication reviews. The most potent pain medication was identified and used to

1 determine the medication sub-score in the following manner: “no analgesia” (0), “non-opioid” (1), “weak
2 opioid” (2), or “strong opioid” (3) (Hutt et al., 2006).

3 **Pain Management Index (PMI):** PMIs were calculated by subtracting the pain sub-score from the
4 medication sub-score. A score of “0” could be considered appropriate pain management, as the determined
5 pain sub-score and medication sub-score are identical, which would indicate medication management is
6 appropriate for the level of pain that is present. A negative score, especially a score of -3 or -2, would
7 indicate poor pain management, and may indicate that the medication being used for pain is not sufficient for
8 the level of pain. Finally a positive score, especially a score of +3 or +2 would indicate that the medication
9 being used for pain is more potent than needed for the level of pain that appears to be present.

10 **RESULTS**

11 **Characteristics of the Sample**

12 At baseline, we recruited 98 to the control group, 108 to the partial intervention group, and 139
13 residents to the full intervention group (Figure 1). Over the one-year intervention period, there was a 25%
14 dropout rate/death rate for the control group (24/98), 30% death rate for the partial intervention group
15 (33/108), and a 32% death rate for the full intervention group (45/139). The mean age of residents was 83.1
16 (SD=10.0) years in the control group, 84.0 (SD=10.0) years in the partial intervention group, and 84.0
17 (SD=8.5) years in the full intervention group (Table 1). Each of the three groups had about 25-30% males.
18 The mean number of years that residents had been living in the LTC home was 2.9 (SD=5.5) for the control
19 group, 2.5 (SD=2.0) for the partial intervention group, and 2.5 (SD=2.3) for the full intervention group. The
20 most common diagnoses were cardiovascular disease, dementia, osteoporosis, arthritis, and mood disorders.
21 A total of 16 personal support workers and 13 licenses nurses participated in focus groups for the qualitative
22 evaluation with 96% being female, and mean age being 44.2 (SD: 9.3) years old.

23 **Primary Outcomes**

24 Before the intervention, the mean pain level was reported as being ‘mild’ or ‘low’ for all three groups
25 using all of the pain assessment tools, both at rest and during activity (see Table 2). There were statistically

1 significant decreases in pain levels during activity and rest from Time 1 to Time 3 for both the partial and full
2 intervention groups compared to the control group, using all pain assessment tools except for the PPI score
3 during rest for the full intervention group and the PACI score during rest for the partial intervention group
4 (see Figure 2). Based on 10% of the overall sample across all time points, the inter-rater reliability for the
5 PACI and PACSLAC was acceptable during both rest (n=90) and activity (n=90), ranging from 0.57-0.84
6 (Table 3).

7 *Secondary Outcomes*

8 There were no significant differences among the groups over the intervention period for depression or
9 agitation (Table 4). However, there were statistically significant improvements in functional status in both
10 the partial intervention (p<.001) and full intervention group (p=.002).

11 *Clinical Practice Behaviours*

12 When we examined the effectiveness of the NP intervention in improving clinical practice behaviours,
13 we found significantly more positive changes over the intervention period in the full intervention group for
14 the following indicators: (a) use of a standardized pain assessment tool (p=.01); (b) evidence that
15 characteristics of pain were identified (p<0.001); (c) use of an admission pain assessment form (p<0.001); (d)
16 causes of pain were sought (p=0.019); (e) goals related to pain were identified (p<0.001); (f) a care plan was
17 developed (p=0.003); (g) documented effectiveness of pain interventions (p=0.004); and (h) goals were
18 modified (p<0.001; see Table 5). Due to missing chart data at Time 2, we did not include Time 2 data in our
19 analysis.

20 *Quality of Pain Medication Prescribing Practices*

21 **Pain sub-scores:** The median pain sub-score decreased from 2 (moderate pain) to 1 (mild pain) from
22 baseline to post-intervention in all three groups (full and partial intervention, control). However, there were
23 greater trends in reductions of moderate and severe pain in both the full and partial intervention groups
24 compared to the control group (Table 6).

1 **Medication sub-scores:** The median medication sub-score remained the same at 1 (non-opioid
2 prescribed) across all three times and across all three groups (Table 6).

3 **PMI:** The median PMI was 0 at baseline and post-intervention for all three groups and increased to 1
4 in both the full and partial intervention groups but not in the control group; this difference was not
5 statistically significant at the $p < 0.05$ level (See Table 6).

6 *Qualitative Outcomes*

7 Data from the focus groups highlighted three main themes including the: benefits of having access to
8 an NP, benefits of the Pain Team, and barriers to implementing a successful Pain Team and improving pain
9 management (see Appendix A for examples of quotes to support each theme).

10 **Benefits of Having Access to an NP:** Staff at both intervention sites recognized the value of having an NP
11 as part of the larger health care team. This was mainly due to the personal attributes and approaches to care
12 of the NPs as well as the tangible outcomes to residents and staff. First, the staff highly regarded the personal
13 attributes of the NPs, which included being approachable, dependable, knowledgeable and having clinical
14 expertise. They characterized the NPs as being effective in their roles and drivers for positive change.
15 Overall, the staff acknowledged the NPs as being great resources and committed to residents' pain issues.

16 In addition to their personal attributes and approaches to care, the staff also highlighted the positive
17 outcomes from having the NP on the team. In both intervention sites the staff recognized that the NPs
18 improved resident and staff access to timely primary care, pain assessment and follow-up management. Not
19 only did the staff express how quick access benefited the residents but also how it saved their time in
20 contacting a physician working outside of the facility. The staff at both intervention sites identified that NP
21 involvement improved team collaboration as well as knowledge about pain assessment and management
22 through education. Staff stated that the NP was available to spend time with the resident, which allowed for
23 the development of rapport. Finally, staff stated they saw the impact of the role which included less resident
24 hospitalizations.

1 **Benefits of the Pain Team:** The staff at the intervention sites highlighted benefits of the Pain Team,
2 specifically by contributing to staff education, using best practices as well as promoting team collaboration,
3 communication and autonomy. The staff recognized that residents' pain levels improved. As a result, some
4 felt the ease in which PSWs could provide hands-on care improved, which led to better professional
5 relationships between the PSW staff and residents. Staff stated that the Pain Team introduced new pain
6 assessment tools to help initiate and communicate individualized resident assessments, provided ongoing
7 education and updated policies and procedures. Also, staff reported that they were more knowledgeable
8 about pain champions and were able to utilize their expertise. Overall, the teams at both intervention sites
9 created awareness about the presence of and appropriate management of resident pain.

10 **Barriers to Pain Management and Effective Pain Team:** While the Pain Teams led to improved pain
11 management practices, the staff members at both intervention sites recognized barriers and issues related to
12 effective Pain Team function and management. Staff identified issues to be addressed for effective Pain
13 Team function including improving staff knowledge about medication management, establishing the NP role
14 on the Pain Team and effectively communicating resident pain among staff. Similarly, some staff were
15 unaware that a Pain Team existed and others suggested having greater interdisciplinarity (e.g., utilizing the
16 pharmacist's expertise), retaining the NP on the team, encouraging team member accountability through
17 homework and timelines for task completion, and maintaining consistent agenda and frequency of meeting
18 dates. They also recognized several factors that were impeding efficacy of the Pain Team and pain
19 management including: the large number of staff at the home in need of pain education, the lines of
20 communication among staff, the limited NP availability in the LTC home and conflicting team member
21 priorities.

22 **DISCUSSION**

23 The results of this study support the implementation of an NP-led Pain Team in LTC as a strategy to
24 reduce residents' pain. We found similar results for the NP-only intervention, highlighting the positive
25 outcomes that result from employing an NP in LTC. The NP role has great potential to improve quality of

1 care and, in our case, improve pain for residents living in LTC, given their scope of practice and advanced
2 skill level (CNO, 2008). These results add to the growing body of knowledge that demonstrates the
3 effectiveness of NPs in LTC (Donald et al., 2013; Intrator et al., 1999; Kane et al., 2003).

4 Along with improvements in pain, there was also an improvement in functional status for LTC residents
5 in both the NP-led Pain Team and NP only intervention groups, indicating that by adding an NP to the LTC
6 team, improvement in both pain and functional status for residents occurs. This finding is consistent with
7 other research, showing the direct relationship between pain and functional status; that is, as pain improves,
8 functional status also improves (Morrison et al., 2009). Although there were statistical improvements in pain
9 and function over the intervention period for both the full and partial intervention groups, one might question
10 the clinical significance of these improvements given they were relatively small. Ostelo et al., (2008) suggest
11 a 30% improvement is considered a useful threshold for identifying clinically meaningful improvement.

12 Hence, this implies that the improvement in pain levels in our study were, for the most part, clinically
13 meaningful, since we had over a 30% improvement in pain scores during activity and rest for all of the pain
14 tools used, except the NRS (NP-led Pain Team and NP only groups) and the PACSLAC (NP-led Pain Team
15 group). However, the improvements in functional status for both interventions groups in our study would not
16 be considered clinically significant based on Ostelo et al., (2008) threshold level of 30% improvement.

17 Similar improvements for the other secondary outcomes, including depression and agitation, were not
18 observed in our study. It could be that more intensive and focused interventions, within an NP model of care,
19 are needed to specifically address the unique needs of residents suffering from these other prevalent
20 conditions in LTC (AMDA, 2011).

21 Positive changes in clinical practice behaviours occurred over the intervention period for both the NP-
22 led Pain Team and NP-only groups that did not occur to the same extent in the control group; specifically
23 related to: (a) using a pain assessment tool; (b) identifying characteristics of pain; (c) completing an initial
24 pain assessment; (d) seeking out the cause of pain; (e) identifying goals; (f) developing a care plan; (g)
25 documenting the effectiveness of pain interventions; (h) and modifying goals related to pain management.

1 These findings indicate that the NP facilitates the improvement of pain-related practices of other LTC staff.
2 Moreover, the NPs spent a great deal of time both assessing pain and collaborating with staff to complete
3 pain assessments for residents. These findings are consistent with previous work that examined the NP role in
4 LTC related to pain management (Kaasalainen et al., 2010).

5 These findings were supported in the qualitative evaluation of the intervention as well. Here, staff felt
6 that NPs were effective in their role in driving positive change within LTC, and that NPs were great
7 resources to staff in answering questions and providing on-the-spot education when needed. However, NPs
8 highlighted that the intervention would have benefited from having more time to collaborate with staff and
9 better communication between staff and the physician. Donald et al. (2009) also found similar barriers that
10 impede optimal role implementation for NPs, such as lack of planning for collaboration with LTC staff,
11 including physicians, and lack of expectation for collaboration and resistance to change.

12 However, significant differences for the intervention group were not found for two other clinical
13 practice behaviours – use of pain medications and non-pharmacological interventions. This could be due to
14 the fact that a high proportion of residents were prescribed at least a non-opioid for pain at baseline,
15 according to the PMI, leaving little room for improvement; it remained consistent over the entire intervention
16 period for all groups. Interestingly, Baier et al. (2004) found that use of appropriate pain assessments
17 increased significantly ($p < .001$) but use of pain medications for residents with moderate to severe pain,
18 prescriptions and change in pain medications did not. They suggested that lack of communication between
19 nurses and physicians may have contributed to these poor findings regarding pain medication use. Future
20 work needs to focus on the extent that medications are prescribed on a prn (*pro re nata*; given as needed)
21 basis, and if so, whether they are actually given to residents by the nurses. How nurses communicate with
22 physicians and make decisions about administering a prn pain medication requires further investigation.

23 Use of non-pharmacological interventions is another important area for future research, given their
24 potential to improve resident pain without the potent side effects that medications may have. In our study,
25 there was not a significant difference in the use of non-pharmacological interventions, although all three

1 groups showed positive trends in their use over the intervention period. Other research found similar results,
2 in that use of non-pharmacological interventions did not improve while frequency of pain assessments did
3 (Kaasalainen et al., 2010).

4 The qualitative data analysis highlighted how NPs facilitate IP collaboration. Specifically, staff reported
5 that the NP was able to support LTC staff with managing resident pain. By taking on a leadership role, the
6 NP is in the position to encourage IP participation and help others to recognize the value of that approach.
7 These findings are consistent with previous work in the area (Kaasalainen et al., 2010; Musclow et al., 2002)
8 and provide some evidence that NPs can address some barriers to improving pain management in LTC (Jones
9 et al., 2004; Kaasalainen et al., 2007a; Martin et al., 2005; Stevenson et al., 2006; Tarzian & Hoffman, 2004).

10 In addition, the qualitative evaluation underscores the added benefits of having an NP onsite in that
11 there is more timely follow-up of resident pain issues often with no need to contact the physician; hence,
12 reducing costs associated with physician time. Staff commented that they would contact the NP first, if she
13 was available, before contacting the physician. A comprehensive cost-benefit study is needed to examine the
14 costs and benefits associated with implementing an NP-led Pain Team in LTC. Bakerjian et al. (2012)
15 suggest that a cost/benefit analysis related to implementing a pain management program should compare
16 expected benefits with costs; including all start-up, program implementation, and indirect costs. By building
17 a business case related to implementing a pain management program in LTC, including processes considered
18 to improve quality and reduce costs, decision makers and LTC administrators may put more emphasis on
19 implementing a pain management program (Bakerjian et al, 2012); in this case, one that is led by an NP.

20 There are both strengths and limitations to this study. First, the use of a prospective, mixed methods
21 approach that incorporated psychometrically sound data collections tools allowed for more accurate and
22 timely data collection. However, randomization was not used to assign the intervention and control groups
23 which could have biased results. Also, we did not measure the ‘dose’ of the intervention (NP time allocated
24 to implementing the intervention). Moreover, we were not able to analyze any data from time point 2 (after 6
25 months post-implementation) due to the lack of chart data documented in resident charts. However, this was

1 corrected for in the final data collection time point (one year post-implementation) for our final analysis.
2 Finally, it would have been helpful to interview residents and family members about their perceptions of
3 working with the NP. Further study is needed to explore these important areas for research.

4 **CONCLUSIONS AND RECOMMENDATIONS**

5 This study evaluated an NP role in leading an IP team focused on pain management and adds to
6 the developing body of knowledge that supports the effectiveness of the NP role in LTC. Specifically
7 the implementation of an NP-led Pain Team in LTC significantly reduced residents' pain compared to
8 usual care without access to an NP. Along with reductions in pain, there was also an improvement in
9 functional status for LTC residents in both the NP-led Pain Team and NP only intervention groups,
10 indicating that by adding an NP to the LTC team, improvements occur in both pain and function for
11 residents.

12 Our findings also inform the role of nurses, specifically the NP, within the IP team in pain
13 management and are likely transferable to other LTC facilities and other practice sectors. That is,
14 implementing an NP-led Pain Team can significantly improve clinical practice behaviours of LTC
15 staff and reduce resident pain. This is important considering the high rates of pain that exist in LTC.
16 Given the growing aging population and increasing numbers of LTC beds, this study demonstrates an
17 effective and efficient solution to improving the quality of life of older adults who live in LTC by
18 improving the way pain is managed in this vulnerable population.

19 As such, the following recommendations are proposed:

- 20 1. LTC homes should employ an NP to facilitate more consistent and timely access to pain
21 management and to provide opportunities for the inter-professional team to gel and come
22 together on a regular and an 'as-needed' basis.
- 23 2. LTC homes should host onsite interdisciplinary Pain Teams; the Pain Teams should meet on
24 a frequent and regular basis.

- 1 3. All LTC staff should be made aware of the existence of the Pain Team and how to access it
- 2 when needed.
- 3 4. NPs should be educated about evidence-based pain assessment approaches to use in practice
- 4 and should be trained to build capacity among other LTC staff to use them.
- 5 5. All LTC home staff should be educated about the prevalence of pain, myths of pain in older
- 6 adults, as well as current evidence-based tools and approaches to use in practice.
- 7 **6.** Regular and effective communication among all team members is essential to improve pain
- 8 management practices.

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REFERENCES

- Aigner MJ, Drew S, Phipps J. A comparative study of nursing home resident outcomes between care provided by nurse practitioners/physicians versus physicians only. *J Am Med Dir Assoc.* 2004; 5(1): 16-23.
- Alexopoulos GS, Abrams RC, Young RC, et al. Cornell Scale for Depression in Dementia. *Biol Psychiatry.* 1988; 23: 271-84.
- American Medical Directors Association (AMDA). (2011). *Depression in the long-term care setting.* Columbia (MD): American Medical Directors Association (AMDA).
- Baier, R, Giffor, D, Patry, G, Banks, S, Rochon, T, Desilva, D, & Teno, J. (2004). Ameliorating pain in nursing homes: a collaborative quality-improvement project. *Journal of the American Geriatrics Society* 52: 1988-1995.
- Bakerjian D, Prevost S, Herr K, Swafford K. & Ersek M. (2012). Challenges in making a business case for effective pain management in nursing homes. *Journal of Gerontological Nursing*, 38(2), 42-52.
- Burl JB, Bonner A, Rao M, Khan AM. Geriatric nurse practitioners in long-term care: Demonstration of effectiveness in managed care. *J Am Geriatr Soc.* 1998; 46(4): 506-510.
- Cohen-Mansfield J. Assessment of disruptive behavior/agitation in the elderly: function, methods, and difficulties. *J Geriatr Psychiatry Neurol.* 1995; 8(1): 52-60.
- Hutt E, Pepper G, Vojir C, Fink R, Jones K. Assessing the appropriateness of pain medication prescribing practices in nursing homes. *J Am Geriatr Soc.* 2006; 54:231–239.
- College of Nurses. *Nurse Practitioner Scope of Practice* 2008.
- DiCenso A, Hutchison B, Grimshaw J, Edwards N, Guyatt G. Health services interventions. In DiCenso A, Guyatt G, Ciliska, D. *Evidence-Based Nursing: A Guide to Practice.* St. Louis, MO: Elsevier Mosby; 2005.
- Donald, F., Martin-Misener, R., Carter, N., Donald, E.E., Kaasalainen, S., Wickson-Griffiths, A., Lloyd, M., Akhtar-Danesh, N., & DiCenso, A. (2013). A systematic review of the effectiveness of advanced practice nurses in long-term care. *Journal of Advanced Nursing.* doi:10.1111/jan.12140
- Donald, F., Mohide, E.A., DiCenso, A., Brazil, K., Stephenson, M., & Akhtar-Danesh, N. (2009). Nurse practitioner and physician collaboration in long-term care homes: Survey results. *Canadian Journal on Aging*, 28(1), 77-87. doi: 10.1017/S0714980809090060
- Fillenbaum GG. *Multidimensional functional assessment of older adults: the Duke Older Americans Resources and Services procedures.* Mahwah (NJ): Lawrence Erlbaum Associates Inc.; 1988
- Fuchs-Lacelle S, Hadjistavropoulos T. Development and preliminary validation of the pain assessment checklist for seniors with limited ability to communicate (PACSLAC). *Pain Manag Nurs.* 2004; 5(1): 37-49.
- Hadjistavropoulos, T., Marchildon, G., Fine, P., Herr, K., Palley, H., Kaasalainen, S. & Beland, F. (2009). Transforming long-term care pain management in North America: The policy clinical interface. *Pain Medicine*, 10, 506-520.

- 1
2 Intrator O, Castle N, Mor V. Facility characteristics associated with hospitalization of nursing home
3 residents: results of a national study. *Med Care*. 1999; 37(3): 228-237.
4
- 5 Kaasalainen S, Brazil K, Akhtar-Danesh N, Coker E, Ploeg J, Donald F, Martin-Misener R, DiCenso A,
6 Hadjistavropoulos T, Dolovich L, Papaioannou P. (2012). The evaluation of an interdisciplinary pain
7 protocol in long-term care. *Journal of the American Medical Directors Association*, published online,
8 doi.org/10.1016/j.jamda.2012.05.013.
9
- 10 Kaasalainen S, Coker E, Dolovich L, Papaioannou A, Hadjistavropoulos T, Emili A, Ploeg J. (2007a). Pain
11 management decision-making among long-term care physicians and nurses. *West J Nurs Res*. 29(5): 561-
12 580.
13
- 14 Kaasalainen S. & Crook J. (2003). A comparison of pain-assessment tools for use with elderly long-term care
15 residents. *Canadian Journal of Nursing Research*, 35(4): 58-71.
16
- 17 Kaasalainen, S., & Crook, J. (2004). An exploration of seniors' ability to report pain. *Clinical Nursing
18 Research*, 13(3), 35-42.
19
- 20 Kaasalainen S, DiCenso A, Donald F, Staples E. (2007b). Optimizing the role of the nurse practitioner to
21 improve pain management in long-term care. *Canadian Journal of Nursing Research*, 39(2): 14-31.
22
- 23 Kaasalainen S, Martin-Misener R, Carter N, DiCenso A, Donald F, Baxter P. (2010). The nurse practitioner
24 role in pain management in long-term care. *Journal of Advanced Nursing*, 66(3), 542–551.
25
- 26 Kaasalainen S, Middleton J, Knezacek S, Stewart N, Hartley T, Ife C, Robinson L. (1998). Pain and
27 cognitive status of institutionalized elderly: perceptions and interventions. *Journal of Gerontological Nursing*,
28 24(8): 24-31.
29
- 30 Kaasalainen, S., Stewart, N., Middleton, J., Knezacek, S., Hartley, T., Ife, C. & Robinson, L. (2011). The
31 development and psychometric evaluation of the Pain Assessment in the Communicatively Impaired (PACI)
32 tool: Part 1. *International Journal of Palliative Nursing*, 17(8)387-391.
33
- 34 Kane RL, Keckhafer G, Flood S, Bershadsky B, Siadaty S. The effect of Evercare on hospital use. *J Am
35 Geriatr Soc*. 2003; 51(10): 1427-1434.
36
- 37 Krichbaum K, Pearson V, Savik K, Mueller C. Improving resident outcomes with GAPN organization level
38 interventions. *West J Nurs Res*. 2005; 27(3): 322-337.
39
- 40 Lints-Martindale, A.C., Hadjistavropoulos, T., Lix, L. M. & Thorpe, L. (2012). A comparative investigation
41 of observational pain assessment tools for older adults with dementia. *Clinical Journal of Pain*, 28, 226-237.
42
- 43 Martin R, Williams J, Hadjistavropoulos T, Hadjistavropoulos HD, MacLean M. A qualitative investigation
44 of seniors' and caregivers' views on pain assessment and management. *Can J Nurs Res*. 2005; 37(2): 142-164.
45
- 46 McAiney C, Haughton D, Jennings J, Farr D, Hillier L, Morden P. A unique practice model for nurse
47 practitioners in long-term care homes. *J Adv Nurs*. 2008; 62(5): 562-571.
48
- 49 Medical College of Wisconsin. Nursing Staff Education Resource Manual: Pain Management 101 in Long-
50 Term Care Facilities. Milwaukee, WI: The Medical College of Wisconsin; 2000.

- 1
2 Melzack, R. (1975). The McGill Pain Questionnaire: major properties and scoring. *Pain, 1*(3), 277-299.
- 3
4 Meziniskis PM, Keller AW, Luggen AS. Assessment of pain in the cognitively impaired older adult in long-
5 term care. *Geriatr Nurs.* 2004; 25(2): 107-112.
- 6
7 Morrison S, Flanagan S, Fischberg D, Cintron A, & Siu A. (2009). A novel interdisciplinary analgesic
8 program reduces pain and improves function in older adults following orthopedic surgery. *J Am Geriatr Soc,*
9 *57*(1): 1–10.
- 10
11 Morse J, Niehaus L. Principles of Mixed Method Design. Workshop at the International Institute for
12 Qualitative Methodology, University of Edmonton, Alberta; April 2, 2006.
- 13
14 Moulin D, Clark A, Speechley M, Morley-Forster P. Chronic pain in Canada - prevalence, treatment, impact
15 and the role of opioid analgesia. *Pain Res Manag.* 2002; 7(4): 179-184.
- 16
17 Musclow S, Sawhney M, Watt-Watson J. The emerging role of advanced nursing practice in acute pain
18 management throughout Canada. *Clin Nurse Spec.* 2002; 16(2): 63-67.
- 19
20 National Institutes of Health (2008). Making Your Printed Materials Senior Friendly: Tips from the National
21 Institute on Aging. Retrieved October 15, 2015 from: [https://www.nia.nih.gov/health/publication/making-](https://www.nia.nih.gov/health/publication/making-your-printed-health-materials-senior-friendly)
22 [your-printed-health-materials-senior-friendly](https://www.nia.nih.gov/health/publication/making-your-printed-health-materials-senior-friendly)
- 23
24 [Ostelo RW, Deyo RA, Stratford P, Waddell G, Croft P, Von Korff M, Bouter LM & de Vet HC \(2008\).
25 \[Interpreting change scores for pain and functional status in low back pain: towards international consensus
26 \\[regarding minimal important change. *Spine, 33*\\\(1\\\):90-94.\\]\\(#\\)\]\(#\)](#)
- 27
28 Proctor W, Hirdes J. Pain and cognitive status among nursing home residents in Canada. *Pain Res Manag.*
29 2001; 6: 119-125.
- 30
31 Rosenfeld P, Kobayashi M, Barber P, Mezey M. Utilization of nurse practitioners in long-term care: findings
32 and implications of a national survey. *J Am Med Dir Assoc.* 2007; 5: 9-15.
- 33
34 Stevenson, K.M., Dahl, J.L., Berry, P.H., Beck, S.L., & Griffie, J. (2006). Institutionalizing effective pain
35 management practices: Practice change programs to improve the quality of pain management in small health
36 care organizations. *Journal of Pain and Symptom Management, 31*(3), 248-261.
- 37
38 Swafford KL, Miller LL, Tsai PF, Herr KA & Ersek, M. (2009). Improving the process of pain care in
39 nursing homes: A literature synthesis. *Journal of the American Geriatrics Society, 57*(6), 1080-1087.
- 40
41 Won, A., Lapane, K., Vallow, S., Schein, J., Morris, J., & Lipsitz, L. (2004). Persistent Nonmalignant Pain
42 and Analgesic Prescribing Patterns in Elderly Nursing Home Residents. *Journal of the American Geriatrics*
43 *Society, 52,* 867–874.
- 44
45 Yin R. Case Study Research: Design and Methods. London: Sage Publications; 1984.
- 46
47 Zwakhalen, S., Koopmans, R., Geels, P., Berger, M. & Hamers, J. (2009). The prevalence of pain in nursing
48 home residents with dementia measured using an observational pain scale. *European Journal of Pain, 13*(1),
49 89-93.
- 50

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Appendix A: Qualitative Evaluation of NP-Led Pain Team

Theme	Example of Supporting Quote
<p>Benefits of Having Access to an NP</p>	<p><i>“Within our Pain Team she’s a good resource, like even if you just have questions, she’s more willing to answer them. And if she doesn’t have the answers she will tell you that and then she will get back to you too.” PSW</i></p> <p><i>“[NP] is good, knowledgeable and a positive resource.” Nurse</i></p> <p><i>“It saves a lot of time I think for the registered staff. They just call on [NP], she comes to the unit and assess[es] and everything else and if she can you know, prescribe what the resident needs, it’s done a lot faster. Or she could call the physician herself and you know, get it done a lot quicker.” PSW</i></p>
<p>Benefits of the Pain Team</p>	<p><i>“I think we’re a lot quicker at jumping on um, getting butterflies in and starting them on something early. And then we’re also pretty quick at discontinuing them when they get better. I’ve had a couple on my unit that we started up and they got better” Nurse</i></p> <p><i>“It’s better when you can level out their pain and keep it on the same, and then we as PSWs doing their bedside care are not struggling with these residents because they act out in different ways you know. So if that’s under control [makes your job a lot..] our rapport with them a lot better, they’re not you know [yeah] they’re not fighting with us.” PSW</i></p> <p><i>“[Pain Team] brought awareness of pain being the 5th vital sign. Staff ... are considering pain more now.” Nurse</i></p>
<p>Barriers to Pain Management and Effective Pain Team</p>	<p><i>“I didn’t even know we had one (Pain Team) to tell you the truth.” PSW</i></p> <p><i>“Pain Team needs a multi professional perspective to get full picture.” Pharmacist</i></p>

Figure 1: Flow Diagram of Study Participants

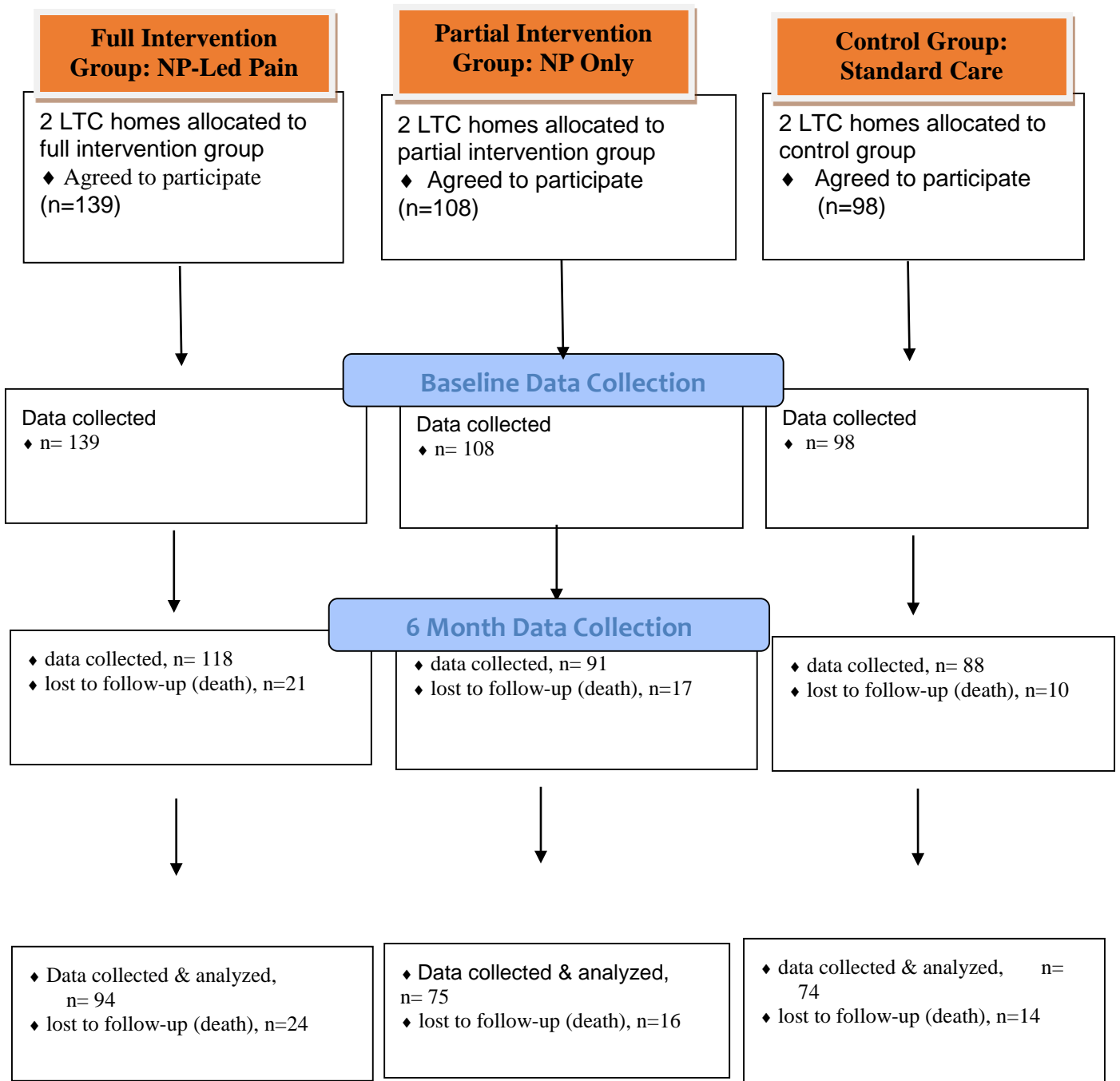


Figure 2: Changes in Pain During Activity for Each Pain Assessment Tool Over the Intervention Period

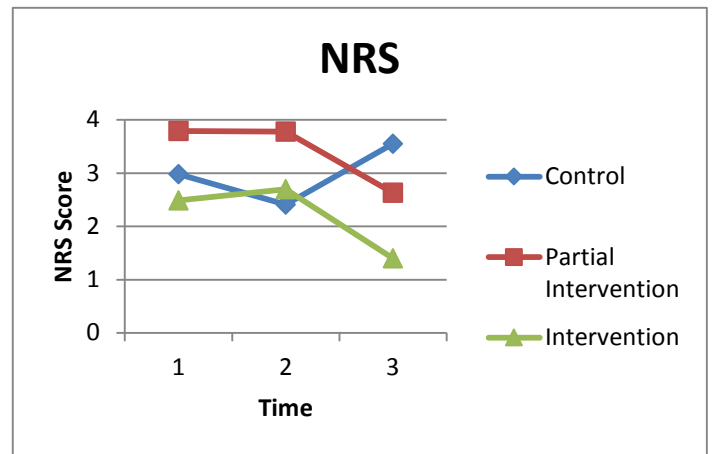
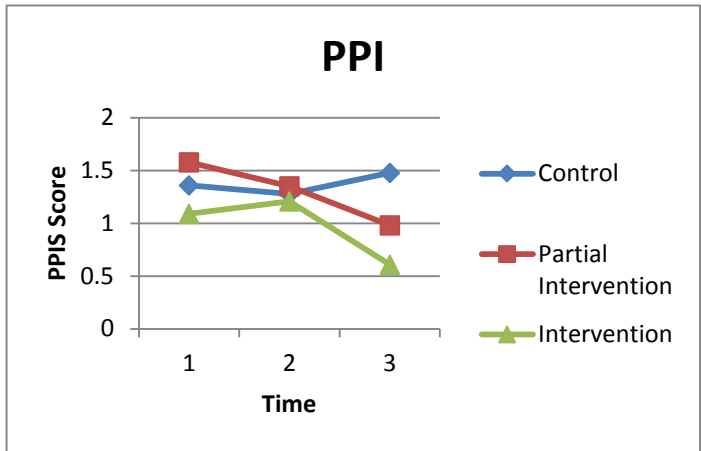
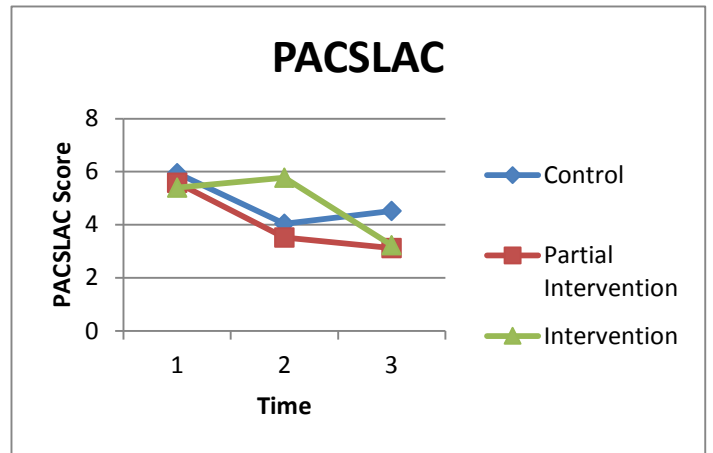
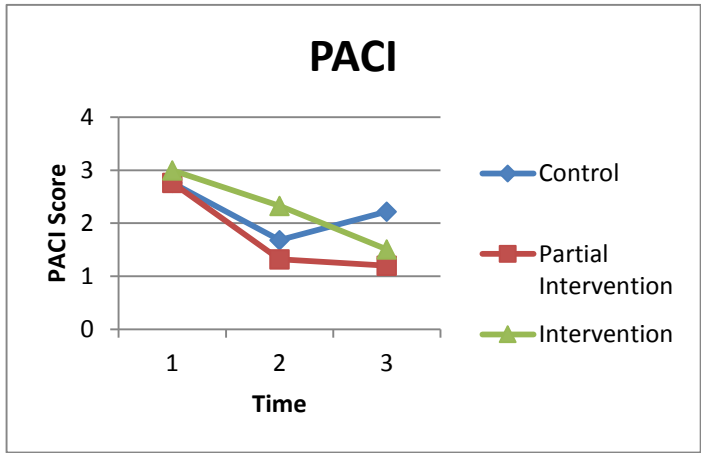


Table 1. Demographics of Residents

	Control (n = 74)	Partial Intervention (n=75)	Intervention (n =94)
Age (in years) – Mean (SD)	83.1 (10.0)	84.0 (10.0)	84.0 (8.5)
Gender –			
Male	30.6 (30)	25.9 (28)	25.9 (36)
Female	69.4 (68)	74.1 (80)	74.1 (103)
Length of Stay (in years) – Mean (SD)	2.9 (5.5)	2.5 (2.0)	2.5 (2.3)
Diagnoses - % (n)			
Cardiovascular Disease	74.5 (73)	68.5 (74)	75.5 (105)
Dementia	49.0 (48)	48.1 (52)	46.8 (65)
Osteoporosis	31.6 (31)	25.0 (27)	25.2 (35)
Arthritis	29.6 (29)	25.0 (27)	27.3 (38)
Mood Disorders	24.5 (24)	21.3 (23)	18.7 (26)
Sensory problems	18.4 (18)	17.6 (19)	17.3 (24)
Previous Fracture	16.3 (16)	13.0 (14)	14.4 (20)
GI diseases	13.2 (13)	10.2 (11)	12.9 (18)
Diabetes	13.2 (13)	12.0 (13)	14.4 (20)
Respiratory Diseases	12.2 (12)	12.0 (13)	10.8 (15)
Other	18.4 (18)	14.8 (16)	10.8 (15)

Table 2: Changes in Pain Over the Intervention Period

	Control Group (n=74)	Partial Intervention Group (n=75)		Full Intervention Group (n=94)	
	Mean (SD)	Mean (SD)	p-value (control vs partial intervention) ^e	Mean (SD)	p-value (control vs full intervention) ^e
Pain-Activity					
PPI ^a					
Time 1	1.36 (1.26)	1.58 (1.41)		1.09 (1.23)	
Time 2	1.28 (1.49)	1.35 (1.41)		1.21 (1.17)	
Time 3	1.48 (1.29)	0.98 (1.25)		0.61 (0.86)	
T3-T1	0.21 (1.53)	-0.55 (1.48)	0.010**	-0.43 (1.26)	0.013*
NRS ^b					
Time 1	2.98 (2.87)	3.79 (3.12)		2.49 (2.86)	
Time 2	2.41 (2.97)	3.78 (3.42)		2.7 (3.03)	
Time 3	3.55 (3.12)	2.63 (3.26)		1.40 (2.46)	
T3-T1	0.57 (2.81)	-1.07 (3.67)	0.029*	-0.71 (3.28)	0.007**
PACI ^c					
Time 1	2.76 (1.52)	2.76 (1.39)		3.00 (1.10)	
Time 2	1.68 (1.57)	1.32 (1.16)		2.33 (1.35)	
Time 3	2.22 (1.45)	1.20 (1.22)		1.51 (1.14)	
T3-T1	-0.40 (2.08)	-1.65 (1.59)	0.001***	-1.22 (1.39)	0.001***
PACSLAC ^d					
Time 1	5.94 (3.61)	5.58 (3.21)		5.40 (2.97)	
Time 2	4.04 (3.40)	3.52 (3.33)		5.78 (4.22)	
Time 3	4.52 (2.95)	3.12 (2.44)		3.23 (2.79)	
T3-T1	-0.76 (4.30)	-2.65 (3.54)	0.042*	-1.47 (2.78)	0.001***
Pain- Rest					
PPI					
Time 1	0.98 (1.06)	1.48 (1.38)		1.06 (1.13)	
Time 2	0.89 (1.28)	1.17 (1.32)		0.90 (0.97)	
Time 3	0.84 (1.21)	0.83 (1.25)		0.53 (1.10)	
T3-T1	-0.03 (1.17)	-0.68 (1.56)	0.003**	-0.37 (0.96)	0.115
NRS					
Time 1	2.11 (2.62)	3.34 (2.92)		2.57 (3.01)	
Time 2	2.30 (2.66)	2.56 (2.68)		2.75 (3.03)	
Time 3	2.21 (3.07)	2.57 (3.38)		1.11 (2.42)	
T3-T1	0.22 (2.78)	-1.17 (3.33)	0.006**	-0.25 (2.72)	0.013*
PACI					
Time 1	1.86 (1.30)	1.82 (1.45)		2.21 (1.32)	
Time 2	1.38 (1.25)	1.23 (1.17)		1.97 (1.25)	
Time 3	1.44 (1.24)	1.03 (1.14)		1.11 (1.07)	
T3-T1	-0.12 (1.53)	-1.36 (1.51)	0.127	-0.33 (1.79)	.002**
PACSLAC					
Time 1	3.76 (2.52)	4.12 (3.04)		4.01 (2.74)	
Time 2	3.76 (3.64)	2.66 (2.79)		4.28 (3.34)	
Time 3	3.19 (2.88)	2.36 (2.25)		2.20 (2.55)	
T3-T1	0.25 (3.59)	-2.32 (3.49)	0.002*	-0.90 (3.16)	.010**

^a Range of PPI: 0 (no pain) to 5 (excruciating pain); ^b Range of NRS: 0 (no pain) to 10 (worst possible pain);

^c Range of PACI: 0 to 7; ^d Range of PACSLAC: 0 to 60; ^eAll the p-values are based on a multilevel regression analysis

Table 3. Interrater Reliability Across Time Points for PACI & PACSLAC During Periods of Activity (n= 90) and Rest (n=90)

State	Instrument	ICC	CI
Activity			
	PACI	0.57	0.37, 0.72
	PACSLAC	0.62	0.44, 0.75
Rest			
	PACI	0.73	0.60, 0.83
	PACSLAC	0.84	0.75, 0.90

Table 4. Changes in Depression, Function, and Agitation Over the Intervention Period

	Control Group (n=74)	Partial Intervention Group (n=75)		Full Intervention Group (n=94)	
	Mean (SD)	Mean (SD)	p-value (control vs partial intervention) ^d	Mean (SD)	p-value (control vs full intervention) ^d
Depression^a					
Time 1	4.80(5.07)	4.98(3.03)		5.11(4.53)	
Time 2	6.76(5.81)	6.64(4.01)		3.91(3.64)	
Time 3	5.96(5.59)	7.29(3.75)	0.113	5.81(4.50)	0.368
T3-T1	2.89 (3.07)	0.07 (4.19)		0.96 (4.99)	
Function^b					
Time 1	1.19(0.54)	1.40(0.34)		1.14(0.56)	
Time 2	1.27(0.58)	1.29(0.55)		1.18(0.60)	
Time 3	1.26(0.53)	1.15(0.55)	< 0.001***	1.08(0.51)	0.002**
T3-T1	0.06 (0.83)	-0.03 (1.10)		-0.09 (1.19)	
Agitation^c					
Time 1	21.74(8.12)	18.84(4.74)		22.09(8.34)	
Time 2	22.96(8.72)	20.49(6.08)		19.70(6.56)	
Time 3	21.90(8.01)	20.57(6.78)	0.190	23.34(10.1)	0.515
T3-T1	2.21 (4.89)	0.68 (7.28)		0.51 (5.45)	

Notes:

^a Total score of CORNELL ranges from 0 (symptoms are absent) to 38 (symptoms are severe)

^b Total score of OARS ranges from 0 (can perform activities without help) to 28 (unable to perform activities)

^c Total score of CMAI ranges from 14 (behaviours never occur) to 70 (behaviours occur very frequently)

^d All the p-values are based on a multilevel regression analysis where time point, group, and interaction between time point and group are included as independent variables and time is nested within resident to adjust for the resident's cluster effect.

**significant at the p<0.01

***significant at the p<0.001

Table 5. Changes in Clinical Practice Behaviors Over the Intervention Period Among the Groups

Behavior	Control n=74 % (n)			Partial Intervention n=75 % (n)			Full Intervention n=94 % (n)			Chi-Square χ^2	p
	Negative Change	No Change	Positive Change	Negative Change	No Change	Positive Change	Negative Change	No Change	Positive Change		
Standardized pain assessment tool used	1 (1)	96 (71)	3 (2)	0 (0)	93 (70)	7 (5)	0 (0)	84 (79)	16 (15)	12.46	.010
Characteristics of pain identified	10 (7)	81 (60)	10 (7)	11 (8)	57 (43)	32 (24)	1 (1)	48 (45) ^b	50 (47)	35.90	<.001
Initial pain assessment completed	4 (3)	93 (69)	3 (2)	7 (5)	68 (51)	25 (19)	6 (6)	31 (29)	63 (59)	74.31	<.001
Cause of pain sought	7 (5)	78 (58)	15 (11)	6 (4)	72 (54) ^b	21 (16)	2 (2)	62 (58)	36 (34)	11.84	.019
Goals identified	15 (11)	82 (61)	3 (2)	7 (5)	89 (64) ^b	3 (2)	1 (1)	80 (75)	19 (18)	28.32	<.001
Care plan developed	12 (9)	81 (60)	7 (5)	8 (6)	86 (62)	6 (4)	1 (1)	81 (76)	18 (17)	15.82	.003
Non-pharmacological interventions used	3 (2)	66 (49)	32 (23)	9 (7)	51 (39)	40 (29)	6 (6)	57 (54)	36 (34)	4.08	.395
Pain medications ordered	8 (6)	82 (61)	10 (7)	4 (4)	92 (68)	4 (3)	3 (3)	85 (80)	12 (11)	5.33	.255
Documented effectiveness of pain interventions	12 (9)	71 (53)	16 (12)	7 (6)	65 (49) ^b	26 (19)	3 (3)	55 (52)	41 (39)	15.57	.004
Goals modified	34 (25)	64 (48)	1 (1)	29 (21)	64 (48)	7 (6)	1 (1)	69 (65)	30 (28)	55.12	<.001

^a **Note:** to assess change over the full intervention period, we excluded those who died over the course of the intervention in this analysis

^b 1 missing response

*p<.05

**p<.01

Table 6. Pain Management Index (PMI Scores)

Variables	Control			Partial Intervention			Full Intervention		
	Baseline %	Interim %	Final %	Baseline %	Interim %	Final %	Baseline %	Interim %	Final %
Pain sub-score^a									
Median	2.00	1.00	1.00	2.00	1.00	1.00	2.00	2.00	1.00
No Pain	16.9	37.6	12.8	10.1	29.9	40.5	17.0	21.4	24.6
Mild Pain	32.6	31.2	43.6	34.2	29.9	39.2	27.7	37.1	49.2
Moderate	44.2	24.7	34.0	45.6	33.7	16.5	48.9	35.7	21.5
Severe Pain	6.3	6.5	9.6	10.1	6.5	3.8	6.4	5.7	4.6
Medication sub-score^b									
Median	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No analgesia	13.5	10.0	13.2	3.8	6.2	3.8	13.8	8.1	12.9
Non-opioid	56.3	48.9	46.2	73.7	64.2	66.2	63.8	60.8	62.9
Weak opioid	19.8	22.2	13.2	12.5	16.0	16.2	10.6	18.9	12.9
Strong opioid	9.4	18.9	27.4	10.0	13.6	13.8	11.7	12.2	11.3
Pain Management Index (PMI)^c									
Median	0.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00
Chi-square									

Notes:

^a 0=no pain; 1=mild pain; 2=moderate pain; 3=severe pain^b 0=no analgesia prescribed; 1=non-opioid prescribed; 2=weak opioid prescribed; 3=strong opioid prescribed^c Acceptable PMI is: ≥ 0 ; possible range: -3 \rightarrow +3