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The Effect of Animal-Assisted Therapy on Pain Medication Use After Joint Replacement

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ABSTRACT Animal-assisted therapy (AAT) has been used in a variety of healthcare settings and studies to evaluate the potential patient benefits are warranted. This retrospective study measured the impact of AAT on the use of oral pain medications by adults after total joint replacement surgery. One group of patients received care in a hospital with an AAT program and the comparison group was in a hospital without an AAT program. Adult patient cohorts were matched on: age, gender, ethnicity, length of stay, and Diagnosis Related Group code for type of total joint replacement. Pain medication doses, converted into morphine equivalent daily doses (MEDD), were compared. Pain medication use was significantly less in the AAT group: 15.32 mg vs. 21.16 (t(119) = 2.72, p = 0.007). The effectiveness of AAT in decreasing the need for pain medication and its effect on patient well-being in the post-operative period and in other settings deserves further study.

Keywords: alternative therapy, animal-assisted therapy, pain medication, pet therapy

Animal-assisted therapy (AAT) is the preferred term used by Pet Partners (formerly Delta Society) to describe an activity that involves companion animals visiting people, with the goal of providing opportunities to promote improvement in human physical, social, emotional, and/or cognitive functioning to enhance quality of life. AAT is delivered in a variety of environments by specially trained handlers, usually volunteers, with animals which meet specific criteria. In this study, AAT is operationalized as the availability of daily animal visits during an entire hospitalization and could involve patients, family, and staff. The companion animals in this study were specially trained dogs.
The primary investigator did a review of the literature via the Cumulative Index to Nursing and Allied Health Literature (CINAHL) database in 2009 which returned 445 primarily qualitative studies. An updated review in 2011 resulted in nearly twice as many studies (805). This review of multiple data sources suggested a common theme related to the concept of AAT as well as a conceptual definition. Animal-assisted therapy is an animal-human interaction that takes place with varying degrees of involvement on both sides that generates a sense of well-being. An animal-assisted interaction takes place when the animal and the human are in specific proximity to each other and paying attention to the other. The animal used is usually a dog, but other animals such as birds, fish, or cats can be used.

Animal-assisted therapy is a modality that can be incorporated into healthcare practice even if the provider is not the personal handler of the animal and/or part of an animal team. Interest in measuring the effectiveness of AAT is relatively new (Glacken and Lawrence 2005). Cole et al. (2007) studied AAT on heart failure patients in cardiac care or cardiac observation units; they measured hemodynamic and neuroendocrine responses in the humans. Multiple physiological variables related to stress such as cardiopulmonary pressures and epinephrine and norepinephrine were measured. These measurements were significantly lowered in the patients who received an AAT visit.

Several studies have explored the effects of AAT on pain management, primarily focused on social behavioral benefits, such as AAT-related distraction (Kaminski, Pellino and Wish 2002; Richeson and McCullough 2003; Anscombe Wood 2006; Halm 2008; Johnson et al. 2008). The effect of AAT has been shown to be the reduction of stress preoperatively, the promotion of a positive attitude and post-operative activity in patients, and a reduction in pain medication. AAT may also have a complimentary effect on the staff and family members (Miller and Ingram 2000). Wu et al. (2002) studied AAT on a pediatric cardiology inpatient unit. Physiological responses were measured and both a stimulating and relaxing effect was observed. Relaxation effects were stronger as rapport was established between the dog and the child. The researchers noted that no standardization was made in the nature and duration of the interaction (playing versus petting). The study included measurements related to the presence of parents and the effect of AAT on them. No participant reported a negative experience with the AAT intervention. Additional empirical research is needed to evaluate the therapeutic impact of AAT on hospitalized patients.

The impetus for the current research originates from the seminal study that reported outpatients in a cardiac unit lived longer if they were pet owners (Friedmann et al. 2000). Indeed, Fine (2006) points to this study as the tipping point for the focus on the mechanisms at work in the use of animals in the healthcare arena.

Kaplan and Ludwig-Beymer (2004) describe a decrease in pain medication use when using AAT as an adjunctive intervention for post-operative pain control, using a case-controlled study of individuals who had joint replacement surgery. The participants of the AAT group used significantly less pain medication (almost a 50% decrease). This finding was reported by Kaplan and Ludwig-Beymer in 2004 at a Nursing Grand Rounds conference based on the AAT program Kaplan implemented in a community hospital in 2002. Kaplan’s program has expanded over the last decade. The initial 15 teams of dogs and handlers have increased to 100 teams, with over 45 dog breeds represented. In 2007, the average number of patients visited per month was 1,372; the program visited its 110,000th patient in June, 2011. The program schedules four to five teams daily to visit nearly all service areas within the hospital so that patients may have access to animals on a daily basis. Staff and patients may request visits outside of these
scheduled times for specific needs such as adjuncts for therapy or support tools for sensitive clinical tasks. Despite concerns about the risk of transmission of pathogens from animals to humans, Kaplan has not reported any instance of zoonotic infections related to the program.

**Current Study**

The purpose of the current study was to extend the findings of Kaplan/Ludwig-Beymer in their unpublished 2004 work. The effects of AAT on pain medication use was explored by comparing patient cohorts who were exposed to the intervention with a comparison group in which AAT was not available. Patient cohorts from separate hospitals were used to control for possible contamination due to passive or random AAT interventions that would not be documented.

**Methods**

The project was reviewed by the Institutional Review Board of both participating hospitals and ruled exempt. The two cohorts of patients were compared using retrospective patient chart audit which compared pain medication use between joint replacement patients in a hospital with an established AAT program (site of the Kaplan/Ludwig-Beymer 2004 study) and a hospital without any AAT program.

**Participants—AAT Program**

The standardized AAT program at Hospital A conducts temperament testing on dogs and provides 24 hours of initial training per dog-and-human team. All canine–human teams are certified by an established therapy program such as Therapy Dogs, Inc. or Pet Partners. Teams are available to provide visits to hospitalized patients upon request. During the admission process for elective procedures at Hospital A, patients are asked if they would like a dog visit and their records are flagged to include them on a patient list that the AAT teams use during their rounds on the unit. At any time during their stay, a patient can ask to be added to the AAT visit list. Any staff member (as well as family) may specifically request an AAT visit at any time at Hospital A. Clinicians can specifically incorporate AAT into their plan of care for the patient. Nearly all of the AAT teams in Hospital A’s program include a Caucasian female handler between the age of 35 to 70 years. Visits may last anywhere from 5 to 15 minutes. Hospital B had no AAT program.

**Participant Inclusion**

Each hospital in the study used the same electronic health record software program, allowing for the same data query to be used for patient identifications and matching without the need for redefinition of data elements. Data were collected from each facility for adult admissions from January 1, 2009 to December 31, 2009 using Diagnosis Related Groups (DRG) codes. DRG is a system implemented by the US government for reimbursing hospitals with a fixed fee based on the principal diagnosis, surgical procedure used, age of the patient, and expected length of stay in the hospital. For this study, DRG 470 (Major joint replacement or reattachment of lower extremity w/o MCC), 469 (Major joint replacement or reattachment of lower extremity w MCC) or 468 (Revision of hip or knee replacement w/o CC/MCC) were used to identify the patient population which had received total joint replacement of either hip or knee.

Each hospital in the study provides health care in a non-academic hospital setting. Joint replacement surgeries are elective procedures. The patient acuity levels and capability to safely provide the procedures were assumed to be comparable. However, data on hospital acuity levels and/or risk scores for patients were not analyzed in this exploratory study due to time and resource constraints.
Both hospitals have dedicated orthopedic units and standardized post-surgical care for orthopedic joint replacement patients which includes patient-controlled analgesia during the first 24 hours and/or peripheral nerve block administration. These pain control methods are continued until oral pain medication is instituted, usually the evening of or the day after surgery. Data for this study were collected starting on post-operative day 2, regardless if the patient started strictly oral pain medication earlier than that day or not.

Hospital A provided 709 electronic admission records that met the defined criteria of admission date and DRG. In addition, multiple electronic data files were received from the pharmacy dispensing system for the same defined patient population. These files were then matched to the demographic file. Only drugs classified as therapeutic class 2-Analgesic, Anesthetic were included in this study. An additional file was accessed of patients who received an AAT visit. The demographic file was then matched to this AAT-visit-received file. As a result, 209 patients met additional criteria of receiving an AAT visit (28.5%). This cohort of total joint replacement patients receiving AAT had a total of 541 dog visits, a mean of 2.5 per patient.

Hospital B provided a cohort of 88 admission records via an electronic data file that matched the defined criteria of admission date and DRG. The charts of the 46 demographically matched patient cohorts from Hospital B were examined in the organization’s medical records office as a paper medication-administration record was in use in 2009. A manual file review of medication administered to the 46 patients was done and only the drugs classified as therapeutic class 2-Analgesic, Anesthetic were included in this study.

Some challenges arose during the paper audit when an order for as-needed pain medication of one to two tablets was administered with no notation of how many tablets were given. Best judgment was used by analyzing the history of that drug use during the hospital stay and the dosages given before and after the questionable dose. Handwriting on occasion was difficult to decipher and what extraneous marks were significant or not, on occasion, was a challenge to discern. The cohorts from both hospitals were matched on key data demographic and process variables including age, gender, ethnicity, and length of stay. Each cohort had 12 different surgeons. This match on demographic variables included 46 patients from each hospital (Table 1).

Analysis of Pain Medication Usage

Pain medications administered to the patients from both cohorts were converted into intravenous morphine equivalencies using conversion rates in the existing literature (mean equivalent daily dose conversion: MEDD) (Edmonton Regional Palliative Care Program 2001; McPherson 2010). A daily medication administration count began and ended at midnight in concurrence with both hospitals’ medication administration record keeping. The conversion tool chosen for this study was the Edmonton Regional Palliative Care Program (2001) which contains conversion factors for all the drugs used by the study patients (Table 2). Specifically, propoxyphene containing compounds (e.g., Darvocet® and Darvon®) were discontinued for use in the US in late 2010. These drugs were used by some study patients in 2009. Oral pain medication use, which typically began on the second post-operative day, was examined by mean daily dose use (an entire 24-hour period) excluding the day of discharge as only a partial medication administration for that 24-hour period was recorded while the patient was hospitalized.
Results
To examine the differences between patients who received AAT and those who did not in their daily use of morphine equivalent, an independent samples t-test was conducted using SYSTAT12 software. The results revealed a significant difference ($t_{119} = -2.72, p = 0.007$): the cohort that received at least one AAT visit (Hospital A patients) had a lower mean MEDD (15.32 mg, $SD = 12.16$) compared with the cohort that did not receive an AAT visit (Hospital B patients) (21.16 mg, $SD = 20.05$). A graphic breakdown of mean MEDD by post-operative day (POD) showed both cohorts had nearly the same pain medication use on the second POD when physical therapy started. However, data revealed that pain medication use dropped off more dramatically in the AAT group in subsequent days (Figure 1).

Table 1. Demographically matched cohorts from Hospitals A and B ($n = 46$, both groups)

<table>
<thead>
<tr>
<th></th>
<th>Hospital A (AAT)</th>
<th>Hospital B (non-AAT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Mean: 66 years</td>
<td>Mean: 66 years</td>
</tr>
<tr>
<td></td>
<td>Range: 44–87 yr</td>
<td>Range: 44–87 yr</td>
</tr>
<tr>
<td>Gender</td>
<td>Female: 38</td>
<td>Female: 38</td>
</tr>
<tr>
<td></td>
<td>Male: 8</td>
<td>Male: 8</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Caucasian: 45</td>
<td>Caucasian: 45</td>
</tr>
<tr>
<td></td>
<td>Hispanic: 1</td>
<td>Hispanic: 1</td>
</tr>
<tr>
<td>Length of Stay</td>
<td>Mean: 3.5 days</td>
<td>Mean: 3.8 days</td>
</tr>
<tr>
<td></td>
<td>Median: 3 days</td>
<td>Median: 4 days</td>
</tr>
<tr>
<td></td>
<td>Range: 3–6 days</td>
<td>Range: 2–7 days</td>
</tr>
<tr>
<td></td>
<td>Total days: 166</td>
<td>Total days: 180</td>
</tr>
<tr>
<td>Diagnosis Related Group (DRG)</td>
<td>470 (94%)</td>
<td>470 (85%)</td>
</tr>
<tr>
<td></td>
<td>469 (2%)</td>
<td>469 (6%)</td>
</tr>
<tr>
<td></td>
<td>468 (2%)</td>
<td>468 (9%)</td>
</tr>
<tr>
<td>No. of Dog Visits</td>
<td>Mean: 2.4 visits/stay</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Range: 1–7</td>
<td></td>
</tr>
</tbody>
</table>

*DRG 470 (Major joint replacement or reattachment of lower extremity w/o MCC).
*DRG 469 (Major joint replacement or reattachment of lower extremity w MCC).
*DRG 468 (Revision of hip or knee replacement w/o CC/MCC).

Table 2. Conversion factors to 1 mg intravenous (IV) morphine equivalents.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Route</th>
<th>Morphine Equivalent Daily Dose Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codeine</td>
<td>Oral</td>
<td>0.05</td>
</tr>
<tr>
<td>Hydrocodone (Norco®, Vicodin®)</td>
<td>Oral</td>
<td>0.40</td>
</tr>
<tr>
<td>Hydromorphone (Dilaudid®)</td>
<td>Oral</td>
<td>2.00</td>
</tr>
<tr>
<td>Morphine</td>
<td>Intravenous</td>
<td>1.00</td>
</tr>
<tr>
<td>Morphone</td>
<td>Oral</td>
<td>0.40</td>
</tr>
<tr>
<td>Oxycodone (Percocet®, Oxycotinin®)</td>
<td>Oral</td>
<td>0.63</td>
</tr>
<tr>
<td>Propoxyphene (Darvon®, Darvocet®)</td>
<td>Oral</td>
<td>0.08</td>
</tr>
<tr>
<td>Tramadol (Ultram®)</td>
<td>Oral</td>
<td>0.05</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>Transdermal</td>
<td>0.10</td>
</tr>
</tbody>
</table>
The Effect of Animal-Assisted Therapy on Pain Medication Use After Joint Replacement

Patients with three or more AAT visits appeared to have lower pain medication use requirements, suggesting an AAT dose response. To investigate these differences, an additional between-groups comparison was performed utilizing an independent-samples t-test procedure. GraphPad Prism software (GraphPad Software, Inc, San Diego, CA, USA) was used for this analysis. The mean MEDD received over the respective number of post-operative days per patient was 19.3 mg (SD = 12.4) for the group of patients receiving one or two AAT visits (n = 26) versus 14.2 mg (SD = 7.5) for the group receiving three or more AAT visits (n = 20). Although there was a trend for the patient group with more animal visits to receive lower MEDDs (i.e., 26% less on average), these differences were not significant (t = 1.63, p = 0.11).

Discussion

Our results further support the observations of Kaplan and Ludwig-Beymer in their unpublished 2004 work demonstrating a significant decrease in oral pain medication use in adult joint-replacement patients who received an AAT visit versus the cohort who did not. The initiation of physical therapy on post-operative day 2 would likely be the most painful common experience by all patients and could explain the nearly equal pain medication use in both groups on this day found in the current study.

One of the unique features of this study was the use of electronic documentation in the health record of the patient population which received the AAT visit. Original documentation of AAT visits included time estimates of the visit and observations by the handler of patient and family responses. This study used combined paper and electronic data mining techniques. A clear understanding of how the electronic health record is used, the availability of discreet data, and defined data mining techniques makes the use of electronic health databases invaluable. Documentation of AAT visits in the electronic health record makes quantitative studies much more robust.
Limitations and Future Studies

There are several limitations of the methods employed in this study:

1) Electronic medical records and paper charts may contain different data elements. Manual paper hospital chart review is based on the assumption that the chart is complete for all related records and can provide an opportunity to review such documentation as the history and physical report, discharge summary, and procedure reports. For the hospital that used only electronic data files, data were limited to all the demographic variables, drugs administered, and length of hospital stay.

2) The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) is the system used internationally to classify and assign codes to diseases, injuries, and causes of death by etiology and anatomic localization. The ICD-9 diagnosis is codified into a 6-digit number, which allows clinicians, statisticians, politicians, health planners, and others to speak a common language. The use of ICD-9 diagnosis codes would have provided additional information but the use of up to 9 diagnosis codes per patient record made it difficult to properly filter when defining the data sets. Therefore, DRG codes were used and actual patient diagnoses were not analyzed.

3) The only outcome studied was the amount of pain medication received post-operatively, and efforts were made to identify comparable groups. Matching was conducted on selected demographic variables and length of stay. It is unknown if other variables such as co-morbidities, type of anesthesia (general vs. general and peripheral nerve block), surgeons, type of appliance, length of surgical procedure, or other unknown variables affected the need for pain medication after joint replacement surgery.

4) It is possible that patients who were in less pain post-operatively were more likely to request AAT. No comparison was made of patients within Hospital A who had the same orthopedic procedure who did not request AAT. Comparison was made instead with a comparison cohort in another hospital where AAT was not available. This controlled for “contamination” of the intervention but does not address possible differences in those accepting or declining AAT when available.

5) Results were analyzed based on the presence or absence of AAT using dogs. Actual interventions were not observed. Examination of AAT variables such as gender of dog or handler, dog breed, coat length or color of dog, and age of dog or handler was not done for this exploratory study due to time and resource constraints.

6) Despite matching on length of stay (LOS), the LOS for the AAT group was less than that for the comparison group. It is possible the AAT group used less pain medication because they were in the study a shorter length of time. However, when the data were compared by post-operative day, the AAT group consistently demonstrated less pain medication day by day, except on day 2.

Future studies should incorporate a larger sample size which would allow for the examination of more variables, including co-morbidities. Selecting for single surgeons, single handler/canine teams, variations in dog sizes, colors, and breeds may or may not have an effect. Confounding variables exist at the AAT handler team and/or the environmental level creating challenges for AAT research. These variables include such things as individual care provider...
influence, handler/canine team influence, previous/concurrent pet ownership of the patient, or
the care delivery process. Marino’s (2012) review of recent AAT literature even discusses
whether a live animal is needed for therapeutic effect. While the matched cohort model pro-
vides initial evidence in support of benefits from AAT, future studies which include a random-
ized control design are needed.

Healthcare providers and nurses in particular, face challenges to provide compassionate
care to offset dehumanizing technology and less “face time” with sicker clients/patients. The
presence of animals at the point of care can provide comfort in the face of dehumanizing tech-
ology. Incorporation of AAT into the nursing or therapy plan of care can benefit a broad pa-
tient population on many levels. Howell-Newman and Goldman’s Animal-Facilitated Therapy
theory (1993) supports the effect of the human–animal bond on the health of the individual. Ex-
isting literature indicates that AAT can boast a simultaneous effect on a patient’s psychosocial,
emotional, physical, and mechanical functional level as well as a complimentary effect on the
caregiver (Wu et al. 2002; Berget, Ekeberg and Braastad 2008). In the current economic cli-
mate of cost-benefit justification, evidence of volunteer-based AAT program effectiveness in im-
proving pain management may move its utilization to an incorporated, multidisciplinary program
of care.

Despite the limitations, this study provides interesting observations about AAT and pain
management in the post-operative joint replacement patient. However, while compelling, they
are not definitive and warrant further study for more general application in post-operative and
other patient populations.

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