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Original Article

A pilot multicentre randomised clinical trial to determine the effect of a pharmacist-partnered opioid tapering intervention before total hip or knee arthroplasty

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Summary

Background Opioid analgesic use before total hip or knee arthroplasty has been associated with worse postoperative outcomes. This pilot study aimed to examine the feasibility of a telehealth-based pharmacist-partnered opioid tapering intervention before elective primary hip or knee arthroplasty and its potential effectiveness compared with usual care.

Methods This study was conducted at seven hospitals in New South Wales, Australia. Eligible patients were those aged ≥ 18 years, scheduled to undergo primary hip or knee arthroplasty for osteoarthritis and taking opioid analgesics pre-operatively. The intervention group participated in an opioid tapering telehealth service, a partnership between a pharmacist and general practitioner, for 3 months pre-operatively up to the day of surgery, while the control group received usual care. The primary outcomes of the study were to investigate the feasibility of the intervention (i.e. adherence to treatment) and potential effectiveness in decreasing baseline daily opioid dose by > 50% before surgery.

Results Between December 2021 and June 2023, 70 patients were recruited and assigned randomly to the intervention group (n = 35) or control group (n = 35). Baseline characteristics were similar between groups. Thirty patients in each group completed their allocated treatment. All patients allocated to the intervention group completed at least one appointment with a pharmacist, with the median (IQR [range]) being 2 (1–4 [1–6]) appointments. The number of patients who successfully decreased their baseline daily opioid dose by ≥ 50% before surgery was 27/30 in the intervention group compared with 5/30 in the usual care group ($p < 0.001$).

Conclusions The findings of this pilot study support the feasibility of a telehealth-delivered, pharmacist-partnered opioid tapering service for patients scheduled for primary hip or knee arthroplasty. A broader multicentre study to examine the effectiveness of this intervention on clinical outcomes is warranted.

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Introduction

Total hip and knee arthroplasty (THA and TKA, respectively) are among the most common elective surgical procedures performed worldwide [1]. In 2021, there were over one million primary THA and TKA procedures performed in the USA [2] and, by 2030, the rate for each of these procedures is expected to increase by 174% and 673%, respectively [3]. Similar trends are reported in other countries including Australia [4] and the UK [1].

Opioid use among people awaiting TKA or THA is fairly common, ranging from 20% to 54% [5, 6]. However, when compared with paracetamol or non-steroidal anti-inflammatory drugs, opioids have a limited role in improving osteoarthritis-related pain and function and are associated with potential patient harm [7]. A meta-analysis involving 7356 patients conducted in 2019 showed that pre-operative opioid use is associated with worse postoperative patient-reported outcomes (e.g. pain intensity, physical function) compared with no opioid use [8]. Pre-operative opioid use is also associated with a longer duration of hospital stay [8], increased risk of prosthesis revision [9] and other postoperative complications [10]. Opioid use before surgery has been identified to be one of the strongest predictors for persistent postoperative opioid use [10], and chronic opioid use is associated with dangerous adverse events such as sedation and respiratory depression [11].

Low-level evidence suggests these harms may be reversible if opioids are tapered before arthroplasty [12]. In a retrospective study, patients who underwent THA or TKA and tapered their pre-operative opioid dose by at least 50% pre-operatively were matched with patients who did not taper their opioids; those who successfully tapered had greater improvements in postoperative functional outcomes compared with matched controls [12]. Decreasing opioid use before elective arthroplasty has been suggested as an intervention to decrease long-term opioid prescribing after surgery [13], although a causal effect between opioid tapering pre-operatively and improved outcomes after surgery has not been established.

In a narrative review of published opioid tapering protocols involving patients on long-term opioid therapy, `planning elective surgery´ is listed as one of 18 potential clinical indications for tapering opioids [14]. However, a subsequent systematic review of interventions to reduce opioids for non-cancer pain before elective surgery identified no relevant published studies, highlighting the need for further research in this area [15]. In light of this gap, we conducted a pilot study that aimed to establish the feasibility of a telehealth-based, pharmacist-partnered opioid tapering intervention before elective primary THA or TKA and its potential effectiveness compared with usual care.

Methods

This study was conducted in accordance with the CONSORT guideline. Ethics approval was obtained from the South Western Local Health District Human Research Ethics Committee and written informed consent was obtained from all patients.

This study was a pilot multicentre, two-armed randomised clinical trial with an embedded observational study intended to inform the design of a subsequent larger trial if feasibility was established and there was evidence in favour of the intervention.

Voluntary patients were recruited from seven (four metropolitan and three regional) hospitals in New South Wales, Australia. Inclusion criteria were: waiting period of at least 4 months before scheduled elective primary THA or TKA; aged ≥ 18 y; able to speak and read English; regular pre-operative opioid use (defined as using opioids ≥ 4 days per week for at least 2 weeks); and interest in tapering baseline opioid use. Opioid analgesics included buprenorphine; codeine; fentanyl; hydromorphone; morphine; methadone; oxycodone; tapentadol; and tramadol. We did not study patients with any of the following criteria: opioid use for oncology, palliative care or substance use disorder (identified by opioid formulation); repeat surgery (defined as the same procedure within 6 months); cognitive impairment; or current or previous participation in an opioid tapering study.

Ongoing care at a pain medicine clinic and active medication management by a pain medicine specialist were exclusion criteria for randomisation, but these patients were eligible for the observational study. The main purposes of the observational study were to determine if long-term opioid therapy managed by pain medicine clinics was being weaned routinely before surgery without additional intervention and to capture characteristics of patients who were not randomised to review for potential selection bias.

Patients who declined enrolment in the randomised trial were also invited to participate in the observational study.

Patients were allocated randomly approximately 3 months before surgery in a 1:1 ratio in permuted blocks of two or four to the intervention or usual care group, stratified by hospital site. The computer-generated randomisation list was secured at the co-ordinating centre. Due to the nature of the intervention, patients and clinicians could not be blinded to allocation. Patients were assigned a unique identifier without indicating group assignment to facilitate blinded statistical analysis.

Patients allocated to the intervention group received a pharmacist-partnered service to taper the baseline opioid dose delivered via video telehealth or telephone (same content and protocol) before scheduled surgery. The pharmacist-partnered intervention involved aspects of shared decision-making with patients [16] and motivational interviewing techniques [17]. The pharmacist who provided this service was trained using freely available online resources on multimodal pain management and opioid tapering, featuring non-pharmacological interventions and non-opioid analgesics (online Supporting Information Appendix S2). The general structure of these sessions included: exploring the patient's pain management expectations; eliciting the patient's motivations to taper their opioid dose; considering the patient's baseline opioid dependency and pain catastrophising tendencies; agreeing on a target opioid dose and opioid tapering rate; discussing ways to improve pain management with a focus on non-pharmacological strategies and non-opioid analgesia as part of a multimodal approach; and scheduling a follow-up appointment.

Before tapering, the pharmacist provided the patient's general practitioner with information about the patient's involvement, outlined the intervention and addressed any concerns. The initial pharmacist appointment took place approximately 3 months before surgery. Using shared decision-making, the pharmacist and patient worked together to develop an individualised pain management and opioid tapering plan using resources from NPS MedicineWise as a guide [18]. Suggested opioid dose tapering rates were influenced by the duration of opioid use. For example, if a patient was taking opioids for < 3 months, the opioid dose was adjusted weekly; if ≥ 3 months, the opioid dose was adjusted monthly. The magnitude of each opioid dose reduction was 10–25% of the patient's most recent daily opioid dose, and this amount could be individualised based on discussion between each patient and the pharmacist [18]. All opioid tapering plans were reviewed and approved by a pain medicine specialist (JS). Patients received pharmacist follow-up appointments 1 week after each opioid dose reduction to review tapering progress, address any difficulties encountered and adjust the opioid tapering plan if required. Patients were educated on the symptoms of opioid withdrawal and what to do to manage them, including calling their general practitioner and returning to the previous opioid dose. The target opioid dose reduction was 50% of the baseline daily opioid dose before the day of surgery [12]. If patients wished to taper their opioid dose beyond the 50% reduction target, the pharmacist-partnered intervention continued, but this was voluntary.

Patients in the control and observational groups received usual care. This involved a routine review by the hospital pre-admission clinic team to assess medical, physical and psychological health before surgery. Patients were provided standardised education for pre- and postoperative care by hospital staff that did not involve a one-on-one meeting with a pharmacist or active pharmacist-partnered opioid tapering programme.

Baseline data collection included: patient characteristics (sex, age, BMI and planned surgery); analgesic use via patient self-report [19], including opioids which were converted to daily oral morphine milligram equivalents (MME) [20]; benzodiazepine use; history of opioid dependency [21]; index joint pain; overall body pain; pain catastrophising [22]; physical function [23]; psychological function [23]; opioid-related adverse events (defined as the incidence of constipation, sedation, dizziness, nausea or vomiting, or pruritis); and opioid withdrawal [24]. Except for baseline patient characteristics, these data were collected again 1–3 days before surgery and 3 months after discharge from acute care.

At the 3-month post-discharge time-point, additional data related to hospital stay were retrieved from patients' electronic medical records including inpatient medication use; discharge medications prescribed; in-hospital complications; duration of hospital stay; discharge destination; and readmission events within 30 or 90 days after discharge. The in-hospital complications were adapted from previous literature [25] and included: major joint (defined as deep surgical site infection, wound bleed/hemarthrosis, dehiscence, nerve injury, dislocation or intra-operative fracture); minor joint (defined as persistent wound ooze, suspected surgical site infection or blistering); and major non-joint (defined as death, myocardial infarction, venous thromboembolism, aspiration, chest infection or excessive non-joint bleeding).

Opioid dependency was measured by assessing Overuse, Worrying, Losing interest in usual activities and

feeling Slowed down, sluggish or sedated (the OWLS tool). The OWLS rating scale for each item was: 0 = `not at all´; 1 = `a little bit´; 2 = `quite a lot´; and 3 = `a great deal´. A minimum aggregate score of 3 suggests opioid dependency [21]. Other measures recorded included: the Pain Catastrophising Scale [22]; the Short Opiate Withdrawal Scale, which has been used in previous opioid tapering research [24]; tobacco use disorder using criteria from the Diagnostic and Statistical Manual for Mental Health Disorders Fifth Edition (DSM-5) [26]; and health-related quality of life using the 29-item Patient-Reported Outcomes Measurement Information System (PROMIS-29 Profile version 2.1) which assesses seven domains (physical function; fatigue; pain interference; depressive symptoms; anxiety; ability to participate in social roles and activities; and sleep disturbance) [23].

Primary feasibility outcomes included recruitment rate; eligibility rate; intervention adherence (defined by evidence of at least one pharmacist-patient appointment); retention of patients in both groups of the study; and the proportion of patients taking low (< 60 MME per day) or high opioid doses (≥ 60 MME). The daily cut-off of 60 MME was defined to meet recommendations by local guidelines to seek specialist advice before using higher opioid doses [27]. Higher pre-operative opioid doses may be associated with a higher risk of opioid withdrawal effects and may be a greater challenge to wean, thus impacting the feasibility of the intervention.

We also performed a preliminary assessment of effectiveness, since this would be the goal of a future multicentre randomised study. The measure of effectiveness was the proportion of patients who tapered 50% or more of their daily opioid dose from baseline (3 months pre-operatively) to 1–3 days before surgery.

Secondary outcomes included: index joint pain and total body pain; patient-reported physical and psychological function; analgesic use; incidence of opioid-related adverse events and opioid withdrawal symptoms measured 1–3 days before surgery and 3 months after surgery; duration of acute hospital stay; 30- and 90-day hospital readmission rates; discharge destination (home/usual residence or inpatient rehabilitation); and post-surgical complications.

While determining feasibility was the primary aim, we powered the study to detect a between-group difference in the proportion achieving the targeted opioid dose reduction of 50% of the original daily opioid dose based on a published study [12]. Assuming a difference between groups of 40%, α of 0.05 in a two-sided test and 80% power, a total of 40 patients were required (G*Power software, version 3.1.9.7, Düsseldorf, Germany). To account for potential dropouts or loss to follow-up, we aimed to recruit 25 patients per group.

Descriptive statistics were used to summarise feasibility outcomes. Categorical outcomes were compared using Fisher's exact test and non-normally distributed continuous outcomes were assessed using the Mann–Whitney U test. A web-based application (HealthMeasures Scoring Service) was used to convert raw PROMIS-29 scores into T-scores, representing a standardised score with a mean of 50 (corresponding to the mean score in a normative population from the USA) and a standard deviation of 10, where a higher T-score indicates more of the variable measured (i.e. more fatigue and greater physical function) [28, 29]. Patient group assignments (i.e. intervention and control) were masked to the statistician. We compared the characteristics of patients with and without missing primary effectiveness outcome data. Between-group differences were reported using a p value for the primary effectiveness outcome and mean difference (95%CI) for secondary outcomes. All statistical tests were two-tailed and performed using SPSS software, version 25 (IBM Corporation, Armonk, NY, USA).

Results

From December 2021 to September 2022, 575 patients were screened for eligibility, and the last follow-up encounter was conducted in June 2023 (Fig. 1). Of those screened, 472 were not eligible for recruitment (Fig. 1). Recruitment over time is shown in Fig. 2. Seventy patients were enrolled and allocated randomly, 35 in each of the intervention and usual care groups. Complete data from the required pre-surgical time-point were not available for five patients in each group before study closure. These patients were excluded, leaving 30 patients in each group for analysis.

Baseline characteristics were similar between the two groups (Table 1). Thirty-one patients underwent THA and 29 underwent TKA. Median (IQR [range]) opioid dose in MME per day was 15 (8–43 [2–90]) in patients allocated to the intervention group and 11 (5–30 [2–106]) in those allocated to the usual care group. The number of patients taking opioid doses ≥ 60 MME was 4/30 in the intervention group and 2/30 in the usual care group.

Intervention adherence, as determined by evidence of at least one pharmacist-patient appointment, was 100% among patients who completed baseline data collection (30/30). All patients in each group received their assigned treatments. No patients withdrew from the study owing to a lack of intervention effectiveness or adverse effects related to opioid tapering. None of the opioid tapering plans

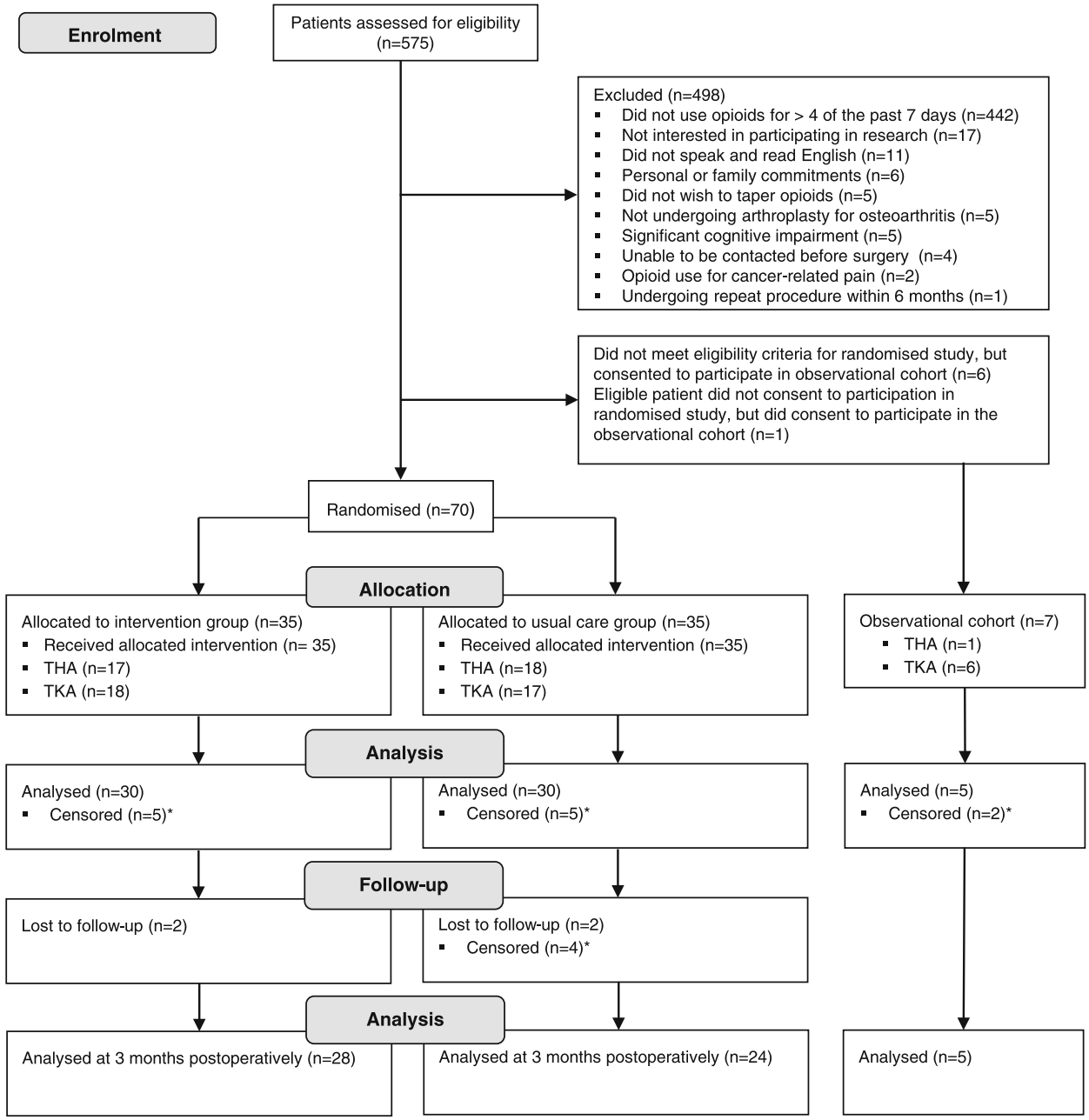

Figure 1 Study flow diagram. *Data were censored for patients who did not receive surgery or reach 3-month postoperative data collection before study closure. THA, total hip arthroplasty; TKA, total knee arthroplasty.

developed by the pharmacist required alteration following review by the pain medicine specialist. Median (IQR [range]) duration of the pharmacist-partnered opioid tapering intervention was 109 (65–128 [14–150]) days. There was a median (IQR [range]) of 2 (1–4 [1–6]) appointments between the patient and the pharmacist. The duration of individual patient-pharmacist appointments was 60 (30–70 [20–90]) min.

For the outcome assessment of effectiveness using the intention-to-treat principle, the number of patients who tapered ≥ 50% of their baseline daily opioid dose before surgery was 27/30 in the intervention group and 5/30 in the usual care group ($p < 0.001$; Table 2).

At the post-intervention follow-up measured 1–3 days before surgery, median (IQR [range]) daily opioid consumption was 0 (0–8 [0–45]) MME in patients allocated

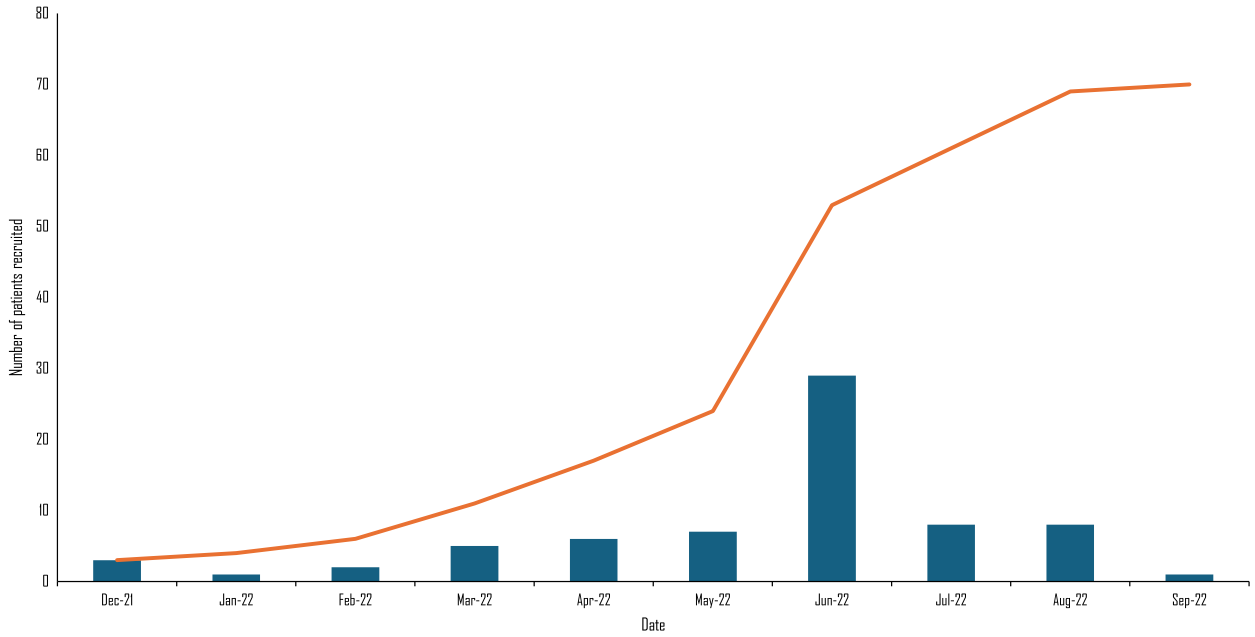

Figure 2 Number of patients recruited per month; orange line represents the cumulative number of patients recruited.

to the intervention group and 13 (3–29 [0–121]) MME in those allocated to the usual care group (Table 2). Patients in the intervention group reported greater physical function and ability to perform social roles and activities with lower sleep disturbance compared with the usual care group (Table 2). The incidence of opioid-related adverse events or opioid withdrawal was similar between groups (Table 2).

Two patients in each group were lost to follow-up by the 3-month postoperative timepoint, and data were censored for an additional four patients in the control group who did not reach the 3-month postoperative follow-up before study closure (Fig. 1). Postoperative acute care and 3-month postoperative follow-up data for 28 patients in the intervention group and 24 patients in the control group were analysed (online Supporting Information Tables S1–S4).

Of the five patients in the observational cohort (i.e. already under the care of a pain specialist or did not wish to be allocated), two were taking ≥ 60 MME and four were taking a modified-release formulation opioid. Other baseline characteristics of this group are shown in online Supporting Information Table S5. None of these patients tapered their baseline daily opioid dose ≥ 50%, and median (IQR [range]) dose increased from 49 (15–83 [8–135]) MME at baseline to 60 (27–101 [5–135]) MME at the pre-operative time-point. Other outcomes from this group are provided in online Supporting Information Tables S6–S8.

Discussion

The results of this pilot multicentre randomised trial show the feasibility of a pharmacist-partnered opioid tapering telehealth intervention before THA or TKA and provide preliminary evidence of effectiveness measured by reduction of baseline daily opioid dosage by > 50%. This intervention was applied successfully in a limited number of patients across multiple metropolitan, regional and rural sites, where rates of pre-operative opioid use are known to differ [5]. Among the patients who received the intervention in this pilot study, none of the opioid tapering plans developed by the pharmacist were altered after review by a pain medicine specialist. These results will be used to inform a subsequent larger multicentre trial.

These study findings are consistent with published research in the chronic pain context, showing the importance of a multidisciplinary effort with pharmacist involvement when tapering patients on long-term opioid therapy [30]. The pharmacist-partnered intervention used in the present study integrates aspects of motivational interviewing, which has been applied for opioid tapering in the THA and TKA population after surgery [17]. This pilot study represents a novel application of this approach before surgery to reduce baseline daily opioid use before arthroplasty for patients who choose to do so.

Preliminary outcome measurements for patients in the intervention group suggest better physical function and

Table 1 Baseline characteristics of patients allocated randomly to pharmacist-partnered opioid tapering (intervention group) before total hip or knee arthroplasty or usual care. Values are mean (SD), number or median (IQR [range]).

	Intervention group n = 30	**Usual care group n = 30**
Age; y	62 (9.8)	63 (11.0)
Sex; female	18	18
BMI; $kg.m^{-2}$	35 (7.8)	33 (8.2)
Opioid dependence[a]	14	14
Pain Catastrophising Scale score[b]	28.0 (6.9)	25.8 (7.5)
Analgesic use		
Paracetamol	25	25
NSAIDs (total)	14	14
Opioids (total)	30	30
Frequency and formulation of opioid use		
Regular	24	22
When required	6	8
Modified-release formulation	12	11
PROMIS-29 Domains[c]		
Physical function	30.8 (3.7)	30.7 (3.6)
Anxiety	57.6 (11.6)	56.6 (10.0)
Depression	56.5 (10.2)	58.4 (10.2)
Fatigue	59.9 (9.2)	56.0 (11.9)
Sleep disturbance	58.6 (7.0)	56.1 (6.7)
Social roles and activities	40.2 (5.9)	42.3 (4.6)
Pain interference	65.0 (4.8)	63.5 (3.6)
Pain intensity at affected joint[d]	7.2 (1.2)	7.2 (1.0)
Overall body pain intensity[d]	5.5 (2.1)	4.9 (1.9)
Opioid-related adverse effects (any)	21	20
Constipation	12	12
Sleepiness or drowsiness	14	16
Dizziness	2	2
Nausea or vomiting	1	2
Itchiness or rash	0	1
Opioid Withdrawal Scale score[e]	0.4 (1.6)	0.6 (2.1)
Alcohol use	11	10
Tobacco use[f]	4	4

NSAIDs, non-steroidal anti-inflammatory drugs; PROMIS, Patient-Reported Outcomes Measurement Information System.
[a]Measured using the OWLS tool [21].
[b]Measured using a 13-item scale with a minimum score of 0 and maximum score of 52.
[c]Presented as standardised T-scores representing a standardised score with a mean of 50 (corresponding to the mean score in a general population) and a standard deviation of 10, where a higher T-score indicates more of the variable measured [29].
[d]Measured using an 11-point numeric rating scale.
[e]Measured using a 30-point numeric rating scale.
[f]Measured using the DSM-5 [26].

health-related quality of life both before and after surgery when compared with the usual care group. We speculate that these findings may be at least partly attributable to the motivational interviewing intervention as well as the dose reduction in opioid consumption itself [12]. A previous retrospective cohort study showed that pre-operative opioid tapering before arthroplasty may be associated with improved postoperative health outcomes compared with matched control patients; this intervention involved shared decision-making being personalised to each patient and included referral to a pain medicine specialist or management by primary care [12]. Our pilot randomised

Table 2 Outcomes collected 1–3 days before surgery for patients allocated randomly to pharmacist-partnered opioid tapering (intervention group) before total hip or knee arthroplasty or usual care. Values are number, mean (SD), median (IQR [range]) or between-group difference (95%CI).

Secondary outcomes	Intervention group n = 30	Usual care group n = 30	Between-group difference* (95%CI)
Opioid dependence[a]	3	11	30% (10–50%)
Analgesic use			
Paracetamol	24	26	7% (-30–10%)
NSAIDs (any)	3	7	13% (-30–10%)
Opioids (any)	14	28	46% (-30–70%)
Frequency and formulation of opioid use			
Regular	9	18	30% (10–50%)
As needed	5	10	16% (10–40%)
Modified-release formulation	3	10	13% (3–20%)
Total opioid dose; $MME.d^{-1}$	0 (0–8 [0–45])	13 (3.3–29 [0–121])	-15.5 (-17.5 to -13.6)
Pre-operative PROMIS-29 domains[b]			
Physical function	33.3 (3.3)	30.0 (4.5)	3.3 (1.3–5.3)
Anxiety	55.1 (8.5)	59.1 (8.7)	-4.0 (-8.5–0.5)
Depression	51.4 (8.5)	56.3 (8.4)	-4.9 (-9.3 to -0.5)
Fatigue	55.7 (6.7)	60.2 (7.1)	-4.5 (-8.1 to -0.9)
Sleep disturbance	54.1 (6.2)	60.9 (4.2)	-6.8 (-9.5 to -4.1)
Social roles and activities	44.3 (4.4)	39.7 (4.5)	4.6 (2.3–6.9)
Pain interference	60.4 (3.5)	64.9 (3.8)	-4.5 (-6.4 to -2.6)
Pain intensity at affected joint[c]	7.1 (1.0)	7.9 (1.1)	-0.8 (-1.3 to -0.3)
Overall body pain intensity[c]	4.4 (1.7)	5.9 (1.6)	-1.5 (-2.4 to -0.6)
Total opioid-related adverse events or withdrawal symptoms	17	22	16% (-40–10%)
Opioid-related adverse events (any)	5	19	47% (30–70%)
Constipation	3	12	
Sleepiness or drowsiness	3	14	
Opioid Withdrawal Scale score[d]	0.1 (0.6)	0.1 (0.4)	0.0 (-0.3–0.3)
Opioid withdrawal symptoms (any)	15	7	27% (5–50%)
Aches and pains	10	2	
Muscle spasms/twitching	4	2	
Feeling sick	2	1	
Muscular tension	1	1	
Insomnia/problems sleeping	0	2	

NSAIDs, non-steroidal anti-inflammatory drugs; MME, oral morphine milligram equivalents; PROMIS, Patient-Reported Outcomes Measurement Information System.
*Between-group differences indicate the mean difference for continuous variables and the proportion difference (as a percentage) for dichotomous variables.
[a]Measured using the OWLS tool [21].
[b]Presented as standardised T-scores representing a standardised score with a mean of 50 (corresponding to the mean score in a general population) and a standard deviation of 10, where a higher T-score indicates more of the variable measured [29].
[c]Measured using an 11-point numeric rating scale.
[d]Measured using a 30-point numeric rating scale.

trial adds to the literature as a prospective study that shows the feasibility of administering the same type of pharmacist-partnered opioid tapering intervention via telehealth pre-operatively with an associated reduction in baseline daily opioid consumption before and after surgery and improvement in some patient-reported postoperative outcomes. The potential mechanism underlying these findings, which is likely multifactorial and may be related to

effects on opioid tolerance and opioid-induced hyperalgesia [12], is not yet fully understood and warrants further investigation.

It is worth noting that the patients in our pilot study were prescribed relatively low opioid doses at baseline. Therefore, the occurrence of opioid-related adverse events and opioid withdrawal symptoms would have been expected to be lower in our sample compared with patients on higher doses [31]. There is a lack of strong evidence to support the use of opioids for long-term arthritis-related pain [7]. However, opioid prescribing is known to vary widely around the world [32]. Opioid stewardship efforts in response to the well-publicised `opioid epidemic´ have likely influenced opioid prescribing patterns, including at the centres involved with the present sample [33, 34].

Regarding feasibility, the most common reason for non-participation among eligible patients was unwillingness to participate in research. Others declined due to personal or family commitments or because they had previously experienced unsuccessful attempts to taper their opioids, leading to perceived futility of the proposed intervention. Among the five patients who were willing to be included in the observational cohort but were not willing to be allocated randomly, none tapered their baseline opioid dose before surgery. These findings highlight the need to investigate patients' past experiences and biases related to tapering opioids and tailor tapering approaches to a patient's individual circumstances [30].

There are several limitations. The rate of recruitment was slower than anticipated due to ongoing disruptions related to COVID-19 in scheduling elective surgeries. Some eligible patients declined participation or were lost to follow-up, which may have contributed to selection bias. The use of patient self-reported data is subject to response and recall biases. The trial was not statistically powered to detect differences in secondary outcomes. Therefore, results of these analyses should be interpreted with caution. While the involvement of seven hospitals across metropolitan and rural settings within New South Wales, Australia, is a potential strength, our findings may not be applicable to other healthcare systems or countries as telehealth modalities and/or pharmacy partnerships may not be available. Patients and investigators could not be blinded, which could have led to bias in performance and/or outcome assessment. Finally, due to the small sample size, subgroup analysis by surgery type and hospital was not conducted for this pilot trial, nor was a detailed analysis of the potential impact of baseline characteristics on postoperative recovery trajectories with and without exposure to the pre-operative opioid tapering intervention. However, these preliminary findings, observations and questions derived from this pilot study have served to inform the design of a subsequent large randomised multicentre trial.

In summary, the results of this pilot multicentre randomised clinical trial show the feasibility of recruiting patients from seven hospital systems and implementing a pharmacist-partnered telehealth intervention in the pre-operative period for those who freely choose to taper their long-term opioid therapy before TKA or THA surgery. Outcomes from this small sample suggest that such an intervention may be successful in helping patients reduce baseline daily opioid consumption by 50% pre-operatively, but definitive conclusions will need to come from a future study.

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Supporting Information

Additional supporting information may be found online via the journal website.

Appendix S1. Pilot study collaborators.

Appendix S2. Opioid tapering resources.

Table S1. Postoperative acute care outcomes collected from patients' electronic medical records.

Table S2. Postoperative medication use during acute care collected from patients' electronic medical records.

Table S3. Three-month postoperative follow-up outcomes.

Table S4. Medication use at three-month postoperative follow-up.

Table S5. Baseline characteristics of the patients in the observational cohort.

Table S6. Pre-operative outcomes measured 1–3 days before surgery for the observational cohort.

Table S7. Postoperative acute care outcomes for the observational cohort.

Table S8. Three-month postoperative follow-up outcomes for the observational cohort.