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Reducing opioid use for chronic non-cancer pain in primary care using an evidence-based, theory-informed, multistrategic, multistakeholder approach: a single-arm time series with segmented regression

Anna K Moffat,[1] Jemisha Apajee,[2] Vanessa T Le Blanc,[1] Kerrie Westaway,[1] Andre Q Andrade ,[1] Emmae N Ramsay,[1] Natalie Blacker,[1] Nicole L Pratt,[1] Elizabeth Ellen Roughead [1]

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[1]Clinical and Health Sciences, University of South Australia, Adelaide, 5000, South Australia, Australia
[2]Family and Community Medicine, University of Toronto, Toronto, Ontario, Canada

Correspondence to
Professor Elizabeth Ellen Roughead, Clinical and Health Sciences, University of South Australia, Adelaide, SA, Australia;
libby.roughead@unisa.edu.au

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ABSTRACT

Background Many countries have high opioid use among people with chronic non-cancer pain. Knowledge about effective interventions that could be implemented at scale is limited. We designed a national intervention that included audit and feedback, deprescribing guidance, information on catastrophising assessment, pain neuroscience education and a cognitive tool for use by patients with their healthcare providers.

Method We used a single-arm time series with segmented regression to assess rates of people using opioids before (January 2015 to September 2017), at the time of (October 2017) and after the intervention (November 2017 to August 2019). We used a cohort with historical comparison group and log binomial regression to examine the rate of psychologist claims in opioid users not using psychologist services prior to the intervention.

Results 13 968 patients using opioids, 8568 general practitioners, 8370 pharmacies and accredited pharmacists and 689 psychologists were targeted. The estimated difference in opioid use was −0.51 persons per 1000 persons per month (95% CI −0.69, −0.34; p<0.001) as a result of the intervention, equating to 25 387 (95% CI 24 676, 26 131) patient-months of opioid use avoided during the 22-month follow-up. The targeted group had a significantly higher rate of incident patient psychologist claims compared with the historical comparison group (rate ratio: 1.37, 95% CI 1.16, 1.63; p<0.001), equating to an additional 690 (95% CI 289, 1167) patient-months of psychologist treatment during the 22-month follow-up.

Conclusions Our intervention addressed the cognitive, affective and sensory factors that contribute to pain and consequent opioid use, demonstrating it could be implemented at scale and was associated with a reduction in opioid use and increasing utilisation of psychologist services.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The majority of randomised interventions to reduce opioid use have been either physician focused or patient focused and tested the effectiveness of one strategy only. The majority of studies have had small samples and not shown positive results.

WHAT THIS STUDY ADDS

⇒ This is the first study to trial an intervention that uses multiple strategies to address the cognitive, affective and sensory factors that contribute to pain and consequent opioid use, targets both health professionals and patients and applies the intervention at national scale.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This intervention, which was feasible to implement at scale, could be adapted for use by other agencies operating quality use of medicine programmes. The research suggests interventions to improve opioid use would benefit from addressing the underlying cognitive, emotional and sensory contributors to pain.

INTRODUCTION

Many countries have seen increasing rates of prescription opioid use[1] with some

countries facing what has been described as an opioid crisis[2] and the USA declaring the overuse of opioids a public health emergency in 2017.[3] Australia's use of opioids increased fourfold from 1990 to 2014, with a consequent increase in opioid-related deaths.[4–6] Use of opioids in chronic non-cancer pain accounts for much of the rising use of prescription opioids in Australia, with one-third of patients in chronic pain treated with opioids in primary care.[7]

There is no evidence to suggest that opioids are effective long term in reducing chronic non-cancer pain or in improving function. A 2015 systematic review found insufficient evidence to support the use of long-term opioid therapy for chronic pain.[8] A 2018 systematic review found evidence for small improvements in pain score and physical function, but this improvement was not dissimilar to non-opioid alternatives.[9] The likelihood of recovery from chronic pain has been found to be four times lower in individuals using opioids.[10 11] Opioids are associated with a number of adverse effects including nausea, vomiting, sedation, constipation, respiratory depression, hyperalgesia, erectile dysfunction, endocrine abnormalities and death as a result of poisoning or accident,[12–18] and long-term use of opioids can lead to psychological and physical dependence, abuse, tolerance, diversion and overdose.[19] Older people taking an opioid are at an increased risk of falls and subsequent hip fracture.[20] Effective interventions to reduce opioid use while improving pain management are essential.

The majority of randomised interventions to reduce opioid use have been undertaken with small samples and not shown positive results.[21 22] A 2017 Cochrane review of randomised controlled trials to reduce opioid use in chronic non-cancer pain included five studies and found insufficient evidence for effect.[21] A 2020 systematic review on deprescribing involving 12 randomised controlled trials,[22] 10 of which were patient-focused interventions and two of which were physician interventions, found only one multistrategic physician intervention had a measurable effect on reducing opioid prescribing.[23] More recent studies targeting physicians demonstrate the potential of weekly telementoring programmes[24] and repeated comparative feedback programmes in the primary care setting.[25 26]

In line with theories of behaviour change[27] and findings from research to improve medicine use and physician prescribing,[28 29] multistrategic solutions that include strategies that create cognitive engagement for the targeted recipients are most likely to be effective.

Opioid use is influenced by personal, social, organisational and legislative factors,[30] and multistrategic solutions are also required to reduce the experience of pain. Pain is now understood to arise from a combination of sensory, cognitive and affective factors,[31] and interventions to address pain must address each of these influences. Catastrophising is one cognitive factor which is known to affect both pain itself and risk of opioid misuse[32 33] and, though associated with anxiety, has an effect on risk of opioid misuse independent of anxiety.[32 33] Pain neuroscience education[34] and cognitive–behavioural therapy[35] have also been found to be effective in improving pain management. Pain neuroscience provides specific education which includes explaining the biological processes that underpin pain, with the aim of shifting a person's understanding of their pain from that of a marker of tissue damage or disease, to that of a marker of the perceived need to protect body tissue.[36 37] This approach helps patients to better understand that pain can be decreased when the credible evidence of danger to the body is less than the credible evidence of safety to the body.[38] Results from studies that have used educational approaches to help patients manage pain have shown that this approach can increase physical function, reduce catastrophising and normalise perception of pain.[36–39] However, it is unknown as to whether this approach assists with reducing opioid use.

Based on the collective epidemiological evidence of factors influencing pain as well as successful strategies for improving medicine use and improving pain management, we designed a model (figure 1) to guide the development of a multistrategic, precision public health intervention targeting long-term opioid users and their health providers.

The intervention strategies included patient-specific audit and feedback, deprescribing guidance, information on how to assess catastrophising, pain neuroscience education and a cognitive tool for use by patients with their primary healthcare providers.

Primary healthcare in Australia is federally funded, with patients free to use a general practitioner (GP) of their choice. Patients do not have to register with a single practice, and are free to attend multiple practices. There is no separate health network for former military service members ('veterans'). Veterans receive care from primary care GPs who also treat non-veteran patients. We considered the GP who provided the most care to a veteran in a year to be the veteran's primary GP.

This study aimed to determine the impact of the effect of a chronic pain intervention and follow-on interventions on opioid use and alternative service utilisation in patients with chronic non-cancer pain.

METHOD

We implemented the intervention within the national Veterans' Medicines Advice and Therapeutics Education Services (MATES) programme (www.veteransmates.net.au). The theoretical frameworks that underpin Veterans' MATES include social cognitive theory[40] which provides a theory for understanding how individuals learn; the transtheoretical model[41] which provides a theory for how people learn over time dependent on the different stages of readiness

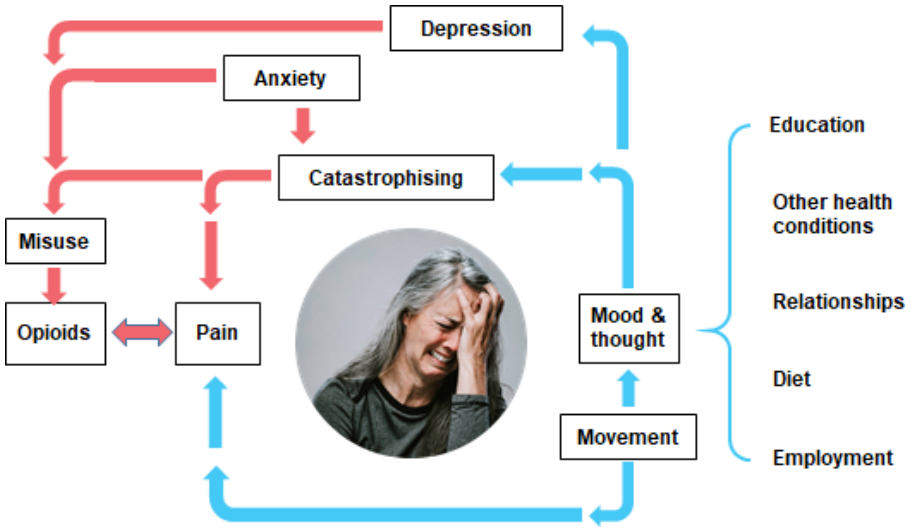

Figure 1 Pain model.

to change and the precede-proceed health promotion model[42] which provides a model for community and system-wide behaviour change. Social influence theory[43] is used to inform the presentation of key messages including call to action (also known as commitment) questions.

Intervention development

In keeping with the precede-proceed health promotion model,[42] an epidemiological and social diagnosis was undertaken prior to intervention planning. For the epidemiological diagnosis, we used the Australian Government Department of Veterans' Affairs database to determine the extent of long-term and potentially inappropriate opioid use in our target population. For the social diagnosis, we consulted with the programme's veteran reference group and a practitioner reference group, which both meet twice a year, to identify barriers, enablers and reinforcers to intervention development and implementation. This approach enabled finalisation of the targeted population and outcomes, messaging and the intervention plan.

All educational materials were developed by a medical writer, supported by a clinical reference group comprising GPs, clinical pharmacists, medicine information specialists and experts in health promotion and consumer education, all with more than 10 years' experience. Prior to finalisation, the materials were peer reviewed by both specialist medical practitioners and GPs and subsequently reviewed and endorsed by a national representative editorial committee comprising membership from the major medical professional organisations and veteran organisations.

The target groups

The target groups were medical practitioners treating patients using opioids for chronic non-cancer pain in the 4 months prior to the intervention, their patients using opioids, pharmacists and psychologists. Patients were excluded if they were receiving palliative care, receiving current cancer treatment or were in a one-on-one targeted pain programme for very high opioid users.

The intervention

The intervention comprised the following components for each target group:

For doctors:

A. An audit with feedback identifying each of the doctor's patients who had been taking opioids for at least 3 months and the average oral morphine equivalent (OME) dose of opioid provided to the patient each month over the last 12 months. The feedback included calls for action that were linked to thresholds of morphine equivalence (eg, for all patients using more than 40 mg of OMEs daily, referral to a psychologist for pain management was recommended (see table 1)).
B. A deprescribing guideline for opioids.
C. The Pain Catastrophizing Scale[44] for use to identify patients at risk of catastrophising.
D. A four-page educational brochure.
E. A copy of the materials developed for their patients, including the patient-focused cognitive tool.

For patients:

A. An educational programme on the neuroscience of pain.
B. A cognitive–behavioural tool for use with the patient's health providers to identify factors that improved or worsened pain based on the tool developed by Moseley and Butler.[38] This tool was sent to patients 4 weeks after completion of their initial educational programme.

Pharmacists and psychologists received the same four-page educational brochure that was sent to doctors and a copy of the materials developed for patients including the cognitive tool.

One-page reply paid response forms were included for all target groups. The response forms for doctors and pharmacists included one 'call to action' question.

Table 1 Suggested actions and rationale indicated in prescriber feedback

Indicator	Suggested action for primary GP	Rationale included in prescriber feedback
Patient received opioid therapy for longer than 3 months.	Review use of opioid, taper the dose and cease where appropriate. Help patient understand how pain works and consider referral to an appropriate allied healthcare team to support this.	*'Current guidelines suggest that there is there is no evidence to support the long-term use of opioids as effective in resolving chronic pain or improving function. Opioid therapy for longer than 90 days is associated with continuing use, opioid use disorders, overdose and worse functional status.'*
Patient received more than the recommended maximum dose of 40 mg OME per day.	Review use of opioid, taper the dose and cease where appropriate. Help patient understand how pain works and consider referral to an appropriate allied healthcare team to support this.	*'Current guidelines suggest that 40mg of oral morphine equivalent (OME) per day is the recommended maximum dose. The risk of adverse effects rises as the opioid dose rises.'*
Dose of opioid has exceeded 100 mg OME per day.	Consider referral for a specialist pain evaluation.	*'Current guidelines suggest that the risk of serious adverse events, including opioid use disorders, overdose and death, increases significantly as the dose exceeds 100mg OME per day.'*
Patient coprescribed a benzodiazepine.	Review use of benzodiazepine.	*'Current guidelines suggest that this combination can depress the central nervous system and increases the risk of death by 15 fold compared to taking neither medicine.'*

GP, general practitioner.

For the doctors, the call to action question focused on asking how many of the listed patients they would review. For patients, the call to action question focused on making an appointment with their doctor to review their pain medicines and asking their doctor about whether a psychologist service may help.

To promote system-wide organisational support, health professional bodies including the Australian Medical Association, Royal Australian College of General Practice, Royal Australian College of Physicians, Pharmaceutical Society of Australia, Pharmacy Guild of Australia, and veteran organisations including Returned and Services League, War Widows Association, Vietnam Veterans Association, Vietnam Veterans Federation, among others, were sent a copy of the materials and rationale for the intervention.

A national call centre and a dedicated email line was available for all participants to provide comments or queries after receipt of information.

See online supplemental appendix 1 for a copy of prescriber feedback. The educational material for veterans and health professionals can be found at https://www.veteransmates.net.au/topic-48. Online supplemental file 2 also has a fuller description of implementation development and implementation according to the Template for Intervention Description and Replication framework.[45]

Table 2 Characteristics of patients targeted in intervention

	Frequency (%) from total targeted cohort (n=13 968)
Male	8117 (58.11)
Age ≤49 years	1464 (10.48)
Age 50–64 years	2133 (15.27)
Age 65–79 years	4522 (32.37)
Age 80 years and older	5849 (41.87)
Opioid therapy for longer than 3 months	8699 (62.28)
High dose (over recommended maximum dose of 40 mg OME per day)	4581 (32.80)
Very high dose (opioid dose above 100 mg OME per day)	1376 (9.85)
Coprescribed a benzodiazepine	3940 (28.21)
Geographic residence	%
Cities	49.37
Inner regional	36.09
Outer regional	13.44
Remote	1.09

OME, oral morphine equivalent.

Intervention implementation

The intervention was provided to health professionals in September 2017. Two consecutive educational mailings were provided to patients in October and November 2017, the first focused on pain neuroscience education and the second focused on use of cognitive tools to improve pain management. The materials were delivered in print form by postal mail to all targeted participants.

Veterans' MATES provides four interventions a year each targeting a different clinical topic, which in 2017 also include chronic obstructive pulmonary disease, wound care and depression management. In March 2018, we followed up the chronic pain intervention with reminder messages about reducing opioid use in a separate intervention focused on reducing the risk of falls in the population 65 years and older. The patient-specific audit and feedback information provided as part of the March 2018 intervention included information on each patient's sedative load and listed sedative medicines, including opioid medicines, used by each patient. This intervention included reinforcing messages about medication cessation and referred

practitioners to the chronic pain intervention educational material on how to cease opioids. In addition, in April 2018, independent letters were distributed by the chief medical officer (CMO) of Australia to GPs who were the top 20% of opioid prescribers. The letters from the CMO encouraged GPs to review their prescribing practices and make improvements where appropriate.

Evaluation and statistical analyses

We used the Australian Government Department of Veterans' Affairs (DVA) administrative health claims data to assess the impact of the intervention on opioid use and claims for psychological services. The primary outcome was monthly rate of veterans using opioids among the total veteran population. We calculated the rate of veterans who had at least one opioid prescription each month between 1 January 2015 and 31 August 2019 for all patients who were aged 18 years or older and had DVA entitlements for at least 12 months. The total veteran population comprised 205 000 veterans in January 2015. Opioids were identified using the Australian Government Pharmaceutical Benefits Scheme item number. Patients were considered to be using opioids for the expected duration of a dispensed prescription based on quantity supplied and clinical doses. If the expected duration of use extended from the date of supply into the next calendar month by at least 1 day patients were considered to be using opioids in that month. A segmented regression model[46] was fitted to the data with one intervention point—October 2017 (the time of the first mailing to patients). The model adjusted for autocorrelation and seasonality. We used one intervention point only (October 2017), as the follow-on interventions began within 4 months of the last patient mailing and the reinforcement messages for opioid cessation were an intentional part of the programme plan. We estimated the preintervention trend (January 2015 to September 2017), the change in level at the time of the intervention (October 2017) and the change in trend following the intervention (November 2017 to August 2019) compared with the preintervention time period. Given the intervention was implemented nationally and evaluation was a single-arm time series, no adjustment was made for patient or doctor characteristics.

The number of patient-months of treatment avoided in the months following the interventions was calculated as the difference between the estimated number of patients taking an opioid in the time period after the intervention and the predicted number of patients who would have been taking an opioid in the same time period if the intervention had not occurred.

A Bayesian change point model[47] was used to confirm the change in the time series trend.

The secondary outcome was the number of new patients accessing psychologist services. New patients were defined as those with no claims for a psychologist service in the previous 2 years. We compared the rate of new psychologist attendances in the target group with a historical comparison group in a time period where no pain intervention occurred. We assessed monthly rates of patients with an incident claim for a psychologist using DVA item codes: 'CL00' to 'CL30' and 'US' in targeted patients who had not had a claim for a psychology service in the 2 years prior to our intervention. A log binomial model was fitted using data from September 2017 (intervention) to August 2019 to compare the rate of psychologist claims in incident users from the target cohort with a historical comparison group with the same inclusion criteria but selected from 2 years prior.

RESULTS

The intervention targeted 13 968 patients, 8568 GPs, 8370 pharmacies and accredited pharmacists and 689 psychologists.

Demographic information for the patients included in the intervention is outlined in table 2. The majority of patients were men (58%), and 42% were aged over 80 years. More than one-quarter were coprescribed a benzodiazepine (28%) and one-third received more than 40 mg OME per day (33%). Residency distribution reflects the distribution of veterans in Australia.

Figure 2 shows the observed rate of patients dispensed an opioid in a given month among the total veteran population and the predicted rate of use without the intervention. Table 3 shows that prior to the intervention, the rate of opioid use was constant, with the trend estimate a non-significant increase of 0.03 persons using opioids per 1000 persons per month (95% CI −0.05, 0.11). The estimated difference in trend from the segmented regression after the intervention compared with preintervention was −0.51 patients dispensed an opioid per 1000 persons per month (95% CI −0.69, –0.34) which was a significant decrease. We calculated the difference in predicted trends with and without the intervention, and as a result of the intervention 25 387 (95% CI 24 676, 26 131) patient-months of opioid use were avoided in the 22-month follow-up period.

The change point analysis confirmed the intervention impact and showed a significant trend break in October 2017 (see online supplemental figure 1).

Figure 3 shows the effect of the intervention on the rate of psychologist visits per month among incident users. After the intervention, the incident users from the targeted group had a significantly higher rate of psychologist claims compared with the historical comparison group (rate ratio: 1.4, 95% CI 1.16, 1.63). The increased rate of claims for psychologists following the intervention resulted in an additional 690 (95% CI 289, 1167) patient-months of treatment in the 22-month follow-up period.

DISCUSSION

This study showed that a multistrategic, multistakeholder intervention targeting medicine use and

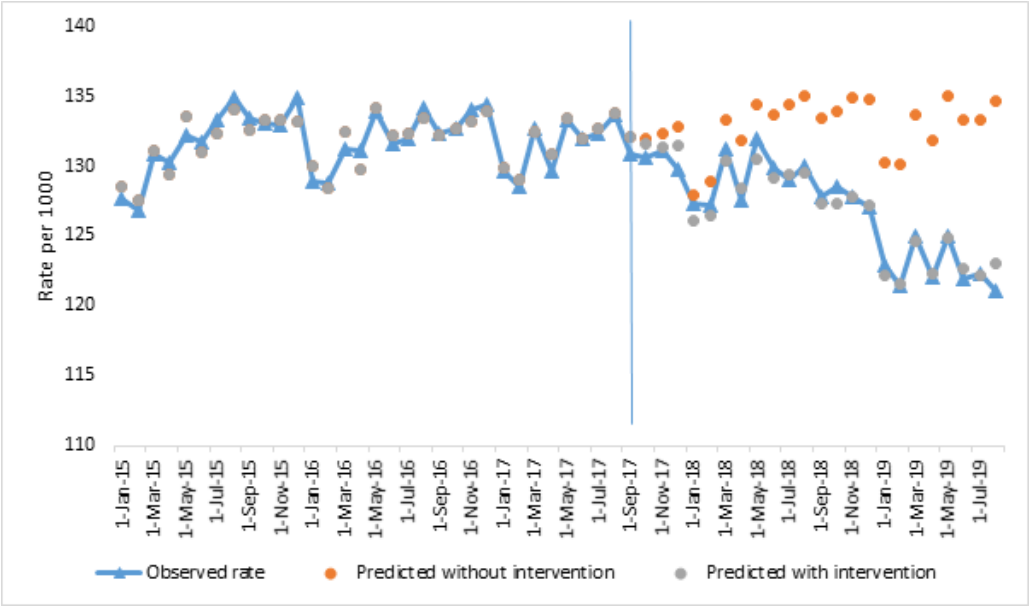

Figure 2 Rate and predicted rate of veterans per 1000 taking an opioid.

biopsychosocial aspects of chronic non-cancer pain including pain neuroscience education, catastrophising and cognitive factors was associated with a reduction in opioid use and increased use of psychology services among patients who were using opioids.

Our research adds to the body of emerging research that shows clinician-directed feedback as part of a multistrategic approach improves opioid use. A 2020 systematic review on interventions to improve opioid use for chronic non-cancer pain identified two randomised controlled trials and five observational studies that had assessed change in opioid use as a result of the intervention, with two studies reporting the results of audit and feedback, finding on average a 20.32 mg morphine equivalent dose reduction.[26] A US study set in emergency departments in 2021 provided clinician feedback in the form of dashboards showing comparisons with their peers and advice via emails from clinical leaders for those with the highest prescribing of opioids.[48] The intervention resulted in a 19% relative reduction in patients discharged on opioids. A separate study, undertaken in US emergency department settings in 2019–2020, compared peer comparison feedback alone or combined with individual audit and feedback with individual audit and feedback alone.[49] It showed that the peer comparison was effective, with a reduction of 0.8 pills per prescription rising to 1.2 pills per prescription when combined with audit and feedback, while individual audit and feedback alone was not effective. A UK study set in primary care during 2013 and 2017 provided comparative and practice-individualised reports, alongside persuasive messaging, recommended actions and action plans.[25] The intervention resulted in a difference decrease of 0.65 patients taking opioids per month per 1000 patients in the practice (95% CI −0.96, −0.34). Our intervention expanded on these strategies by targeting other stakeholders, including patients, psychologists and pharmacists, and included educational messages and tools targeting the psychosocial aspects of pain management.

Our intervention saw a small increase in psychologist visits, consistent with messaging in our educational materials that 'best practice is to include a combination of medical and educational approaches and psychological and physiotherapy interventions' and in our feedback to doctors to 'help patient understand how pain works and consider referral to an appropriate allied healthcare team to support this'.

Our multistrategic intervention was informed by a hypothetical model that integrated interdisciplinary theory and evidence from pain neuroscience, psychological and epidemiological evidence as well as clinical evidence. A significant feature of our intervention

Table 3 Results of segmented regression model assessing the impact of the intervention on opioid use

	Patients dispensed an opioid per 1000 persons per month	95% CI	P value
Intercept (rate in January 2015)	131.42	(129.39, 133.46)	<0.001
Preintervention trend as change in rate per month (January 2015 to September 2017)	0.03	(−0.05, 0.11)	0.48
Change in level in the month of the intervention (October 2017)	0.12	(−2.04, 2.28)	0.91
Change in trend after the intervention (November 2017 to August 2019)	−0.51	(−0.69, −0.34)	<0.001

design was to include strategies addressing the cognitive, emotional and sensory aspects of pain. Two small randomised controlled trials published in 2021, while not focused on opioid use, demonstrate the potential of multistrategic approaches addressing the cognitive, emotional and sensory aspects of pain to improve pain management. One study involving 151 participants[50] and the other with 35 participants[51] tested interventions comprising at least four elements: pain neuroscience education, cognitive therapy, emotional regulation and graded exposure. While small, both trials showed improved patient outcomes with more than 50% of participants pain free or near pain free at 6 months. While not directly targeting opioid use, these studies support the hypothesis that future interventions to support appropriate opioid use may benefit from addressing the underlying cognitive, emotional and sensory contributors to pain.

A significant strength of the intervention lies in the national involvement of patients and healthcare professionals, and the ability to track dispensing of opioids at a national level. The use of administrative health claims data enabled us to identify patients using opioids chronically for education and target them directly. There are advantages of using administrative health claims data for evaluation including large sample sizes and results unaffected by recall bias and social desirability from which this study benefits. However, there are limitations of using health claims data including an inability to determine whether opioids were appropriately prescribed and how and whether they were used by the patient.

Co-occurring programmes that focused on opioid use in Australia may also have impacted the results of the intervention. Eight months after the intervention was disseminated, letters were distributed (June 2018) by the CMO of Australia to the top 20% of opioid-prescribing GPs. It was not possible for us to identify whether doctors targeted in our intervention were also included in the CMO mailing, but it is possible that this also had an impact on opioid prescribing following our intervention.

Limitations of our research include the inability to determine causation. We used an observational time series approach as the intervention was implemented nationwide as part of an ongoing health intervention and promotion programme to improve healthcare. This limited us to a single-arm time series design without comparison. We were unable to use the non-veteran population as a comparison group as the doctors we targeted treat both veteran and non-veteran patients. We included change point analysis as a method for assessing the consistency of results across methods, and it demonstrated the change point was consistent with the intervention implementation time period, and not with other subsequent interventions including the CMO letter. While we deliberately employed a multistrategic approach consistent with the evidence base of improving physician practice[28 29] and the complexity of factors that influence opioid use,[30] a limitation of this approach is that we cannot

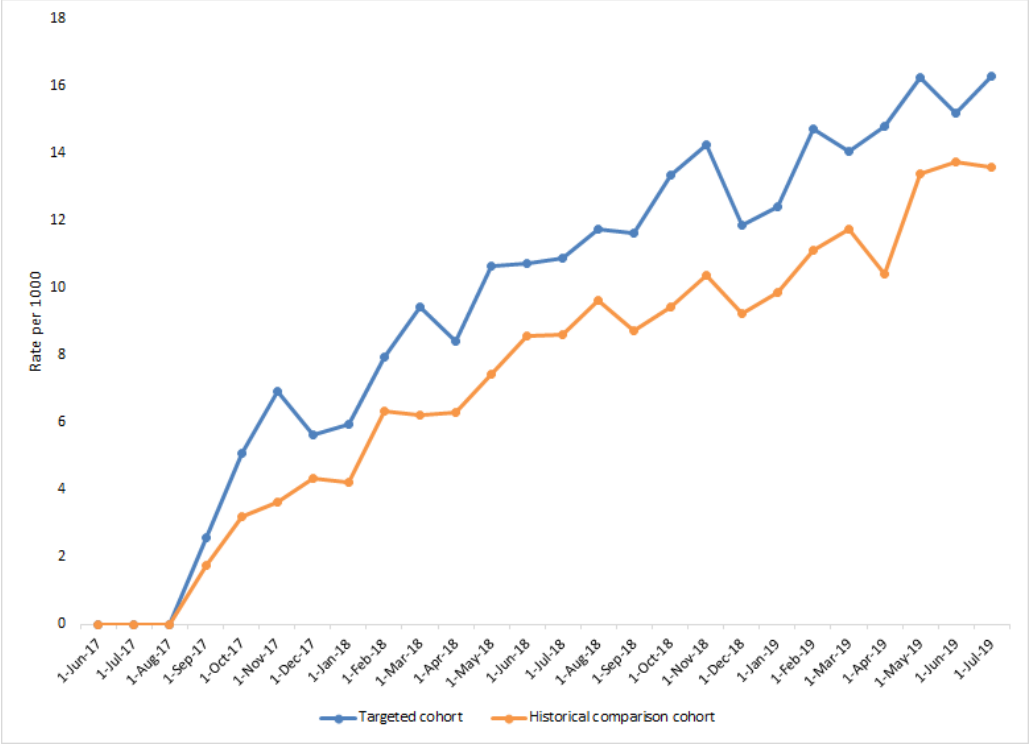

Figure 3 Rate of incident patients with a psychologist visit per month by intervention and historical comparison cohort.

identify which strategies within our intervention had the most impact.

This research demonstrated the feasibility of implementing a multistrategic intervention that addressed the cognitive, emotional and sensory aspects of pain at scale and its potential to reduce opioid use. Our intervention was implemented within the Australian Government Department of Veterans' Affairs Veterans' MATES programme, providing a mechanism for continued implementation and adaptation of materials as evidence evolves. A number of countries, including New Zealand, UK and Canada, have centres or programmes to support quality use of medicines, also known as medicines optimisation. The intervention tested in this research may be suitable for adaptation within programmes supporting quality use of medicines in other countries.

Twitter Andre Q Andrade @AndradeAQ and Elizabeth Ellen Roughead @#QUMPRC

Contributors AKM conceived and designed the evaluation, interpreted the results and drafted and finalised the manuscript. JA undertook the evaluation, interpreted the results and critically reviewed the manuscript. VTLB designed the intervention, interpreted the results and critically reviewed the manuscript. KW and NB designed the intervention and critically reviewed the manuscript. AQA and ENR assisted with evaluation, interpreted the results and critically reviewed the manuscript. NLP designed the evaluation, interpreted the results and critically reviewed the manuscript. EER conceived and designed the intervention, interpreted the results and revised the manuscript. EER is guarantor, fully responsible for the work and conduct of the study, had access to the data, and controlled the decision to publish. All authors read and approved the final version.

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Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by the University of South Australia Human Research Ethics Committee (P203-04) and the Departments of Defence and Veterans' Affairs Human Research Ethics Committee (E016-007). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. Data used in this study may be available on request at the discretion of the Australian Government Department of Veterans' Affairs.

ORCID iDs
Andre Q Andrade http://orcid.org/0000-0001-6587-3169
Elizabeth Ellen Roughead http://orcid.org/0000-0002-6811-8991

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