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Journal

BMJ Open, 14(4)

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Publication Date

2024-04-03

DOI

10.1136/bmjopen-2023-080109

Peer reviewed

BMJ Open

Implementation of an intervention aimed at deprescribing benzodiazepines in a large US healthcare system using patient education materials: a pre/post-observational study with a control group

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To cite: Le TM, Campbell S, Andraos A, *et al*. Implementation of an intervention aimed at deprescribing benzodiazepines in a large US healthcare system using patient education materials: a pre/post-observational study with a control group. *BMJ Open* 2024;**14**:e080109. doi:10.1136/bmjopen-2023-080109

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2023-080109).

Received 20 September 2023
Accepted 18 March 2024

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ABSTRACT

Objectives Long-term benzodiazepine use is common despite known risks. In the original Eliminating Medications Through Patient Ownership of End Results (EMPOWER) Study set in Canada, patient education led to increased rates of benzodiazepine cessation. We aimed to determine the effectiveness of implementing an adapted EMPOWER quality improvement (QI) initiative in a US-based healthcare system.

Design We used a pre–post design with a non-randomised control group.

Setting A network of primary care clinics.

Participants Patients with ≥60 days' supply of benzodiazepines in 6 months and ≥1 risk factor (≥65 years of age, a concurrent high-risk medication prescribed or a diazepam equivalent daily dose ≥10) were eligible.

Intervention In March 2022, we engaged 22 primary care physicians (PCPs), and 308 of their patients were mailed an educational brochure, physician letter and flyer detailing benzodiazepine risks; the control group included 4 PCPs and 291 of their patients.

Primary and secondary measures The primary measure was benzodiazepine cessation by 9 months. We used logistic regression and a generalised estimating equations approach to control for clustering by PCP, adjusting for demographics, frailty, number of risk factors, and diagnoses of arthritis, depression, diabetes, falls, and pain.

Results Patients in the intervention and control groups were comparable across most covariates; however, a greater proportion of intervention patients had pain-related diagnoses and depression. By 9 months, 26% of intervention patients (81 of 308) had discontinued benzodiazepines, compared with 17% (49 of 291) of control patients. Intervention patients had 1.73 greater odds of benzodiazepine discontinuation compared with controls (95% CI: 1.09, 2.75, p=0.02). The unadjusted number needed to treat was 10.5 (95% CI: 6.30, 34.92) and the absolute risk reduction was 0.095 (95% CI: 0.03 to 0.16).

Conclusions Results from this non-randomised QI initiative indicate that patient education programmes using the EMPOWER brochures have the potential to promote cessation of benzodiazepines in primary care.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ A strength of this study is the analysis of cessation and dose reduction in patients by the number of risk factors, including older age, diazepam daily equivalent dose greater than 10 and a concurrent high-risk medication prescribed (such as an opioid or a muscle relaxant).

⇒ Limitations of this study include that (1) we were not able to access medication fill history, so it is possible that we overestimated medication use, as patients could have taken less than prescribed; (2) we estimated the maximum diazepam daily equivalent dose from the prescription instructions (ie, 'sig'), which may overestimate how much patients are taking every day; and (3) we did not have access to medications prescribed outside of the health system, although we were able to capture some prescriptions from Epic's 'CareEverywhere' function during the chart review.

⇒ Moreover, as this was a quality improvement project and not a randomised controlled study, we had additional limitations: assignment to the intervention and control groups was not randomised, and while all patient charts for both the intervention and control groups were reviewed by the study team for potential exclusion, primary care physicians in the intervention group were asked to identify patients whom they deemed inappropriate for the intervention; this same process was not done for control group, which may have led some patients in the control group to be potentially ineligible or not ideally suited for the intervention.

INTRODUCTION

Benzodiazepines are a class of psychotropic medications commonly prescribed for the treatment of insomnia, anxiety, muscle

relaxation and seizure disorders.[1] Although the dangers of using these medications in older adults are widely recognised, such as the risk of memory problems, falls, fractures, motor vehicle accidents, and overall morbidity and mortality,[2–4] even younger adults face potential risks, including the risks of overdose, dependence, motor vehicle accidents, diversion and misuse.[5 6] Long-term use of benzodiazepines, a concept that has been defined in numerous ways in the literature but is often defined as at least 2 months (60 days) of therapeutic use, increases the risk of misuse, dependence and other adverse effects.[1] Despite the risks of long-term use, benzodiazepines are some of the most commonly prescribed medications.[1] The prevalence of long-term benzodiazepine use is estimated to range from 2.2% to 17.6% in middle-income and high-income countries,[7] with greater proportions of older adults aged 65 years and older having long-term use.[8] Moreover, researchers have found that nearly 40% of patients who receive a prescription for benzodiazepines remained long-term users (in one study, long-term use was defined as continuous use of 180 days) after an incident prescription, underscoring the importance of being cautious with benzodiazepine prescribing.[9] While in many high-income countries, there has been a decline in the frequency of long-term benzodiazepine use in the last decade among older adults,[10] benzodiazepine prescribing in the USA has become more frequent. A 2019 study examining ambulatory care visits from 2003 to 2015 found that the use of benzodiazepines in ambulatory care increased from 3.8% to 7.4% of visits,[11] highlighting the importance of informing patients (and their primary care providers) about the risks of these medications.

In an effort to reduce benzodiazepine use, particularly long-term use, numerous interventions have been developed to deprescribe benzodiazepines.[12–14] In one such intervention, the EMPOWER (Eliminating Medications Through Patient Ownership of End Results) randomised controlled trial, 148 patients with chronic benzodiazepine use in Quebec, Canada were mailed an eight-page booklet providing information including the risks of benzodiazepine use, therapeutic alternatives for the treatment of insomnia and/or anxiety and tapering recommendations.[15 16] Intervention patients were also encouraged to discuss benzodiazepine tapering with their physicians. The control group included 155 patients. At the 6-month follow-up, of the 261 patients remaining in the study, 27% of patients in the intervention group discontinued benzodiazepine use compared with 5% in the control group, and an additional 11% of patients who received the booklets had reduced their dose of benzodiazepines. While these are impressive results, they may not translate to other contexts such as the USA, where prescribing, direct-to-consumer advertising and medication use cultures may be different from those in the original study. While several interventions using the EMPOWER brochures have been implemented in the USA,[17 18] these have been implemented in the Veterans Health Administration, an integrated healthcare system where patients have both insurance coverage and healthcare services from the same organisation and which serves a specialised population (ie, veterans). As part of a larger effort to reduce long-term benzodiazepine use among patients in our health system, we implemented a quality improvement (QI) project to examine the effectiveness of adapting this intervention to a setting different from the initial study and extending beyond the veteran population.

METHODS

Setting

The study took place at Cedars-Sinai Medical Care Foundation, a network with locations throughout Los Angeles County which contains multiple medical groups in a quasi-employed model. The largest is a multispecialty group (Cedars-Sinai Medical Group) which has more than 250 physicians, including approximately 100 primary care providers. Patients are predominantly ensured through Medicare (37%) and commercial insurance (40%). This study focused primarily on patients and primary care physicians (PCPs) in the Cedars-Sinai Medical Group.

We used the Standards for Quality Improvement Reporting Excellence 2.0 checklist to report the study.

Intervention

In March 2022, we selected a group of 26 primary care providers in the health system's network based in Los Angeles who had 650 potentially eligible patients identified via the electronic health record. To identify potentially eligible patients, we created a data extract from the electronic health record data warehouse (Clarity) and created filter criteria including age, length of prescription and diazepam equivalent daily dose (DEDD), which was calculated according to a published algorithm (online supplemental appendix 1).[19] Each chart was reviewed by a clinician (physician or pharmacist) or PhD-level researcher with expertise in benzodiazepines to ensure potential eligibility. Patients were eligible to receive the brochure if they had at least 60 days' supply of benzodiazepines prescribed within the previous 6 months and at least one other risk factor (≥65 years of age, a concurrent high-risk medication prescribed or a DEDD ≥10). Concurrent high-risk medications included: opioids, stimulants, muscle relaxants and other sedative-hypnotics. 'Concurrent' was defined as at least 1 day of overlap between the two prescriptions. We only considered benzodiazepines in this intervention and did not include 'z-drugs', otherwise known as non-benzodiazepine sedative-hypnotics (eg, zolpidem and zopiclone); z-drugs may be included in future interventions.

To engage PCPs, we emailed the selected PCPs, described the intervention and provided a list of their eligible patients. We asked primary care providers to identify patients who would not be appropriate for the intervention (see online supplemental appendix 2 for email template). PCPs selected 52 patients for exclusion

from the intervention for the following reasons: already tapering, were being treated for alcohol withdrawal or seizures, had an active substance use disorder or had another condition which the physicians deemed would be inappropriate for participation.

Four primary care providers with 291 patients opted out of the intervention, noting that they preferred to have conversations about benzodiazepine risks or tapering with patients on their own. We used this group of patients from these four primary care providers as the control group. This group of patients did not receive any materials; however, they may have received information from their providers as part of usual care.

The final intervention group included 308 patients from 22 physicians; the control group was composed of 291 patients from four physicians. Due to changes in PCP attribution during the study, one PCP ended up having two patients in the intervention group and four patients in the control group. One patient who received the intervention had no PCP attributed to them.

Our adaptation of the EMPOWER intervention included using a brochure outlining the risks of sleeping pills and anti-anxiety medications (available at https://www.deprescribingnetwork.ca/useful-resources) that was identical to the original intervention except that the last page of the original brochure was omitted. This last page includes a graphical-based tapering schedule and a decision was made by the medical group leadership to omit it to avoid confusing patients. We opted to send the letter from the patient's PCP as opposed to a community pharmacist, as was done in the original intervention, as we thought patients would be more likely to have a closer relationship with their primary doctor in this context. The letter from the patient's PCP was reviewed and edited by deprescribing champions (a geriatrician (AMM), pharmacist (KB), psychiatrist (SC), medical director (CG)) within the health system (online supplemental appendix 3). Additionally, the mailer included an educational flyer developed by the health system which details common side effects and risks of benzodiazepines, specific risks in older adults and information about the health system's pharmacist-led benzodiazepine tapering programme (online supplemental appendix 4), which consists of a pharmacist who consults with patients every 2–4 weeks via phone or video, monitors withdrawal effects and adjusts the tapering schedule collaboratively with the patient.

Data extraction

To capture elements not captured by structured data, two physicians with training in general internal medicine and one PhD-trained health services researcher reviewed all of the charts using a standardised abstraction spreadsheet to obtain the number of referrals to the pharmacy tapering programme, the types of non-benzodiazepine medication alternatives (specifically selective serotonin reuptake inhibitors (SSRIs)/serotonin-norepinephrine reuptake inhibitors (SNRIs)) used to treat insomnia and/or anxiety, the number of documented discussions about the risks of benzodiazepines and the number of patients' direct messages to their providers and subsequent providers' responses after receiving the deprescribing materials.

For analysis, we extracted the following data using an SQL data extract from the electronic health record data warehouse: International Classification of Diseases (ICD)-10 codes in the problem list, encounters, claims, professional billing data 6 months prior to the intervention; benzodiazepine orders; benzodiazepine prescriber; PCP; age; sex; marriage status; race; and ethnicity.

Measures

Primary outcome

The primary outcome was benzodiazepine cessation, meaning no benzodiazepines prescribed at the 9-month mark, which was coded as a dichotomous variable (yes/no). We accounted for prescriptions with refills by calculating the days' supply based on the quantity ordered and number or refills to calculate a total days' supply.

Secondary outcome

We estimated the change in DEDD from baseline (prior to the intervention) and 9 months (online supplemental appendix 2). We estimated the maximum possible DEDD by using the daily amount prescribed in the prescription instructions (eg, 'take 2 tablets every 4–6 hours') multiplied by the dose and the diazepam conversion factor. If the instructions gave a range (eg, '1–2 tablets' or '4–6 hours'), we estimated the maximum possible daily dose. The prescription closest to, and overlapping with, the time points of interest (baseline and 9 months) was used to calculate the estimated DEDD.

Covariates

We controlled for age, sex, race, ethnicity and marriage status (as a proxy for social support). We controlled for frailty using the algorithm from Pajewski *et al*[20] to calculate whether the patient was characterised as frail or not. We also controlled for the following diagnoses often present in individuals with chronic pain, who may be regularly taking benzodiazepines: arthritis, depression, diabetes, falls and pain. All diagnoses were coded using the ICD-10 codes from Pajewski *et al*[20] and were coded dichotomously (yes/no).

Analyses

The unit of analysis was the patient. We used univariate analyses (frequencies, proportions) and bivariate statistics (χ^2 tests, analyses of variance, t-tests) among the intervention and control groups. To examine the primary outcome (benzodiazepine discontinuation), we used a generalised estimating equations approach to control for clustering by PCP and estimated a logistic regression using the Stata command *xtgee* with a binomial family and a logistic link. We also calculated the predicted probability of the outcome (benzodiazepine cessation) using the Stata command *margins*.[21] We used the Stata command

bcii to calculate the number needed to treat (NNT) and the absolute risk reduction (ARR).[22]

For the second outcome, we transformed the change in DEDD by adding the lowest possible negative observation to make all observations non-negative. We then used a linear regression and a generalised estimating equations approach to control for clustering by PCP using the Stata command *xtreg*. We controlled for the covariates listed earlier.

We examined both outcomes by a risk stratification algorithm which we created. Patients were given a risk flag for each of the following risk factors: 65 years of age or older; had a DEDD ≥10; had a DEDD ≥40; or concurrently prescribed an opioid, muscle relaxant, benzodiazepine receptor agonist (defined as having at least 1 day of overlap in the prescription days' supply). We examined outcomes by the number of risk factors in three groups (one, two or three risk factors) and estimated separate regressions for each outcome and each risk factor group.

Patient and public involvement

None.

RESULTS

Patient characteristics by intervention and control groups

Our sample included 599 patients in total: 308 in the intervention group, 291 in the control group (table 1). The mean age was 70 years (SD: 13). 32% of patients in our sample were under age 65 years, and 68% were aged 65 years or older. The proportions of patients with arthritis, depression, diabetes and falls were comparable across the two groups. However, patients in the intervention group had a greater proportion of pain diagnoses (13% vs 4.8%, p<0.001) and depression (10.4% vs 4.5%, p<0.01) compared with the control group. For additional participants' characteristics, see table 1.

We also examined patient characteristics across the risk categories for benzodiazepine-related adverse events (table 2). 145 patients had one risk factor, 250 patients had two risk factors and 204 patients had three risk factors. With increasing risk factors were increasing age, DEDD at baseline and greater proportions of patients with frailty. Larger proportions of patients in the highest risk category also had arthritis, depression or pain-related diagnoses. For additional participant characteristics corresponding with the number of risk factors, see table 2.

Patient and provider acceptance of the intervention

As noted above, four PCPs selected not to engage in the intervention, noting that they would prefer to have discussions with patients on their own, citing concerns about upsetting patients or noting that benzodiazepine use among this patient population was deemed appropriate. Moreover, during our chart review and in emails or phone calls communicated by physicians, physicians received three patient messages or phone calls where patients expressed concerns about the EMPOWER intervention. However, we also noted that several patients wrote messages that while they were unpleasantly surprised by the contents of the letter, they wanted to make an appointment to speak to their PCP about the medications. The notes indicate that in most of these cases, patients and physicians agreed to begin deprescribing the benzodiazepine, in some cases starting a non-benzodiazepine alternative medication.

Benzodiazepine cessation

By 9 months, 26% of intervention patients (81 of 308) discontinued benzodiazepines, compared with 17% (49 of 291) of control patients. Patients in the intervention group had 1.73 greater odds of benzodiazepine discontinuation (95% CI: 1.09 to 2.75, p=0.02) and a 9% greater predicted probability of complete benzodiazepine cessation (95% CI: 1% to 16%), by 9 months compared with the control group (table 3 and online supplemental table A). Among patients with one risk factor, the odds of discontinuation were 1.81 higher in the intervention compared with the control group (95% CI: 0.79 to 4.10); among patients with two risk factors, the odds of discontinuation were 1.59 higher in the intervention compared with the control group (95% CI: 0.83 to 3.07); and among patients with three risk factors, the odds of discontinuation were 1.62 higher in the intervention compared with the control group (95% CI: 0.94 to 2.78), all else equal. The unadjusted NNT was 10.5 (95% CI: 6.30 to 34.92) and the ARR was 9.5% (95% CI: 3% to 16%).

Change in DEDD at baseline and 9 months

Out of the 599 patients, 219 (37%) experienced a reduction in their DEDD, 358 (60%) saw no change and 22 (4%) saw an increase in DEDD. In the intervention group, 126 (41%) experienced a reduction in their DEDD, 175 (57%) saw no change and 7 (2%) had an increase. In the control group, 93 (32%) had a reduction in their DEDD, 183 (63%) had no change and 15 (5%) had an increase.

Patients in the intervention group saw an average of 0.79 reduction in the DEDD compared with the control group; however, this difference was not statistically significant (95% CI: −2.29 to 0.71, p=0.30) (table 4). In the one-risk factor group, participation in the EMPOWER intervention resulted in a −1.23 decrease in DEDD, which was not statistically significant (95% CI: −3.32 to 0.87, p=0.25). In the two-risk factor group, participation in the EMPOWER intervention resulted in a −0.88 decrease in DEDD (95% CI: −2.32 to 0.56, p=0.23). In the three-risk factor group, participation in the EMPOWER intervention resulted in a −0.31 increase in DEDD, which was not statistically significant (95% CI: −4.30 to 3.69, p=0.88).

Referrals to behavioural health and/or pharmacy taper programme

14 patients in the intervention group had physicians who wrote referrals and/or discussed the importance of follow-up with behavioural health professionals (4.5%). Patients in the intervention group had physicians

Table 1 Clinical and demographic characteristics of patients who received the EMPOWER patient education intervention and patients in the control group

	Intervention	Control	Total	P value
N	308 (51.4%)	291 (48.6%)	599 (100.0%)	
Age, mean (SD)	68.40 (13.40)	70.65 (12.51)	69.49 (13.01)	0.04
Sex, N (%)				
Female	200 (64.90)	158 (54.30)	358 (59.80)	
Male	108 (35.10)	133 (45.70)	241 (40.20)	0.17
Race, N (%)				
White	257 (83.4)	270 (92.8)	527 (88.0)	
Black	4 (1.3)	0 (0.0)	4 (0.7)	
Asian	12 (3.9)	6 (2.1)	18 (3.0)	
Other	19 (6.2)	7 (2.4)	26 (4.3)	
Unknown	16 (5.2)	8 (2.7)	24 (4.0)	0.01
Ethnicity, N (%)				
Non-Hispanic	268 (87.0)	256 (88.0)	524 (87.5)	
Hispanic	8 (2.6)	8 (2.7)	16 (2.7)	
Don't know	32 (10.4)	27 (9.3)	59 (9.8)	0.90
Marital status, N (%)				
Married/significant other	180 (58.4)	188 (64.6)	368 (61.4)	
Divorced/widowed	64 (20.8)	62 (21.3)	126 (21.0)	
Single	52 (16.9)	32 (11.0)	84 (14.0)	
Unknown	12 (3.9)	9 (3.1)	21 (3.5)	0.18
Arthritis, N (%)				
No	279 (90.6)	253 (86.9)	532 (88.8)	
Yes	29 (9.4)	38 (13.1)	67 (11.2)	0.16
Depression, N (%)				
No	276 (89.6)	278 (95.5)	554 (92.5)	
Yes	32 (10.4)	13 (4.5)	45 (7.5)	0.01
Diabetes, N (%)				
No	274 (89.0)	253 (86.9)	527 (88.0)	
Yes	34 (11.0)	38 (13.1)	72 (12.0)	0.45
Falls, N (%)				
No	304 (98.7)	289 (99.3)	593 (99.0)	
Yes	4 (1.3)	2 (0.7)	6 (1.0)	0.45
Pain, N (%)				
No	268 (87.0)	277 (95.2)	545 (91.0)	
Yes	40 (13.0)	14 (4.8)	54 (9.0)	0.00
Frailty, N (%)				
No	109 (35.4)	71 (24.4)	180 (30.1)	
Yes	199 (64.6)	220 (75.6)	419 (69.9)	0.00
DEDD at baseline	11.93 (11.76)	11.56 (12.23)	11.75 (11.98)	0.70
Change in DEDD at 9 months from baseline	−3.82 (9.67)	−2.97 (8.46)	−3.41 (9.11)	0.25
Benzodiazepine discontinued at 9 months				
No	227 (73.7%)	242 (83.2%)	469 (78.3%)	
Yes	81 (26.3%)	49 (16.8%)	130 (21.7%)	0.01

Continued

Table 1 Continued

	Intervention	Control	Total	P value
Risk factors				
1	85 (27.6%)	60 (20.6%)	145 (24.2%)	
2	126 (40.9%)	124 (42.6%)	250 (41.7%)	
3	97 (31.5%)	107 (36.8%)	204 (34.1%)	0.11

Risk factors included: ≥65 years of age, a concurrent high-risk medication prescribed (opioid, muscle relaxant, sedative-hypnotic or stimulant), DEDD ≥10, DEDD ≥40.
DEDD, diazepam equivalent daily dose.EMPOWER, Eliminating Medications Through Patient Ownership of End Results;

who wrote 11 referrals to the benzodiazepine taper programme; five patients were ultimately enrolled.

Prescription of non-benzodiazepine medications

Among the 308 patients who received the intervention, 129 patients (42%) were prescribed an SSRI/SNRI at baseline. 18 patients (5.9%) were either started on or saw increased doses of their SSRI/SNRI after receiving the intervention.

Documented discussions about risks of benzodiazepines

We found 34 (11%) documented discussions between the providers and patients regarding the risks of benzodiazepine use among patients who received the EMPOWER intervention. 22 patients (7.1%) reached out to their provider directly after receiving the intervention, most of whom requested assistance with tapering off the medication as they had been unaware of the potential side effects of long-term benzodiazepine use. Patients also requested prescriptions for non-benzodiazepine alternatives or referrals to behavioural health from their providers after receiving the intervention. Subsequently, the patients were started on benzodiazepine tapers, prescribed non-benzodiazepine alternatives, and/or referred to psychiatry/behavioural health or the benzodiazepine taper programme.

There were instances where the providers themselves expressed some resistance to the EMPOWER intervention. One provider responded to a patient message by informing the patient that they were not abusing the medication and did not recommend a non-benzodiazepine alternative. Another provider advised a patient to not pay attention to the contents of the letter and that it was not necessary to change their benzodiazepine use. Some providers justified ongoing prescription of benzodiazepines for certain patients based on their assessment that a given patient had 'failed' non-benzodiazepine alternatives.

Intervention expansion

Following this pilot, the EMPOWER intervention has been adopted as a yearly intervention in the health system, with a focus on patients with low-risk to medium-risk benzodiazepine use. In addition, based on physician feedback, there will be a maximum of 10 patients receiving the intervention per provider to reduce the potential for inbox burden. Since this QI intervention, the EMPOWER intervention has been implemented once again in the system, with plans to continue the intervention in the future via the patient portal messaging function.

DISCUSSION

This study provides some insights about the effectiveness of a patient education-based intervention aimed at increasing benzodiazepine deprescribing in a US-based health system. Among patients receiving the EMPOWER intervention, we found significantly greater odds of benzodiazepine discontinuation at the 9-month mark (OR: 1.73). We also found referrals to behavioural health providers and the health system's pharmacy taper programme and documented discussions about the risks of benzodiazepines among patients who received the intervention. To our knowledge, this is one of the first studies to examine the implementation of the EMPOWER materials in the USA among non-veteran populations. In addition, our inclusion of all ages of adults suggests that direct-to-consumer education can also benefit younger patients with long-term benzodiazepine use.

However, as this was a non-randomised controlled study, there were several limitations, including potential differences among the patient groups. It is possible that patients of the physicians who did not participate in the study are different in unmeasured ways compared with patients who received the education materials. Additionally, we used medication orders and not prescription fills, so it is possible that we overestimated medication use. We also estimated the maximum DEDD using the prescription instructions, which may have overestimated the amount that patients were taking per day. Moreover, we did not have access to medications prescribed outside of the health system, and therefore may have missed prescriptions that were not captured in the electronic health record. We did not systematically examine medication switches, but we found some indication in the notes that some patients may have been started on an antidepressant or alternative medications such as gabapentin. As these medications have their own risks, a future study may examine the rate of medication switches or substitutions following an educational intervention. Moreover, while all patient charts for both the intervention

Table 2 Clinical and demographic characteristics of all eligible patients (intervention and control groups) by number of risk factors

	Number of risk factors			
	1	2	3	Total
N	145 (24.2%)	250 (41.7%)	204 (34.1%)	599 (100.0%)
Age, mean (SD)	63.18 (13.6)	69.60 (13.7)	73.843 (9.5)	69.49 (13.0)
Sex, N (%)				
Female	97 (66.9)	141 (56.4)	120 (58.8)	358 (59.8)
Male	48 (33.1)	109 (43.6)	84 (41.2)	241 (40.2)
Race, N (%)				
White	129 (89.0)	217 (86.8)	181 (88.7)	527 (88.0)
Black	2 (1.4)	0 (0.0)	2 (1.0)	4 (0.7)
Asian	4 (2.8)	10 (4.0)	4 (2.0)	18 (3.0)
Other	7 (4.8)	12 (4.8)	7 (3.4)	26 (4.3)
Unknown	3 (2.1)	11 (4.4)	10 (4.9)	24 (4.0)
Ethnicity, N (%)				
Non-Hispanic	132 (91.0)	217 (86.8)	175 (85.8)	524 (87.5)
Hispanic	3 (2.1)	9 (3.6)	4 (2.0)	16 (2.7)
Don't know	10 (6.9)	24 (9.6)	25 (12.3)	59 (9.8)
Marital status, N (%)				
Married/significant other	94 (64.8)	161 (64.4)	113 (55.4)	368 (61.4)
Divorced/widowed	22 (15.2)	50 (20.0)	54 (26.5)	126 (21.0)
Single	27 (18.6)	32 (12.8)	25 (12.3)	84 (14.0)
Unknown	2 (1.4)	7 (2.8)	12 (5.9)	21 (3.5)
Arthritis, N (%)				
No	137 (94.5)	221 (88.4)	174 (85.3)	532 (88.8)
Yes	8 (5.5)	29 (11.6)	30 (14.7)	67 (11.2)
Depression, N (%)				
No	133 (91.7)	237 (94.8)	184 (90.2)	554 (92.5)
Yes	12 (8.3)	13 (5.2)	20 (9.8)	45 (7.5)
Diabetes, N (%)				
No	137 (94.5)	215 (86.0)	175 (85.8)	527 (88.0)
Yes	8 (5.5)	35 (14.0)	29 (14.2)	72 (12.0)
Falls, N (%)				
No	143 (98.6)	249 (99.6)	201 (98.5)	593 (99.0)
Yes	2 (1.4)	1 (0.4)	3 (1.5)	6 (1.0)
Pain, N (%)				
No	139 (95.9)	232 (92.8)	174 (85.3)	545 (91.0)
Yes	6 (4.1)	18 (7.2)	30 (14.7)	54 (9.0)
Frailty, N (%)				
No	56 (38.6)	76 (30.4)	48 (23.5)	180 (30.1)
Yes	89 (61.4)	174 (69.6)	156 (76.5)	419 (69.9)
DEDD at baseline, mean (SD)	5.57 (4.6)	8.62 (6.9)	20.00 (15.6)	11.75 (12.0)
Change in DEDD at 9 months from baseline, mean (SD)	−1.34 (5.1)	−1.31 (5.24)	−6.23 (13.4)	−3.41 (9.1)
BZD discontinued at 9 months				
No	103 (71.0%)	198 (79.2%)	168 (82.4%)	469 (78.3%)
Yes	42 (29.0%)	52 (20.8%)	36 (17.6%)	130 (21.7%)

Risk factors included: ≥65 years of age, a concurrent high-risk medication prescribed (opioid, muscle relaxant, sedative-hypnotic or stimulant), DEDD ≥10, DEDD ≥40.
BZD, benzodiazepine; DEDD, diazepam equivalent daily dose.

Table 3 Odds of benzodiazepine discontinuation at 9 months, EMPOWER intervention versus a non-randomised control group

Outcome: benzodiazepine discontinued at 9 months	OR	P value	95% CI
Intervention	1.73	0.02	1.09, 2.75
Age	1.01	0.37	0.99, 1.03
Sex			
Female	Reference group		
Male	1.07	0.76	0.69, 1.65
Frailty			
No	Reference group		
Yes	1.14	0.61	0.68, 1.92
Number of risk factors			
1	Reference group		
2	0.59	0.05	0.35, 0.99
3	0.46	0.03	0.23, 0.91
Race			
White	Reference group		
Black	2.78	0.34	0.34, 22.88
Asian	1.32	0.62	0.44, 3.93
Other	0.53	0.27	0.17, 1.64
Unknown	0.60	0.42	0.17, 2.08
Marital status			
Married/significant other	Reference group		
Divorced/widowed	0.58	0.08	0.33, 1.06
Single	0.77	0.42	0.41, 1.45
Unknown	1.20	0.76	0.38, 3.73
Ethnicity			
Non-Hispanic	Reference group		
Hispanic	2.54	0.11	0.82, 7.83
Don't know	1.88	0.09	0.9, 3.93
Arthritis			
No	Reference group		
Yes	0.89	0.73	0.45, 1.75
Depression			
No	Reference group		
Yes	0.87	0.73	0.38, 1.96
Diabetes			
No	Reference group		
Yes	1.16	0.66	0.61, 2.2
Falls			
No	Reference group		
Yes	0.43	0.46	0.05, 3.99
Pain diagnosis			
No	Reference group		
Yes	2.16	0.03	1.09, 4.28

N=599. We used a generalised estimating equations logistic regression, controlling for clustering by physician. Risk factors included: ≥65 years of age, a concurrent high-risk medication prescribed (opioid, muscle relaxant, sedative-hypnotic or stimulant), diazepam equivalent daily dose ≥10, diazepam equivalent daily dose ≥40.
EMPOWER, Eliminating Medications Through Patient Ownership of End Results.

and control groups were reviewed by the study team for potential exclusion (using criteria for exclusion such as actively tapering already or in treatment for an alcohol use disorder), PCPs in the intervention group were asked to identify patients they deemed inappropriate for the intervention; this same process was not done for control group as the physicians in the control group opted out of the intervention, which may have led some patients in the control group to be potentially ineligible or not ideally suited for the intervention.

Our findings suggest the importance of both physician and patient engagement in the process of tapering from benzodiazepines. We found direct evidence of patient engagement in their medication use during our intervention, including patient messages to their physicians about benzodiazepine tapering and several documented discussions of benzodiazepine risks. In contrast to the original EMPOWER intervention, the physicians were not blinded in this study and were actively engaged in the intervention; they agreed to participate in the study and were sent several emails about the brochure and about tapering. Our experience highlights the importance of having fully engaged providers for the deprescribing intervention to be effective. We found several instances where providers were not fully engaged and told their patients *not* to pay attention to the letter/education materials. These results point to the importance of full provider buy-in for such QI projects to maximise effectiveness. Our study adds to the evidence base regarding the effectiveness of various iterations of EMPOWER and patient education materials about benzodiazepines that have been used in various settings. Mendes *et al* used the EMPOWER brochure among 2020 older veterans in southern California and southern Nevada, finding that the odds of benzodiazepine discontinuation were 1.42 (95% CI: 1.24 to 1.61) at 12 months compared with a control population.[23] Also in the USA, Erwin e*t al* sent the EMPOWER brochures and a tailored (veteran-specific) letter to 59 veterans and surveyed their providers post-intervention, finding that 22% of their patients had their benzodiazepine and/or sedative-hypnotic deprescribed. Providers in this study also reported that they discussed the dose of the sedative-hypnotic with 74% of their patients and developed tapering plans with 56% of patients.[17] In Montreal, Canada, Wilson *et al* distributed the EMPOWER brochure to hospitalised participants with chronic benzodiazepine use and found that 64% of participants who received the intervention had their sedatives deprescribed 30 days after discharge.[24] In a randomised controlled trial of 2009 veterans aged 65 years or older receiving care in western USA, Mak *et al* found no differences in the odds of a benzodiazepine prescription among intervention patients (including two arms, EMPOWER mailing only and EMPOWER mailing plus a reinforcing phone call) versus control.[18] In the D-PRESCRIBE randomised clinical trial in Quebec, Canada, in which pharmacists in the intervention group were encouraged to send patients educational deprescribing materials, discontinuation

Table 4 Change in DEDD from baseline to 9 months by intervention group (EMPOWER intervention vs control) and by number of risk factors

	Entire sample	One risk factor	Two risk factors	Three risk factors
N	**599**	**145**	**250**	**204**
	Coefficient	Coefficient	Coefficient	Coefficient
Intervention	−0.79 (−2.29, 0.71)	−1.23 (−3.32, 0.87)	−0.88 (−2.32, 0.56)	−0.31 (−4.3, 3.69)
Age	0.03 (−0.03, 0.1)	0.02 (−0.05, 0.09)	0.05 (−0.01, 0.1)	0.04 (−0.18, 0.27)
Sex				
Female	Reference group	Reference group	Reference group	Reference group
Male	−0.89 (−2.43, 0.65)	1.4 (−0.34, 3.14)	−0.64 (−2.06, 0.78)	−2.96 (−7.04, 1.12)
Frailty				
No	Reference group	Reference group	Reference group	Reference group
Yes	1.36 (−0.45, 3.17)	−1.35 (−3.3, 0.59)	0.04 (−1.63, 1.7)	5.87 (0.83, 10.91)
Race				
White	Reference group	Reference group	Reference group	Reference group
Black	−5.47 (−14.46, 3.51)	−2.78 (−10.11, 4.54)	0 (0, 0)	−11.39 (−30.83, 8.04)
Asian	2.43 (−1.79, 6.65)	−0.32 (−5.25, 4.61)	1.51 (−1.87, 4.9)	11.28 (−3.03, 25.59)
Other	0.5 (−3.04, 4.05)	−2.34 (−6.1, 1.42)	1.49 (−1.62, 4.6)	1.93 (−8.58, 12.43)
Unknown	1.53 (−2.98, 6.04)	−0.27 (−6.21, 5.67)	2.44 (−2.15, 7.03)	2.57 (−8.34, 13.49)
Marital status				
Married/significant other	Reference group	Reference group	Reference group	Reference group
Divorced/widowed	0.53 (−1.4, 2.47)	0.63 (−1.97, 3.24)	−0.26 (−2.06, 1.54)	1.23 (−3.55, 6)
Single	−0.99 (−3.2, 1.22)	1.16 (−1.04, 3.36)	−1.72 (−3.85, 0.41)	−3.39 (−9.56, 2.78)
Unknown	−2.53 (−6.75, 1.68)	2.17 (−4.7, 9.05)	−2.09 (−6.74, 2.55)	−3.93 (−12.65, 4.79)
Ethnicity				
Non-Hispanic	Reference group	Reference group	Reference group	Reference group
Hispanic	−1.24 (−5.74, 3.26)	−4.76 (−10.46, 0.94)	−0.39 (−3.96, 3.19)	−1.66 (−15.47, 12.16)
Don't know	−0.85 (−3.69, 1.99)	0.17 (−3.25, 3.59)	−2.6 (−5.5, 0.31)	0.25 (−6.7, 7.21)
Arthritis				
No	Reference group	Reference group	Reference group	Reference group
Yes	0.29 (−2.09, 2.67)	−2.03 (−5.91, 1.85)	0.69 (−1.47, 2.85)	0.08 (−5.55, 5.71)
Depression				
No	Reference group	Reference group	Reference group	Reference group
Yes	−2.47 (−5.32, 0.38)	1.18 (−2.1, 4.45)	−1.08 (−4.17, 2)	−6.69 (−13.54, 0.17)
Diabetes				
No	Reference group	Reference group	Reference group	Reference group
Yes	−1.01 (−3.33, 1.31)	1.11 (−2.58, 4.8)	0.19 (−1.83, 2.2)	−2.85 (−8.45, 2.76)
Falls				
No	Reference group	Reference group	Reference group	Reference group
Yes	6.45 (−0.88, 13.77)	19.1 (11.72, 26.48)	−1.78 (−13.47, 9.91)	0.69 (−15.28, 16.67)
Pain diagnosis				
No	Reference group	Reference group	Reference group	Reference group
Yes	−1.02 (−3.68, 1.65)	−2.79 (−6.97, 1.39)	0.42 (−2.33, 3.16)	−3.16 (−8.88, 2.56)

We used a generalised estimating equations linear regression, controlling for clustering by physician. Risk factors included: ≥65 years of age, a concurrent high-risk medication prescribed (opioid, muscle relaxant, sedative-hypnotic or stimulant), DEDD ≥10, DEDD ≥40.
DEDD, diazepam equivalent daily dose; EMPOWER, Eliminating Medications Through Patient Ownership of End Results.

of inappropriate medication occurred among 63 of 146 sedative-hypnotic drug users (43.2%) vs 14 of 155 (9.0%) compared with the control group (risk difference: 34% (95% CI: 25% to 43%)) at 6 months.[25] A 2019 feasibility study by Gnjidic *et al* of the use of the EMPOWER brochure in an Australian hospital among 42 patients (20 intervention, 22 control) found roughly equal numbers of benzodiazepine cessation among the control and intervention groups at the 1-month follow-up.[26] A 2018 pre–post QI study in Alberta, Canada found that of 12 patients who received the brochure, all consented to benzodiazepine deprescribing and 11 initiated deprescribing during the hospital stay.[27] Future studies including a cluster-randomised controlled trial (HYPE trial) set in primary care clinics in Switzerland will examine the use of a 1-hour online training for general practitioners on how to discuss deprescribing with patients taking benzodiazepines and other sedative-hypnotics and a patient support tool, which includes elicitation of the original and current reasons for the prescription, a table delineating the advantages and disadvantages of stopping or reducing benzodiazepines and sedative-hypnotics, a discussion of patient priorities, a tapering protocol, behavioural counselling, and a dosage schedule and schedule of following appointments with the general practitioner to supporting tapering.[28] In sum, the majority of these interventions, including our findings, find that a relatively low-touch intervention can lead to dose reductions or benzodiazepine cessation among patients.

In short, we found that the adapted intervention has the potential to activate both patients and their physicians. Not only did physicians initiate tapers, but they also engaged a multidisciplinary team through referrals to behavioural health and pharmacy. An important reason for patient-led interventions such as this one is that benzodiazepines may not come up during regular office visits; this type of intervention can motivate patients and their clinicians to discuss the risks and benefits at more regular intervals, particularly if there are any changes in the patients' health (eg, recent falls, changing physical or cognitive function).

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Contributors TL contributed to the data collection, data analysis, writing and editing of the manuscript. SC contributed to the study design, intervention design, data collection, data analysis, and writing and editing of the manuscript. AA contributed to the study design, intervention design, data collection, data analysis, and writing and editing of the manuscript. PA contributed to the intervention design and writing and editing of the manuscript. HH contributed to the data collection and writing and editing of the manuscript. SI contributed to the data collection and writing and editing of the manuscript. CG contributed to the study design, intervention design, and writing and editing of the manuscript. AMM contributed to the study design, intervention design, and writing and editing of the manuscript. KB contributed to the study design, intervention design, and writing and editing of the manuscript. MSK contributed to the study design, intervention design, data collection, data analysis, and writing and editing of the manuscript. MKS accepts full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval The study was reviewed by the Cedars-Sinai Medical Center Institutional Review Board and deemed exempt as it was conducted as part of a QI project.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. The datasets generated and/or analysed during the current study are not publicly available and cannot be shared because they contain protected health information.

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