Journal of Pain Research

Dovepress
open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Characteristics of physicians who prescribe opioids for chronic pain: a meta-narrative systematic review

This article was published in the following Dove Press journal:
Journal of Pain Research

W Michael Hooten[1]
Jodie Dvorkin[2]
Nafisseh S Warner[1]
Amy CS Pearson[3]
M Hassan Murad[4]
David O Warner[1]

[1]Department of Anesthesiology and Perioperative Medicine, Mayo Clinic College of Medicine, Rochester, MN, USA; [2]Institute for Clinical Systems Improvement, Minneapolis, MN, USA; [3]Department of Anesthesia, University of Iowa Carver College of Medicine, Iowa City, IA, USA; [4]Department of Medicine, Mayo Clinic College of Medicine, Rochester, MN, USA

Background: The primary objective of this systematic review was to identify the characteristics of physicians who prescribe opioids to adults with chronic pain. This review was limited to studies examining fully-trained physicians, as relevant characteristics of resident physicians and non-physician clinicians may differ.

Methods: A comprehensive search of databases from January 1, 1980 to December 5, 2017 was conducted. Eligible study designs included (1) randomized trials; (2) nonrandomized prospective and retrospective studies; and (3) cross-sectional observational studies. The risk of bias in the included studies was assessed using an adapted version of the Newcastle-Ottawa Scale for cross-sectional studies. A total of 2508 records were screened and 22 studies met inclusion criteria. The majority of studies were cross-sectional (n=20) and the total number of participants was 8433.

Results: The risk of bias was high overall. The majority of physicians were confident managing and prescribing opioids for chronic pain but had high levels of dissatisfaction. Physicians reported high awareness of the potential for opioid misuse and were concerned about inadequate prior training in pain management. The majority of physicians were less likely to prescribe for patients with a history of substance abuse and reported major concerns about regulatory scrutiny.

Conclusion: This systematic review provides the foundation for the development of prospective studies aimed at further elucidating the constellation of mechanisms that influence physicians who manage pain and prescribe opioids.

Keywords: systematic review, opioid, prescription, physician characteristics

Introduction

Nonmedical use of prescription opioids remains a public health crisis.[1] Despite recent reductions in opioid prescribing, the quantity of prescribed opioids remains substantially elevated compared to the quantities prescribed prior the year 2000.[2,3] The decline in opioid prescribing has been accompanied by a sharp rise in overdose deaths attributed to illicitly manufactured fentanyl while overdose deaths attributed to heroin have plateaued.[4] As national prescribing guidelines[5] and public health campaigns[6] heighten awareness of the risks associated with long-term opioid therapy initiated for chronic pain, it is apparent that some opioid prescriptions originally intended for short-term use lead to unintended prolonged opioid use (UPOU).[7–16]

Our group has recently published a conceptual framework for understanding UPOU.[17] The overall goal of a conceptual framework is to provide a working

Correspondence: W Michael Hooten
Department of Anesthesiology and Perioperative Medicine, Mayo Clinic College of Medicine, 200 First St SW, Rochester, MN 55905, USA
Email hooten.william@mayo.edu

submit your manuscript | www.dovepress.com
DovePress
http://doi.org/10.2147/JPR.S202376

schema to drive future hypothesis generation. In the absence of standardized methods for developing a conceptual framework, the process involves identifying corroborative evidence and coalescing expert opinion during the adjudication of factors intended for framework inclusion. The UPOU framework is comprised of 3 domains, including patient characteristics, practice environment characteristics, and opioid prescriber characteristics. The framework posited that characteristics of physicians that could influence prescribing behaviors include (1) training in pain management and opioid use; (2) personal attitudes and beliefs about opioids; and (3) perceived professional obligation to treat patients with chronic pain. As prescribers serve as the gatekeepers to prescription opioid access, the focal point of the framework is the opioid prescriber domain; the effects of the other two domains are ultimately mediated by individual prescribing behavior.

The primary objective of this systematic review was to identify the characteristics of physicians who prescribe opioids to adults with chronic pain. Secondary objectives included describing patient and practice environment factors that affect physicians who manage and prescribe opioids for chronic pain. This review was limited to studies examining fully-trained physicians, as relevant characteristics of resident physicians and non-physician clinicians may differ.

Methods

This systematic review was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[18] An a priori protocol was followed.

Search strategy

A comprehensive search of databases from January 1, 1980 to December 5, 2017 was conducted. The databases included MEDLINE Epub Ahead of Print, Medline In-Process and Other Non-Indexed Citations, MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, and Scopus. The search strategy was designed and conducted by a medical reference librarian with input from the principal investigator. No language restrictions were applied. Controlled vocabulary supplemented with keywords was used to search for studies on practitioner characteristics influencing opioid prescribing practices. The actual search strategy is provided in Supplementary materials.

Study selection process

Eligible study designs included (1) randomized-, crossover-, and parallel-designed clinical trials; (2) nonrandomized prospective and retrospective longitudinal studies; and (3) cross-sectional observational studies. Based on our conceptual framework, inclusion criteria included all studies that reported information about (1) physician attitudes and beliefs about opioid use; (2) previous training in pain and opioid management; (3) professionalism; or (4) physician demographics. Exclusion criteria included (1) studies that mixed physician and non-physician data; (2) studies that reported data derived from physician responses to clinical vignettes; (3) data from medical students and residents-in-training; (4) studies of non-physicians and non-US physicians; and (5) qualitative studies that reported data from individual physician interviews.

The studies identified by the search strategy were screened in two phases. First, two independent pairs of reviewers screened all titles and abstracts. Second, the full text of all studies identified in the first phase were screened by two independent pairs of reviewers.

Data extraction

Data were extracted by four independent reviewers using a templated electronic database. Based on the study inclusion criteria and conceptual framework, abstracted data were initially organized into four main categories (attitudes and beliefs; previous training in pain management; professionalism; physician demographics). Following abstraction, data were reorganized into four main categories and several subcategories: (1) physician factors (main category) with subcategories including attitudes and beliefs about opioid use, pain training and knowledge, awareness of adverse events, and opioid management practices; (2) patient factors (main category) with subcategories including pain etiology and comorbid conditions, and patient satisfaction; (3) practice environment (main category) with subcategories including regulatory scrutiny and clinical resources; and (4) physician demographics. No information was identified about physician professionalism. Other data abstracted included (1) author and year of publication; (2) study design; (3) survey type; (4) total number of study participants targeted for recruitment; (5) number of participants completing the study; (6) overall response rate; and (7) physician demographics including age, sex, years of practice, practice environment (ie,

group, solo, hospital-based) and practice location (ie, rural, urban); (8) source of study funding.

Risk of bias assessment

The risk of bias in the included studies was assessed by two independent reviewers using an adapted version of the Newcastle-Ottawa Scale for cross-sectional studies.[19] The adapted version is comprised of 3 domains (eg, selection, comparability and outcome) and has been

used in previous systematic reviews that involved cross-sectional studies.[20–22] We did not calculate an overall score because this practice has been discouraged; rather, we made an overall judgement about the risk of bias focusing on the comparability domain. Reviewer discrepancy was resolved by consensus or by a third reviewer.

Evidence synthesis

Due to the heterogeneity in study characteristics, settings, and outcomes a meta-analysis was not feasible; thus, results are presented using a meta-narrative approach. A meta-narrative review can be used when an area in inquiry has been researched using disparate methods by different groups of investigators.[23,24] This approach is particularly useful when the definition of key terms or clinical factors vary between studies. Meta-narrative methods have been used to study various populations of patients with chronic pain.[25–29] Data were summarized using themes drawn from our conceptual framework and using descriptive statistics.

Results

Characteristics of included studies

A flow diagram of the study selection process is depicted in Figure 1. A total of 22 studies met inclusion criteria (Table 1). The majority of studies were cross-sectional (n=20) where participants completed a survey at a single time point. Two studies used a repeated measures design; one study assessed participants pre-, post- and 6-months following a pain focused educational module[30] and one study assessed participants pre- and 2-years following an initiative to improve opioid prescribing safety.[31] The surveys were completed using email or internet-based software (n=10),[30,32–40] postal system (n=7),[41–47] in-person completion of a paper version (n=2),[31,48] and a combination of postal and email approaches (n=3).[49–51] Three studies pilot tested surveys in small groups of physicians prior to

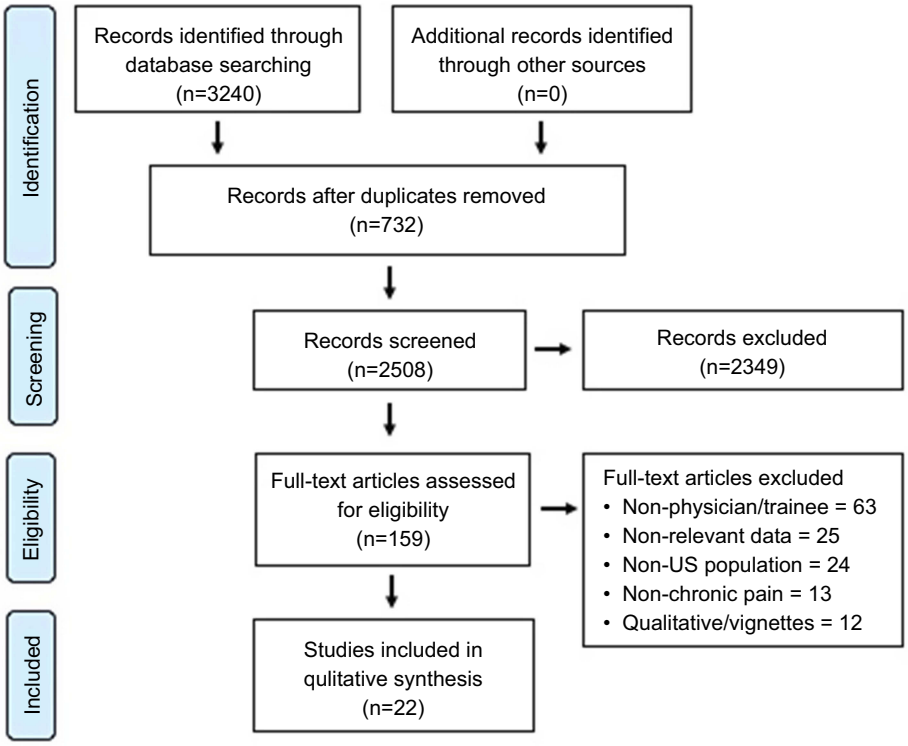

Figure 1 Preferred reporting items for systematic reviews and meta-analyses flow chart of the study selection process.
Note: Reproduced from Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ*. 2009;339:b2535. Creative Commons license and disclaimer available from: http://creativecommons.org/licenses/by/4.0/legalcode"http://creativecommons.org/licenses/by/4.0/legalcode.[18]

Table 1 Study characteristics

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Bhamb 2006[48]	Cross-sectional	4-page written survey	Total=335; completed study=248; completion rate=74%	Wisconsin physicians; 70% family medicine; 29% internal medicine; mean age 41 years with 68% between ages 30–49; male 49%		56% with pain training in medical school or residency 17% concerned about lack of knowledge on which opioid to prescribe	84% concerned about opioid abuse, 75% about addiction, 68% about side effects, 61% about tolerance, 32% about medication interaction	93% do not do UDS before starting opioids and 85% do not do UDS 1–2 per year on established patients	Majority more likely to prescribe opioids to a patient with terminal cancer than patients with low back pain			56% established a system to track opioid patients Opioid tracking system associated with 2.5 greater odds of UDS use More than 1/3 of practices had no general agreement among physicians and staff about prescribing opioids	National Institutes of Health

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Breuer 2010[41]	Cross-sectional; full study included PCP, PP, acupuncture specialists, chiropractors	Postal survey	Total (PCP and PP) =2000; completed study=474 completion rate=24%	National sample; median age PP 46; median age PCP 50; PP 84% male; PCP 71% male; private practice >72%; PP rural 9%; PCP rural 21%	PCP less confident treating musculoskeletal and neuropathic pain	PP had more chronic pain CME hours (76 hrs) compared to PCP (10 hrs) 56% PCPs and 73% PP favor pain education for all PCPs For PCPs, correlation between CME hours and confidence treating MSK and neuropathic pain		PCPS and PPs treated similar proportion of patients with short-acting opioids and tramadol; PCPs used more NSAIDs, PP more long-acting opioids			Regulatory concerns influence opioid prescribing in 29% PCP and 16% PP		Cephalon, Inc. Endo Pharmaceuticals

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Chen 2011[49]	Cross-sectional	Postal and email survey; 23 items	Total=1083; completed study=197; completion rate=18%	National sample; PCP 48%; pain medicine 54%; oncology-palliative care 20%; teaching hospital 67%; urban areas 91%; male 65%	66% consider opioids somewhat effective 15% considered opioids to be dose limited		Opioid abuse indicative of failed therapy (60%)	Abuse or diversion suspected then 53% obtain drug screen 69% consider opioid contract necessary; 65% believe it improves communication; 37% believe it is legally protective About 50% initiate opioids with a combination of short and long-acting medications 55% self-initiated opioid therapy, 33% continued opioid therapy initiated by another physician Indicators of effective opioid therapy: improved function 76%; lower pain 62% Indicators of failed opioid therapy: no pain reduction 84%; function not improved 67% 73% considered methadone unique and 62% prefer oxycodone	75% considered opioids for cancer-related pain and 54% for low back pain 62% avoid opioids for fibromyalgia and 49% for chronic headache				Partially supported by a grant from the National Institutes of Health

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Donovan 2016[30]	Cross-sectional with repeated measures assessment	Internet survey; 25-item multiple choice (assessing knowledge) and 16-item 5-point Likert scale assessment at pre-, post-, and 6-months after educational module	Total=53; completed study=33; response rate 62%	Physician faculty at Univ. Pittsburgh; male 51%; mean years of practice 16	Following educational module: improved confidence in the ability to improve lives of chronic pain patients; improved comfort in discussing opioid discontinuation with patients	61% with previous training in prescribing opioids at the faculty level Knowledge-based test scores improved following educational module (75% to 90%) Completion of educational module associated with improved teaching of residents							Thomas H. Nimick, Jr. Competitive Research Fund of the University of Pittsburgh Medical Center Shadyside

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Duensing 2010[32]	Cross-sectional; full study included physicians and patients	Internet survey; physician survey included 21 items answered using multiple choice and 5-point Likert scale;	Repeated email sampling to achieve total sample size of 275 physicians	National sample; male 86%; age 30–59 yrs 90%; mean years in practice 17 General practice 44%; pain medicine 27% Private practice 83%; hospital-based 12%	Comfortable prescribing opioids for long term pain 71% 97% responded that effectiveness of opioids for providing pain relief somewhat/very important		Abuse or diversion somewhat or very important 87% 78%-89% reported side effects of N/V, constipation, dizziness, drowsiness, drug interactions somewhat or very important					85% non-pain specialists feel comfortable working with pain specialists to manage pain patients 67% felt widespread managed care coverage was somewhat or very important factor when prescribing opioid	Ortho-McNeil Janssen Scientific Affairs

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Franklin 2013[33]	Cross-sectional; study included physicians as well as non-physician providers	Internet survey; 39 items	Completed study=285; total number and response rate not reported	Physicians in Washington State; PCP 100%		79%-84% state "web-based" CME or advanced training in chronic pain treatment would be helpful 71% read or applied guideline	73% very concerned about overdose, addiction, dependence or diversion.	91% would find use of PDMP helpful			25% very concerned about regulatory scrutiny	78% responded telephone consultation with experts would be helpful 68% had policy, guidelines, or algorithms available in clinic 86% reported patient decision aids would be helpful	Centers for Disease Control and Prevention National Center for Injury Prevention and Control
Green 2001[42]	Cross-sectional	Postal survey; 110 items	Total=1553; completed study=368; adjusted response rate=26%	Licensed Michigan physicians ale 73%; mean age 45; White 80%; Asian 12%; Black 6%; Hispanic/Latin2% PCP 63%; specialists 37%	Generally, respondents were satisfied with the pain care they provide	10% reported previous pain education; younger physicians more likely to receive pain education. Majority reported confidence in knowledge about various pain treatments					Disagreement over whether there is too much regulatory scrutiny Concern that prescribing opioids would "attract a medical review"		Blue Cross Blue Shield Foundation of Michigan

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Howell 2015[50]	Cross-sectional; full study included non-physician opioid prescribers	Postal and emailed survey; 23-items	19% and 24% response rate for MD and DO; actual numbers not reported	Physicians in Washington State	80–83% reported moderate to extreme competence treating chronic pain 42%-52% report moderate to extreme satisfaction treating chronic pain			19–37% always require biological sample for drug screen 76%-90% always document health history 32%-34% always require written agreement 58–62% always conduct review of patient course 57–66% always require prescriptions by single provider 29–38% always specify reasons for discontinuing drug therapy	68–81% always review patient history for substance abuse				Bureau of Justice Affairs (Washington State) American Nurses Association

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Hwang 2016[51]	Cross-sectional	Postal and email survey; 45 items; "most" responses 4-point Likert scale	Total=1000; completed study=420; adjusted response rate=58%	National sample; mean age 50; male 55%; white 70%; Asian 19%; African American 11% family medicine or internists 95%			95% believe addictive potential of opioids responsible for some to a lot of opioid abuse	90% somewhat or strongly support urine drug testing 98% somewhat or strongly support opioid contracts 98% somewhat or strongly support getting opioids from one prescriber 88% somewhat or strongly support PDMP					Robert Wood Johnson Foundation Public Law Research Program Lipitz Public Bloomberg School of Public Health
Kraus 2015[34]	Cross-sectional	Internet survey; 11-items	Completed study=219; total number targeted and response rate not reported	National sample; PCP 37%; pain specialist 26%; other 37%				51% report opioid contracts clarify therapeutic goals, side effects and drug interactions 47% report opioid contracts represent a mutually agreed upon course of treatment					Medscape, LLC

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Macerollo 2014[35]	Cross-sectional	Internet survey; 16 items answered using 4-point Likert scale	Total=1099; completed study=581; response rate=53%	National sample of academic family medicine physicians; male 58%; non-Hispanic white 84%	74% believe pain management is a high priority 19% found it satisfying to prescribe opioids for pain 88% somewhat/strongly confident and 76% somewhat/strongly comfortable in their prescribing of opioids for CNMP 74% believe opioids provide substantial pain relief 73% believe opioids improve function Physicians who were more comfortable and/or confident were significantly more satisfied in prescribing opioids to patients with chronic pain		54% believe many patients become addicted Concerns about compliance (64–73%) and overdose (65%) 65% concerned about lack of addiction treatment resources			62% concerned about disagreement with patients about opioids	32% believe regulations influence prescribing practices	53% concerned about lack of specialized pain clinics	Not reported

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Nishimori 2006[43]	Cross-sectional	Postal survey; 23-items	Total=250; completed survey=147; response rate=59%	Massachusetts area physicians; PCP 56%; pain specialists 44%	Pain specialists with >20 patients receiving opioids rated opioid effectiveness higher			91%-96% believe that drug loss, prescription tampering, multiple prescribing physicians, functional deterioration, frequent ED visits, and non-pain use indicative of unsuccessful treatment 75%-87% believe that unsuccessful treatment indicated by aberrant toxicology screen, unemployment, use of other person's medication, relationship deterioration, use of alcohol or illicit drugs, cognitive deterioration, no pain improvement, dose escalation, unwilling to try other treatments, frequent unscheduled clinic appts Aside from changes in pain control, increases or decreases in function most important outcome					

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Nwokeji 2007[36]	Cross-sectional	Internet survey; 20 items answered using 7-point Likert scale	Total=2750; completed survey=267; response rate=10%	Texas Academy of Family Physicians; male 63%; white 74%; urban or suburban 71%; mean years in practice 16.5	63% somewhat to extremely likely to prescribe controlled-release (CR) opioids to patients with moderate to severe CNMP Prescribing CR opioids somewhat to extremely likely to control pain (81%) and improve quality of life (80%) Physicians unwilling to prescribe continuous release opioids held stronger beliefs about occurrence of opioid abuse or addiction		Prescribing continuous release opioids somewhat to extremely likely to lead to addiction (51%)				Prescribing CR opioids somewhat to extremely likely to lead to regulatory scrutiny (78%) Physicians unwilling to prescribe continuous release opioids held stronger beliefs about regulatory scrutiny	Prescribing continuous release opioids somewhat to extremely likely lengthen office visit (65%)	Not reported

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Ponte 2005[44]	Cross-sectional	Postal survey; 20 items answered using 5-point Likert scale	Total 537; completed survey=186; response rate=34.5%	West Virginia Chapter of American Academy of Family Physicians; male 77%; age 35–54 yrs 64%; mean yrs in practice 15.5; group or solo private practice 71%	80% anxious about prescribing high-dose opioids to chronic pain patients; however 80% not apprehensive to prescribe for patients with chronic malignant pain 85% frustrated with chronic pain patients 93% believe patients satisfied with their pain management	60% report that their formal medical training in pain management was inadequate Incorrect knowledge about transdermal fentanyl use in opioid-naïve patients (67%), treatment of respiratory depression (51%), treatment of constipation (46%)			92% do not prescribe to patients with substance abuse history		68% believe regulatory scrutiny affected prescribing practices	89% report managing chronic pain is time consuming	Not reported

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Porucznik 2013[37]	Cross-sectional	Internet survey; Yes/No and free text responses	Total=85; completed survey=47; response rate=55%	University-based community clinic system in Utah; PCP 70% 77% of respondents prescribe opioids for CNMP	8% comfortable, 34% somewhat comfortable, 34% somewhat uncomfortable, 8% uncomfortable with prescribing opioids Majority report dissatisfaction treating patients with chronic pain (mean score 17 and median score 16 on 0 to 100 scale)	Reported previous training about opioids during medical school (39%), residency (70%), CME (72%) Mean of 5 hrs (median of 3 hrs) opioid CME past 2 yrs 54% reported inadequate training about opioids 39% familiar with Utah opioid guidelines 85% report need for additional addiction training	Behaviors predictive of abuse include lost medications (92%), early refills (87%), persistent requests (85%), modifying prescriptions (81%)	Prior to starting opioids check PDMP (77%), sign contract (72%), perform urine toxicology screen (47%), assess function (45%) Report always documenting opioid contracts (41%), pain scale (38%), function (4%), discuss risks and benefits (37%), trials of non-opioid drugs (61%)					Food and Drug Administration Centers for Disease Control and Prevention National Institutions of Health Utah Department of Health

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Remster 2011[45]	Cross-sectional	Postal survey; 29 items answered Yes/No, multiple choice, 4- to 5-point Likert scale	Total=1719; completed survey=413; adjusted response rate 26%	Physicians in Ohio's Appalachian counties; male 74%; mean age 51; mean years of practice 20; work with chronic pain patients daily 42%	Perceived barriers to chronic pain management: physician reluctance to prescribe opioids (71%),		Perceived barriers to chronic pain management: patient fear of addiction (40%), patient reluctance due to adverse effects (36%)	Perceived barriers to chronic pain management: lack of objective pain measurement (72%), inadequate pain assessment (59%)		Perceived barriers to chronic pain management: patient reluctance to make lifestyle changes (88%), Perceived barriers to chronic pain management: financial burden for patient (73%), lack of patient transportation (57%)	Perceived barriers to chronic pain management were federal and state regulations (53%)	Perceived barriers to chronic pain management: inadequate access to pain specialists (78%)	Ohio Univ. College of Osteopathic Medicine Department of Family Medicine Research and Scholarly Affairs Committee

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Slevin 2011[38]	Cross-sectional	Internet survey; 11-items with majority questions using Yes/No responses	Total=2800; completed study 259; response rate=9%	Pennsylvania family physicians; PCP 87%; specialist 13%; urban 52%; rural 48%;		48% willing to complete 2 hr CME on transmucousal fentanyl product 31% would discontinue opioids if required to complete mandated transmucousal fentanyl education		64% use signed contracts 40% use urine drug testing 18% do "periodic" pill counts			22% would discontinue opioids if required to document ongoing monitoring including efficacy, safety, aberrant behavior		
Turk 1994[46]	Cross-sectional	Postal survey; 12-items most answered using 7-point Likert scale	Total=6962; completed study=1912; completion rate=27.46%	National sample of primary care and specialty physicians; mean number years in practice 17 Physicians from Midwest least likely to prescribe opioids; rheumatologists more likely to prescribe		Majority did not receive adequate pain education in medical school or residency	Expressed concerns about side effects, addiction, tolerance, physical dependence	Physicians expressed concerns functional improvement			Concerns about regulatory pressure were mixed between the different medical specialties		Purdue Frederick Company

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Turk 2014[39]	Cross-sectional	Internet survey; Clinicians Attitudes about Opioids Scale (CAOS); validated, 38 items answered using 0–10 scale.	Total not reported, completed study=1535, response rate 47%	National sample of primary care and specialty physicians; male 83%; age 45–60 53%; 15 to >19 yrs practice 54%; group practice 75%; PCP 42%		Being certified in Pain Medicine and satisfaction with education/training in pain management associated with greater likelihood of prescribing tamper resistant opioids	Concerns about misuse or abuse predictive of prescribing tamper resistant opioids						Not reported but 2 co-authors employed by Janssen Scientific Affairs

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Wastanmo 2015[31]	Cross-sectional with repeated measures assessment	Paper survey; 18 items answered using 5-point Likert scale administered pre- and 2 yrs post opioid safety initiative	Total pre-safety initiative=46; completed pre-assessment=34; completion rate=74% Total post-safety initiative=48; completed post assessment=31; adjusted response rate=61%	Physicians working at the Minneapolis VA Hospital		Pre/Post safety initiative 32% and 29% reported to have adequate training in chronic pain care Majority able to calculate MED	Majority agreed >200 MED increased risk of overdose Pre/Post safety initiative the majority reported doses <200 MED improved patient safety, improved quality of life, and protect prescriber			Pre/Post safety initiative majority reported lowering opioid dose <200 MED would upset patients		100% acknowledged importance of having consistent standard for prescribing opioids	

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Wilson 2013[40]	Cross-sectional validation study; dataset from Turk 2014 and Turk 1994	Internet survey; development and validation study of the 18 item CAOS questionnaire	1535 involved in validation study, see Turk 2014	National sample; demographics see Turk 2014 No differences in beliefs/practices among different regions on the country	Strong agreement to avoid long-term opioids if possible More male vs females believed strongly about efficacy of opioids Age <45 vs age 45–60 less confident about efficacy of opioids Orthopedist indicated greatest concerns about long-term opioid use Higher volume of chronic pain associated with increased opioid prescribing, less concern about impediments, less concern about Schedule II vs III drugs, indicated adequate pain training	Strong disagreement that pain education was adequate	Strong agreement that patients take opioids for non-pain reasons Strong agreement that tolerance is an impediment to long-term efficacy						Janssen Scientific Affairs, LLC

(*Continued*)

Table 1 (Continued).

					Physician factors				Patient factors		Practice environment		
Author	**Study design**	**Survey**	**Number of physician participants**	**Physician demographics**	**Attitudes about pain and opioids**	**Pain training and knowledge**	**Awareness of adverse events**	**Opioid management**	**Pain etiology and other conditions**	**Patient satisfaction**	**Regulatory scrutiny**	**Clinical resources**	**Study funding**
Wolfert 2010[47]	Cross-sectional	Postal survey; 32-items	Total=600; completed study=216; response rate 36%	Licensed Wisconsin physicians; working full-time 74%		40% with poor knowledge about state/federal prescribing laws 38% aware of one clinical guideline for chronic pain 51% reported previous training in pain management; 25% reported no formal training 43% reported good to excellent knowledge about pain management	54% believed diversion was a moderate to severe problem 19% correctly identified addiction		10% believed that prescribing to patients with a history of substance abuse was an acceptable practice		59% reported no regulatory concerns about prescribing practices Strategies to avoid investigation included limiting refills, prescribe smaller quantities and dose, prescribe opioid in lower schedule	76% reported that media coverage about opioid abuse did not impact prescribing practices	Shapiro Summer Research Program at the Univ. of Wisconsin School of Medicine and Public Health Univ. of Wisconsin Paul P. Carbone Comprehensive Cancer Center

Abbreviations: UDS, urine drug screen; PP, pain physician; PCPs, primary care providers; CME, continuing medical education; PDMP, prescription drug monitoring programs; N/V, nausea/vomiting; MD, medical doctor; DO, doctor of osteopathy; MED, morphine equivalent dose; CNMP, chronic non-malignant pain.

use[41,48,49] and a single study used a validated survey.[39] A total of 23,726 physician participants [median =1042; 25th to 75th interquartile range (IQR), 271 to 2492; range, 46 to 6962] were targeted for study recruitment and 8433 (median =254; 25th to 75th IQR, 189 to 418; range, 33 to 1912) completed the surveys. Six studies did not report the total number of targeted participants[32–34,39,40,50] and a single study did not report the number of participants completing the survey.[50] The median response rate for completion of the surveys was 35% (25th to 75th IQR, 26 to 58; range, 9 to 74); the response rate was not reported in 3 studies.[32–34]

Study funding

The sources of funding were reported in 15 studies. Four studies received funding from the National Institutes of Health,[48,49] or a combination of state and federal government agencies.[33,37] Private foundations or universities provided funding for 5 studies.[30,42,45,47,51] A single study received funding from a state government agency and a private foundation.[50] Five studies received funding from industry; 4 of the 5 funding sources were from the pharmaceutical industry[32,40,41,46] and the remaining study was funded by a health information company.[34] The funding source for 1 study was not reported but 2 co-authors were employed by a pharmaceutical company.[39]

Risk of bias evaluation

Table 2 contains the judgements made about each item of the Newcastle-Ottawa Scale for each study. The studies had major limitations in the comparability domain because of variations in study design and lack of study controls. Limitations were also noted in the selection domain due to variations in sample size and response rates. Similarly, limitations were noted in the outcome domain due to differences in methods used to perform the outcome assessment and variations in statistical analyses. Overall, the risk of bias was considered to be high across this body of evidence.

Prescriber characteristics

Demographics

A national sample was used in 9 studies[32,34,35,39–41,46,49,51] and the 13 studies with state-level data were drawn

Table 2 Quality assessment using the adapted Newcastle-Ottawa scale for cross-sectional studies

Author	Selection domain[a]	Comparability domain[b]	Outcome domain[c]	Overall judgement about risk of bias
Bhamb 2006[48]	2	0	1	High risk
Breuer 2010[41]	3	0	1	High risk
Chen 2011[49]	2	0	0	High risk
Donovan 2016[30]	1	0	1	High risk
Duensing 2010[32]	2	0	2	High risk
Franklin 2013[33]	1	0	1	High risk
Green 2001[42]	2	0	1	High risk
Howell 2015[50]	1	0	2	High risk
Hwang 2016[51]	1	0	2	High risk
Kraus 2015[34]	1	0	1	High risk
Macerollo 2014[35]	3	0	1	High risk
Nishimori 2006[43]	1	0	1	High risk
Nwokeji 2007[36]	1	0	1	High risk
Ponte 2005[44]	2	0	1	High risk
Porucznik 2013[37]	1	0	1	High risk
Remster 2011[45]	2	0	1	High risk
Slevin 2011[38]	1	0	1	High risk
Turk 1994[46]	4	0	1	High risk
Turk 2014[39]	3	1	2	High risk
Westanmo 2015[31] [d]	1	0	0	High risk
Wilson 2013[40]	4	0	2	High risk
Wolfert 2010[47]	3	0	1	High risk

Notes:[a]Selection domain scores ranged from 0–4. One point assigned for each criteria: (1) representativeness of exposed cohort; (2) selection of non-exposed cohort; (3) ascertainment of exposure; (4) targeted outcome not present at baseline. [b]Comparability domain scores ranged from 0–2. One point assigned for each criteria: (1) study controlled for age; (2) study controlled for any additional factor. [c]Outcome domain scores ranged from 0–3. One point assigned for each criteria: (1) assessment of outcome; (2) was follow-long enough for outcome to occur; (3) adequacy of follow-up of cohorts. [d]Score of provider perceptions survey only.

from Massachutes,[43] Michigan,[42] Minnesota,[31] Ohio,[45] Pennsylvania,[30,38] Texas,[36] Utah,[37] Washington,[33,50] West Virginia,[44] and Wisconsin.[47,48] The majority of participants (range, 70% to 100%) were primary care physicians in 6 studies,[35–38,44,48] and the participant samples were comprised of mixed specialties in 8 studies.[30,32,34,39,41–43,49] The mean or median age of participants was reported in 5 studies[41,42,45,48,51] and ranged from 41 to 51 years. The age range was reported in 3 studies[32,39,44] in which the majority of participants were 35 to 60 years of age. Participant sex was reported in 11 studies[30,32,35,36,39,41,42,44,45,48,51] with the proportion of male participants ranging from 49% to 86%. Race was reported in 4 studies[35,36,42,51] with the majority of physicians identified as "white" (range, 70% to 84%). The mean years of practice reported in 5 studies[30,32,43–45] ranged from 16 to 20 years and the majority of physicians in a single study had been in practice greater than 15 years.[39] In 4 studies,[36,38,41,49] the majority of participants resided in urban areas (range, 52% to 91%) and, in 3 studies,[39,41,44] the majority of participants were in private or group practice.

Attitudes about pain and opioids

The majority of participants (73% to 88%) in 4 studies,[32,35,43,50] which represented a mixture of primary care physicians and specialists, reported feeling confident, comfortable or competent prescribing opioids and managing pain. Several studies described physician satisfaction treating patients with chronic pain. Five studies that reported information related to the physician's beliefs about pain and opioids were published between 2011 and 2015[31,35,37,38,50] and 2 studies were published earlier in 2001[42] and 2005.[44] High levels of dissatisfaction treating chronic pain were reported in 2 studies where 81% were not satisfied prescribing opioids[35] and 85% were frustrated treating patients with chronic pain.[44] In a single study of university-based community physicians in Utah, satisfaction treating patients with chronic pain was assessed using a zero to 100 point visual analog scale where zero indicated no satisfaction and 100 indicated "much" satisfaction.[37] The median response of the 47 physicians was 16.[37] Alternatively, the majority of participants in a physician sample from Michigan were satisfied treating patients with chronic pain,[42] and 42% to 52% of physicians from Washington were moderately to extremely satisfied treating chronic pain.[50]

Pain training and knowledge

Information about training in pain management was reported in 12 studies[30,31,33,37,38,40,42,44–48] but the level of detail about training varied. In 5 studies[30,31,37,47,48] published between 2006 and 2016, 32% to 72% of participants reported previous training in pain management. More specifically, in a study that involved 47 physicians working in a university-based community clinic system, 39% reported previous training about opioids during medical school, 70% reported training during residency, and 72% reported receiving opioid-related continuing medical education (CME).[37] Despite previous training, 54% continued to report inadequate training about opioids and 85% reported the need for additional training in addiction.[37] Similarly, in another study, 51% reported previous pain management training but only 43% reported having "good" to "excellent" knowledge about pain management.[47] An earlier study published in 2001[42] reported that 10% of participants had received pain management training and younger age was associated with a greater likelihood of receiving previous training. In 3 studies that span 19 years,[40,44,46] the majority of participants reported that previous pain management training was inadequate.

Physician participation and support of CME for chronic pain varied. In a national study,[31] pain specialists had devoted an average of 76 hrs of CME to pain management in the past three years compared to an average of 10 hrs for primary care providers (PCPs). For PCPs, there was a significant correlation between the number of CME hours and the level of confidence in treating musculoskeletal and neuropathic pain, being in favor of mandatory pain education, and treating with NSAIDs and tramadol.[31] In a separate study,[37] 72% of physicians in a Utah university-based community clinic system (70% were PCPs) reported participating in an average of 5.25 hrs of pain management CME activities over the past 2 years. In one study in Washington,[33] 79% to 84% of participants agreed that internet-based CME about pain management would be helpful.

Awareness of adverse events

The majority of participants (54–87%) reported some level of concern about opioid misuse, addiction, overdose, or diversion.[32,33,35,36,43,44,47–49,51] Opioid tolerance was identified as an impediment to long-term efficacy in 3 studies.[40,46,48] In a single study, 81–92% of participants reported that lost medications, request for early refills, persistent requests for opioids, and modifying opioid prescriptions were predictive of abuse.[37] Concerns about other adverse effects were described in 2 studies including

nausea and vomiting, constipation, dizziness, drowsiness, and drug interactions.[32,48] In a study from Ohio's Appalachian counties, 36–40% of physicians perceived that patient fear of addiction and other adverse opioid effects were barriers to successful management of chronic pain.[45]

Opioid management

Important areas about opioid management included knowledge and use of prescription drug monitoring programs (PDMP), urine drug screen (UDS), and opioid contracts. In 3 studies published between 2011 and 2016,[33,37,51] 77–91% endorsed use of PDMP. However, there was greater variability regarding the use of opioid contracts. In a study published in 2016, 98% of respondents "somewhat" or "strongly" supported use of opioid contracts.[51] A 2011 study demonstrated that 64% of participants reported requiring patients to sign agreements[38] and 89% of participants in a 2013 study reported "always" or "sometimes" having documentation of a medication contract.[37] In 2 studies published in 2015,[34,50] only 32–51% reported always requiring opioid contracts. Similarly, less consensus was observed for use of UDS. In 3 studies published between 2010 and 2016,[37,38,50] 19–47% of participants reported use of UDS but in a single study published in 2016,[51] 88% of a national sample "somewhat" or "strongly" support use of UDS.

Patient factors

Pain etiology and co-existing conditions

Pain etiology and comorbid conditions influenced physicians' prescribing practices. In 2 studies,[44,47] over 90% endorsed not prescribing to patients with a substance abuse history, and 60% to 81% reported reviewing the patient's history for a substance abuse disorder prior to prescribing opioids.[50] The majority of physicians were more likely to prescribe opioids to patients with cancer-related pain compared to individuals with chronic nonmalignant pain.[48,49] In one study, 62% of physicians did not prescribe opioids for fibromyalgia and 49% did not prescribe opioids for chronic headache.[49]

Patient satisfaction

Although 74% of physicians in a national survey reported that pain management was a priority, 62% were concerned about "disagreement" with patients about opioids.[35] In a study from a Veterans Affairs hospital, the majority of physicians reported concerns that lowering opioid doses would upset patients.[31] In a single study, other physician perceived barriers to chronic pain management included patient reluctance to make lifestyle changes (88%), financial burden for the patient (73%), and lack of patient transportation (57%).[45]

Practice environment

Regulatory scrutiny

Varying levels of concern about regulatory scrutiny were reported to influence prescribing practices. For example, 53–68% of participants in 3 studies based on state level data from Ohio,[45] West Virginia,[44] and Wisconsin[47] reported that regulatory concerns influenced opioid prescribing practices. Alternatively, in 2 studies[35,41] based on national samples, 16–32% reported that potential regulatory scrutiny influenced prescribing practices.

Clinical resources

In 2 studies, 78–85% of physicians reported that access to a pain specialist would be helpful.[32,33] Lack of access to pain specialists was identified as a barrier to chronic pain management by 53–78% physicians in 3 studies.[35,37,45] The use of clinical guidelines and standardized approaches to manage opioids varied. In a 2013 study,[37] 26% reported lack of agreement among physicians and clinic staff regarding prescription of opioids for chronic pain. However, 100% of physicians (n=48) working at a Veterans Affairs hospital agreed that it was important to have a consistent standard for prescribing opioids.[31] In 2 studies, 56–68% reported that opioid prescribing policies, guidelines, algorithms or an opioid tracking system were available in their clinical setting.[33,48] The presence of a clinical system to track patients using opioids was associated with a 2.5 greater odds of performing UDS.[48] Managing chronic pain was considered time consuming by 89% of physicians in a single study from West Virginia,[44] and in a study from Texas, 65% reported that prescribing continuous release opioids lengthened clinic visits.[36] In one study, 21% of participants reported that time constraints and limited staff support was the greatest barrier affecting implementation of patient-provider agreements.[34]

The main findings of this systematic review are summarized in Figure 2 which highlight physician views on chronic pain and opioids.

Discussion

This systematic review provides clinically relevant information and views of physicians who manage and prescribe

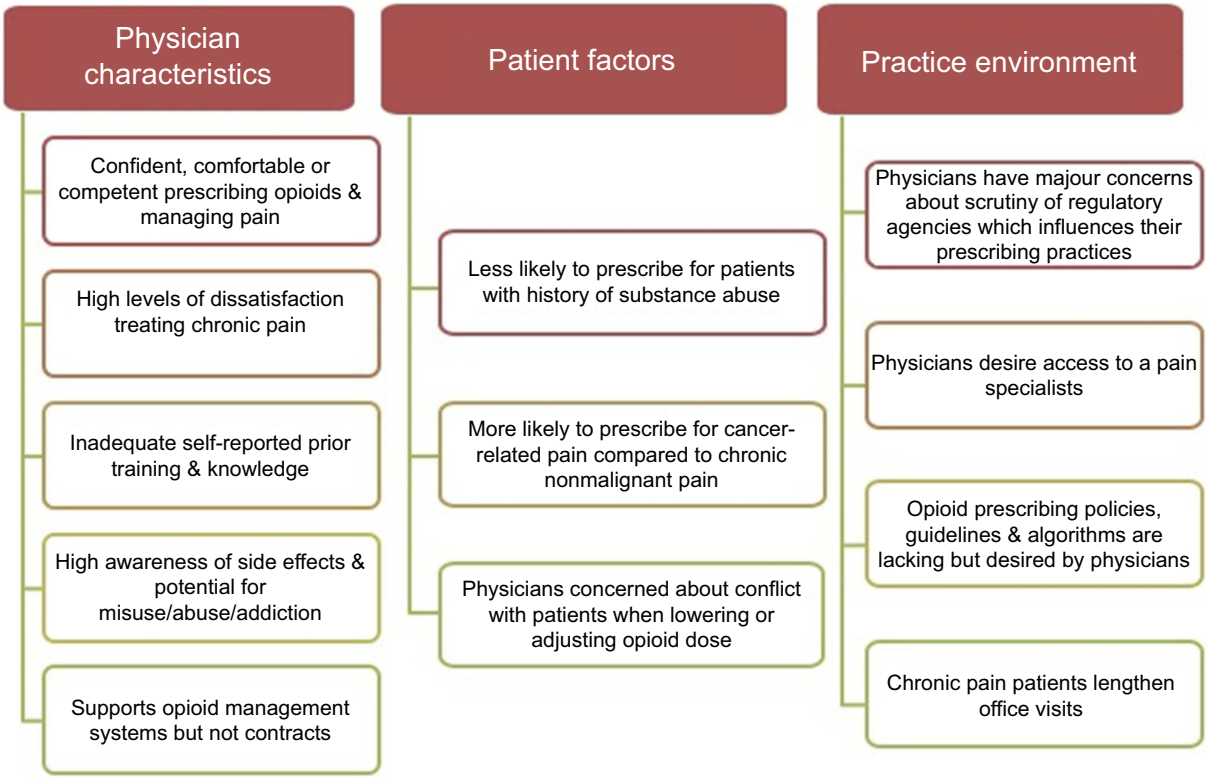

Figure 2 Factors associated with prescribing opioids for chronic pain (reported by >50% of physicians).

opioids for chronic pain. Many physicians reported feeling at least somewhat confident or competent prescribing opioids and managing pain. In two studies,[25,40] over 80% of respondents reported feeling confident and competent, while a much smaller proportion (19–52%) reported satisfaction treating pain and prescribing opioids. Further research is needed to elucidate how this dissatisfaction affects provider practices (eg prescriptions, care plans, communication, referrals) and to develop interventions to improve provider satisfaction treating chronic pain.

Inadequate training in pain management and opioids was also identified. For example, despite 51–70% of physicians reporting previous training in pain management and opioid prescribing, 54% reported that previous training was inadequate and only 43% reported having good to excellent knowledge about pain management. Other reports describing the associations between physician confidence and training in pain management and opioid prescribing have been mixed. These studies were not included in the systematic review because they included resident physicians and non-physician clinicians. In a study where the Opioid Therapy Provider Survey was completed by a mixed group of 69 clinicians (physicians =56%) attending a pain and opioid focused CME course, clinician confidence in managing chronic pain was not associated with previous training in pain management or mandated opioid-related CME.[52] However, in a study that involved 572 primary care physicians and residents-in-training, the intensity of post-residency education about pain management was associated with greater levels of comfort managing chronic pain.[53]

Our findings suggest that despite perceived confidence, physicians could benefit from ongoing education and training about pain management and opioid prescribing. While one study reported a need for further training in addiction,[27] most of the studies in this review did not ask participants about the type of training needed. Because some of the findings suggest good knowledge about adverse events of opioids, additional research is needed to understand the specific training physicians would find beneficial. One study found that the number of CME hours correlated with greater levels of confidence in treating chronic pain.[41] Given this finding, voluntary participation in CME activities may be one approach to delivering ongoing pain-related education. The intensity of CME activity may need to be tailored to successfully meet the diverse expectations of individual physicians.

In addition to inherent prescriber characteristics, the results describe several patient and environmental factors

that affect the physician. Patient diagnosis and patient satisfaction may play a role in physician decision to prescribe opioids. Physicians were more likely to prescribe opioids to patients with cancer than those with nonmalignant chronic pain. These provider views are in line with recent Centers for Disease Control and Prevention (CDC) guidelines that recommend opioids should be avoided for treatment of nonmalignant chronic pain when possible.[54] However, the two studies with these findings were published in 2006 and 2011, well before publication of the 2016 CDC guidelines.[38,39] Further exploration is needed to understand how physicians perceive pain related to the patient's diagnosis and whether these perceptions affect care management.

Physicians also reported that concern about regulatory scrutiny and limited resources influenced opioid prescribing practices. Regulatory scrutiny was found to negatively affect opioid prescribing. As regulatory oversight expands with the current opioid epidemic, it is important to understand the intended and unintended consequences on physician behavior.

This review found some factors which were directly reported to affect opioid prescribing but not to the extent anticipated in our original hypothesis. While we suspect that other physician-related factors affect opioid prescribing, more research is needed to specifically examine prescribing patterns of physicians by looking at actual prescription data. Although our conceptual framework was developed to better understand UPOU, the results of this review, which were centered around long-term opioid therapy, could be used to refine key components of the framework (Figure 2).

This review has limitations. The literature search strategy was limited to studies comprised of practicing physicians; thus, the study findings may not represent the opioid prescribing practices of resident physicians or non-physician clinicians. The majority of physician participants were white men greater than 40 years of age who had been in clinical practice greater than 15 years and self-identified as residing in urban areas. Therefore, the findings may not be generalizable beyond the sociodemographic parameters of the study participants. The median response rate to the various surveys was 35% and 3 studies did not report a response rate. The methodological quality of all studies was low. As a result, the study findings may not be fully representative of the opioid prescribing practices of all physicians targeted for recruitment in the 22 studies identified in our literature search. The majority of surveys used in the identified studies were not validated which could jeopardize the accuracy and reproducibility of individual study results. Similarly, the characteristics of physician prescribing practices were assessed and described using a variety of methods, which limited the ability to consistently compare outcomes across studies. Finally, although heroin and illicitly manufactured fentanyl are important public health problems,[4] investigating the potential relationships between prescriber characteristics and individual use of illicitly acquired opioids are beyond the scope of this review.

In summary, this systematic review leveraged a conceptual framework to investigate the characteristics of physicians who prescribe long-term opioid therapy for chronic pain. The long-term goal of this area of research is to develop, test, and deploy interventions to mitigate the risks of long-term opioid use. The summary data from this systematic review provides the foundation for the development of prospective studies aimed at further elucidating the constellation of mechanisms that influence physicians who manage pain and prescribe opioids. It is anticipated that the outcomes of future studies will reveal the need for a range of time-dependent interventions to effectively attenuate the various clinician factors that contribute to long-term opioid use.

Disclosure

The authors report no conflicts of interest in this study.

References

1. Califf RM, Woodcock J, Ostroff S. A proactive response to prescription opioid abuse. *N Engl J Med*. 2016;374:1480–1485. doi:10.1056/NEJMsr1601307
2. Guy GP Jr., Zhang K, Bohm MK, et al. Vital signs: changes in opioid prescribing in the United States, 2006–2015. *MMWR Morb Mortal Wkly Rep*. 2017;66:697–704. doi:10.15585/mmwr.mm6626a4
3. Jeffery MM, Hooten WM, Henk HJ, et al. Trends in opioid use in commercially insured and medicare advantage populations in 2007–16: retrospective cohort study. *BMJ*. 2018;362:k2833. doi:10.1136/bmj.k2833
4. Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. Drug and opioid-involved overdose deaths - United States, 2013–2017. *MMWR Morb Mortal Wkly Rep*. 2018;67:1419–1427. doi:10.15585/mmwr.mm675152e1
5. Chang HY, Lyapustina T, Rutkow L, et al. Impact of prescription drug monitoring programs and pill mill laws on high-risk opioid prescribers: A comparative interrupted time series analysis. *Drug Alcohol Depend*. 2016;165:1–8. doi:10.1016/j.drugalcdep.2016.04.033
6. Substance Abuse and Mental Health Services Administration. Substance Misuse Prevention Media Campaigns. Available from: https://www.samhsa.gov/capt/tools-learning-resources/prevention-media-campaigns Accessed February 10, 2017.
7. Hooten WM, St Sauver JL, McGree ME, Jacobson DJ, Warner DO. Incidence and risk factors for progression from short-term to episodic or long-term opioid prescribing: A population-based study. *Mayo Clin Proc*. 2015;90:850–856. doi:10.1016/j.mayocp.2015.04.012

8. Callinan CE, Neuman MD, Lacy KE, Gabison C, Ashburn MA. The initiation of chronic opioids: a survey of chronic pain patients characterizing chronic opioid use. *J Pain*. 2017;18:360–365.
9. Stumbo SP, Yarborough BJH, McCarty D, Weisner C, Green CA. Patient-reported pathways to opioid use disorders and pain-related barriers to treatment engagement. *J Subst Abuse Treat*. 2017;73:47–54. doi:10.1016/j.jsat.2016.11.003
10. Deyo RA, Hallvik SE, Hildebran C, et al. Association between initial opioid prescribing patterns and subsequent long-term use among opioid-naive patients: a statewide retrospective cohort study. *J Gen Intern Med*. 2017;32:21–27. doi:10.1007/s11606-016-3810-3
11. Alam A, Gomes T, Zheng H, Mamdani MM, Juurlink DN, Bell CM. Long-term analgesic use after low-risk surgery: a retrospective cohort study. *Arch Intern Med*. 2012;172:425–430. doi:10.1001/archinternmed.2011.1827
12. Clarke H, Soneji N, Ko DT, Yun L, Wijeysundera DN. Rates and risk factors for prolonged opioid use after major surgery: population based cohort study. *BMJ*. 2014;348:g1251. doi:10.1136/bmj.g1251
13. Sun EC, Darnall BD, Baker LC, Mackey S. Incidence of and risk factors for chronic opioid use among opioid-naive patients in the postoperative period. *JAMA Intern Med*. 2016;176:1286–1293. doi:10.1001/jamainternmed.2016.3298
14. Shah A, Hayes CJ, Martin BC. Characteristics of initial prescription episodes and likelihood of long-term opioid use - United States, 2006–2015. *MMWR Morb Mortal Wkly Rep*. 2017;66:265–269. doi:10.15585/mmwr.mm6610a1
15. Barnett ML, Olenski AR, Jena AB. Opioid-prescribing patterns of emergency physicians and risk of long-term use. *N Engl J Med*. 2017;376:663–673. doi:10.1056/NEJMsa1610524
16. Brummett CM, Waljee JF, Goesling J, et al. New persistent opioid use after minor and major surgical procedures in US adults. *JAMA Surg*. 2017;152:e170504. doi:10.1001/jamasurg.2017.0504
17. Hooten WM, Brummett CM, Sullivan MD, et al. A conceptual framework for understanding unintended prolonged opioid use. *Mayo Clin Proc*. 2017. doi:10.1016/j.mayocp.2017.10.010
18. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ*. 2009;339:b2535. doi:10.1136/bmj.b2651
19. Wells GA, Shea B, O'Connell D, et al. *The Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Nonrandomised Studies in Meta-analyses*. Ottawa, ON: Ottawa Hospital Research Institute; 2011. Available from: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp. Accessed May 1, 2018.
20. Brady JE, Giglio R, Keyes KM, DiMaggio C, Li G. Risk markers for fatal and non-fatal prescription drug overdose: a meta-analysis. *Inj Epidemiol*. 2017;4:24. doi:10.1186/s40621-017-0118-7
21. Herzog R, Alvarez-Pasquin MJ, Diaz C, Del Barrio JL, Estrada JM, Gil A. Are healthcare workers' intentions to vaccinate related to their knowledge, beliefs and attitudes? A systematic review. *BMC Public Health*. 2013;13:154. doi:10.1186/1471-2458-13-154
22. Patra J, Bhatia M, Suraweera W, et al. Exposure to second-hand smoke and the risk of tuberculosis in children and adults: a systematic review and meta-analysis of 18 observational studies. *PLoS Med*. 2015;12:e1001835;. discussion e1001835. doi:10.1371/journal.pmed.1001809
23. Wong G, Greenhalgh T, Westhort G, Pawson R. Development of methodological guidance, publication standards and training materials for realist and meta-narrative reviews: the RAMESES (Realist And Meta-narrative Evidence Syntheses - Evoling Standards) project. *Health Serv Deliv Res*. 2014;2:1–278. doi:10.1177/1742395313476901
24. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O, Peacock R. Storylines of research in diffusion of innovation: a meta-narrative approach to systematic review. *Soc Sci Med*. 2005;61:417–430. doi:10.1016/j.socscimed.2004.12.001
25. MacNeela P, Doyle C, O'Gorman D, Ruane N, McGuire BE. Experiences of chronic low back pain: a meta-ethnography of qualitative research. *Health Psychol Rev*. 2015;9:63–82. doi:10.1080/17437199.2013.840951
26. Sim J, Madden S. Illness experience in fibromyalgia syndrome: a metasynthesis of qualitative studies. *Soc Sci Med*. 2008;67:57–67. doi:10.1016/j.socscimed.2008.03.003
27. Snelgrove S, Liossi C. Living with chronic low back pain: a metasynthesis of qualitative research. *Chronic Illn*. 2013;9:283–301. doi:10.1177/1742395313476901
28. Toye F, Seers K, Allcock N, et al. Patients' experiences of chronic non-malignant musculoskeletal pain: a qualitative systematic review. *Br J Gen Pract*. 2013;63:e829–e841. doi:10.3399/bjgp13X675412
29. Wong AYL, Forss KS, Jakobsson J, Schoeb V, Kumlien C, Borglin G. Older adult's experience of chronic low back pain and its implications on their daily life: study protocol of a systematic review of qualitative research. *Syst Rev*. 2018;7:81. doi:10.1186/s13643-018-0742-5
30. Donovan AK, Wood GJ, Rubio DM, Day HD, Spagnoletti CL. Faculty communication knowledge, attitudes, and skills around chronic non-malignant pain improve with online training. *Pain Med*. 2016;17:1985–1992. doi:10.1093/pm/pnw029
31. Westanmo A, Marshall P, Jones E, Burns K, Krebs EE. Opioid dose reduction in a VA health care system-implementation of a primary care population-level initiative. *Pain Med*. 2015;16:1019–1026. doi:10.1111/pme.12699
32. Duensing L, Eksterowicz N, Macario A, Brown M, Stern L, Ogbonnaya A. Patient and physician perceptions of treatment of moderate-to-severe chronic pain with oral opioids. *Curr Med Res Opin*. 2010;26:1579–1585. doi:10.1185/03007991003783747
33. Franklin GM, Fulton-Kehoe D, Turner JA, Sullivan MD, Wickizer TM. Changes in opioid prescribing for chronic pain in Washington State. *J Am Board Fam Med*. 2013;26:394–400. doi:10.3122/jabfm.2013.04.120274
34. Kraus CN, Baldwin AT, Curro FA, McAllister RG. Clinical implications of patient-provider agreements in opioid prescribing. *Curr Drug Saf*. 2015;10:159–164.
35. Macerollo AA, Mack DO, Oza R, Bennett IM, Wallace LS. Academic family medicine physicians' confidence and comfort with opioid analgesic prescribing for patients with chronic nonmalignant pain. *J Opioid Manag*. 2014;10:255–261. doi:10.5055/jom.2014.0213
36. Nwokeji ED, Rascati KL, Brown CM, Eisenberg A. Influences of attitudes on family physicians' willingness to prescribe long-acting opioid analgesics for patients with chronic nonmalignant pain. *Clin Ther*. 2007;29(Suppl):2589–2602. doi:10.1016/j.clinthera.2007.12.007
37. Porucznik CA, Johnson EM, Rolfs RT, Sauer BC. Opioid prescribing knowledge and practices: provider survey following promulgation of guidelines-Utah, 2011. *J Opioid Manag*. 2013;9:217–224. doi:10.5055/jom.2013.0162
38. Slevin KA, Ashburn MA. Primary care physician opinion survey on FDA opioid risk evaluation and mitigation strategies. *J Opioid Manag*. 2011;7:109–115.
39. Turk DC, Dansie EJ, Wilson HD, Moskovitz B, Kim M. Physicians' beliefs and likelihood of prescribing opioid tamper-resistant formulations for chronic noncancer pain patients. *Pain Med*. 2014;15:625–636. doi:10.1111/pme.12352
40. Wilson HD, Dansie EJ, Kim MS, Moskovitz BL, Chow W, Turk DC. Clinicians' attitudes and beliefs about opioids survey (CAOS): instrument development and results of a national physician survey. *J Pain*. 2013;14:613–627. doi:10.1016/j.jpain.2013.01.769
41. Breuer B, Cruciani R, Portenoy RK. Pain management by primary care physicians, pain physicians, chiropractors, and acupuncturists: a national survey. *South Med J*. 2010;103:738–747. doi:10.1097/SMJ.0b013e3181e74ede

42. Green CR, Wheeler JR, Marchant B, LaPorte F, Guerrero E. Analysis of the physician variable in pain management. *Pain Med*. 2001;2:317–327. doi:10.1046/j.1526-4637.2001.01045.x
43. Nishimori M, Kulich RJ, Carwood CM, Okoye V, Kalso E, Ballantyne JC. Successful and unsuccessful outcomes with long-term opioid therapy: a survey of physicians' opinions. *J Palliat Med*. 2006;9:50–56. doi:10.1089/jpm.2006.9.50
44. Ponte CD, Johnson-Tribino J. Attitudes and knowledge about pain: an assessment of West Virginia family physicians. *Fam Med*. 2005;37:477–480.
45. Remster EN, Marx TL. Barriers to managing chronic pain: perspectives of Appalachian providers. *Osteopathic Family Physician*. 2011;3:141–148. doi:10.1016/j.osfp.2010.07.003
46. Turk DC, Brody MC, Okifuji EA. Physicians' attitudes and practices regarding the long-term prescribing of opioids for non-cancer pain. *Pain*. 1994;59:201–208.
47. Wolfert MZ, Gilson AM, Dahl JL, Cleary JF. Opioid analgesics for pain control: wisconsin physicians' knowledge, beliefs, attitudes, and prescribing practices. *Pain Med*. 2010;11:425–434. doi:10.1111/j.1526-4637.2009.00761.x
48. Bhamb B, Brown D, Hariharan J, Anderson J, Balousek S, Fleming MF. Survey of select practice behaviors by primary care physicians on the use of opioids for chronic pain. *Curr Med Res Opin*. 2006;22:1859–1865. doi:10.1185/030079906X132398
49. Chen L, Houghton M, Seefeld L, Malarick C, Mao J. Opioid therapy for chronic pain: physicians' attitude and current practice patterns. *J Opioid Manag*. 2011;7:267–276.
50. Howell D, Kaplan L. Statewide survey of healthcare professionals: management of patients with chronic noncancer pain. *J Addict Nurs*. 2015;26:86–92. doi:10.1097/JAN.0000000000000075
51. Hwang CS, Turner LW, Kruszewski SP, Kolodny A, Alexander GC. Primary care physicians' knowledge and attitudes regarding prescription opioid abuse and diversion. *Clin J Pain*. 2016;32:279–284. doi:10.1097/AJP.0000000000000268
52. Pearson AC, Moman RN, Moeschler SM, Eldrige JS, Hooten WM. Provider confidence in opioid prescribing and chronic pain management: results of the opioid therapy provider survey. *J Pain Res*. 2017;10:1395–1400. doi:10.2147/JPR.S136478
53. O'Rorke JE, Chen I, Genao I, Panda M, Cykert S. Physicians' comfort in caring for patients with chronic nonmalignant pain. *Am J Med Sci*. 2007;333:93–100.
54. Dowell D, Haegerich TM, Chou R. CDC guideline for prescribing opioids for chronic pain–United States, 2016. *JAMA*. 2016;315:1624–1645. doi:10.1001/jama.2016.1464