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Association of clinical competence, specialty and physician country of origin with opioid prescribing for chronic pain: a cohort study

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ABSTRACT

Background Although little is known about why opioid prescribing practices differ between physicians, clinical competence, specialty training and country of origin may play a role. We hypothesised that physicians with stronger clinical competence and communication skills are less likely to prescribe opioids and prescribe lower doses, as do medical specialists and physicians from Asia.

Methods Opioid prescribing practices were examined among international medical graduates (IMGs) licensed to practise in the USA who evaluated Medicare patients for chronic pain problems in 2014–2015. Clinical competence was assessed by the Educational Commission for Foreign Medical Graduates (ECFMG) Clinical Skills Assessment. Physicians in the ECFMG database were linked to the American Medical Association Masterfile. Patients evaluated for chronic pain were obtained by linkage to Medicare outpatient and prescription files. Opioid prescribing was measured within 90 days of evaluation visits. Prescribed dose was measured using morphine milligram equivalents (MMEs). Generalised estimating equation logistic and linear regression estimated the association of clinical competence, specialty, and country of origin with opioid prescribing and dose.

Results 7373 IMGs evaluated 65 012 patients for chronic pain; 15.2% received an opioid prescription. Increased clinical competence was associated with reduced opioid prescribing, but only among female physicians. For every 10% increase in the clinical competence score, the odds of prescribing an opioid decreased by 16% for female physicians (OR 0.84, 95% CI 0.75 to 0.94) but not male physicians (OR 0.99, 95% CI 0.92 to 1.07). Country of origin was associated with prescribed opioid dose; US and Canadian citizens prescribed higher doses (adjusted MME difference +3.56). Primary care physicians were more likely to prescribe opioids, but surgical and hospital-based specialists prescribed higher doses.

Conclusions Clinical competence at entry into US graduate training, physician gender, specialty and country of origin play a role in opioid prescribing practices.

INTRODUCTION

The USA is in the midst of an opioid epidemic, with the highest rate of opioid consumption in the world.[1–4] Initially fuelled by a threefold increase in opioid prescribing rates from 1990 to 2012,[5] physicians and state regulatory authorities responded by lowering both prescribing rates and quantities.[6–8] Of interest, although the monthly incidence of new opioid prescriptions fell by 54% by 2017, along with the number of prescribing physicians, the subgroup of physicians who continued to prescribe opioids were more likely to initiate opioid therapy at higher doses and for longer duration.[9]

Little is known about why opioid prescribing practices vary among physicians. A recent study noted that surgeons with less experience were more likely to prescribe higher opioid doses,[10] which may be related to the common complaint that current training programmes do not provide sufficient education in pain management.[11] The finding that physicians graduating from the top 10 medical schools in the USA were less likely to prescribe opioids strengthens the possibility that differences in training and clinical decision-making may be contributing to varying opioid prescribing practices.[12] An intriguing study of dentists in the USA and UK found a 37-fold difference in opioid prescribing following dental procedures: 0.05% among UK dentists compared with 3.5% among US dentists.[13] An international study of common low-risk surgical procedures also showed striking differences, with 91% of patients in the USA receiving postoperative opioid prescriptions vs 5% of patients not in the USA.[14] While these differences may be due to training, there is also the possibility of differences in cultural expectations for pain management. It has been noted that

the creation of pain as the fifth vital sign in the USA promoted an expectation that all pain was to be eliminated.[15 16] In contrast, in countries such as Japan, the Philippines and England, stoicism toward pain is both valued and expected.[17–21]

We had a unique opportunity to evaluate the contribution of clinical competence, country of origin, training location and specialty to opioid prescribing for chronic non-cancer pain. We examined opioid prescribing in a cohort of international medical graduates (IMGs) from over 700 medical schools and 100 countries who were licensed to practise in the USA after passing the required Clinical Skills Assessment (CSA) examination.[22] We evaluated opioid prescribing practices in the period after 2012, when stricter controls were implemented to restrict opioid prescribing, with the aim of identifying the characteristics of physicians who continued to prescribe to opioids for non-cancer-related chronic pain and at higher doses. Prior research on performance-based examinations has shown that examination scores are associated with quality of care even after 12 years in practice.[23–25] We hypothesised that physicians with stronger clinical and communication skills are less likely to prescribe opioids and prescribed them at lower doses, as do medical specialists and physicians from Asia, associations that may be modified by physician age and gender due to differing practice characteristics.[26–31]

METHODS

Design

IMGs who completed the Educational Commission for Foreign Medical Graduates (ECFMG) CSA between 1998 and 2004 and saw one or more US Medicare patients for common chronic pain conditions in 2014–2015 were assessed with respect to use of opioids for pain management.

Physician population

Physicians were eligible if they were licensed to practise in at least one jurisdiction in the USA, were in active practice, billed the Centre for Medicare and Medicaid Services (CMS) for at least one patient in 2014–2015, and conducted an evaluation in an ambulatory setting of patient(s) they diagnosed as having a common chronic pain problem. Physicians identified in ECFMG CSA examination files were linked to the American Medical Association (AMA) Physician Masterfile by first and last name, sex, and date of birth and then to the National Plan and Provider Enumeration System to obtain National Provider Identifiers (NPIs), specialty, type of practice and current location. Once linked, nominal data were deleted to protect confidentiality. Physician NPIs were sent to the CMS, who identified all patients seen by these physicians in 2014–2015 in the Medicare Carrier RIF file, inpatient files, outpatient file and Part D files, and then all services provided to these patients by any health professional.

Patient population

Opioids are generally not recommended for chronic non-cancer pain,[32–34] of which the most common problems are back and neck pain,[35–37] migraine/headache,[36 37] osteoarthritis or rheumatoid arthritis,[35–37] and neuropathic-related pain disorders.[35 37] To assess opioid prescribing practices, we assembled all patients who had one of these pain problems. To be included, patients had to have had an ambulatory evaluation visit with a study physician between June 2014 and September 2015 for which the physician submitted a billing diagnosis for one of the respective pain conditions, and been covered during this period in the Medicare Part D drug insurance programme. We excluded inpatients, visits for procedure-related treatments and consultation visits as the respective physician may not have provided ongoing management for the patient's condition. We also excluded patients who had received an opioid prescription from another physician in the 6 months prior to the evaluation visit, and those covered by CMS for end-stage renal failure. Previously validated International Classification of Disease versions 9–10 Clinical Modification codes were used to identify each common chronic pain problem[38] (online supplemental etable 1). If patients saw multiple study physicians, only the visit with the first physician was included.

Clinical competence

The CSA examination administered by the ECFMG between 1998 and 2004 was used as a measure of clinical competence. Modelled after the Canadian national standardised clinical licensing examination,[22 39 40] it was put in place to ensure that all IMGs could demonstrate a level of clinical skills necessary for entry into US graduate medical education programmes. In 2004, it was transferred to the National Board of Medical Examiners as USMLE Step 2 Clinical Skills, and became a requirement for medical licensure for graduates of all US and foreign medical schools.[40–42] The CSA consisted of 10 or 11 modelled encounters between the candidate and a standardised patient. An overall clinical competence score was given based on history taken and physical examination conducted in these encounters and each candidate's diagnosis and management plan as written in a post-encounter clinical note. Candidates' interpersonal skills were assessed in each encounter by the standardised patient, as was their spoken English proficiency. Ratings from each encounter were pooled to form a doctor–patient communication composite (COM) score. Acceptable clinical competence and COM scores were both required to pass the examination. First time scores and the

number of attempts to pass the examination were assessed in relationship to opioid prescribing.

Country of origin and training location

While there is no direct measure of cultural expectations for pain management, we anticipated that a physician's country of origin and/or location of training may reflect these expectations. We measured geographical location of medical training, as well as citizenship at the time of training. Training location was categorised as Asia, Europe, India/Pakistan, the Middle East, Central, South America and the Caribbean, and other. Citizenship was categorised as Asia, Europe, India/Pakistan, Middle East, USA/Canada and other, and was documented at the time of medical school entry.

Specialty

Certain specialties, namely primary care physicians, orthopaedic surgeons, pain specialists and emergency medicine physicians, are more likely to prescribe opioids,[43–46] possibly due to patient mix. Specialty designation retrieved from the National Plan and Provider Enumeration System was grouped into the following categories based on the CMS classification (online supplemental etable 2): primary care, internal medicine, medical specialty, surgical specialty, hospital-based specialty and other. While internal medicine is often included in primary care, a large number of physicians in the cohort were trained in general practice, family medicine and internal medicine; and as differences in quality of care have been documented for internal medicine physicians compared with other primary care physicians, we kept these groups separate.[47–51]

Opioid prescribing practices

At the patient level, we measured whether an opioid had been prescribed by the study physician, defined as a dispensing of an opioid prescribed by the study physician within 90 days of the evaluation visit. Opioids included buprenorphine, codeine, fentanyl, hydrocodone, hydromorphone, meperidine, morphine, oxycodone, oxymorphone, pentazocine and tramadol. Opioid prescribing guidelines for chronic non-cancer pain indicate that an opioid may be appropriate if non-opioid analgesics and/or physiotherapy/chiropractic treatment has failed.[33 34 52 53] We used prescription drug event files and claims from institutional (outpatient) and non-institutional providers to measure whether patients had received a dispensed prescription for non-steroidal anti-inflammatory drugs (Anatomic Therapeutic Classification M01A) or physiotherapy/chiropractic treatment prior to the opioid prescription, and adjusted for this in the analysis. Among patients prescribed an opioid, we measured the prescribed daily dose using morphine milligram equivalents (MMEs) to enable comparisons among opioids. MME/day was defined as the prescribed daily dose multiplied by the equivalent analgesic ratio of the opioid type as specified by the Centre for Disease Control and Prevention.[54]

Physician and patient covariates

As male physicians and younger physicians are more likely to prescribe opioids,[55–58] we adjusted for these characteristics using demographic information from the ECFMG database. We also adjusted for the US census classification for practice region (South, West, Northeast, Midwest), as higher rates of opioid use are noted in southern US regions.[46 59]

To address potential differences in case mix between physicians that may influence opioid prescribing, we measured patient sex, age and type of medicare plan (65 years and older or CMS disability coverage). To account for differences in severity and complexity of patients' conditions, we measured whether there was an emergency department (ED) visit or hospitalisation in the 6 months prior to the evaluation visit, the presence of the 30 conditions included in the Elixhauser Comorbidity Index, the type of pain problem, and whether the evaluation visit occurred in the ED or an office/clinic setting.[60–64] To determine patients' probabilities of receiving an opioid prescription based on their characteristics, we estimated the association between patient characteristics and the likelihood of receiving an opioid prescription using logistic regression within a generalised estimating equation (GEE) framework to account for clustering by physician. OR estimates for each characteristic were used to create a probability of receiving an opioid score for each patient. The same approach with multiple linear GEE regression was used to estimate MME dose among patients prescribed an opioid.

Analysis

Descriptive statistics were used to summarise physician and patient characteristics. To estimate the association of clinical competence, citizenship, training location and specialty with the risk of opioid prescribing, we used GEE logistic regression. Patient was the unit of analysis and physicians were the clustering factor, accounted for using an exchangeable correlation coefficient. Each CSA score (clinical competence, communication) and its respective subscores (history and physical examination, diagnosis and management, interpersonal skills, English proficiency) were fit in a separate model as a continuous variable, with citizenship included as dummy variables using Asia as the reference category, as it was one of the largest groups and enabled more stable estimates. As citizenship and medical school location were highly correlated (ie, collinear), we could not estimate the independent contribution of each to the outcome. Therefore, we assessed which one was the better predictor of opioid prescribing, using the penalised quasi-likelihood under the independence

model criterion to determine the best fitting model. We also included a binary indicator representing whether the physician passed their first examination attempt. All models were adjusted for physician age and gender, location and region of practice, whether physiotherapy/chiropractic services or non-steroidal anti-inflammatory drugs had been provided prior to an opioid dispensation, and the patient's probability of receiving an opioid prescription. As there are known differences in practice patterns of male and female physicians and younger and older physicians,[55–58] we assessed whether the impact of clinical competence or country of origin/medical school location on opioid prescribing was modified by physician gender or age by fitting the respective two-way interaction terms. The same approach with dose modelled as a continuous variable using multiple linear GEE regression was used for the investigation of physician characteristics and opioid dose, among patients who received an opioid prescription. To facilitate interpretation of findings for clinical competence, we plotted the probability of opioid prescribing and predicted dose, and 95% CIs, per 10% increase in clinical competence, based on the models. The potential impact of multiple comparisons was assessed using the Bonferroni correction. All analyses were done using SAS V.9.4.

RESULTS

Overall, 7373 IMGs passed the ECFMG CSA, achieved ECFMG certification, received a license to practise in the USA and billed an evaluation visit for at least one patient with a common chronic pain problem in an ambulatory setting in 2014–2015. Of the 32 886 physicians who took the CSA examination, 20.5% were not linked to the AMA file either because they did not apply for a license to practise or could not be linked. Compared with physicians who were found in the AMA files, the CSA scores of those not found were equivalent (linked vs not linked: mean±SD clinical competence score: 65.0±5.3 vs 65.0±5.5; communication score: 78.0±7.8 vs 77.5±7.9). Most of the 7373 study physicians were male (61.1%), with an average age of 43.5 years in 2014 (table 1). At entry into medical school, 53.4% were citizens of India/Pakistan (30.3%) or the USA/Canada (23.1%). Over one-third attended medical school in Central/South America, Mexico or the Caribbean (36.0%), 75.8% of whom were US citizens. Most physicians specialised in primary care (35.6%) or internal medicine (32.1%), and over one-third practised in the southern USA (35.8%). On the first attempt, 85.9% of physicians passed the CSA. The overall mean clinical competence score was 64.6%. The highest examination scores were in communication (78.1%) and its two component subscores, English proficiency (85.4%) and interpersonal skills (76.5%). The lowest scores were in diagnosis and management (59.5%).

Overall, 65 012 patients were evaluated and diagnosed by study physicians with one of the four common pain problems, the most common being back, neck and/or lumbar pain (70.3%) (table 2). Of these patients, 9870 (15.2%) were prescribed and

Table 1 Characteristics of the 7373 international medical graduate physicians who billed Medicare for an evaluation visit in an ambulatory setting for patients with common chronic pain problems

Characteristic	Number	%	Characteristic	Number	%
Physician gender			Internal medicine	2364	32.1
Female	2867	39.0	Medical specialty	951	12.9
Male	4506	61.0	Surgery specialty	326	4.4
Citizenship			Hospital-based specialty	644	8.7
Asia	948	12.9	Emergency medicine	464	6.3
Europe	840	11.4	Region of practice		
India and Pakistan	2233	30.3	Northeast	1727	23.4
Middle East	610	8.3	Midwest	1511	20.5
Other	1036	14.0	South	2641	35.8
USA and Canada	1706	23.1	West	1494	20.3
Medical school location			Clinical Skills Assessment proficiency	**Mean**	**SD**
Asia	755	10.2	Passed assessment on first attempt	6330	85.85
Europe	978	13.3	Physician age	43.5	5.5
India and Pakistan	2018	27.4		**Mean**	**SD (range)**
Middle East	506	6.9	Clinical competence score	64.6	5.4 (37–85)
Central America/Caribbean/Mexico/ South America	2667	36.0	History and physical examination	68.1	6.8 (35–89)
Other	449	6.1	Diagnosis and management	59.5	9.5 (22–95)
Physician specialty			Communication	78.1	8.1 (40–98)
Primary care	2624	35.6	English proficiency	85.4	14.5 (29.5–100)
			Interpersonal skills	76.5	7.8 (44–100)

Table 2 The association between patient characteristics and the odds of being prescribed an opioid and the morphine milligram equivalent (MME) dose of opioid prescribed

	Odds of prescribing an opioid for the 65 012 patients				MME opioid dose prescribed for the 9870 patients who received an opioid prescription			
Characteristic	N patients (%)	N patients with opioid (%)	OR (95% CI)	P value	N patients (%)	Mean (SD)	Estimated difference (95% CI)	P value
Type of chronic pain problem								
Migraine, headache	7348 (11.3)	509 (6.9)	0.3 (0.30 to 0.36)	**<0.001**	509 (5.2)	22.5 (15.2)	−3.6 (−5.2 to −2.0)	**<0.001**
Neuropathic pain disorders	4682 (7.2)	513 (11.0)	0.6 (0.49 to 0.61)	**<0.001**	513 (5.2)	38.1 (54.2)	10.4 (2.8 to 18.1)	**0.007**
Osteo-rheumatoid pain	7253 (11.2)	449 (6.2)	0.4 (0.35 to 0.46)	**<0.001**	449 (4.5)	21.9 (28.1)	−2.5 (−5.3 to 0.3)	0.080
Back, neck lumbar pain	45 729 (70.3)	8399 (18.4)	Reference		8399 (85.1)	27.3 (36.2)	Reference	
Sex								
Female	42 644 (65.6)	6203 (14.5)	Reference		6203 (62.8)	25.9 (33.4)	Reference	
Male	22 368 (34.4)	3667 (16.4)	1.0 (0.97 to 1.06)	0.506	3667 (37.2)	30.0 (40.7)	2.3 (0.8 to 3.9)	**0.003**
Race								
Asian	2966 (4.6)	320 (10.8)	0.8 (0.72 to 0.92)	**0.001**	320 (3.2)	21.1 (27.0)	−2.6 (−6.5 to 1.3)	0.190
Black	6777 (10.4)	1081 (16.0)	0.9 (0.85 to 0.99)	0.035	1081 (11.0)	29.4 (39.2)	−5.1 (−9.3 to −0.9)	**0.017**
Hispanic	3553 (5.5)	430 (12.1)	0.8 (0.69 to 0.85)	**<0.001**	430 (4.4)	23.4 (36.5)	−3.5 (−6.8 to −0.3)	0.032
North American Native	228 (0.4)	36 (15.8)	0.9 (0.64 to 1.35)	0.695	36 (0.4)	29.6 (58.5)	2.6 (−13.2 to 18.4)	0.745
Other race	2542 (3.9)	301 (11.8)	0.8 (0.72 to 0.90)	**<0.001**	301 (3.0)	23.3 (25.6)	−3.1 (−6.7 to 0.5)	0.090
White	48 946 (75.3)	7702 (15.7)	Reference		7702 (78.0)	27.8 (36.4)	Reference	
Insurance group								
65+	51 631 (79.4)	7395 (14.3)	Reference		7395 (74.9)	23.3 (23.6)	Reference	
Disabled	13 381 (20.6)	2475 (18.5)	1.3 (1.18 to 1.39)	**<0.001**	2475 (25.1)	39.6 (58.4)	8.2 (4.6 to 11.7)	**<0.001**
Evaluation visit was in the emergency								
Yes	4638 (7.1)	1092 (23.5)	1.7 (1.59 to 1.93)	**<0.001**	1092 (11.1)	29.1 (14.0)	5.1 (3.6 to 6.6)	**<0.001**
No	60 374 (92.9)	8778 (14.5)	Reference		8778 (88.9)	27.2 (38.2)	Reference	
Acute care in the 6 months pre-evaluation								
Emergency department visit	19 379 (29.8)	2996 (15.5)	1.0 (0.92 to 1.02)	0.262	2996 (30.4)	26.9 (35.7)	−0.6 (−2.4 to 1.2)	0.528
No emergency department visit	45 633 (70.2)	6874 (15.1)	Reference		6874 (69.6)	27.6 (36.6)	Reference	
Hospitalisation	7630 (11.7)	1202 (15.8)	1.1 (1.05 to 1.22)	**0.002**	1202 (12.2)	28.1 (35.1)	5.3 (2.8 to 7.7)	**<0.001**
No hospitalisation	57 382 (88.3)	8668 (15.1)	Reference		8668 (87.8)	27.3 (36.5)	Reference	
Age at evaluation visit (per 10 years)			1.0 (0.98 to 1.03)	0.663			−1.6 (−2.6 to −0.5)	**0.003**
20–65 years old	16 456 (25.3)	3118 (18.9)			3118 (31.6)	38.6 (56.0)		
66–70 years old	14 807 (22.8)	2028 (13.7)			2028 (20.5)	24.6 (24.1)		
71–80 years old	20 970 (32.3)	2848 (13.6)			2848 (28.9)	22.0 (16.2)		
More than 80 years old	12 779 (19.7)	1876 (14.7)			1876 (19.0)	20.1 (20.0)		

filled an opioid prescription written by the study physician. The majority were prescribed hydrocodone (37.0%) or tramadol (34.1%) (online supplemental etable 3). Patient characteristics associated with a significantly increased risk of receiving an opioid prescription included being insured because of disability, the evaluation visit being conducted in the ED and a hospitalisation having occurred in the 6 months prior to the evaluation visit (table 2). Patients who presented with migraine, neuropathic, or arthritic pain had a significantly lower risk of receiving an opioid compared with those with back or neck pain, as were patients from any other race compared with white. Patients with pre-existing psychoses, collagen disease or neurological disorders were also less likely to receive an opioid (online supplemental etable 4). The overall mean prescribed MME dose was 27.4 (SD 36.3). Significantly higher doses were prescribed for patients with neuropathic pain disorders compared with back pain, patients who were insured because of disability, patients whose evaluation visit was in the ED and patients who were hospitalised in the past 6 months. Lower doses were prescribed to black patients and Hispanics compared with white patients, to older patients, and to patients with pre-existing chronic pulmonary disease or HIV/AIDs (table 2, online supplemental etable 4).

The association between clinical competence and opioid prescribing was significantly modified by physician gender, but not by age or citizenship. For every 10% increase in the clinical competence score, the odds of prescribing an opioid significantly decreased by 16% (OR 0.84, 95% CI 0.75 to 0.94) for female physicians but not for male physicians (OR 0.99, 95%

Table 3 The association between clinical competence scores, the odds of opioid prescribing and prescribed morphine milligram equivalent (MME) dose by physician gender per 10% increase in score

	Odds of prescribing an opioid for the 65 012 patients		MME opioid dose prescribed for the 9870 patients	
Score×gender interaction	**OR (95% CI)**	**P value**	**Estimate (95% CI)**	**P value**
Clinical competence score				
Male	0.99 (0.92 to 1.07)	0.7889	0.60 (−1.26 to 2.46)	0.5272
Female	0.84 (0.75 to 0.94)	**0.0019**	−1.37 (−3.94 to 1.20)	0.2965
History and physical examination				
Male	0.99 (0.93 to 1.05)	0.6600	0.50 (−1.28 to 2.29)	0.5820
Female	0.92 (0.84 to 1.00)	0.0511	−0.95 (−3.03 to 1.13)	0.3724
Diagnosis and management				
Male	0.99 (0.95 to 1.03)	0.5237	1.05 (0.01 to 2.09)	**0.0482**
Female	0.92 (0.86 to 0.98)	**0.0102**	−0.92 (−2.37 to 0.53)	0.2120
Communication score				
Male	1.01 (0.96 to 1.07)	0.6387	1.23 (−0.08 to 2.54)	0.0651
Female	0.90 (0.84 to 0.97)	**0.0062**	0.69 (−1.11 to 2.49)	0.4519
English proficiency				
Male	1.00 (0.97 to 1.03)	0.9340	0.43 (−0.43 to 1.29)	0.3273
Female	0.97 (0.93 to 1.01)	0.1715	0.28 (−0.82 to 1.38)	0.6216
Interpersonal skills				
Male	1.03 (0.97 to 1.08)	0.3493	0.99 (−0.36 to 2.34)	0.1523
Female	0.91 (0.85 to 0.98)	**0.0123**	−0.10 (−1.84 to 1.65)	0.9152

Models were adjusted for physician's gender, citizenship, specialty, region of practice, age, prescribed physio-NSAID before opioid, score and patient confounder score.
P value for gender×clinical competence score interaction opioid prescription: 0.04; p value for gender×communication score opioid prescription: 0.009; p value for gender×diagnosis and management score and MME dose: 0.03.
NSAID, non-steroidal anti-inflammatory drug.

CI 0.92 to 1.07) (table 3; figure 1A). A significant reduction of 8% in the odds of prescribing an opioid per 10% increase in score was also found for female physicians for the two clinical competence subscores: history and physical examination (OR 0.92, 95% CI 0.84 to 1.00) and diagnosis and management (OR 0.92, 95% CI 0.86 to 0.98). Similarly, a 10% increase in communication score was associated with a significant 10% reduction in the odds of opioid prescribing for female physicians (OR 0.90, 95% CI 0.84 to 0.97) but not male physicians (OR 1.01, 95% CI 0.96 to 1.07), a finding predominantly related to competence in interpersonal skills rather than English proficiency. Among the 3675 physicians who prescribed an opioid, clinical competence was not associated with the dose prescribed with the exception of competence in diagnosis and management: a 10% increase in score was associated with a significant increase in dose of 1.05 MME (95% CI 0.01 to 2.09) prescribed by male physicians, but had the opposite effect of lower prescribed doses for female physicians, although the latter was not significant. If the p value were corrected for multiple comparisons, the association between clinical competence and dose prescribed would not be statistically significant.

Physician citizenship provided a better fitting model than medical school location so it was used in all models. While the proportion of patients receiving an opioid prescription was highest for US/Canadian citizens (17.5% vs 12.5%–15.6% for physicians from other countries), physician citizenship was not significantly associated with the odds of prescribing, after adjusting for other physician and patient characteristics (table 4). However, US and Canadian physicians prescribed opioids at significantly higher doses (mean MME 31.5) compared with physicians from Asia (mean MME 25.1: adjusted difference 3.56, 95% CI 0.70 to 6.42). The main difference was in drug choice, with US/Canadian physicians more likely to prescribe oxycodone (16.3% vs 10.5%) and less likely to prescribe codeine (6.6% vs 11.8%) than Asian physicians (online supplementary etable 3).

Male physicians were 11% more likely to prescribe an opioid (OR 1.11, 95% CI 1.03 to 1.19) and prescribed it at higher doses compared with female physicians (mean MME dose 29.1 vs 22.8; adjusted mean difference 2.60, 95% CI 0.90 to 4.31). Physician age was not associated with the odds of opioid prescribing, but older physicians prescribed moderately higher doses (per 10 years, adjusted MME dose increase 1.82, 95% CI −0.03 to 3.67). The majority of opioids were prescribed by primary care physicians, internal medicine or hospital-based specialists. Compared with primary care physicians, physicians in all other specialties, except hospital-based specialties, were less likely to prescribe opioids, particularly

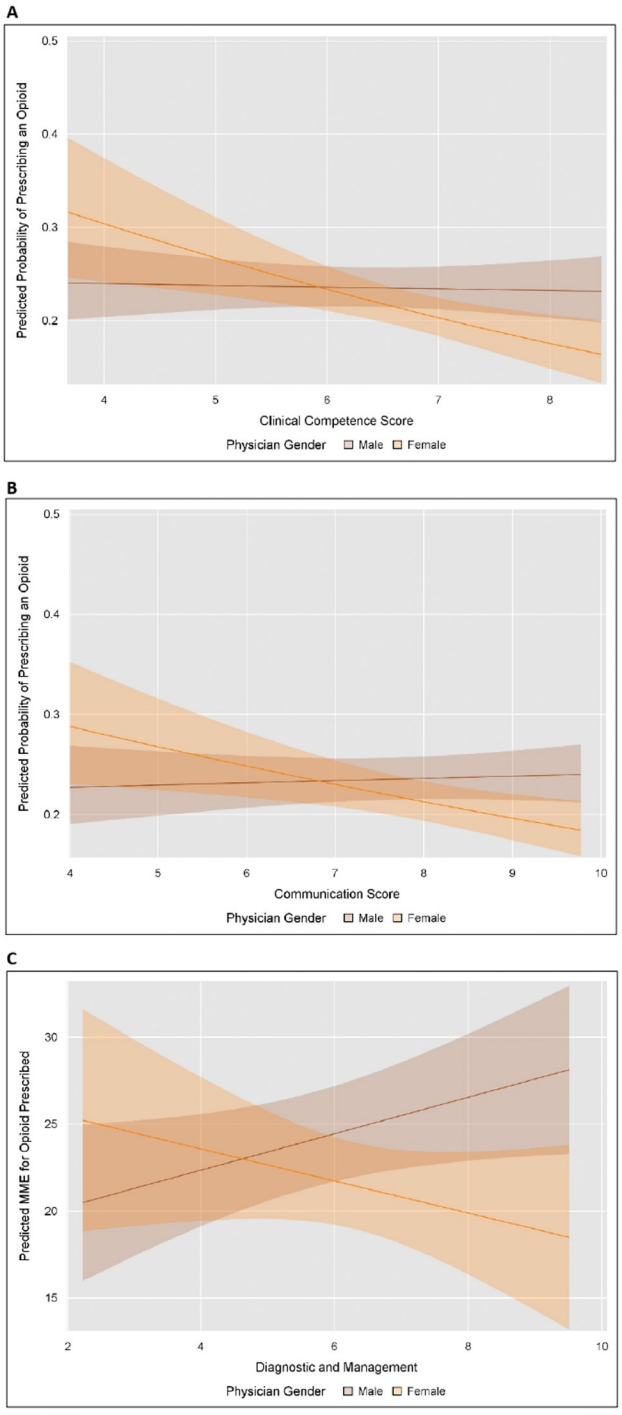

Figure 1 The association between Clinical Skills Assessment scores and the predicted probability of prescribing an opioid and predicted morphine milligram equivalent (MME) dose by physician gender. Figure created by the authors. (A,B) Predicted probability of opioid prescribing based on the following values for the multiple logistic generalised estimating equation (GEE) model regression coefficients: age of physician=43.7, physician region of practice=South, analgesic/physiotherapy before=1, predicted confounder score=0.15; predicted confounder score=26 (C), physician specialty=primary care, physician citizenship=Asia. (C) Predicted MME opioid dose based on the following values for the multiple linear GEE regression coefficients: age of physician=43.7, physician region of practice=South, analgesic/physiotherapy before=1, predicted confounder score=26, physician specialty=primary care, physician citizenship=Asia.

those in medical (OR 0.34, 95% CI 0.29 to 0.40) and surgical (OR 0.65, 95% CI 0.52 to 0.82) specialties. Among hospital-based specialists, 72.4% were rehabilitation or pain management specialists. When opioids were prescribed, surgical (mean MME dose 40.2) and hospital-based specialists (mean MME dose 35.4) prescribed higher doses than primary care physicians (mean MME dose 23.9; adjusted difference surgeons: 11.62, 95% CI 7.51 to 15.73, hospital-based specialists: 9.80, 95% CI 6.66 to 12.95).

Physicians whose practice was located in the northern (OR 0.63, 95% CI 0.58 to 0.69) or western (OR 0.88, 95% CI 0.80 to 0.96) USA were less likely to prescribe opioids compared with physicians in the South, although physicians in the West prescribed significantly higher doses (2.71 MME higher, 95% CI 0.52 to 4.89). Patients who had previously received physiotherapy or non-steroidal anti-inflammatory drugs were 56% more likely to be prescribed an opioid (OR 1.56, 95% CI 1.49 to 1.63).

DISCUSSION

This study is the first to investigate whether clinical competence, physician country of origin or training location are associated with opioid prescribing for common non-cancer-related pain problems. We found that physician gender modified the effect of clinical competence on opioid prescribing. More competent female physicians were less likely to prescribe opioids, and more competent male physicians prescribed higher doses. Country of origin did not influence the odds of opioid prescribing, but US and Canadian physicians prescribed opioids at significantly higher doses. Primary care physicians were more likely to prescribe opioids than medical and surgical specialties, but when opioids were prescribed, surgical and hospital-based specialties prescribed higher doses. Male physicians were more likely to prescribe opioids and at higher doses.

Standardised performance-based examinations such as the CSA were added to written examinations for licensure in Canada, the USA and the UK based on the need to measure both clinical and communication skills.[40] Many medical schools also conduct this form of assessment for their students.[65–67] Scores achieved on these assessments have been shown to predict quality of care, as well as complaints to and disciplinary action by medical regulatory authorities.[24 68–70] This study provided new insights about the contribution of clinical competence to opioid prescribing. Even though female physicians uniformly receive higher scores than male physicians in examinations that measure clinical knowledge, skills and communication,[71–73] our findings suggest that greater proficiency in clinical, communication, and diagnostic and management skills has a different impact on opioid prescribing among male and female physicians. Higher scoring female physicians are more cautious about

Table 4 The association between physician characteristics and the odds of prescribing an opioid for the 65 012 patients seen by 7373 physicians for common chronic pain problems, and the morphine milligram equivalent (MME) dose prescribed for the 9870 patients who received an opioid prescription

	Odds of prescribing an opioid for the 65 012 patients				MME opioid dose prescribed for the 9870 patients who received an opioid prescription			
Characteristic	N patients (%)	N patients with opioid (%)	OR (95% CI)	P value	N patients (%)	Mean (SD)	Estimated difference (95% CI)	P value
Physician gender								
Female	20 202 (31.1)	2679 (13.3)	Reference		2679 (27.1)	22.8 (30.5)	Reference	
Male	44 810 (68.9)	7191 (16.0)	1.11 (1.03 to 1.19)	**0.006**	7191 (72.9)	29.1 (38.1)	2.60 (0.90 to 4.31)	**0.003**
Citizenship								
Asia	8900 (13.7)	1284 (14.4)	Reference		1284 (13.0)	25.1 (34.0)	Reference	
Europe	7508 (11.5)	940 (12.5)	0.94 (0.82 to 1.07)	0.354	940 (9.5)	26.5 (31.9)	0.47 (–4.30 to 2.60)	0.793
India and Pakistan	17 457 (26.9)	2520 (14.4)	0.98 (0.88 to 1.10)	0.754	2520 (25.5)	25.9 (38.8)	–0.14 (–2.89 to 2.60)	0.919
Middle East	5714 (8.8)	853 (14.9)	0.97 (0.85 to 1.12)	0.718	853 (8.6)	24.8 (27.4)	–0.87 (–4.38 to 2.63)	0.626
Other	8814 (13.6)	1371 (15.6)	0.92 (0.81 to 1.04)	0.178	1371 (13.9)	25.8 (41.9)	–1.38 (–4.51 to 1.75)	0.387
USA and Canada	16 619 (25.6)	2902 (17.5)	1.03 (0.92 to 1.16)	0.569	2902 (29.4)	31.5 (35.6)	3.56 (0.70 to 6.42)	**0.015**
Physician specialty								
Primary care	18 505 (28.5)	3407 (18.4)	Reference		3407 (34.5)	23.9 (31.4)	Reference	
Internal medicine	15 719 (24.2)	2441 (15.5)	0.85 (0.79 to 0.92)	**<0.001**	2441 (24.7)	22.2 (22.6)	0.09 (–1.50 to 1.69)	0.907
Medical specialty	12 495 (19.2)	754 (6.0)	0.34 (0.29 to 0.40)	**<0.001**	754 (7.6)	29.3 (51.7)	1.42 (–3.16 to 6.00)	0.543
Surgery specialty	2573 (4.0)	376 (14.6)	0.65 (0.52 to 0.82)	**<0.001**	376 (3.8)	40.2 (23.0)	11.62 (7.51 to 15.73)	**<0.001**
Hospital-based specialty	12 241 (18.8)	2104 (17.2)	0.90 (0.81 to 1.01)	0.076	2104 (21.3)	35.4 (52.3)	9.80 (6.66 to 12.95)	**<0.001**
Emergency medicine	3479 (5.4)	788 (22.7)	0.85 (0.75 to 0.96)	**0.012**	788 (8.0)	29.2 (14.4)	1.51 (–0.50 to 3.52)	0.142
Physio-NSAID before opioid								
Yes	27 232 (41.9)	5071 (18.6)	1.56 (1.49 to 1.63)	**<0.001**	5071 (51.4)	27.4 (36.9)	0.64 (–1.07 to 2.36)	0.462
No	37 780 (58.1)	4799 (12.7)	Reference		4799 (48.6)	27.4 (35.8)	Reference	
Study physician region of practice								
North	16 860 (25.9)	1866 (11.1)	0.63 (0.58 to 0.69)	**<0.001**	1866 (18.9)	29.5 (47.3)	0.40 (–1.81 to 2.62)	0.720
Midwest	11 402 (17.5)	2079 (18.2)	1.04 (0.96 to 1.13)	0.364	2079 (21.1)	26.1 (30.4)	–0.79 (–2.76 to 1.18)	0.433
West	13 728 (21.1)	1931 (14.1)	0.88 (0.80 to 0.96)	**0.006**	1931 (19.6)	27.9 (34.0)	2.71 (0.52 to 4.89)	**0.016**
South	23 022 (35.4)	3994 (17.3)	Reference		3994 (40.5)	26.9 (34.3)	Reference	
Physician age (per 10 years)								
30–40 years old	21 119 (32.5)	3151 (14.9)	1.00 (0.99 to 1.00)	0.207	3151 (31.9)	28.2 (38.8)	1.82 (–0.03 to 3.67)	0.053
41–50 years old	35 633 (54.8)	5518 (15.5)			5518 (55.9)	26.6 (32.8)		
51 years old and more	8260 (12.7)	1201 (14.5)			1201 (12.2)	29.0 (44.3)		

Models were adjusted for clinical competence score, physician's gender, citizenship, specialty, region of practice, age, prescribed physio-NSAID before opioid, score and patient confounder scores.
NSAID, non-steroidal anti-inflammatory drug.

prescribing opioids, whereas higher scoring male physicians are more likely to prescribe more potent opioids and at higher doses. A similar phenomenon was reported in relationship to antibiotic prescribing for viral infections: higher scoring male physicians on the Canadian national standardised performance examination were more likely to prescribe antibiotics, whereas the opposite was true for female physicians.[23] One possible explanation is that more competent male physicians provide more aggressive treatment while more competent female physicians are more conservative. While this particular hypothesis has not been investigated, female physicians prescribe lower starting doses of anti-cholinesterase inhibitors for patients with dementia and are more likely to screen patients for cardiac problems,[26] refer a greater proportion of patients for specialty consultation, even after controlling for uncertainty and malpractice fear,[27] and have higher rates of test ordering.[28] A predisposition towards more aggressive treatment may also explain why more competent male physicians prescribe higher opioid doses, whereas more competent female physicians exhibit more caution in treatment decisions. These differences in the behaviour of male and female physicians are hypothesised to be related to fundamental differences in personality traits[74] and risk-taking behaviour.[26 75 76] Men are more likely to engage in riskier behaviour in fields such as finance and investment decision-making,[77] driving[76 78] and gambling—differences that are seen even in childhood.[79]

Based on prior research that showed substantial differences in opioid prescribing practices of US and UK dentists, we hypothesised that cultural expectations for pain management may influence a physician's likelihood of opioid prescribing for common chronic pain problems. While there was considerable variation in the country of origin and training location of IMGs in this study, we did not find that this influenced opioid prescribing practices. The only exception was the significantly higher opioid doses prescribed by US and Canadian citizens. Direct-to-consumer drug advertising in the USA, coupled with a societal trend for improved pain management,[15 16 80–83] may explain these differences.

We found that primary care physicians and hospital-based specialties were more likely than other specialty groups to prescribe opioids for patients with chronic pain problems. Our findings are consistent with recent studies that showed a trend of reduced opioid prescribing by surgeons and emergency medicine physicians and increased opioid prescribing by primary care physicians and pain specialists. Unlike previous studies,[43–45 84] we were able to show that these differences are not related to clinical competence or case mix, as we restricted the population of interest to patients who had been diagnosed with chronic pain problems by the study physician and adjusted for patient characteristics that influenced the likelihood of opioid prescribing. From a policy perspective, interventions to reduce the risk of opioid-related harms should be targeted at primary care physicians and pain specialists as well as surgical specialists as the latter prescribe substantially higher opioid doses, which increase the risk of opioid-related harms and long-term use.[85–89]

A number of limitations should be considered in interpreting the results of this study. Our study population was limited to Medicare patients with drug coverage. The prescribing trends observed in this population may not be representative of those for other patients in the physician's practice. However, we did find that factors that increased the risk of receiving an opioid were similar to those reported in other observational studies: back pain, receiving care in the ED, younger age, and having failed on prior conservative treatments such as non-opioid analgesics and physiotherapy.[43 61 62 90] Moreover, we noted that higher doses were prescribed by surgeons and hospital-based specialties, which has also been reported.[45 91] Higher rates of opioid prescribing are associated with regions with higher poverty and unemployment levels.[92 93] We do not have patient-level measures of these attributes, which may contribute to residual confounding if physicians with lower competence levels were more likely to practise in these regions. It is also possible that patients migrate to physicians who are natives of the same country and cultural differences in patient expectation for opioids are contributing to opioid prescribing, which may contribute to residual confounding. The measurement of clinical competence took place 10 years before the assessment of opioid prescribing, and may not reflect current knowledge and skills. However, prior research has shown that performance-based examination test scores are associated with quality of care, even after 12 years in practice,[23–25] which explains the observation that over 40% of the variance in maintenance of certification examination scores is explained by performance on the initial certification examination. The strong correlation between examination scores may explain why an association exists even after 10 years in practice. The CSA was replaced by USMLE Step 2, but the format of the examination and its psychometric properties are the same as the CSA, and thus our findings are relevant to standardised performance-based examinations.[40–42 72 94 95] Although we had no measure of institutional protocols for opioid prescribing, there is wide variation in physician opioid prescribing, even in the same institution and for the same surgical procedure.[96 97] As our study was limited to ambulatory visits, mainly to primary care physicians and internists in private practice, institutional practices likely had limited impact. There may be other regional attributes of a physician's practice location that we did not measure that could influence their prescribing patterns. Finally, we had only proxy measures of cultural expectations for pain management, and this limitation needs

to be addressed by better methods of measurement in future research.

CONCLUSION

In summary, greater clinical competence at the time of entry into US graduate medical training reduces the likelihood of prescribing opioids for common chronic non-cancer pain problems, but only among female physicians. While primary care physicians are more likely to prescribe opioids, surgical and hospital-based specialties prescribe higher starting doses, as do physicians from Canada and the USA.

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REFERENCES

1 Wilson N, Kariisa M, Seth P, *et al*. Drug and Opioid-Involved Overdose Deaths - United States, 2017-2018. *MMWR Morb Mortal Wkly Rep* 2020;69:290–7.
2 CDC. Drug overdose deaths: centers for disease control and prevention (CDC), 2020. Available: https://www.cdc.gov/drugoverdose/data/statedeaths.html [Accessed 22 Oct 2020].
3 Shipton EA, Shipton EE, Shipton AJ. A review of the opioid epidemic: what do we do about it? *Pain Ther* 2018;7:23–36.
4 Berterame S, Erthal J, Thomas J, *et al*. Use of and barriers to access to opioid analgesics: a worldwide, regional, and national study. *Lancet* 2016;387:1644–56.
5 Ciccarone D. The triple wave epidemic: supply and demand drivers of the US opioid overdose crisis. *Int J Drug Policy* 2019;71:183–8.
6 Rose ME. Are prescription opioids driving the opioid crisis? assumptions vs facts. *Pain Med* 2018;19:793–807.
7 Kertesz SG. Turning the tide or RIPtide? the changing opioid epidemic. *Subst Abus* 2017;38:3–8.
8 Gleber R, Vilke GM, Castillo EM, *et al*. Trends in emergency physician opioid prescribing practices during the United States opioid crisis. *Am J Emerg Med* 2020;38:735–40.
9 Zhu W, Chernew ME, Sherry TB, *et al*. Initial opioid prescriptions among U.S. commercially insured patients, 2012–2017. *N Engl J Med Overseas Ed* 2019;380:1043–52.
10 Santosa KB, Wang CS, Hu H-M, *et al*. Surgeon experience and opioid prescribing. *Am J Surg* 2020;220:823–7.
11 Hooten WM, Dvorkin J, Warner NS, *et al*. Characteristics of physicians who prescribe opioids for chronic pain: a meta-narrative systematic review. *J Pain Res* 2019;12:2261–89.
12 Inoue K, Figueroa JF, Orav EJ. Association between industry payments for opioid products and physicians' prescription of opioids: observational study with propensity-score matching. *J Epidemiol Community Health* 2020;74:647–54.
13 Suda KJ, Durkin MJ, Calip GS, *et al*. Comparison of opioid prescribing by dentists in the United States and England. *JAMA Netw Open* 2019;2:e194303.
14 Kaafarani HMA, Han K, El Moheb M. Opioids after surgery in the United States versus the rest of the world: the International patterns of opioid prescribing (iPOP) multicenter study. *Ann Surg* 2020;272.
15 Chidgey BA, McGinigle KL, McNaull PP. When a vital sign leads a country Astray-The opioid epidemic. *JAMA Surg* 2019;154:987–8.
16 Rummans TA, Burton MC, Dawson NL. How good intentions contributed to bad outcomes: the opioid crisis. *Mayo Clin Proc* 2018;93:344–50.
17 Moore A, Grime J, Campbell P, *et al*. Troubling stoicism: sociocultural influences and applications to health and illness behaviour. *Health* 2013;17:159–73.
18 Hobara M. Beliefs about appropriate pain behavior: cross-cultural and sex differences between Japanese and Euro-Americans. *Eur J Pain* 2005;9:389–93.
19 Pillay T, Zyl HAvan, Blackbeard D. Chronic pain perception and cultural experience. *Procedia Soc Behav Sci* 2014;113:151–60.
20 Galanti GA. Filipino attitudes toward pain medication. A lesson in cross-cultural care. *West J Med* 2000;173:278–9.
21 Wagstaff GF, Rowledge AM. Stoicism: its relation to gender, attitudes toward poverty, and reactions to emotive material. *J Soc Psychol* 1995;135:181–4.

22 Whelan GP. Educational Commission for foreign medical graduates: clinical skills assessment prototype. *Med Teach* 1999;21:156–60.
23 Cadieux G, Abrahamowicz M, Dauphinee D, *et al*. Are physicians with better clinical skills on licensing examinations less likely to prescribe antibiotics for viral respiratory infections in ambulatory care settings? *Med Care* 2011;49:156–65.
24 Tamblyn R, Abrahamowicz M, Dauphinee D, *et al*. Physician scores on a national clinical skills examination as predictors of complaints to medical regulatory authorities. *JAMA* 2007;298:993–1001.
25 Wenghofer E, Klass D, Abrahamowicz M, *et al*. Doctor scores on national qualifying examinations predict quality of care in future practice. *Med Educ* 2009;43:1166–73.
26 Rochon PA, Gruneir A, Bell CM, *et al*. Comparison of prescribing practices for older adults treated by female versus male physicians: a retrospective cohort study. *PLoS One* 2018;13:e0205524.
27 Franks P, Williams GC, Zwanziger J, *et al*. Why do physicians vary so widely in their referral rates? *J Gen Intern Med* 2000;15:163–8.
28 Cadogan SL, Browne JP, Bradley CP, *et al*. Physician and practice characteristics associated with immunoglobulin test ordering. *Fam Pract* 2018;35:41–6.
29 Tamblyn R, McLeod P, Hanley JA, *et al*. Physician and practice characteristics associated with the early utilization of new prescription drugs. *Med Care* 2003;41:895–908.
30 Rosso S, Battista RN, Segnan N, *et al*. Determinants of preventive practices of general practitioners in Torino, Italy. *Am J Prev Med* 1992;8:339–44.
31 Christian AH, Mills T, Simpson SL, *et al*. Quality of cardiovascular disease preventive care and physician/practice characteristics. *J Gen Intern Med* 2006;21:231–7.
32 Qaseem A, Wilt TJ, McLean RM, *et al*. Noninvasive treatments for acute, subacute, and chronic low back pain: a clinical practice guideline from the American College of physicians. *Ann Intern Med* 2017;166:514–30.
33 Hochberg MC, Altman RD, April KT, *et al*. American College of rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. *Arthritis Care Res* 2012;64:465–74.
34 O'Connor AB, Dworkin RH. Treatment of neuropathic pain: an overview of recent guidelines. *Am J Med* 2009;122:S22–32.
35 Reid KJ, Harker J, Bala MM, *et al*. Epidemiology of chronic non-cancer pain in Europe: narrative review of prevalence, pain treatments and pain impact. *Curr Med Res Opin* 2011;27:449–62.
36 GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the global burden of disease study 2016. *Lancet* 2017;390:1211–59.
37 Schopflocher D, Taenzer P, Jovey R. The prevalence of chronic pain in Canada. *Pain Res Manag* 2011;16:445–50.
38 Lacasse A, Ware MA, Dorais M, *et al*. Is the Quebec provincial administrative database a valid source for research on chronic non-cancer pain? *Pharmacoepidemiol Drug Saf* 2015;24:980–90.
39 Reznick RK, Blackmore D, Dauphinée WD, *et al*. Large-scale high-stakes testing with an OSCE: report from the medical Council of Canada. *Acad Med* 1996;71:S19–21.
40 Boulet JR, Smee SM, Dillon GF, *et al*. The use of standardized patient assessments for certification and licensure decisions. *Simul Healthc* 2009;4:35–42.
41 Howley LD, Engle DL. Discontinuation of the USMLE step 2 clinical skills examination: studying the past to define the future. *Acad Med* 2021;96:1247–9.
42 Klass D, DeChamplain A, Fletcher E. Development of a performance-based test of clinical skills for the United States medical licensure examination. *J Medical Licens Discip* 1998;85.
43 Borgundvaag B, McLeod S, Khuu W, *et al*. Opioid prescribing and adverse events in opioid-naive patients treated by emergency physicians versus family physicians: a population-based cohort study. *CMAJ Open* 2018;6:E110–7.
44 Weiner SG, Baker O, Rodgers AF, *et al*. Opioid prescriptions by specialty in Ohio, 2010-2014. *Pain Med* 2018;19:978–89.
45 Ringwalt C, Gugelmann H, Garrettson M, *et al*. Differential prescribing of opioid analgesics according to physician specialty for Medicaid patients with chronic noncancer pain diagnoses. *Pain Res Manag* 2014;19:179–85.
46 Nataraj N, Zhang K, Guy GP, *et al*. Identifying opioid prescribing patterns for high-volume prescribers via cluster analysis. *Drug Alcohol Depend* 2019;197:250–4.
47 Bertakis KD, Callahan EJ, Helms LJ, *et al*. Physician practice styles and patient outcomes: differences between family practice and general internal medicine. *Med Care* 1998;36:879–91.
48 Grumbach K, Selby JV, Schmittdiel JA, *et al*. Quality of primary care practice in a large HMO according to physician specialty. *Health Serv Res* 1999;34:485–502.
49 Chen J, Radford MJ, Wang Y, *et al*. Care and outcomes of elderly patients with acute myocardial infarction by physician specialty: the effects of comorbidity and functional limitations. *Am J Med* 2000;108:460–9.
50 Chin MH, Zhang JX, Merrell K. Specialty differences in the care of older patients with diabetes. *Med Care* 2000;38:131–40.
51 Yabroff KR, Saraiya M, Meissner HI, *et al*. Specialty differences in primary care physician reports of Papanicolaou test screening practices: a national survey, 2006 to 2007. *Ann Intern Med* 2009;151:602–11.
52 Chou R, Qaseem A, Snow V, *et al*. Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of physicians and the American pain Society. *Ann Intern Med* 2007;147:478–91.
53 Dagenais S, Tricco AC, Haldeman S. Synthesis of recommendations for the assessment and management of low back pain from recent clinical practice guidelines. *Spine J* 2010;10:514–29.
54 Dowell D, Haegerich TM, Chou R. CDC Guideline for Prescribing Opioids for Chronic Pain—United States, 2016. *JAMA* 2016;315:1624–45.
55 Deepmala D, Franz L, Aponte C, *et al*. Identification of provider characteristics influencing prescription of analgesics: a systematic literature review. *Pain Pract* 2013;13:504–13.
56 Bartley EJ, Boissoneault J, Vargovich AM, *et al*. The influence of health care professional characteristics on pain management decisions. *Pain Med* 2015;16:99–111.

57 Dhalla IA, Mamdani MM, Gomes T, *et al*. Clustering of opioid prescribing and opioid-related mortality among family physicians in Ontario. *Can Fam Physician* 2011;57:e92.
58 Varney SM, Bebarta VS, Mannina LM, *et al*. Emergency medicine providers' opioid prescribing practices stratified by gender, age, and years in practice. *World J Emerg Med* 2016;7:106–10.
59 McDonald DC, Carlson K, Izrael D. Geographic variation in opioid prescribing in the U.S. *J Pain* 2012;13:988–96.
60 St Clair CO, Golub NI, Ma Y, *et al*. Characteristics associated with U.S. outpatient opioid analgesic prescribing and Gabapentinoid co-prescribing. *Am J Prev Med* 2020;58:e11–19.
61 McCann-Pineo M, Ruskin J, Rasul R, *et al*. Predictors of emergency department opioid administration and prescribing: a machine learning approach. *Am J Emerg Med* 2021;46:217–24.
62 Urman RD, Böing EA, Khangulov V, *et al*. Analysis of predictors of opioid-free analgesia for management of acute post-surgical pain in the United States. *Curr Med Res Opin* 2019;35:283–9.
63 Shao Q, Rascati KL, Lawson KA, *et al*. Patterns and predictors of opioid use among migraine patients at emergency departments: a retrospective database analysis. *Cephalalgia* 2020;40:1489–501.
64 Breckenridge J, Clark JD. Patient characteristics associated with opioid versus nonsteroidal anti-inflammatory drug management of chronic low back pain. *J Pain* 2003;4:344–50.
65 Howley LD, Gliva-McConvey G, Thornton J, *et al*. Standardized patient practices: initial report on the survey of US and Canadian medical schools. *Med Educ Online* 2009;14:7.
66 Petrusa ER. Taking standardized patient-based examinations to the next level. *Teach Learn Med* 2004;16:98–110.
67 Hauer KE, Teherani A, Kerr KM, *et al*. Consequences within medical schools for students with poor performance on a medical school standardized patient comprehensive assessment. *Acad Med* 2009;84:663–8.
68 Cuddy MM, Young A, Gelman A. Exploring the relationships between USMLE performance and disciplinary action in practice: a validity study of score inferences from a licensure examination. *Acad Med* 2017;92:1780–5.
69 Kawasumi Y, Ernst P, Abrahamowicz M, *et al*. Association between physician competence at licensure and the quality of asthma management among patients with out-of-control asthma. *Arch Intern Med* 2011;171:1292–4.
70 Tamblyn R, Abrahamowicz M, Dauphinee WD, *et al*. Association between licensure examination scores and practice in primary care. *JAMA* 2002;288:3019–26.
71 Graf J, Smolka R, Simoes E, *et al*. Communication skills of medical students during the OSCE: gender-specific differences in a longitudinal trend study. *BMC Med Educ* 2017;17:75.
72 van Zanten M, Boulet JR, McKinley DW, *et al*. Assessing the communication and interpersonal skills of graduates of international medical schools as part of the United States medical licensing exam (USMLE) step 2 clinical skills (CS) exam. *Acad Med* 2007;82:S65–8.
73 Swygert KA, Cuddy MM, van Zanten M, *et al*. Gender differences in examinee performance on the step 2 clinical skills data gathering (dG) and patient note (PN) components. *Adv Health Sci Educ Theory Pract* 2012;17:557–71.
74 Feingold A. Gender differences in personality: a meta-analysis. *Psychol Bull* 1994;116:429–56.
75 Hardies K, Breesch D, Branson J. Gender differences in overconfidence and risk taking: do self-selection and socialization matter? *Econ Lett* 2013;118:442–4.
76 Byrnes JP, Miller DC, Schafer WD. Gender differences in risk taking: a meta-analysis. *Psychol Bull* 1999;125:367–83.
77 Charness G, Gneezy U. Strong evidence for gender differences in risk taking. *J Econ Behav Organ* 2012;83:50–8.
78 Turner C, McClure R. Age and gender differences in risk-taking behaviour as an explanation for high incidence of motor vehicle crashes as a driver in young males. *Inj Control Saf Promot* 2003;10:123–30.
79 Cárdenas J-C, Dreber A, von Essen E, *et al*. Gender differences in competitiveness and risk taking: comparing children in Colombia and Sweden. *J Econ Behav Organ* 2012;83:11–23.
80 Dasgupta N, Beletsky L, Ciccarone D. Opioid crisis: no easy fix to its social and economic determinants. *Am J Public Health* 2018;108:182–6.
81 Vadivelu N, Kai AM, Kodumudi V, *et al*. The opioid crisis: a comprehensive overview. *Curr Pain Headache Rep* 2018;22:16.
82 Fain KM, Alexander GC. Mind the gap: understanding the effects of pharmaceutical direct-to-consumer advertising. *Med Care* 2014;52:291–3.
83 Schwartz LM, Woloshin S. Medical marketing in the United States, 1997-2016. *JAMA* 2019;321:80–96.
84 Guy GP, Zhang K. Opioid prescribing by specialty and volume in the U.S. *Am J Prev Med* 2018;55:e153–5.
85 Gomes T, Mamdani MM, Dhalla IA, *et al*. Opioid dose and drug-related mortality in patients with nonmalignant pain. *Arch Intern Med* 2011;171:686–91.
86 Oderda GM, Said Q, Evans RS, *et al*. Opioid-related adverse drug events in surgical hospitalizations: impact on costs and length of stay. *Ann Pharmacother* 2007;41:400–7.
87 Liang Y, Turner BJ. National cohort study of opioid analgesic dose and risk of future hospitalization. *J Hosp Med* 2015;10:425–31.
88 Deyo RA, Hallvik SE, Hildebran C, *et al*. Association between initial opioid prescribing patterns and subsequent long-term use among Opioid-Naïve patients: a statewide retrospective cohort study. *J Gen Intern Med* 2017;32:21–7.
89 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;66:265–9.
90 Rasu RS, Knell ME. Determinants of opioid prescribing for nonmalignant chronic pain in US outpatient settings. *Pain Med* 2018;19:524–32.
91 Cron DC, Lee JS, Dupree JM, *et al*. Provider characteristics associated with outpatient opioid prescribing after surgery. *Ann Surg* 2020;271:680–5.
92 Guy GP, Zhang JX, Bohm M. *Vital signs: changes in opioid prescribing in the United States, 2006-2015*, 2017: 697–704.
93 Zhou C, Yu NN, Losby JL. The association between local economic conditions and opioid prescriptions among disabled Medicare beneficiaries. *Med Care* 2018;56:62–8.
94 Ayers WR, Boulet JR. Establishing the validity of test score inferences: performance of 4th-year U.S. medical students on the ECFMG clinical skills assessment. *Teach Learn Med* 2001;13:214–20.
95 van Zanten M, Boulet JR, McKinley D. Using standardized patients to assess the interpersonal skills of physicians: six years' experience with a high-stakes certification examination. *Health Commun* 2007;22:195–205.

96 Barnett ML, Olenski AR, Jena AB. Opioid-Prescribing patterns of emergency physicians and risk of long-term use. *N Engl J Med Overseas Ed* 2017;376:663–73.

97 Sabatino MJ, Kunkel ST, Ramkumar DB, *et al*. Excess opioid medication and variation in prescribing patterns following common orthopaedic procedures. *J Bone Joint Surg Am* 2018;100:180–8.

APPENDIX

Table of Contents

eTable 1. ICD9-10CM codes used to identify common chronic pain problems

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	**Detailed subgroups**	**ICD9-CM**	**Description**	**ICD10-CM**	**Description**
Back, neck & lumbar pain	Back pain	7210	Cervical spondylosis without myelopathy	M47812	Spondylosis w/o myelopathy or radiculopathy, cervical regio
		7211	Cervical spondylosis with myelopathy	M4712	Other spondylosis with myelopathy, cervical region
		7212	Thoracic spondylosis without myelopathy	M47814	Spondylosis w/o myelopathy or radiculopathy, thoracic regio
		7213	Lumbosacral spondylosis without myelopathy	M47817	Spondyls w/o myelopathy or radiculopathy, lumbosacr region
		72141	Spondylosis with myelopathy, thoracic region	M4714	Other spondylosis with myelopathy, thoracic region
		72142	Spondylosis with myelopathy, lumbar region	M4716	Other spondylosis with myelopathy, lumbar region
		7215	Kissing spine	M4820	Kissing spine, site unspecified
		7216	Ankylosing vertebral hyperostosis	M4810	Ankylosing hyperostosis [Forestier], site unspecified
		7217	Traumatic spondylopathy	M4830	Traumatic spondylopathy, site unspecified
		7218	Other allied disorders of spine	M489	Spondylopathy, unspecified
		72190	Spondylosis of unspecified site, without mention of myelopathy	M47819	Spondylosis without myelopathy or radiculopathy, site unsp
		72191	Spondylosis of unspecified site, with myelopathy	M4710	Other spondylosis with myelopathy, site unspecified
		7220	Displacement of cervical intervertebral disc without myelopathy	M5020	Other cervical disc displacement, unsp cervical region
		72210	Displacement of lumbar intervertebral disc without myelopathy	M5127	Other intervertebral disc displacement, lumbosacral region
			Displacement of lumbar intervertebral disc without myelopathy	M5126	Other intervertebral disc displacement, lumbar region
		72211	Displacement of thoracic intervertebral disc without myelopathy	M5124	Other intervertebral disc displacement, thoracic region
			Displacement of thoracic intervertebral disc without myelopathy	M5125	Other intervertebral disc displacement, thoracolumbar regio
		7222	Displacement of intervertebral disc, site unspecified, without myelopathy	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		72230	Schmorl's nodes, unspecified region	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		72231	Schmorl's nodes, thoracic region	M5144	Schmorl's nodes, thoracic region
			Schmorl's nodes, thoracic region	M5145	Schmorl's nodes, thoracolumbar region
		72232	Schmorl's nodes, lumbar region	M5146	Schmorl's nodes, lumbar region
			Schmorl's nodes, lumbar region	M5147	Schmorl's nodes, lumbosacral region
		72239	Schmorl's nodes, other region	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		7224	Degeneration of cervical intervertebral disc	M5030	Other cervical disc degeneration, unsp cervical region
		72251	Degeneration of thoracic or thoracolumbar intervertebral disc	M5134	Other intervertebral disc degeneration, thoracic region
			Degeneration of thoracic or thoracolumbar intervertebral disc	M5135	Other intervertebral disc degeneration, thoracolumbar regio

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
		72252	Degeneration of lumbar or lumbosacral intervertebral disc	M5136	Other intervertebral disc degeneration, lumbar region
			Degeneration of lumbar or lumbosacral intervertebral disc	M5137	Other intervertebral disc degeneration, lumbosacral region
		7226	Degeneration of intervertebral disc, site unspecified	M5135	Other intervertebral disc degeneration, thoracolumbar regio
			Degeneration of intervertebral disc, site unspecified	M5136	Other intervertebral disc degeneration, lumbar region
			Degeneration of intervertebral disc, site unspecified	M5137	Other intervertebral disc degeneration, lumbosacral region
			Degeneration of intervertebral disc, site unspecified	M5134	Other intervertebral disc degeneration, thoracic region
		72270	Intervertebral disc disorder with myelopathy, unspecified region	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		72271	Intervertebral disc disorder with myelopathy, cervical region	M5000	Cervical disc disorder with myelopathy, unsp cervical regio
		72272	Intervertebral disc disorder with myelopathy, thoracic region	M5104	Intervertebral disc disorders w myelopathy, thoracic region
			Intervertebral disc disorder with myelopathy, thoracic region	M5105	Intvrt disc disorders w myelopathy, thoracolumbar region
		72273	Intervertebral disc disorder with myelopathy, lumbar region	M5106	Intervertebral disc disorders with myelopathy, lumbar regio
		72280	Postlaminectomy syndrome, unspecified region	M961	Postlaminectomy syndrome, not elsewhere classified
		72281	Postlaminectomy syndrome, cervical region	M961	Postlaminectomy syndrome, not elsewhere classified
		72282	Postlaminectomy syndrome, thoracic region	M961	Postlaminectomy syndrome, not elsewhere classified
		72283	Postlaminectomy syndrome, lumbar region	M961	Postlaminectomy syndrome, not elsewhere classified
		72290	Other and unspecified disc disorder, unspecified region	M4640	Discitis, unspecified, site unspecified
			Other and unspecified disc disorder, unspecified region	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		72291	Other and unspecified disc disorder, cervical region	M5080	Other cervical disc disorders, unspecified cervical region
			Other and unspecified disc disorder, cervical region	M5090	Cervical disc disorder, unsp, unspecified cervical region
		72292	Other and unspecified disc disorder, thoracic region	M4645	Discitis, unspecified, thoracolumbar region
			Other and unspecified disc disorder, thoracic region	M5184	Other intervertebral disc disorders, thoracic region
			Other and unspecified disc disorder, thoracic region	M5185	Other intervertebral disc disorders, thoracolumbar region
		72293	Other and unspecified disc disorder, lumbar region	M4647	Discitis, unspecified, lumbosacral region
			Other and unspecified disc disorder, lumbar region	M5187	Other intervertebral disc disorders, lumbosacral region
			Other and unspecified disc disorder, lumbar region	M5186	Other intervertebral disc disorders, lumbar region
		7230	Spinal stenosis in cervical region	M4802	Spinal stenosis, cervical region

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
		7231	Cervicalgia	M542	Cervicalgia
		7232	Cervicocranial syndrome	M530	Cervicocranial syndrome
		7233	Cervicobrachial syndrome (diffuse)	M531	Cervicobrachial syndrome
		7234	Brachial neuritis or radiculitis NOS	M5413	Radiculopathy, cervicothoracic region
			Brachial neuritis or radiculitis NOS	M5412	Radiculopathy, cervical region
		7235	Torticollis, unspecified	M436	Torticollis
		7236	Panniculitis specified as affecting neck	M5402	Panniculitis affecting regions of neck/bk, cervical region
		7237	Ossification of posterior longitudinal ligament in cervical region	M6788	Other specified disorders of synovium and tendon, other sit
		7238	Other syndromes affecting cervical region	M5382	Other specified dorsopathies, cervical region
		7239	Unspecified musculoskeletal disorders and symptoms referable to neck	M5382	Other specified dorsopathies, cervical region
		72400	Spinal stenosis, unspecified region	M4800	Spinal stenosis, site unspecified
		72401	Spinal stenosis, thoracic region	M4804	Spinal stenosis, thoracic region
		72402	Spinal stenosis, lumbar region, without neurogenic claudication	M4806	Spinal stenosis, lumbar region
		72403	Spinal stenosis, lumbar region, with neurogenic claudication	M4806	Spinal stenosis, lumbar region
		72409	Spinal stenosis, other region	M4808	Spinal stenosis, sacral and sacrococcygeal region
		7241	Pain in thoracic spine	M546	Pain in thoracic spine
		7242	Lumbago	M545	Low back pain
		7243	Sciatica	M5430	Sciatica, unspecified side
		7244	Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5416	Radiculopathy, lumbar region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5417	Radiculopathy, lumbosacral region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5415	Radiculopathy, thoracolumbar region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5414	Radiculopathy, thoracic region
		7245	Backache, unspecified	M549	Dorsalgia, unspecified
			Backache, unspecified	M5489	Other dorsalgia
		7246	Disorders of sacrum	M4328	Fusion of spine, sacral and sacrococcygeal region
			Disorders of sacrum	M4327	Fusion of spine, lumbosacral region
			Disorders of sacrum	M532X7	Spinal instabilities, lumbosacral region
			Disorders of sacrum	M533	Sacrococcygeal disorders, not elsewhere classified
		72470	Unspecified disorder of coccyx	M533	Sacrococcygeal disorders, not elsewhere classified
		72471	Hypermobility of coccyx	M532X8	Spinal instabilities, sacral and sacrococcygeal region
		72479	Other disorders of coccyx	M533	Sacrococcygeal disorders, not elsewhere classified
		7248	Other symptoms referable to back	M5408	Panniculitis aff regions of neck/bk, sacr/sacrocygl region
		7249	Other unspecified back disorders	M438X9	Other specified deforming dorsopathies, site unspecified
			Other unspecified back disorders	M539	Dorsopathy, unspecified
		7370	Adolescent postural kyphosis	M4000	Postural kyphosis, site unspecified
		73710	Kyphosis (acquired) (postural)	M4000	Postural kyphosis, site unspecified
			Kyphosis (acquired) (postural)	M40209	Unspecified kyphosis, site unspecified

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
		73711	Kyphosis due to radiation	M962	Postradiation kyphosis
		73712	Kyphosis, postlaminectomy	M963	Postlaminectomy kyphosis
		73719	Other kyphosis (acquired)	M40299	Other kyphosis, site unspecified
		73720	Lordosis (acquired) (postural)	M4040	Postural lordosis, site unspecified
		73721	Lordosis, postlaminectomy	M964	Postsurgical lordosis
		73722	Other postsurgical lordosis	M964	Postsurgical lordosis
		73729	Other lordosis (acquired)	M4050	Lordosis, unspecified, site unspecified
		73730	Scoliosis [and kyphoscoliosis], idiopathic	M4120	Other idiopathic scoliosis, site unspecified
		73731	Resolving infantile idiopathic scoliosis	M4100	Infantile idiopathic scoliosis, site unspecified
		73732	Progressive infantile idiopathic scoliosis	M4100	Infantile idiopathic scoliosis, site unspecified
		73733	Scoliosis due to radiation	M965	Postradiation scoliosis
		73734	Thoracogenic scoliosis	M4130	Thoracogenic scoliosis, site unspecified
		73739	Other kyphoscoliosis and scoliosis	M419	Scoliosis, unspecified
			Other kyphoscoliosis and scoliosis	M4180	Other forms of scoliosis, site unspecified
		73740	Curvature of spine, unspecified, associated with other conditions	M438X9	Other specified deforming dorsopathies, site unspecified
		73741	Kyphosis associated with other conditions	M4010	Other secondary kyphosis, site unspecified
		73742	Lordosis associated with other conditions	M4050	Lordosis, unspecified, site unspecified
		73743	Scoliosis associated with other conditions	M4140	Neuromuscular scoliosis, site unspecified
			Scoliosis associated with other conditions	M4150	Other secondary scoliosis, site unspecified
		7378	Other curvatures of spine	M438X9	Other specified deforming dorsopathies, site unspecified
		7379	Unspecified curvature of spine	M438X9	Other specified deforming dorsopathies, site unspecified
	Lumbar pain	72400	Spinal stenosis, unspecified region	M4800	Spinal stenosis, site unspecified
		72401	Spinal stenosis, thoracic region	M4804	Spinal stenosis, thoracic region
		72402	Spinal stenosis, lumbar region, without neurogenic claudication	M4806	Spinal stenosis, lumbar region
		72403	Spinal stenosis, lumbar region, with neurogenic claudication	M4806	Spinal stenosis, lumbar region
		72409	Spinal stenosis, other region	M4808	Spinal stenosis, sacral and sacrococcygeal region
		7241	Pain in thoracic spine	M546	Pain in thoracic spine
		7242	Lumbago	M545	Low back pain
		7243	Sciatica	M5430	Sciatica, unspecified side
		7244	Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5414	Radiculopathy, thoracic region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5415	Radiculopathy, thoracolumbar region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5417	Radiculopathy, lumbosacral region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5416	Radiculopathy, lumbar region
		7245	Backache, unspecified	M5489	Other dorsalgia
			Backache, unspecified	M549	Dorsalgia, unspecified
		7246	Disorders of sacrum	M532X7	Spinal instabilities, lumbosacral region
			Disorders of sacrum	M4327	Fusion of spine, lumbosacral region
			Disorders of sacrum	M4328	Fusion of spine, sacral and sacrococcygeal region
			Disorders of sacrum	M533	Sacrococcygeal disorders, not elsewhere classified
		72470	Unspecified disorder of coccyx	M533	Sacrococcygeal disorders, not elsewhere classified

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
		72471	Hypermobility of coccyx	M532X8	Spinal instabilities, sacral and sacrococcygeal region
		72479	Other disorders of coccyx	M533	Sacrococcygeal disorders, not elsewhere classified
		7248	Other symptoms referable to back	M5408	Panniculitis aff regions of neck/bk, sacr/sacrocygl region
		7249	Other unspecified back disorders	M539	Dorsopathy, unspecified
			Other unspecified back disorders	M438X9	Other specified deforming dorsopathies, site unspecified
	Neck back pain	7211	Cervical spondylosis with myelopathy	M4712	Other spondylosis with myelopathy, cervical region
		7212	Thoracic spondylosis without myelopathy	M47814	Spondylosis w/o myelopathy or radiculopathy, thoracic regio
		7213	Lumbosacral spondylosis without myelopathy	M47817	Spondyls w/o myelopathy or radiculopathy, lumbosacr region
		72141	Spondylosis with myelopathy, thoracic region	M4714	Other spondylosis with myelopathy, thoracic region
		72142	Spondylosis with myelopathy, lumbar region	M4716	Other spondylosis with myelopathy, lumbar region
		7215	Kissing spine	M4820	Kissing spine, site unspecified
		7216	Ankylosing vertebral hyperostosis	M4810	Ankylosing hyperostosis [Forestier], site unspecified
		7217	Traumatic spondylopathy	M4830	Traumatic spondylopathy, site unspecified
		7218	Other allied disorders of spine	M489	Spondylopathy, unspecified
		72190	Spondylosis of unspecified site, without mention of myelopathy	M47819	Spondylosis without myelopathy or radiculopathy, site unsp
		72191	Spondylosis of unspecified site, with myelopathy	M4710	Other spondylosis with myelopathy, site unspecified
		72210	Displacement of lumbar intervertebral disc without myelopathy	M5127	Other intervertebral disc displacement, lumbosacral region
			Displacement of lumbar intervertebral disc without myelopathy	M5126	Other intervertebral disc displacement, lumbar region
		72211	Displacement of thoracic intervertebral disc without myelopathy	M5125	Other intervertebral disc displacement, thoracolumbar regio
			Displacement of thoracic intervertebral disc without myelopathy	M5124	Other intervertebral disc displacement, thoracic region
		7222	Displacement of intervertebral disc, site unspecified, without myelopathy	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		72230	Schmorl's nodes, unspecified region	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		72231	Schmorl's nodes, thoracic region	M5144	Schmorl's nodes, thoracic region
			Schmorl's nodes, thoracic region	M5145	Schmorl's nodes, thoracolumbar region
		72232	Schmorl's nodes, lumbar region	M5146	Schmorl's nodes, lumbar region
			Schmorl's nodes, lumbar region	M5147	Schmorl's nodes, lumbosacral region
		72239	Schmorl's nodes, other region	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		7224	Degeneration of cervical intervertebral disc	M5030	Other cervical disc degeneration, unsp cervical region

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
		72251	Degeneration of thoracic or thoracolumbar intervertebral disc	M5134	Other intervertebral disc degeneration, thoracic region
			Degeneration of thoracic or thoracolumbar intervertebral disc	M5135	Other intervertebral disc degeneration, thoracolumbar regio
		72252	Degeneration of lumbar or lumbosacral intervertebral disc	M5136	Other intervertebral disc degeneration, lumbar region
			Degeneration of lumbar or lumbosacral intervertebral disc	M5137	Other intervertebral disc degeneration, lumbosacral region
		7226	Degeneration of intervertebral disc, site unspecified	M5135	Other intervertebral disc degeneration, thoracolumbar regio
			Degeneration of intervertebral disc, site unspecified	M5136	Other intervertebral disc degeneration, lumbar region
			Degeneration of intervertebral disc, site unspecified	M5137	Other intervertebral disc degeneration, lumbosacral region
			Degeneration of intervertebral disc, site unspecified	M5134	Other intervertebral disc degeneration, thoracic region
		72270	Intervertebral disc disorder with myelopathy, unspecified region	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		72271	Intervertebral disc disorder with myelopathy, cervical region	M5000	Cervical disc disorder with myelopathy, unsp cervical regio
		72272	Intervertebral disc disorder with myelopathy, thoracic region	M5104	Intervertebral disc disorders w myelopathy, thoracic region
			Intervertebral disc disorder with myelopathy, thoracic region	M5105	Intvrt disc disorders w myelopathy, thoracolumbar region
		72273	Intervertebral disc disorder with myelopathy, lumbar region	M5106	Intervertebral disc disorders with myelopathy, lumbar regio
		72280	Postlaminectomy syndrome, unspecified region	M961	Postlaminectomy syndrome, not elsewhere classified
		72281	Postlaminectomy syndrome, cervical region	M961	Postlaminectomy syndrome, not elsewhere classified
		72282	Postlaminectomy syndrome, thoracic region	M961	Postlaminectomy syndrome, not elsewhere classified
		72283	Postlaminectomy syndrome, lumbar region	M961	Postlaminectomy syndrome, not elsewhere classified
		72290	Other and unspecified disc disorder, unspecified region	M4640	Discitis, unspecified, site unspecified
			Other and unspecified disc disorder, unspecified region	M519	Unsp thoracic, thoracolum and lumbosacr intvrt disc disorde
		72291	Other and unspecified disc disorder, cervical region	M5080	Other cervical disc disorders, unspecified cervical region
			Other and unspecified disc disorder, cervical region	M5090	Cervical disc disorder, unsp, unspecified cervical region
		72292	Other and unspecified disc disorder, thoracic region	M4645	Discitis, unspecified, thoracolumbar region
			Other and unspecified disc disorder, thoracic region	M5185	Other intervertebral disc disorders, thoracolumbar region
			Other and unspecified disc disorder, thoracic region	M5184	Other intervertebral disc disorders, thoracic region
		72293	Other and unspecified disc disorder, lumbar region	M4647	Discitis, unspecified, lumbosacral region

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
			Other and unspecified disc disorder, lumbar region	M5187	Other intervertebral disc disorders, lumbosacral region
			Other and unspecified disc disorder, lumbar region	M5186	Other intervertebral disc disorders, lumbar region
		7231	Cervicalgia	M542	Cervicalgia
		7232	Cervicocranial syndrome	M530	Cervicocranial syndrome
		7233	Cervicobrachial syndrome (diffuse)	M531	Cervicobrachial syndrome
		7234	Brachial neuritis or radiculitis NOS	M5412	Radiculopathy, cervical region
			Brachial neuritis or radiculitis NOS	M5413	Radiculopathy, cervicothoracic region
		7235	Torticollis, unspecified	M436	Torticollis
		7237	Ossification of posterior longitudinal ligament in cervical region	M6788	Other specified disorders of synovium and tendon, other sit
		7238	Other syndromes affecting cervical region	M5382	Other specified dorsopathies, cervical region
		7239	Unspecified musculoskeletal disorders and symptoms referable to neck	M5382	Other specified dorsopathies, cervical region
		7241	Pain in thoracic spine	M546	Pain in thoracic spine
		7242	Lumbago	M545	Low back pain
		7243	Sciatica	M5430	Sciatica, unspecified side
		7244	Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5415	Radiculopathy, thoracolumbar region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5417	Radiculopathy, lumbosacral region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5416	Radiculopathy, lumbar region
			Thoracic or lumbosacral neuritis or radiculitis, unspecified	M5414	Radiculopathy, thoracic region
		7245	Backache, unspecified	M549	Dorsalgia, unspecified
			Backache, unspecified	M5489	Other dorsalgia
		7246	Disorders of sacrum	M4327	Fusion of spine, lumbosacral region
			Disorders of sacrum	M4328	Fusion of spine, sacral and sacrococcygeal region
			Disorders of sacrum	M532X7	Spinal instabilities, lumbosacral region
			Disorders of sacrum	M533	Sacrococcygeal disorders, not elsewhere classified
		7248	Other symptoms referable to back	M5408	Panniculitis aff regions of neck/bk, sacr/sacrocygl region
		7249	Other unspecified back disorders	M539	Dorsopathy, unspecified
			Other unspecified back disorders	M438X9	Other specified deforming dorsopathies, site unspecified
		73710	Kyphosis (acquired) (postural)	M4000	Postural kyphosis, site unspecified
			Kyphosis (acquired) (postural)	M40209	Unspecified kyphosis, site unspecified
		73711	Kyphosis due to radiation	M962	Postradiation kyphosis
		73712	Kyphosis, postlaminectomy	M963	Postlaminectomy kyphosis
		73719	Other kyphosis (acquired)	M40299	Other kyphosis, site unspecified
		73720	Lordosis (acquired) (postural)	M4040	Postural lordosis, site unspecified
		73721	Lordosis, postlaminectomy	M964	Postsurgical lordosis
		73722	Other postsurgical lordosis	M964	Postsurgical lordosis
		73729	Other lordosis (acquired)	M4050	Lordosis, unspecified, site unspecified
		7382	Acquired deformity of neck	M953	Acquired deformity of neck
		7384	Acquired spondylolisthesis	M4300	Spondylolysis, site unspecified
			Acquired spondylolisthesis	M4310	Spondylolisthesis, site unspecified

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	**Detailed subgroups**	**ICD9-CM**	**Description**	**ICD10-CM**	**Description**
		7385	Other acquired deformity of back or spine	M9984	Other biomechanical lesions of sacral region
			Other acquired deformity of back or spine	M9983	Other biomechanical lesions of lumbar region
		7391	Nonallopathic lesions, cervical region	M9901	Segmental and somatic dysfunction of cervical region
		7392	Nonallopathic lesions, thoracic region	M9902	Segmental and somatic dysfunction of thoracic region
		7393	Nonallopathic lesions, lumbar region	M9903	Segmental and somatic dysfunction of lumbar region
		7394	Nonallopathic lesions, sacral region	M9904	Segmental and somatic dysfunction of sacral region
		75610	Anomaly of spine, unspecified	Q7649	Oth congenital malform of spine, not associated w scoliosis
		75611	Spondylolysis, lumbosacral region	Q762	Congenital spondylolisthesis
		75612	Spondylolisthesis	Q762	Congenital spondylolisthesis
		75613	Absence of vertebra, congenital	Q7649	Oth congenital malform of spine, not associated w scoliosis
		75614	Hemivertebra	Q7649	Oth congenital malform of spine, not associated w scoliosis
		75615	Fusion of spine (vertebra), congenital	Q7649	Oth congenital malform of spine, not associated w scoliosis
		75616	Klippel-Feil syndrome	Q761	Klippel-Feil syndrome
		75617	Spina bifida occulta	Q760	Spina bifida occulta
		75619	Other anomalies of spine	Q7649	Oth congenital malform of spine, not associated w scoliosis
			Other anomalies of spine	Q76419	Congenital kyphosis, unspecified region
Osteo/rhumatoid pain	Osteo pain	7140	Rheumatoid arthritis	M069	Rheumatoid arthritis, unspecified
		7141	Felty's syndrome	M0500	Felty's syndrome, unspecified site
		7142	Other rheumatoid arthritis with visceral or systemic involvement	M0560	Rheu arthritis of unsp site w involv of organs and systems
			Other rheumatoid arthritis with visceral or systemic involvement	M0530	Rheumatoid heart disease w rheumatoid arthritis of unsp sit
			Other rheumatoid arthritis with visceral or systemic involvement	M061	Adult-onset Still's disease
		71430	Polyarticular juvenile rheumatoid arthritis, chronic or unspecified	M0800	Unsp juvenile rheumatoid arthritis of unspecified site
		71431	Polyarticular juvenile rheumatoid arthritis, acute	M083	Juvenile rheumatoid polyarthritis (seronegative)
		71432	Polyarticular juvenile rheumatoid arthritis	M0840	Polyarticular juvenile rheumatoid arthritis, unsp site
		71433	Monoarticular juvenile rheumatoid arthritis	M0840	Polyarticular juvenile rheumatoid arthritis, unsp site
		7144	Chronic postrheumatic arthropathy	M1200	Chronic postrheumatic arthropathy, unspecified site
		71481	Rheumatoid lung	M0510	Rheumatoid lung disease w rheumatoid arthritis of unsp site
		71489	Other specified inflammatory polyarthropathies	M064	Inflammatory polyarthropathy
		7149	Unspecified inflammatory polyarthropathy	M064	Inflammatory polyarthropathy
		71500	Osteoarthrosis, generalized, site unspecified	M150	Primary generalized (osteo)arthritis

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
			Osteoarthrosis, generalized, site unspecified	M159	Polyosteoarthritis, unspecified
		71504	Osteoarthrosis, generalized, hand	M152	Bouchard's nodes (with arthropathy)
			Osteoarthrosis, generalized, hand	M151	Heberden's nodes (with arthropathy)
		71509	Osteoarthrosis, generalized, multiple sites	M150	Primary generalized (osteo)arthritis
		71510	Osteoarthrosis, localized, primary, site unspecified	M1991	Primary osteoarthritis, unspecified site
		71511	Osteoarthrosis, localized, primary, shoulder region	M19019	Primary osteoarthritis, unspecified shoulder
		71512	Osteoarthrosis, localized, primary, upper arm	M19029	Primary osteoarthritis, unspecified elbow
		71513	Osteoarthrosis, localized, primary, forearm	M19039	Primary osteoarthritis, unspecified wrist
		71514	Osteoarthrosis, localized, primary, hand	M19049	Primary osteoarthritis, unspecified hand
		71515	Osteoarthrosis, localized, primary, pelvic region and thigh	M1610	Unilateral primary osteoarthritis, unspecified hip
		71516	Osteoarthrosis, localized, primary, lower leg	M1710	Unilateral primary osteoarthritis, unspecified knee
		71517	Osteoarthrosis, localized, primary, ankle and foot	M19079	Primary osteoarthritis, unspecified ankle and foot
		71518	Osteoarthrosis, localized, primary, other specified sites	M1991	Primary osteoarthritis, unspecified site
		71520	Osteoarthrosis, localized, secondary, site unspecified	M1993	Secondary osteoarthritis, unspecified site
		71521	Osteoarthrosis, localized, secondary, shoulder region	M19219	Secondary osteoarthritis, unspecified shoulder
		71522	Osteoarthrosis, localized, secondary, upper arm	M19229	Secondary osteoarthritis, unspecified elbow
		71523	Osteoarthrosis, localized, secondary, forearm	M19239	Secondary osteoarthritis, unspecified wrist
		71524	Osteoarthrosis, localized, secondary, hand	M19249	Secondary osteoarthritis, unspecified hand
		71525	Osteoarthrosis, localized, secondary, pelvic region and thigh	M167	Other unilateral secondary osteoarthritis of hip
		71526	Osteoarthrosis, localized, secondary, lower leg	M175	Other unilateral secondary osteoarthritis of knee
		71527	Osteoarthrosis, localized, secondary, ankle and foot	M19279	Secondary osteoarthritis, unspecified ankle and foot
		71528	Osteoarthrosis, localized, secondary, other specified sites	M1993	Secondary osteoarthritis, unspecified site
		71530	Osteoarthrosis, localized, not specified whether primary or secondary, site unspecified	M1990	Unspecified osteoarthritis, unspecified site
		71531	Osteoarthrosis, localized, not specified whether primary or secondary, shoulder region	M1990	Unspecified osteoarthritis, unspecified site
		71532	Osteoarthrosis, localized, not specified whether primary or secondary, upper arm	M1990	Unspecified osteoarthritis, unspecified site
		71533	Osteoarthrosis, localized, not specified whether primary or secondary, forearm	M1990	Unspecified osteoarthritis, unspecified site
		71534	Osteoarthrosis, localized, not specified whether primary or secondary, hand	M189	Osteoarthritis of first carpometacarpal joint, unspecified
		71535	Osteoarthrosis, localized, not specified whether primary or secondary, pelvic region and thigh	M169	Osteoarthritis of hip, unspecified
		71536	Osteoarthrosis, localized, not specified whether primary or secondary, lower leg	M179	Osteoarthritis of knee, unspecified
		71537	Osteoarthrosis, localized, not specified whether primary or secondary, ankle and foot	M1990	Unspecified osteoarthritis, unspecified site

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	**Detailed subgroups**	**ICD9-CM**	**Description**	**ICD10-CM**	**Description**
		71538	Osteoarthrosis, localized, not specified whether primary or secondary, other specified sites	M1990	Unspecified osteoarthritis, unspecified site
		71580	Osteoarthrosis involving, or with mention of more than one site, but not specified as generalized, site unspecified	M158	Other polyosteoarthritis
		71589	Osteoarthrosis involving, or with mention of more than one site, but not specified as generalized, multiple sites	M153	Secondary multiple arthritis
			Osteoarthrosis involving, or with mention of more than one site, but not specified as generalized, multiple sites	M158	Other polyosteoarthritis
		71590	Osteoarthrosis, unspecified whether generalized or localized, site unspecified	M1990	Unspecified osteoarthritis, unspecified site
			Osteoarthrosis, unspecified whether generalized or localized, site unspecified	M159	Polyosteoarthritis, unspecified
		71591	Osteoarthrosis, unspecified whether generalized or localized, shoulder region	M1990	Unspecified osteoarthritis, unspecified site
		71592	Osteoarthrosis, unspecified whether generalized or localized, upper arm	M1990	Unspecified osteoarthritis, unspecified site
		71593	Osteoarthrosis, unspecified whether generalized or localized, forearm	M1990	Unspecified osteoarthritis, unspecified site
		71594	Osteoarthrosis, unspecified whether generalized or localized, hand	M189	Osteoarthritis of first carpometacarpal joint, unspecified
		71595	Osteoarthrosis, unspecified whether generalized or localized, pelvic region and thigh	M169	Osteoarthritis of hip, unspecified
		71596	Osteoarthrosis, unspecified whether generalized or localized, lower leg	M179	Osteoarthritis of knee, unspecified
		71597	Osteoarthrosis, unspecified whether generalized or localized, ankle and foot	M1990	Unspecified osteoarthritis, unspecified site
		71598	Osteoarthrosis, unspecified whether generalized or localized, other specified sites	M1990	Unspecified osteoarthritis, unspecified site
Migraine/headache	Migraine pain	33900	Cluster headache syndrome, unspecified	G44009	Cluster headache syndrome, unspecified, not intractable
		33901	Episodic cluster headache	G44019	Episodic cluster headache, not intractable
		33902	Chronic cluster headache	G44029	Chronic cluster headache, not intractable
		33903	Episodic paroxysmal hemicrania	G44039	Episodic paroxysmal hemicrania, not intractable
		33904	Chronic paroxysmal hemicrania	G44049	Chronic paroxysmal hemicrania, not intractable
		33905	Short lasting unilateral neuralgiform headache with conjunctival injection and tearing	G44059	Shrt lst unil nerlgif hdache w cnjnct inject/tear, not ntrc
		33909	Other trigeminal autonomic cephalgia	G44099	Other trigeminal autonomic cephalgias (TAC), not intractabl
		33910	Tension type headache, unspecified	G44209	Tension-type headache, unspecified, not intractable
		33911	Episodic tension type headache	G44219	Episodic tension-type headache, not intractable
		33912	Chronic tension type headache	G44221	Chronic tension-type headache, intractable
			Chronic tension type headache	G44229	Chronic tension-type headache, not intractable
		33920	Post-traumatic headache, unspecified	G44309	Post-traumatic headache, unspecified, not intractable

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
		33921	Acute post-traumatic headache	G44319	Acute post-traumatic headache, not intractable
		33922	Chronic post-traumatic headache	G44329	Chronic post-traumatic headache, not intractable
		3393	Drug induced headache, not elsewhere classified	G4441	Drug-induced headache, not elsewhere classified, intractabl
		33941	Hemicrania continua	G4451	Hemicrania continua
		33942	New daily persistent headache	G4452	New daily persistent headache (NDPH)
		33943	Primary thunderclap headache	G4453	Primary thunderclap headache
		33944	Other complicated headache syndrome	G4459	Other complicated headache syndrome
		33981	Hypnic headache	G4481	Hypnic headache
		33982	Headache associated with sexual activity	G4482	Headache associated with sexual activity
		33983	Primary cough headache	G4483	Primary cough headache
		33984	Primary exertional headache	G4484	Primary exertional headache
		33985	Primary stabbing headache	G4485	Primary stabbing headache
		33989	Other headache syndromes	G4489	Other headache syndrome
		34600	Migraine with aura, without mention of intractable migraine without mention of status migrainosus	G43109	Migraine with aura, not intractable, w/o status migrainosus
		34601	Migraine with aura, with intractable migraine, so stated, without mention of status migrainosus	G43119	Migraine with aura, intractable, without status migrainosus
		34602	Migraine with aura, without mention of intractable migraine with status migrainosus	G43101	Migraine with aura, not intractable, with status migrainosu
		34603	Migraine with aura, with intractable migraine, so stated, with status migrainosus	G43111	Migraine with aura, intractable, with status migrainosus
		34610	Migraine without aura, without mention of intractable migraine without mention of status migrainosus	G43009	Migraine w/o aura, not intractable, w/o status migrainosus
		34611	Migraine without aura, with intractable migraine, so stated, without mention of status migrainosus	G43019	Migraine w/o aura, intractable, without status migrainosus
		34612	Migraine without aura, without mention of intractable migraine with status migrainosus	G43001	Migraine w/o aura, not intractable, with status migrainosus
		34613	Migraine without aura, with intractable migraine, so stated, with status migrainosus	G43011	Migraine without aura, intractable, with status migrainosus
		34620	Variants of migraine, not elsewhere classified, without mention of intractable migraine without mention of status migrainosus	G43D0	Abdominal migraine, not intractable
			Variants of migraine, not elsewhere classified, without mention of intractable migraine without mention of status migrainosus	G43B0	Ophthalmoplegic migraine, not intractable
			Variants of migraine, not elsewhere classified, without mention of intractable migraine without mention of status migrainosus	G43C0	Periodic headache syndromes in chld/adlt, not intractable
			Variants of migraine, not elsewhere classified, without mention of intractable migraine without mention of status migrainosus	G43809	Other migraine, not intractable, without status migrainosus
			Variants of migraine, not elsewhere classified, without mention of intractable migraine without mention of status migrainosus	G43A0	Cyclical vomiting, not intractable
		34621	Variants of migraine, not elsewhere classified, with intractable migraine, so stated, without mention of status migrainosus	G43B1	Ophthalmoplegic migraine, intractable
			Variants of migraine, not elsewhere classified, with intractable migraine, so stated, without mention of status migrainosus	G43D1	Abdominal migraine, intractable
			Variants of migraine, not elsewhere classified, with intractable migraine, so stated, without mention of status migrainosus	G43A1	Cyclical vomiting, intractable

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	Detailed subgroups	ICD9-CM	Description	ICD10-CM	Description
			Variants of migraine, not elsewhere classified, with intractable migraine, so stated, without mention of status migrainosus	G43C1	Periodic headache syndromes in child or adult, intractable
			Variants of migraine, not elsewhere classified, with intractable migraine, so stated, without mention of status migrainosus	G43819	Other migraine, intractable, without status migrainosus
		34622	Variants of migraine, not elsewhere classified, without mention of intractable migraine with status migrainosus	G43801	Other migraine, not intractable, with status migrainosus
		34623	Variants of migraine, not elsewhere classified, with intractable migraine, so stated, with status migrainosus	G43811	Other migraine, intractable, with status migrainosus
		34630	Hemiplegic migraine, without mention of intractable migraine without mention of status migrainosus	G43409	Hemiplegic migraine, not intractable, w/o status migrainosu
		34631	Hemiplegic migraine, with intractable migraine, so stated, without mention of status migrainosus	G43419	Hemiplegic migraine, intractable, without status migrainosu
		34632	Hemiplegic migraine, without mention of intractable migraine with status migrainosus	G43401	Hemiplegic migraine, not intractable, w status migrainosus
		34633	Hemiplegic migraine, with intractable migraine, so stated, with status migrainosus	G43411	Hemiplegic migraine, intractable, with status migrainosus
		34640	Menstrual migraine, without mention of intractable migraine without mention of status migrainosus	G43829	Menstrual migraine, not intractable, w/o status migrainosus
		34641	Menstrual migraine, with intractable migraine, so stated, without mention of status migrainosus	G43839	Menstrual migraine, intractable, without status migrainosus
		34642	Menstrual migraine, without mention of intractable migraine with status migrainosus	G43821	Menstrual migraine, not intractable, with status migrainosu
		34643	Menstrual migraine, with intractable migraine, so stated, with status migrainosus	G43831	Menstrual migraine, intractable, with status migrainosus
		34650	Persistent migraine aura without cerebral infarction, without mention of intractable migraine without mention of status migrainosus	G43509	Perst migrn aura w/o cereb infrc, not ntrct, w/o stat migr
		34651	Persistent migraine aura without cerebral infarction, with intractable migraine, so stated, without mention of status migrainosus	G43519	Perst migraine aura w/o cerebral infrc, ntrct, w/o stat mig
		34652	Persistent migraine aura without cerebral infarction, without mention of intractable migraine with status migrainosus	G43501	Perst migraine aura w/o cereb infrc, not ntrct, w stat migr
		34653	Persistent migraine aura without cerebral infarction, with intractable migraine, so stated, with status migrainosus	G43511	Perst migraine aura w/o cerebral infrc, ntrct, w stat migr
		34660	Persistent migraine aura with cerebral infarction, without mention of intractable migraine without mention of status migrainosus	G43609	Perst migraine aura w cereb infrc, not ntrct, w/o stat migr
		34661	Persistent migraine aura with cerebral infarction, with intractable migraine, so stated, without mention of status migrainosus	G43619	Perst migraine aura w cerebral infrc, ntrct, w/o stat migr
		34662	Persistent migraine aura with cerebral infarction, without mention of intractable migraine with status migrainosus	G43601	Perst migraine aura w cerebral infrc, not ntrct, w stat mig
		34663	Persistent migraine aura with cerebral infarction, with intractable migraine, so stated, with status migrainosus	G43611	Perst migraine aura w cerebral infrc, ntrct, w stat migr
		34670	Chronic migraine without aura, without mention of intractable migraine without mention of status migrainosus	G43709	Chronic migraine w/o aura, not intractable, w/o stat migr
		34671	Chronic migraine without aura, with intractable migraine, so stated, without mention of status migrainosus	G43719	Chronic migraine w/o aura, intractable, w/o stat migr
		34672	Chronic migraine without aura, without mention of intractable migraine with status migrainosus	G43701	Chronic migraine w/o aura, not intractable, w stat migr
		34673	Chronic migraine without aura, with intractable migraine, so stated, with status migrainosus	G43711	Chronic migraine w/o aura, intractable, w status migrainosu

Type of pain problem groupings		Mapping ICD9-CM to ICD10-CM			
		ICD9-CM		ICD10-CM	
Pain groups	**Detailed subgroups**	**ICD9-CM**	**Description**	**ICD10-CM**	**Description**
		34680	Other forms of migraine, without mention of intractable migraine without mention of status migrainosus	G43809	Other migraine, not intractable, without status migrainosus
		34681	Other forms of migraine, with intractable migraine, so stated, without mention of status migrainosus	G43819	Other migraine, intractable, without status migrainosus
		34682	Other forms of migraine, without mention of intractable migraine with status migrainosus	G43801	Other migraine, not intractable, with status migrainosus
		34683	Other forms of migraine, with intractable migraine, so stated, with status migrainosus	G43811	Other migraine, intractable, with status migrainosus
		34690	Migraine, unspecified, without mention of intractable migraine without mention of status migrainosus	G43909	Migraine, unsp, not intractable, without status migrainosus
		34691	Migraine, unspecified, with intractable migraine, so stated, without mention of status migrainosus	G43919	Migraine, unsp, intractable, without status migrainosus
		34692	Migraine, unspecified, without mention of intractable migraine with status migrainosus	G43901	Migraine, unsp, not intractable, with status migrainosus
		34693	Migraine, unspecified, with intractable migraine, so stated, with status migrainosus	G43911	Migraine, unspecified, intractable, with status migrainosus
		7840	Headache	R51	Headache
			Headache	G441	Vascular headache, not elsewhere classified

eTable 2. Classification of Physician Specialty by the Centre for Medicare and Medicaid

Specialty	Description
Emergency Medicine	Emergency Medicine
Hospital based specialty	Anesthesiology
	Critical Care (Intensivists)
	Diagnostic Radiology
	Hospitalist (self designated)
	Interventional Pain Management
	Interventional Radiology
	Nuclear Medicine
	Pain Management
	Pathology
	Physical Medicine And Rehabilitation
	Radiation Oncology
Internal Medicine	Internal Medicine
Medical specialty	Addiction Medicine
	Advanced Heart Failure and Transplant Cardiology
	Allergy/Immunology
	Cardiac Electrophysiology
	Cardiovascular Disease (Cardiology)
	Dermatology
	Endocrinology
	Gastroenterology
	Hematology
	Hematology/Oncology
	Hematopoietic Cell Transplantation and Cellular Therapy
	Infectious Disease
	Interventional Cardiology
	Medical Genetics and Genomics
	Medical Oncology
	Medical Toxicology
	Nephrology
	Neurology
	Pulmonary Disease
	Rheumatology
	Sleep Medicine
Other	Obstetrics/Gynecology
	Psychiatry
	Geriatric Psychiatry
	Neuropsychiatry
	Other (as such in PECOS)
Primary care	Family Practice
	General Practice
	Geriatric Medicine
	Hospice And Palliative Care
	Osteopathic Manipulative Medicine
	Pediatric Medicine
	Preventative Medicine
Surgical specialty	Cardiac Surgery
	Colorectal Surgery
	General Surgery
	Hand Surgery
	Neurosurgery
	Ophthalmology
	Orthopedic Surgery
	Otolaryngology
	Peripheral Vascular Disease
	Plastic And Reconstructive Surgery
	Sports Medicine
	Surgical Oncology
	Thoracic Surgery
	Urology
	Vascular Surgery

eTable 3. Choice of Opioid Prescribed by Physicians who Prescribed to Patients with Chronic Non-Cancer Pain Problems

Molecule	Asia (N=1,284)	Europe (N=940)	India & Pakistan (N=2,520)	Middle East (N=2,520)	Other (N=1,371)	United States &Canada (N=2,902)
Hydrocodone	482 (37.5)	346 (36.8)	958 (38.0)	319 (37.4)	432 (31.5)	1,113 (38.4)
Tramadol	447 (34.8)	314 (33.4)	881 (35.0)	267 (31.3)	526 (38.4)	930 (32.0)
Codeine	152 (11.8)	86 (9.1)	189 (7.5)	105 (12.3)	130 (9.5)	192 (6.6)
Oxycodone	139 (10.8)	143 (15.2)	357 (14.2)	117 (13.7)	199 (14.5)	472 (16.3)
Multiple Opioids	30 (2.3)	29 (3.1)	71 (2.8)	20 (2.3)	35 (2.6)	95 (3.3)
Morphine	13 (1.0)	4 (0.4)	17 (0.7)	4 (0.5)	13 (0.9)	20 (0.7)
Hydromorphone	7 (0.5)	8 (0.9)	10 (0.4)	4 (0.5)	11 (0.8)	28 (1.0)
Fentanyl	6 (0.5)	3 (0.3)	20 (0.8)	9 (1.1)	7 (0.5)	22 (0.8)
Buprenorphine	4 (0.3)	3 (0.3)	4 (0.2)	3 (0.4)	11 (0.8)	16 (0.6)
Other	4 (0.4)	4 (0.4)	13 (0.5)	5 (0.6)	7 (0.5)	14 (0.4)

eTable 4. Association Between Patient Comorbidities and the Odds of Being Prescribed an Opioid and the Morphine Milligram Equivalent (MME) Dose of Opioid Prescribed

Characteristic	Odds of Prescribing an Opioid for the 65,012 Patients				MME Opioid Dose Prescribed for the 9,870 Patients who Received an Opioid Prescription			
	N Patients (%)	N Patients with Opioid (%)	OR (95% CI)	P-Value	N Patients (%)	Mean (std)	Estimated Difference (95% CI)	P-Value
Co-Morbidities								
Congestive Heart Failure	6,105 (9.4)	939 (15.4)	1.1 (0.97 ; 1.13)	0.217	939 (9.5)	23.4 (24.9)	-0.2 (-2.3 ; 1.9)	0.835
Cardiac Arrhythmia	12,010 (18.5)	1,764 (14.7)	1.0 (0.92 ; 1.04)	0.531	1,764 (17.9)	23.4 (24.5)	-0.5 (-1.9 ; 0.9)	0.478
Valvular Disease	7,852 (12.1)	1,147 (14.6)	1.0 (0.93 ; 1.07)	0.899	1,147 (11.6)	22.2 (23.8)	-0.9 (-2.7 ; 0.8)	0.288
Pulmonary Circulation Disorders	1,846 (2.8)	291 (15.8)	1.1 (0.93 ; 1.20)	0.369	291 (2.9)	24.1 (25.9)	1.8 (-1.2 ; 4.9)	0.237
Peripheral Vascular Disorders	10,395 (16.0)	1,399 (13.5)	0.9 (0.88 ; 1.00)	0.039	1,399 (14.2)	23.3 (27.1)	-0.5 (-2.2 ; 1.2)	0.566
Hypertension without complications	40,560 (62.4)	6,013 (14.8)	1.0 (0.94 ; 1.04)	0.624	6,013 (60.9)	24.1 (28.0)	-2.6 (-4.3 ; -1.0)	**0.001**
Hypertension with complications	6,042 (9.3)	909 (15.0)	1.1 (0.98 ; 1.14)	0.180	909 (9.2)	23.6 (28.1)	1.5 (-0.5 ; 3.6)	0.148
Paralysis	827 (1.3)	98 (11.9)	0.8 (0.66 ; 0.99)	**0.036**	98 (1.0)	25.8 (23.4)	-6.0 (-11.3 ; -0.8)	**0.024**
Other Neurological Disorders	4,968 (7.6)	597 (12.0)	0.8 (0.75 ; 0.89)	**<.001**	597 (6.0)	26.4 (33.1)	-1.5 (-4.0 ; 1.0)	0.236
Chronic Pulmonary Disease	13,257 (20.4)	2,095 (15.8)	1.1 (1.03 ; 1.15)	**0.001**	2,095 (21.2)	24.0 (27.0)	-3.5 (-5.7 ; -1.4)	**0.001**
Diabetes without complications	18,217 (28.0)	2,766 (15.2)	1.1 (1.00 ; 1.12)	**0.033**	2,766 (28.0)	24.9 (29.5)	0.6 (-1.1 ; 2.2)	0.514
Diabetes with complications	6,849 (10.5)	1,060 (15.5)	1.0 (0.96 ; 1.12)	0.340	1,060 (10.7)	23.8 (21.9)	-0.6 (-2.6 ; 1.4)	0.546
Hypothyroidism	14,775 (22.7)	2,044 (13.8)	0.9 (0.87 ; 0.97)	**0.003**	2,044 (20.7)	23.2 (27.1)	-1.1 (-2.6 ; 0.5)	0.166
Renal Failure	6,254 (9.6)	1,001 (16.0)	1.1 (1.02 ; 1.19)	**0.018**	1,001 (10.1)	23.3 (24.4)	-1.4 (-3.0 ; 0.3)	0.100
Liver Disease	3,304 (5.1)	501 (15.2)	1.1 (0.99 ; 1.19)	0.086	501 (5.1)	25.0 (31.3)	-2.1 (-4.6 ; 0.4)	0.095
Peptic Ulcer Disease excluding	822 (1.3)	139 (16.9)	1.2 (1.03 ; 1.46)	**0.020**	139 (1.4)	26.7 (26.4)	0.9 (-3.5 ; 5.4)	0.682
HIV/AIDS	223 (0.3)	36 (16.1)	1.0 (0.69 ; 1.35)	0.844	36 (0.4)	26.4 (17.0)	-7.3 (-13.6 ; -1.0)	**0.024**
Rheumatoid Arthritis/Collagen	10,263 (15.8)	971 (9.5)	0.9 (0.80 ; 0.94)	**<.001**	971 (9.8)	24.9 (30.9)	1.2 (-1.2 ; 3.6)	0.330
Coagulopathy	1,865 (2.9)	280 (15.0)	1.0 (0.88 ; 1.14)	0.936	280 (2.8)	23.9 (27.9)	-1.9 (-5.2 ; 1.4)	0.251
Obesity	7,268 (11.2)	1,134 (15.6)	1.0 (0.93 ; 1.06)	0.841	1,134 (11.5)	25.7 (28.2)	-1.7 (-3.7 ; 0.3)	0.095
Weight Loss	2,371 (3.6)	315 (13.3)	0.9 (0.82 ; 1.04)	0.184	315 (3.2)	25.0 (35.5)	1.0 (-2.4 ; 4.3)	0.566
Fluid and Electrolyte Disorders	6,895 (10.6)	1,003 (14.5)	0.9 (0.88 ; 1.02)	0.139	1,003 (10.2)	25.3 (26.1)	0.7 (-1.5 ; 2.8)	0.545
Blood Loss Anemia	684 (1.1)	94 (13.7)	0.9 (0.76 ; 1.16)	0.576	94 (1.0)	27.3 (38.7)	2.1 (-4.5 ; 8.7)	0.525
Deficiency Anemia	5,494 (8.5)	723 (13.2)	0.9 (0.86 ; 1.01)	0.076	723 (7.3)	24.8 (27.4)	0.4 (-2.2 ; 3.1)	0.762
Drug Abuse	1,405 (2.2)	248 (17.7)	1.0 (0.88 ; 1.17)	0.837	248 (2.5)	41.7 (56.4)	5.8 (-0.8 ; 12.5)	0.086
Psychoses	3,081 (4.7)	361 (11.7)	0.7 (0.61 ; 0.77)	**<.001**	361 (3.7)	25.9 (39.4)	-3.1 (-7.4 ; 1.2)	0.162
Depression	12,034 (18.5)	1,754 (14.6)	1.0 (0.94 ; 1.05)	0.905	1,754 (17.8)	28.3 (38.9)	-0.5 (-2.4 ; 1.5)	0.644