OPEN ACCESS

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

Robyn Tamblyn ,[1] Nadyne Girard,[2] John Boulet,[3] Dale Dauphinee,[3,4] Bettina Habib [2]

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjqs-2021-013503).

For numbered affiliations see end of article.

Correspondence to
Dr Robyn Tamblyn, Department of Medicine and Department of Epidemiology and Biostatistics, McGill University, Montreal, Quebec H3A 1A3, Canada; robyn.tamblyn@mcgill.ca

Received 12 April 2021
Accepted 31 August 2021

Linked

► http://dx.doi.org/10.1136/bmjqs-2021-013697

Check for updates

To cite: Tamblyn R, Girard N, Boulet J, *et al*. *BMJ Qual Saf* Epub ahead of print: [please include Day Month Year]. doi:10.1136/bmjqs-2021-013503

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

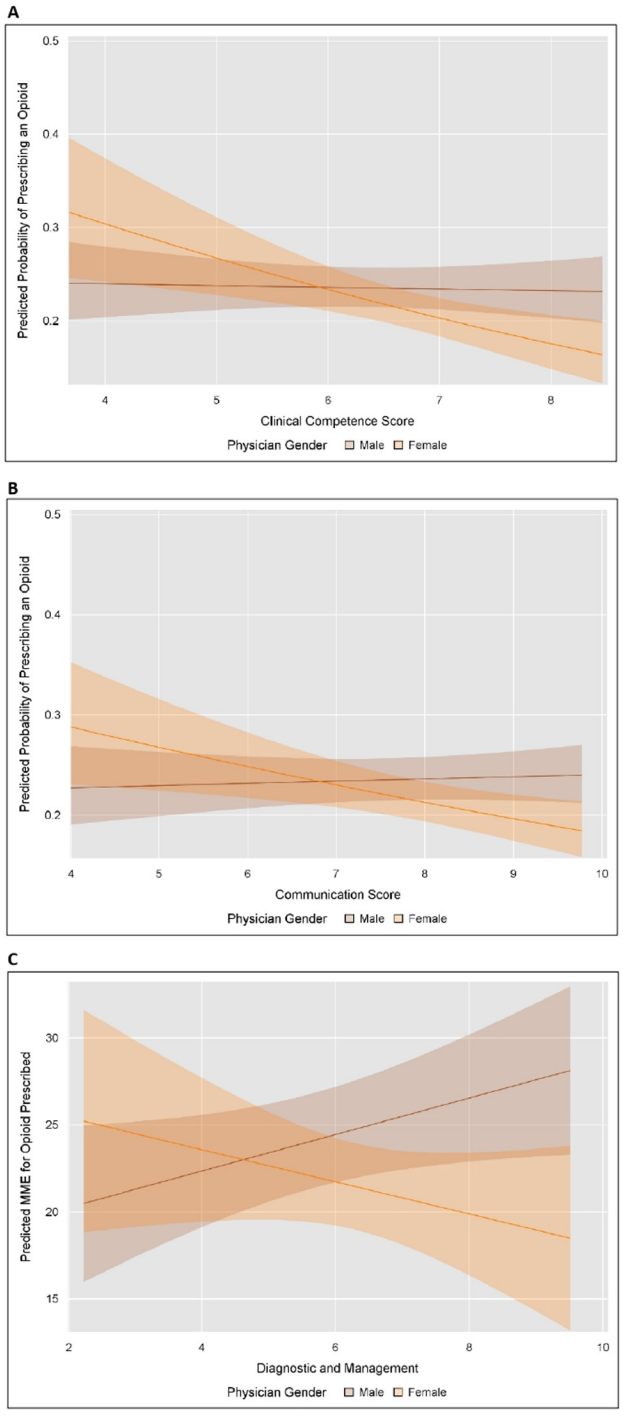

Figure 1 The association between Clinical Skills Assessment scores and the predicted probability of prescribing an opioid and predicted morphine milligram equivalent (MME) dose by physician gender. Figure created by the authors. (A,B) Predicted probability of opioid prescribing based on the following 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.

Author affiliations
[1]Department of Medicine and Department of Epidemiology and Biostatistics, McGill University, Montreal, Quebec, Canada
[2]Clinical and Health Informatics Research Group, McGill University, Montreal, Quebec, Canada
[3]Foundation for Advancement of International Medical Education and Research (FAIMER), Philadelphia, Pennsylvania, USA
[4]McGill University Montreal, Montreal, Quebec, Canada

Contributors All authors contributed to the concept and design of the study. JB obtained access to data. NG performed data analyses. All authors contributed to the interpretation of results. RT drafted the manuscript. All authors provided feedback on the intellectual content of the manuscript and read and approved the final manuscript. RT is the guarantor of this manuscript.

Funding This study was funded by the Foundation for Advancement of International Medical Education and Research (FAIMER), grant number not applicable.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethics approval was provided by the McGill University Institutional Review Board.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available.

ORCID iDs
Robyn Tamblyn http://orcid.org/0000-0003-0134-6954
Bettina Habib http://orcid.org/0000-0001-9570-1026

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.