



EVIDENCE >> INSIGHT >> ACTION

**Rapid Synthesis:
Identifying Risk and Protective Factors for Quality Clinical Practice**

2 February 2015

McMaster Health Forum

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Timeline

Rapid syntheses can be requested in a three-, 10- or 30-business day timeframe. This synthesis was prepared over a 30-business day timeframe. An overview of what can be provided and what cannot be provided in each of the different timelines is provided on the McMaster Health Forum's Rapid Response program webpage (<http://www.mcmasterhealthforum.org/policymakers/rapid-response-program>).

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Conflict of interest

The authors declare that they have no professional or commercial interests relevant to the rapid synthesis. The funder played no role in the identification, selection, assessment, synthesis or presentation of the research evidence profiled in the rapid synthesis.

Merit review

The rapid synthesis was reviewed by a small number of policymakers, stakeholders and researchers in order to ensure its scientific rigour and system relevance.

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KEY MESSAGES

Questions

- What are the risk and protective factors for quality clinical practice?
- What strategies can be used to support quality clinical practices?

Why the issue is important

- Most citizens who access healthcare services in Canada receive safe and high-quality care, but there is increased concern about healthcare professionals who provide low-quality or unsafe care.
- One possible response to this increased attention is regulatory colleges trying to develop a better understanding of the factors that influence the quality of physician practices, and the strategies that can be used to support quality clinical practices.

What we found

- We found 17 primary studies addressing the first question, and two overviews of systematic reviews and 18 systematic reviews addressing the second question
- Risk factors for unsafe medical practice
 - The primary studies provided information regarding factors associated with three indicators of unsafe medical practice: 1) formal complaints; 2) disciplinary cases; and 3) prescription and testing errors, and medical errors more generally.
 - Studies that assessed formal complaints against physicians found: consistent evidence that male physicians and general practitioners had more complaints (although the proportion of complaints was comparable to the proportion of male working doctors); inconsistent results regarding whether international medical graduates had higher rates of formal complaints; and that the majority of complaints relate to the clinical aspects of care rather than issues with communication and/or unethical or improper behaviour.
 - Studies that assessed disciplinary cases found: 606 disciplinary cases in Canada between 2002-2009, almost all of which involved men (92%) and family physicians (62%), psychiatrists (14%), and surgeons (9%); a strong positive correlation between the number of years practised and disciplinary cases (in each of the three Canadian studies); and inconsistent findings related to whether internationally trained medical graduates were more likely to be involved in disciplinary findings.
 - Studies that focused on prescription and testing errors, and medical errors more generally found: physicians scoring in the bottom quartile of the first and second physician qualifying exams had a more than three-fold increase in odds of being considered by peers to provide an unacceptable quality of care; inappropriate practice to be more frequent among male physicians, older physicians/those late in their career, domestically trained physicians, those working in a specialty area that formed a small portion of their practice and those not working in a group practice; and interruptions while prescribing as well as high patient load or workload increase prescription errors.
- Strategies for supporting quality clinical practice
 - Engaging in efforts to support professional behaviour change with the goal of supporting healthy medical practices means: 1) identifying the clinical practice to be optimized and diagnosing the underlying cause of the problem; and 2) selecting and implementing an approach to optimize practice based on the diagnosis of the underlying causes of the problem.
 - The included systematic reviews found beneficial effects for educational materials, educational meetings, educational outreach visits, local opinion leaders, audit and feedback, computerized reminders, and tailored interventions for optimizing medical practice.
 - An overview of systematic reviews found that financial incentives were generally ineffective at improving adherence with guidelines.
 - Two reviews found benefits for quality-improvement strategies for improving processes of care, patient care, and organizational performance, and also indicated that patient- or clinician-driven quality-improvement are more effective than approaches driven by managers or policymakers.

QUESTIONS

1. What are the risk and protective factors for quality clinical practice?
2. What strategies can be used to support quality clinical practices?

WHY THE ISSUE IS IMPORTANT

While most who access health services in Canada receive safe and high-quality care, there is increased attention on those providing low-quality or unsafe care.(1) One possible response to this increased attention begins with regulatory colleges developing a better understanding of the factors that influence the quality and safety of physician practices. The first step in this response is to collect information from the literature about risk and protective factors for quality clinical practice and to identify strategies that can be used to support quality clinical practices.

WHAT WE FOUND

We identified two overviews of systematic reviews, 18 systematic reviews and 17 primary studies from our searches that were relevant to the questions posed. The primary studies address the first question about risk factors for unsafe clinical practice, and both of the overviews and all of the systematic reviews address the second question about mechanisms to keep a healthy clinical practice. We also included one paper that provides an overview of key systematic reviews from the Cochrane Collaboration Effective Practice and Organization of Care (EPOC) group.(2) Given that this paper provides a succinct outline of the features of interventions designed to optimize clinical practice as well as a synthesis of findings from the highest quality and most up-to-date systematic reviews, our synthesis for the second question primarily draws from the overview, with all of the additional reviews we identified provided in Appendix 1.

We also supplemented the findings related to the second question with: 1) content from an evidence brief that is currently being prepared by the McMaster Health Forum about optimizing clinical practice based on data, evidence and guidelines;(3) and 2) a presentation about an approach based in Quebec, Canada for assessing physicians over the age of 70 to identify practices that may need to be optimized.(4)

Risk factors for unsafe medical practice

The 18 primary studies provided information regarding factors associated with three indicators of unsafe medical practice: 1) formal complaints; 2) disciplinary findings; and 3) prescription, testing and medical errors. We have synthesized the key findings from the included studies according to these three domains and provide details for the primary studies in Appendix 2.

Box 1: Background to the rapid synthesis

This rapid synthesis mobilizes both global and local research evidence about a question submitted to the McMaster Health Forum's Rapid Response program. Whenever possible, the rapid synthesis summarizes research evidence drawn from systematic reviews of the research literature and occasionally from single research studies. A systematic review is a summary of studies addressing a clearly formulated question that uses systematic and explicit methods to identify, select and appraise research studies, and to synthesize data from the included studies. The rapid synthesis does not contain recommendations, which would have required the authors to make judgments based on their personal values and preferences.

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This rapid synthesis was prepared over a 30-business day timeframe and involved five steps:

- 1) submission of a question from a health system policymaker or stakeholder (in this case, the College of Physicians and Surgeons of Ontario);
- 2) identifying, selecting, appraising and synthesizing relevant research evidence about the question;
- 3) drafting the rapid synthesis in such a way as to present concisely and in accessible language the research evidence; and
- 4) finalizing the rapid synthesis based on the input of at least two merit reviewers.

Formal complaints

Five studies assessed factors associated with formal complaints against physicians,(5-9) most of which assessed complaints against Australian doctors.(5;7-9) A consistent finding across most of the studies was that male physicians were shown to have more formal complaints against them as compared to female physicians.(5;7;9) For example, a survey of nearly 300 physician complaints in New South Wales, Australia, identified that 87% of complaints were levied against male physicians.(7) Additionally, Bismark et al. observed a nearly 40% higher risk for recurrence of complaints amongst male doctors in a sample of more than 18,000 complaints against Australian physicians.(9) However, these results do not necessarily imply that male physicians have a disproportionate number of complaints as compared to female physicians given that females comprised 29% of all working doctors in 1999 (the date of publication of the survey of 300 physician complaints) and 36% of working doctors in 2009.(10)

Three additional factors were found to be associated with the frequency of complaints against physicians: 1) type of physician practice (general practitioner versus specialist); 2) location of physician training; and 3) subject of complaints. First, Bismark et al. found that general practitioners had twice the risk of recurrence of complaints as plastic surgeons.(9) This was supported by Daniel and colleagues' work, which demonstrated that over half of complaints in their study sample were filed against general practitioners.(7) These findings should be interpreted with caution given that primary care practitioners comprise the largest group of physicians in Australia (38% in 2009).(10) Another study by Bismark et al. found that 'complaint-prone' physicians (with four or more separate complaints) were more likely to be psychiatrists or surgeons,(5) indicating that this is likely an area requiring further investigation.

Studies provide contradictory results regarding associations between domestic versus internationally trained medical graduates. One study conducted in Australia found that physicians with four or more separate complaints were more likely to have trained in the same jurisdiction they were practising in, whereas another study conducted in Australia observed that international medical graduates were 25% more likely to have a complaint filed against them.(8)

Lastly, two studies,(7;9) reported that the majority of complaints (61% and 64%, respectively) were regarding clinical aspects of care, which included concerns addressing diagnosis, medications and the focus of treatment. Other complaints commonly related to issues with communication and/or unethical or improper behaviour.(7;9) One of these studies also revealed that over half of the incidents described in complaints against physicians took place in a physician's consulting room.(7)

Box 2: Identification, selection and synthesis of research evidence

For the first question we conducted a related articles search using one highly relevant article,(9) and then conducted keyword searches using the following combinations of terms

- (quality assurance, health care/standards[MeSH major topic] AND physician's practice patterns/standards[MeSH major topic]
- (physician's practice patterns/standards[MeSH major topic] AND physician's practice patterns/statistics & numerical data[MeSH subheading] AND Canada
- "physician's practice patterns/standards"[MAJR] AND (performance OR safety)

For the second question, we identified systematic reviews by searching Health Systems Evidence using the provider-targeted implementation strategy category and limiting the search to reviews with a general focus.

The results from the searches were assessed by one reviewer for inclusion. A document was included if it fit within the scope of the questions posed for the rapid synthesis.

For each review we included in the synthesis, we documented the focus of the review, key findings, last year the literature was searched (as an indicator of how recently it was conducted), methodological quality using the AMSTAR quality appraisal tool (see the Appendix for more detail), and the proportion of the included studies that were conducted in Canada. For primary research (if included), we documented the focus of the study, methods used, a description of the sample, the jurisdiction(s) studied, key features of the intervention, and key findings. We then used this extracted information to develop a synthesis of the key findings from the included reviews and primary studies.

Disciplinary cases

We identified five studies,(1;6;8;11;12) that assessed characteristics of physicians associated with disciplinary cases and/or case outcomes (e.g., malpractice lawsuits or disciplinary cases by licensing authorities). Three of these studies were conducted in Canada, and addressed cases of sexual misconduct, standard-of-care issues, and unprofessional conduct.(1;11;12) Similar to the findings related to formal complaints against physicians, there are inconsistent findings across studies related to whether domestic versus internationally trained medical graduates are more likely to be involved in disciplinary cases. One Canadian study found that the majority (67%) of 606 disciplinary cases between 2000 and 2009 involved Canadian medical graduates.(1) Similarly, a Canadian study conducted by the same authors found that of the 11 disciplinary proceedings where anesthesiologists were found to be guilty between 2000-2011, seven (63.6%) were international medical graduates.(12) In addition, an Australian study found that international medical graduates were 41% more likely to have had an adverse disciplinary finding than locally trained physicians.(8) However, another Canadian study focused specifically on psychiatrists disciplined in Canada from 2000 to 2009 and found no difference between jurisdiction of training.(11)

Three of the studies (including two of the Canadian studies) evaluated the frequency of disciplinary cases based on physician specialty. One study based in a teaching hospital in the United States reported that the risk of malpractice for individual physicians was associated with their area of specialization.(6) In contrast, the study of 606 Canadian physicians found that disciplinary cases were primarily clustered among physicians in family medicine (62%), psychiatry (14%), and surgery (9%).(1) Additionally, the same authors found that as compared to all other physicians, psychiatrists were more than three times as likely to be disciplined for sexual misconduct and unprofessional conduct, and more than twice as likely to be disciplined for fraudulent behaviour.(11)

The three Canadian studies also found associations between physician gender and frequency of disciplinary care. Specifically, 92% of the 606 Canadian physicians disciplined between 2000 and 2009 were male and 91% of the 82 psychiatrists involved in disciplinary cases were male. In addition, all of the 11 instances where anesthesiologists were found to be guilty in disciplinary hearings between 2000 and 2011 involved male physicians.(12)

The number of years practised was also strongly correlated with disciplinary cases in each of the three Canadian studies. Specifically, an average of 28.9 years (standard deviation = 11.3 years) from medical school graduation to disciplinary action was found for 606 Canadian physicians with a disciplinary finding between 2000 and 2009.(1) In the same time period, psychiatrists had a mean of 33 years of practice (standard deviation = 11 years) until disciplinary conviction.(11) Lastly, anesthesiologists involved in disciplinary cases between 2000 and 2011, had practised for a mean of 31.9 years (standard deviation = 12.9) before disciplinary conviction.(12)

Prescriptions, tests, medical errors

We identified nine studies that assessed factors associated with unsafe prescribing practices, tests and medical errors.(13-20) One study assessed nursing home prescribing practices among physicians and found that those with the best prescribing practices were female, had a certificate of added qualification in geriatrics, and had frequent consultation with psychiatrists.(13) The same study found that doctors with the most inappropriate prescribing practice were older, had graduated from medical school before 1965, were domestically trained (either in the United States or Canada), had a small nursing home practice, and infrequently consulted with psychiatrists.(13) Another study looking at the prescription of tests for patients with diabetes similarly found that female physicians more often prescribed the recommended tests.(15) Both of these studies, as well as one other that analyzed inappropriate prescriptions for elderly patients, also found better prescribing practices among younger physicians.(13;15;21) These findings are consistent with an assessment of physician referrals to the National Clinical Assessment Service in the United Kingdom for performance-related concerns, which found that male physicians were twice as likely to be referred as compared to their female counterparts, and

physicians late in their careers were approximately six times more likely to be referred than physicians early in their careers.(17) Another study conducted in the United Kingdom that assessed more than one million low-, intermediate- and high-level electronic prescribing alerts (where high-level alerts were indicative of serious prescribing errors) found that such data was not sufficient to detect physicians who were more likely to generate high-level alerts.(22)

Three studies evaluated the association between the type or setting of practice and appropriate prescribing and test ordering. Two of these studies found that working in a group practice was associated with better prescribing practices. One of the studies found that physicians working in a group practice more often appropriately prescribed HbA1c tests,(15) and the other study based in Norway found a correlation between better prescribing practices and working in a group practice.(21) The third study focused on the setting of care and found that the majority of medical errors were reported to have occurred in a physician's office.(16)

Other factors that have been cited as influencing prescription errors include patient load or workload, interruptions while prescribing, pressure from other staff and work environment.(18;19) In addition, a Canadian study assessed physicians' quality of care more generally and found that physicians scoring in the bottom quartile of the first and second physician qualifying exams had a more than three-fold increase in odds of being considered by peers to provide an unacceptable quality of care.(14)

Strategies for supporting healthy practices

Those engaged in efforts to support professional behaviour change with the goal of supporting healthy medical practices need to “identify modifiable and non-modifiable barriers relating to behavior; identify potential adopters and practice environments; and prioritise which barriers to target based upon consideration of ‘mission critical’ barriers.”(2) As outlined in a recent evidence brief about optimizing clinical practice in Ontario, this generally involves: 1) identifying the clinical practice to be optimized and diagnosing the underlying cause of the problem; and 2) selecting and implementing an approach to optimize practice based on the diagnosis of the underlying causes of the problem.(3)

The first set of activities involves an iterative process that begins by identifying the clinical practice that needs to be optimized (using high-quality data and evidence), specifying the behaviour(s) that need to be changed,(23) diagnosing the cause of the problem, and engaging key stakeholders to determine the appropriate level of action (e.g., provincial or organizational).(3)

Fundamental to these activities is the need to use explicit criteria with high-quality data to identify the clinical practice that needs to be optimized. Quebec has adopted such an approach where a scoring grid consisting of 10 questions to assess the risk for unsatisfactory medical practice has been developed.(4) The 2012 pilot evaluation process in Quebec consisted of questionnaires sent to all physicians over the age of 70 and then having an independent physician review all questionnaires and assigning two scores. The first was a numerical score from 10 to 28 based on a risk assessment grid consisting of 10 criteria, and the second was a subjective letter grade of A, B or C. The 10 risk-factor scoring criteria relate to:

- 1) scope of practice (open practice, limited practice or only one field of practice);
- 2) volume of activities (active/ full-time practice and/or a high volume of patients);
- 3) percentage of practice outside of medical training (based on whether the percentage is greater than 30%);
- 4) support in the practice (solo office or lone specialist, outpatient clinic or community practice with peers or university hospital/ family medicine group/ network clinic);
- 5) new patients (yes or no);
- 6) hospital practice (yes or no);
- 7) locum only (yes or no);
- 8) types of techniques (high versus low risk);
- 9) continuing professional development (limited medical education in last two years, proof of attendance or valid continuing professional development plan); and
- 10) future plan (no intention to retire within next year or precise plan to retire in less than a year).(4)

Following the grid assessment, peer review is conducted for those whose score is 26 to 28, or for those who score 24-25 along with a subjective grade assessment of 'B'.(4)

The evidence brief about optimizing clinical practice in Ontario outlines that activities related to selecting and implementing an approach to optimizing practice similarly involves an iterative process consisting of several steps.(3) In general, this involves using the diagnosis of the problem to: 1) identify the active ingredients or approach needed to optimize practice (e.g., education, audit and feedback, financial incentives, etc.) based on the diagnosis of the problem, relevant frameworks and research evidence; 2) determine how the active ingredients are likely to work (i.e., the causal mechanisms); 3) consider different modes of delivery for the active ingredients (e.g., website, personalized email, electronic health records, etc.); 4) specify the target for change (e.g., motivation, tasks, roles, rules and/or strategies); 5) engage key stakeholders to evaluate the previous four activities and identify barriers and facilitators to the approach;(23) and 6) iteratively revise the approach as required and decide on an optimal approach to implement.(3;24)

High-quality research evidence is particularly important for this set of activities, and as of December 2014, Health Systems Evidence (www.healthsystemsevidence.org), which provides a comprehensive inventory of systematic reviews addressing governance, financial and delivery arrangements in health systems as well as implementation strategies that can support change, contained 860 systematic reviews evaluating provider-targeted implementation strategies. While assessing this volume of research evidence is beyond the scope of this synthesis, Grimshaw et al. provide a summary of the results of the highest quality and most up-to-date systematic reviews produced by the Cochrane Effective Practice and Organizational Change group.(2) In Table 1 below we present content extracted directly from the Grimshaw et al. 2013 paper about the key features of the professional behaviour change interventions they profile. In addition, we present the details and findings of the reviews of these interventions in Table 2, which has also been directly extracted from Grimshaw et al., but updated where new reviews have since been published.

In general, the reviews presented in Table 2 found beneficial effects for each of the interventions, including educational materials,(25) educational meetings,(26) educational outreach visits,(27) local opinion leaders,(28) audit and feedback,(29) computerized reminders,(30) and tailored interventions.(31) As noted in Table 1, findings from an older systematic review evaluating multifaceted interventions (i.e., approaches combining two or more of these interventions) indicate that effect sizes do not necessarily increase as more interventions are added.(32)

We also identified:

- a recent overview of systematic reviews (33) and an older medium-quality review (34) focused on continuing medical education (CME);
- a recent overview of systematic reviews about the use of financial incentives;(35)
- a recent medium-quality review about quality-improvement and accreditation mechanisms in primary care;(36) and
- a recent medium-quality review about the use of safety checklists for improving patient safety.(37)

The overview about CME found that approaches with multiple exposures and interactive methods (such as audit and feedback, interactive educational opportunities and multimedia) improve physician performance and patient health outcomes.(33) The older medium-quality review found mixed effects in several comparisons between multifaceted interventions, educational outreach visits, educational meetings, and distribution of educational materials.(34) However, multifaceted interventions were deemed to be effective as compared to educational materials, and educational outreach was effective as compared to controls, further suggesting that more interactive approaches are more effective. The overview about the use of financial incentives found that they are generally ineffective at improving adherence to guidelines.(35) The first recent medium-quality review focused on primary care and defined quality improvement as “a sustained effort to improve healthcare quality that incorporates repeated performance measurement and feedback to healthcare

providers”, and accreditation as “a self-assessment against a given set of standards, an on-site survey by peers from other organizations trained in assessment, an assessment of the degree of compliance with the standards, a written report with or without recommendations, and the granting or denial of accreditation status.”(36) The review found mixed evidence regarding the use of quality improvement in primary care, but sufficient evidence to recommend its use in two specific areas (colorectal screening and foot examination rates for diabetic patients). For accreditation, the review found a lack of research about whether and how it affects outcomes of care, patients’ perceptions of care, healthcare utilization and costs, and the perceptions of primary healthcare providers.(36) Lastly, the review about the use of safety checklists found that they improved communication and adherence to standard operating procedures, and reduced adverse events, morbidity and mortality.(37)

While beneficial effects are observed for each of the interventions in Table 2, the absolute effect sizes for each are similar. As Grimshaw et al. point out, there are two possible explanations for this finding. First, it could be that the intervention chosen is unimportant as compared to simply doing something to improve practice, suggesting that effects are not specific to the type of intervention used.(2) The second, which they indicate is their interpretation of the findings, is instead that the effects of interventions vary in relation to the degree to which the causal mechanisms of action for the intervention address the specific barriers identified during the process of diagnosing the problem. As Grimshaw et al. state: “Researchers are likely to have tested interventions that they believed likely effective given the particular behaviours and likely barriers within the context of their study.”(2) This interpretation lends further support to the need to engage in the general processes outlined above for diagnosing the underlying cause of the problem, and then selecting and implementing an approach to optimize practice based on the diagnosis.

Table 1: Key features of professional behaviour change interventions (content for this table has been directly extracted from the summary of interventions presented in Grimshaw et al. 2013)(2)

Intervention	Key features
Printed educational materials	<ul style="list-style-type: none"> • EPOC defines printed educational materials as the ‘distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audio-visual materials and electronic publications’. • The materials may have been delivered personally or through mass mailings.(25) • Printed educational materials target knowledge and potential skill gaps of individual healthcare professionals. • They could also be used to target motivation when written as a ‘persuasive communication’, but there is little evidence of them being used in this way. • Printed educational materials are commonly used, have a relatively low cost and are generally feasible in most settings.
Educational meetings	<ul style="list-style-type: none"> • EPOC defines educational meetings as the ‘participation of healthcare providers in conferences, lectures, workshops or traineeships’.(26) • An important distinction is between didactic meetings (that largely target knowledge barriers at the individual healthcare professional/peer group level) and interactive workshops (that can target knowledge, attitudes and skills at the individual healthcare professional/peer group level). • Educational meetings are commonly used, with the main cost related to the release time for healthcare professionals, and are generally feasible in most settings.
Educational outreach	<ul style="list-style-type: none"> • EPOC defines educational outreach or academic detailing as ‘use of a trained person who meets with providers in their practice settings to give information with the intent of changing the providers’ practice’. • The information given may have included feedback on the performance of the provider(s).(27) • Soumerai and Avorn suggest that educational outreach derives from social marketing approaches that target an individual’s knowledge and attitudes.(38) • Typically, the detailer aims to get a maximum of three messages across during a 10- to 15-minute meeting with a healthcare provider. • The detailer will tailor their approach to the characteristics of the individual healthcare provider, and typically use additional provider behaviour change strategies to reinforce their message. • Most studies of educational outreach have focused on changing relatively simple behaviours in the control of individual physician behaviours, such as the choice of drugs to prescribe. • Educational outreach programs have been used across a wide range of healthcare settings, especially to target prescribing behaviours, and require considerable resources including the costs of detailers and preparation of materials.
Local opinion leaders	<ul style="list-style-type: none"> • EPOC defines local opinion leaders as ‘use of providers nominated by their colleagues as ‘educationally influential’,(28) and the investigators must have explicitly stated that their colleagues identified the opinion leaders.’ • Opinion leadership is the degree to which an individual is able to influence other individuals’ attitudes or overt behaviour informally in a desired way with relative frequency. • This informal leadership is not a function of the individual’s formal position or status in the system; it is earned and maintained by the individual’s technical competence, social accessibility, and conformity to the system norms. • When compared to their peers, opinion leaders have greater exposure to all forms of external communication, have somewhat higher social status and are more innovative. • The most striking feature of opinion leaders is their unique and influential position in their system’s communication structure; they are at the centre of interpersonal communication networks (interconnected individuals who are linked by patterned flows of information). • Opinion leaders target the knowledge, attitudes and social norms of their peer group, and their potential success is dependent upon the existence of intact social networks within professional communities. • Grimshaw and colleagues observed that the existence of such networks varied across communities and settings within the United Kingdom, and that they were

	<p>condition-specific (in other words, colleagues identified different opinion leaders for different clinical problems).(39)</p> <ul style="list-style-type: none"> • Doumit also observed that opinion leaders were not stable over time.(40) • The resources required for opinion leaders include costs of the identification method, training of opinion leaders and additional service costs.
Audit and feedback	<ul style="list-style-type: none"> • EPOC defines audit and feedback as ‘any summary of clinical performance of healthcare over a specified period of time’ to change health professional behaviour, as indexed by ‘objectively measured professional practice in a healthcare setting or healthcare outcomes.’ • The summary may also have included recommendations for clinical action, and the information may have been obtained from medical records, computerized databases, or observations from patients. • The subsequent feedback of and resulting action planning based on the audit summary are also important elements of an audit and feedback intervention.(29;41) • Adams and colleagues observed that healthcare professionals often over estimated their performance by around 20% to 30%.(42) • Audit and feedback target healthcare provider/peer groups’ perceptions of current performance levels, and is useful to create cognitive dissonance within healthcare professionals as a stimulus for behaviour change. • The resources required to deliver audit and feedback include data abstraction and analysis costs and dissemination costs. The feasibility of audit and feedback may depend on the availability of meaningful routine administrative data for feedback.
Computerized reminders	<ul style="list-style-type: none"> • EPOC defines reminders as ‘patient or encounter specific information, provided verbally, on paper or on a computer screen, which is designed or intended to prompt a health professional to recall information.(30) This would usually be encountered through their general education, in the medical records or through interactions with peers, and so remind them to perform or avoid some action to aid individual patient care. Computer-aided decision support and drugs dosage are included.’ • Reminders prompt healthcare professionals to remember to do important items during professional-patient interactions.(43) • The majority of early studies on computerized reminders were undertaken in highly computerized U.S. academic health science centres, and their generalizability to other settings is less certain.(44) • The resources required vary across the delivery mechanism, and there is insufficient knowledge at present about how to prioritize and optimize reminders.
Tailored interventions	<ul style="list-style-type: none"> • Tailored interventions are ‘strategies to improve professional practice that are planned taking account of prospectively identified barriers to change.’(31) • Barriers to change refer to factors that have the potential to impair the effectiveness of interventions designed to improve professional behaviour/practice, and EPOC classifies barriers to change into nine categories (information management, clinical uncertainty, sense of competence, perceptions of liability, patient expectations, standards of practice, financial disincentives, administrative constraints, and other).(45) • In a recent review, Baker and colleagues assessed the effectiveness of interventions tailored to address identified barriers to change on professional practice or patient outcomes and found that tailored interventions are more likely to improve professional practice (e.g., prescribing and adherence to guideline recommendations) than is no intervention or the dissemination of guidelines or educational materials. • Further research is needed to determine the effectiveness of tailored interventions in comparison with other interventions.(31)
Multifaceted interventions	<ul style="list-style-type: none"> • EPOC defines multifaceted interventions as ‘any intervention including two or more components’ and potentially target different barriers in the system. • Grimshaw and colleagues explored whether there was a dose response curve for multifaceted interventions and observed that effect sizes did not necessarily increase with increasing number of components,(46) and also observed that few studies provided any explicit rationale or theoretical base for the choice of intervention. • As a result, it was unclear whether researchers had an <i>a priori</i> rationale for the choice of components in multifaceted interventions based upon possible causal mechanisms or whether a ‘kitchen sink’ approach formed the basis for the choice. • It is plausible that multifaceted interventions built upon a careful assessment of barriers and coherent theoretical base may be more effective than single interventions. • Multifaceted interventions are likely to be more costly than single interventions, and when planning multifaceted interventions, it is important to carefully consider how components are likely to interact to maximize benefits.

Table 2: Effectiveness of professional behaviour change strategies from selected EPOC systematic reviews (this table has been extracted from Grimshaw et al. 2013 and updated with revised versions of some of the reviews originally summarized)(2)

Intervention	Number of studies/individuals	Effect sizes
Printed educational materials* (25)	14 randomized trials and 31 non-randomized studies	Median absolute differences from randomized trials were: 2% (range from 0 to +11%) for categorical practice outcomes (e.g., X-ray requests, prescribing and smoking cessation activities); and 13% (range from -16% to +36%) for continuous professional practice outcomes. Only two randomized trials and two non-randomized studies reported patient outcomes. After the data was re-analyzed, significant improvements in patient outcomes were observed (but there is insufficient evidence to reliably estimate their effect on patient outcomes).
Educational meetings (26)	81 randomized trials (involving more than 11,000 health professionals)	Median absolute improvement in care of 6.0% (interquartile range +1.8% to 15.3%).
Educational outreach (27)	69 randomized trials (involving more than 15,000 health professionals)	Median absolute improvements in: prescribing behaviours (17 comparisons) of 4.8% (interquartile range +3.0% to +6.5%); other behaviours (17 comparisons) of 6.0% (interquartile range +3.6% to +16.0%). The effects of educational outreach for changing more complex behaviours are less certain.
Local opinion leaders (28)	18 randomized trials (involving more than 296 hospitals and 318 primary care physicians)	Median absolute improvement of care of 12.0% across studies (interquartile range +6.0% to +14.5%).
Audit and feedback* (29)	140 randomized trials	Median absolute improvement of 4.3% (interquartile range +0.5% to +16%). More than 16% absolute improvement is observed when baseline performance is low and/or when key intervention features are incorporated.
Computerized reminders (30)	28 randomized trials	Median absolute improvement of care of 4.2% (interquartile range +0.8% to +18.8%).
Tailored interventions (31)	26 randomized trials	Meta-regression using 12 randomized trials. Pooled odds ratio of 1.52 (95% CI, 1.27 to 1.82, $p < .001$)

*We have revised the findings for these interventions based on updated reviews that have been published since this table was published by Grimshaw et al. in 2013.

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APPENDICES

The following tables provide detailed information about the systematic reviews and primary studies identified in the rapid synthesis. The ensuing information was extracted from the following sources:

- systematic reviews - the focus of the review, key findings, last year the literature was searched and the proportion of studies conducted in Canada; and
- primary studies - the focus of the study, methods used, study sample, jurisdiction studied, key features of the intervention and the study findings (based on the outcomes reported in the study).

For the appendix table providing details about the systematic reviews, the fourth column presents a rating of the overall quality of each review. The quality of each review has been assessed using AMSTAR (A Measurement Tool to Assess Reviews), which rates overall quality on a scale of 0 to 11, where 11/11 represents a review of the highest quality. It is important to note that the AMSTAR tool was developed to assess reviews focused on clinical interventions, so not all criteria apply to systematic reviews pertaining to delivery, financial or governance arrangements within health systems. Where the denominator is not 11, an aspect of the tool was considered not relevant by the raters. In comparing ratings, it is therefore important to keep both parts of the score (i.e., the numerator and denominator) in mind. For example, a review that scores 8/8 is generally of comparable quality to a review scoring 11/11; both ratings are considered “high scores.” A high score signals that readers of the review can have a high level of confidence in its findings. A low score, on the other hand, does not mean that the review should be discarded, merely that less confidence can be placed in its findings and that the review needs to be examined closely to identify its limitations. (Lewin S, Oxman AD, Lavis JN, Fretheim A. SUPPORT Tools for evidence-informed health Policymaking (STP): 8. Deciding how much confidence to place in a systematic review. *Health Research Policy and Systems* 2009; 7 (Suppl1):S8).

All of the information provided in the appendix tables was taken into account by the authors in describing the findings in the rapid synthesis.

Appendix 1: Summary of findings from systematic reviews about mechanisms for keeping a healthy practice

Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
Factors that influence the effectiveness of continuing medical education (CME) on physician clinical care and healthcare outcomes (33)	The eight systematic reviews indicated that CME that included interactive methods (e.g. audit and feedback, interactive education, multimedia) and involved multiple exposures were found to be effective. CME has positive impacts and improves physician performance and patient health outcomes. Further research and rigorous methods are needed in order to account for other factors (e.g., organizational, political) that may contribute to physician performance and patient health outcomes.	2014	No rating tool available for overviews of systematic reviews	Not applicable (includes systematic reviews as the unit of analysis and not single studies)
Effects of safety checklists for improving patient safety (37)	The review included 34 studies and found that safety checklists improved communication, reduced adverse events, resulted in better adherence to standard operating procedures, and reduced morbidity and mortality. None of the studies found that the introduction of patient safety checklists resulted in negative effects on safety.	2013	5/10 (AMSTAR rating from Program in Policy Decision-making)	2/34
Effectiveness of university-based interprofessional education (IPE) for health students (47)	There was some evidence of attitudinal changes post-intervention for the interprofessional groups. Mixed results were obtained related to the learning outcomes of IPE. One study reported improved clinical decision-making by medical students, while another study showed that the knowledge scores of the control group improved compared to the intervention group. One-third of the studies implemented campus- or classroom-based IPE approaches, and this was considered to be the most appropriate method to ensure delivery of IPE to large cohorts of students. All of the studies had certain methodological shortcomings.	2011	7/11 (AMSTAR rating from Program in Policy Decision-making)	1/9
Effects of patient participation in face-to-face primary care consultations on patient-oriented and/or disease-oriented outcomes (48)	Despite the underlying theory, the review saw no significant effect (a suggestion of a positive impact at most) of patient participation on patient-related outcomes. For disease-related outcomes, no overall effect of patient participation could be demonstrated; some studies even revealed deterioration in disease-oriented outcomes.	2010	6/10 (AMSTAR rating from Program in Policy Decision-making)	1/7
Effects of teamwork training for clinical staff on attitudes, teamwork skills, technical performance, efficiency and clinical outcomes (49)	Most of the 14 included studies found that teamwork training improved staff attitudes, and six of eight studies that evaluated outcomes related to improved teamwork found significantly better outcomes after the intervention. Five of eight studies that assessed technical performance found improvements in efficiency or reduced errors. Of the three studies that reported on clinical benefits, either modest or borderline significant effects were found as a result of teamwork training. Studies with more intense training reported more significant benefits as compared to interventions that provided less training. The authors concluded that the evidence for technical or clinical benefit from teamwork training in medicine is weak, but that there is some evidence that greater benefits are achieved with more intensive training programs.	Not reported	6/11 (AMSTAR rating from Program in Policy Decision-making)	Not reported
Effects of local opinion leaders on professional practice and healthcare outcomes (28)	Local opinion leaders alone and local opinion leaders with audit and feedback were found to be generally effective for improving appropriate care behaviour. Multifaceted interventions that included the use of opinion leaders in addition to one or more interventions had mixed results for improving appropriate care behaviour (based on 10 randomized controlled trial (RCT) comparisons).	2009	10/10 (AMSTAR rating from Program in Policy Decision-making)	6/18

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Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
Effects of continuing education meetings and workshops on professional practice and healthcare outcomes (26)	Educational meetings (e.g., courses, conferences, lectures, workshops, seminars and symposia) for physicians (and other healthcare professionals), alone or combined with other interventions, improved professional practice and the achievement of treatment goals by patients. Seven studies of 81 targeted interventions for improving the detection of cancer, and these studies did not find any statistically significant impact of educational meetings on professional practice.	2006	10/11 (AMSTAR rating from Program in Policy Decision-making)	4/81
Effects of on-screen, point-of-care computer reminders on processes and outcomes of care (30)	Computer reminders lead to a 4.2% median improvement in process adherence for all outcomes, 3.3% for medication ordering, 3.8% for vaccinations and 3.8% for test ordering. Generally, point-of-care computer reminders achieve small improvements in physician behaviour. The evidence is unclear about design features and context of these messages which associates them to larger improvements.	2008	9/11 (AMSTAR rating from Program in Policy Decision-making)	1/28
Effectiveness of financial incentives in changing healthcare professional behaviours and patient outcomes (35)	Payment for working for a specified time period was generally ineffective, improving three of 11 outcomes from one study reported in one review. Payment for each of the following were generally effective: service, episode or visit; providing care for a patient or specific population; and providing a pre-specified level or providing a change in activity or quality of care. Mixed and other systems of financial incentives were of mixed effectiveness. Assessing the effect of financial incentives overall across categories of outcomes, they were: of mixed effectiveness on consultation or visit rates; generally effective in improving processes of care; generally effective in improving referrals and admissions; generally ineffective in improving compliance with guidelines outcomes; and generally effective in improving prescribing costs outcomes.	2010	No rating tool available for this type of document (overview of systematic reviews)	n/a (included systematic reviews as the unit of analysis)
Whether different factors influence the effectiveness of educational outreach visits (EOVs) and whether adding another intervention to EOVs, such as the use of patient-mediated interventions or using manuals or computerized reminders to prompt clinicians to perform clinical actions, alters their effectiveness (27)	Multifaceted interventions that included educational outreach and distribution of educational materials and/or other intervention compared to a control group, compared to audit and feedback and compared to educational materials were all found to be generally effective for improving appropriate care. Educational outreach interventions used alone compared to a control group and compared to educational materials were found to be generally effective. There was insufficient evidence for comparisons of multifaceted versus educational meetings, educational outreach visits versus continuity of care, and multifaceted versus reminders.	2007	8/11 (AMSTAR rating from www.rxforchange.ca)	1/69
Effectiveness of various quality-improvement strategies for enhancing healthcare (50)	Research evidence suggests clinician/patient-driven quality-improvement strategies are more effective compared to manager/policymaker-driven approaches. The most effective quality-improvement strategies included clinician-directed audit and	2008	2/11 (AMSTAR rating from Program in Policy Decision-making)	Not Reported

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Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	feedback, decision support systems, and the use of small-group discussions in continuing professional education.			
Effectiveness of quality-improvement collaboratives in enhancing the quality of care (51)	<p>Systematic review of nine controlled trials found a positive effect of quality-improvement collaboratives on processes of care and patient outcomes.</p> <p>Review additionally examined the findings of 60 uncontrolled reports of which 53 trials indicated specific improvements in patient care and organizational performance due to participation in a quality-improvement collaborative.</p>	2006	4/11 (AMSTAR rating from www.rxforchange.ca)	Not Reported
To assess the effects of audit and feedback on professional practice and healthcare outcomes (29)	In all comparisons - audit and feedback alone compared to no other interventions, audit and feedback with educational meetings compared to no intervention, audit and feedback as part of a multifaceted intervention compared to no intervention, audit and feedback combined with complementary interventions compared to audit and feedback alone, and audit and feedback compared to other interventions - audit and feedback was found to be generally effective.	2010	8/11 (AMSTAR rating from www.rxforchange.ca)	11/140
Guideline dissemination and implementation strategies (32)	<p>Single interventions compared with no intervention showed that reminders, audit and feedback, patient-mediated approaches, and the distribution of educational materials were found to be effective for improving appropriate care with medium effect sizes.</p> <p>Time series data were reported for the distribution of educational materials, and half of the studies showed an immediate effect or effect over time.</p> <p>Insufficient evidence exists for educational meetings, other professional interventions (interviewing physicians about outpatient referrals, and a rapid rule-out protocol), continuity of care, and revision of pharmacy-related professional roles.</p> <p>Insufficient evidence exists to determine the effects physicians responding to reminders compared with reminders, educational materials compared with reminders, and reminders compared with patient-mediated interventions.</p> <p>Multifaceted interventions compared with no intervention were found to be effective for improving appropriate care with medium effect sizes. Time series data show that these interventions also have immediate effects, most of which are sustained over time.</p> <p>Multifaceted interventions compared with intervention controls were found to be effective for improving appropriate care with small effect sizes.</p>	1998	7/11 (AMSTAR rating from www.rxforchange.ca)	15/235
To determine the overall effect size of practice facilitation and possible moderating factors(52)	<p>The review found that practice facilitation has potential to address the challenges faced when translating evidence into practice. Based on the review, primary care practices are 2.76 times more likely to employ evidence guidelines when using practice facilitation.</p> <p>It has not yet been determined whether facilitation can be applied in areas requiring direct physician uptake. Specific impact on patients with comorbid conditions was not discussed at length in this review.</p>	2010	6/11 (AMSTAR rating from Program in Policy Decision-making)	3/22

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Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	The review concluded that practice facilitation has a moderately robust effect on evidence-based guideline adoption within primary care.			
Educational games for health professionals (53)	One randomized controlled trial of fair methodological quality evaluated the use of an education game with a focus on infection control, and was based on the television game show “Family Feud”. The study found that those who took part in the game had significantly higher knowledge scores than those who didn’t play the game. No patient or process of care outcomes were reported.	2012	9/9 (AMSTAR rating from Program in Policy Decision-making)	1/1
Effects of printed educational materials on professional practice and healthcare outcomes (25)	When used alone and compared to no intervention, the review found that printed educational materials have a small beneficial effect on professional practice outcomes. However, the review indicated that there is insufficient information to reliably estimate the effect of printed educational materials on patient outcomes.	2011	8/11 (AMSTAR rating from www.rxforchange.ca)	12/50
Effects of computerized clinical decision-support systems improve practitioners’ diagnostic test ordering behaviour (54)	<p>Eighteen of the 35 included studies found that computerized clinical decision-support systems improved overall test ordering behaviour.</p> <p>Five of the six studies that focused on diagnostic test ordering found improvements, five of the eight studies that focused on treatment monitoring found improvements, and six of the 17 studies that focused on disease monitoring found improvements.</p> <p>Four of the systems that were evaluated specifically focused on reducing test ordering rates, and all were successful. Minimal or no evidence related to costs, user satisfaction and impact on workflow was reported in the included studies.</p>	2010	8/10 (AMSTAR rating from Program in Policy Decision-making)	2/44
Enabling healthcare decision-making through clinical decision support and knowledge management (55)	<p>Based on findings from 311 studies, the review concluded that there is strong evidence that clinical decision-support systems and knowledge-management systems are effective for improving healthcare process measures related to performing preventive services, ordering clinical studies and prescribing therapies. The findings were consistent across diverse settings and for both commercially and locally developed systems.</p> <p>Nine success features for clinical decision-support systems were identified: 1) integration with charting or order entry system; 2) promotion of action rather than inaction; 3) no requirement for additional clinician data entry; 4) justification of decision support based on research evidence; 5) local user involvement; 6) provision of decision-support results to patients as well as providers; 7) automatic provision of decision support as part of clinician workflow; 8) provision of decision support at time and location of decision-making; and 9) provision of a recommendation, not just an assessment.</p> <p>There is minimal evidence about the effects of clinical decision support systems on clinical outcomes and costs.</p>	2010	8/11 (AMSTAR rating from Program in Policy Decision-making)	19/311
Effects of patient feedback on physicians’ consultation skills (56)	<p>The review included studies that assessed physicians in general healthcare who received formal feedback regarding their consultation skills from real patients.</p> <p>The review included 15 studies and found positive results across the studies for</p>	2010	5/10 (AMSTAR rating from Program in Policy Decision-making)	1/15

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Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
	improvements in physician knowledge and intended behaviour, but mixed results were found in studies that assessed effects of patient feedback on actual performance.			
Effects of continuing medical education on retaining medical knowledge (34)	<p>Comparisons of multifaceted interventions versus distribution of educational materials (n=2) and educational outreach visit versus control (n=2) yielded generally effective results for appropriate care.</p> <p>Mixed effects for appropriate care were found for comparisons of multifaceted interventions versus control (n=39), multifaceted versus distribution of educational materials (n=5), distribution of educational materials versus control (n=6), and educational meetings versus control (n=13).</p> <p>Educational meetings, as compared with distribution of educational materials, demonstrated generally ineffective results (n=2).</p> <p>There was insufficient evidence to assess the effect of comparisons of audit and feedback versus control (n=1) and multifaceted interventions versus audit and feedback (n=1).</p>	2006	7/11 (AMSTAR rating from www.rxforchange.ca)	Not available
Effects of tailored interventions to address barriers to change in health professional performance (31)	Strategies to implement change in health professional performance face barriers in different settings and at different times. Interventions tailored to prospectively identify barriers may improve care and patient outcomes. The effectiveness of tailored interventions remains uncertain and more rigorous trials are needed.	2009	7/11 (AMSTAR rating from www.rxforchange.ca)	2/26

Appendix 2: Summary of findings from primary studies about risk factors for unsafe medical practice

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
Identification of doctors at risk of recurrent complaints in Australia (9)	<p><i>Publication date:</i> 2013</p> <p><i>Jurisdiction studied:</i> Australia</p> <p><i>Methods used:</i> Recurrent-event survival analysis using formal patient complaints</p>	Formal patient complaints against Australian medical professionals (n=18,907) between 2000-2011	n/a	The total sample of 18,907 complaints were filed against 11,148 physicians. 61% of complaints were regarding clinical aspects of care (most frequently treatment [41%], diagnosis [16%], and medications [8%]), and approximately 25% of complaints were regarding communication concerns. There were significant differences among complaint distribution based on physician sex and specialty; male doctors were found to have a 40% higher risk of recurrence than female counterparts, and general practitioners had twice the risk of recurrence as plastic surgeons. Approximately 3% of all physicians accounted for 49% of all complaints, and 1% accounted for about 25% of complaints.
Prevalence and characteristics of complaint-prone doctors in private practice (5)	<p><i>Publication date:</i> 2011</p> <p><i>Jurisdiction studied:</i> Victoria, Australia</p> <p><i>Methods used:</i> Case-control study</p>	Physicians in private practice in Victoria who had at least one patient complaint filed against them between January 1, 2000 and December 31, 2009 (n=384) ('complaint-prone' physicians had 4+ separate complaints within the study period [n=96], and physicians with a single complaint in the study period served as the control group [n=288])	n/a	Of private practitioners in Victoria with a complaint filed against them in the study period, 4.5% had more than four separate complaints (i.e., 'complaint-prone' group), and this group accounted for 17.6% of all complaints. Univariate analyses were used to demonstrate that 'complaint-prone' physicians had a higher likelihood of being male, surgeons or psychiatrists, having trained in Australia, and having practised for a minimum of 30 years when compared to their controls.
Relationship between patient satisfaction and complaints against physicians and malpractice law suits (6)	<p><i>Publication date:</i> 2005</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Analysis of patient surveys, complaints against physicians, and risk management episodes</p>	Physicians employed by The Brigham and Women's Hospital in Boston, Massachusetts with admitting privileges between January 1, 2001 and March 31, 2003, who received more than 10 survey evaluations from patients (n=353)	n/a	Decreases in a physician's patient satisfaction survey score were shown to be associated with an increase in both risk management episodes and complaints from patients. Additionally, it was found that individual physicians' malpractice risk was not predicted by their specialties.

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Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
Patients' complaints about medical practice (7)	<i>Publication date:</i> 1999 <i>Jurisdiction studied:</i> Australia <i>Methods used:</i> Random sample survey	Complainants to the New South Wales Health Care Complaints Commission from February 1996 to August 1997 (n=290)	n/a	Of the complaints filed, 64% addressed clinical care, 22% were concerning communication, and 14% discussed unethical or improper behaviour. More than half of the incidents addressed in the complaints took place in a physician's consulting room, and more than half of the complaints were about general practitioners. Additionally, 87% of physicians complained about were men.
Characteristics and quality of prescribing by doctors practising in nursing homes (13)	<i>Publication date:</i> 1993 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Cross-sectional physician survey and retrospective analysis of medication orders	Physicians practising in 12 nursing homes in greater Los Angeles (n=306)	n/a	Of the physicians surveyed, 94% were male and the mean age was 53 years. The majority were board certified in their declared specialty (67%), and 80% graduated in the U.S. or Canada. It was found that 40% of residents provided at least one inappropriate prescription, and most physicians did not consult psychiatrists when prescribing psychoactive drugs. Those physicians associated with the best prescribing quartile were female, had a certificate of added qualification in geriatrics, had no board certification, and reported frequent consultation with psychiatrists. Those physicians with the most inappropriate prescribing practices were older, graduated from a U.S. medical school prior to 1965, and infrequently consulted with psychiatrists.
Risks of complaints and adverse disciplinary findings against international medical graduates in Victoria and Western Australia (8)	<i>Publication date:</i> 2012 <i>Jurisdiction studied:</i> Australia <i>Methods used:</i> Retrospective analysis of formal complaints	Physicians with complaints filed against them to the medical boards in Victoria (between July 1, 2001 and December 31, 2008) and Western Australia (between October 1, 2003 and December 31, 2008) (n=3,191)	n/a	Overall, it was found that 5,323 complaints were made against the 3,191 physicians who had at least one complaint in the measured period. Of these 5,323 complaints, an adverse finding was made against the physician in 373 cases. International medical graduates were found to have higher odds of complaints (odds ratio = 1.24; 95% confidence interval, 1.13-1.36), as well as adverse disciplinary findings (odds ratio 1.41; 95% confidence interval, 1.07-1.85), than their Australian-trained counterparts. Specifically, those physicians with a statistically significant higher odds of attracting complaints were qualified in Nigeria, Egypt, Poland, Russia, Pakistan, the Philippines and India.
Association between physician scores on national qualifying examinations and quality of care (14)	<i>Publication date:</i> 2009 <i>Jurisdiction studied:</i> Canada <i>Methods used:</i> Peer assessments, structured chart review and interview	Randomly selected sample of physicians taking the Medical Council of Canada Qualifying Exams Part I and II (QE1/2) between 1993 and 1996, and subsequently entering practice in Ontario, Canada (n=208)	n/a	The physicians observed underwent a College of Physicians and Surgeons of Ontario (CPSO) peer assessment between 1994 and 2005. Fifteen (7.2%) of the physicians assessed were considered to provide an unacceptable quality of care; physicians who scored in the bottom quartile of the QE1 and QE2 had a more than three-fold increase in odds of being considered to provide an unacceptable quality of care.

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
Use of electronic prescribing systems for identifying doctors who are more likely to make a serious prescribing error (22)	<p><i>Publication date:</i> 2011</p> <p><i>Jurisdiction studied:</i> United Kingdom</p> <p><i>Methods used:</i> Retrospective analysis of prescriptions</p>	Prescriptions contained within an electronic prescribing system (PICS) at a large NHS Foundation Trust by junior doctors between August 8, 2007 and July 31, 2008 (n=848,678)	n/a	After excluding data from physicians with less than 20 prescriptions, 381 physicians issued the total amount of prescriptions over the course of the study period (median 1,538 prescriptions/physician). The main outcomes measured were the rate of prescribing alerts (i.e., messages for prescribers pertaining to contraindications, dose limits and interactions), laboratory warnings, and physicians' responses. Overall, 1,079,403 prescribing alerts were generated; these were classified into low-, intermediate-, and high-level alerts (where the high-level alerts were indicative of serious prescribing errors). The authors point out that the relationship between routine prescribing data recording behaviour and alerts, warnings and alarms is not sufficient in detecting physicians more likely to generate alerts indicative of serious prescribing errors.
Variation in HbA1c prescription for patients with diabetes in French general practice (15)	<p><i>Publication date:</i> 2013</p> <p><i>Jurisdiction studied:</i> France</p> <p><i>Methods used:</i> Retrospective database analysis</p>	Workers reimbursed by the French national health insurance fund for salaried workers in the Brittany region of northwestern France between January 1, 2008 and December 31, 2008 (n=41,453)	n/a	The total sample of patients was treated by 2,545 general practitioners. It was demonstrated that patients who were older did not benefit from universal medical coverage, had not been hospitalized, and had more than five visits over the course of the year studied were more likely to be prescribed HbA1c as recommended. The authors also found that physicians who were female, younger, working in a group practice, participating in quality-control groups, and had a low patient load (i.e., ≤1,375 patients) more often prescribed the three or four recommended tests.
Description of medical errors in primary care practices (16)	<p><i>Publication date:</i> 2005</p> <p><i>Jurisdictions studied:</i> Canada, Australia, England, Netherlands, New Zealand, U.S.</p> <p><i>Methods used:</i> Analytical study of reports of errors</p>	In Canada, family physicians providing direct patient care for a minimum of 20 hours per week (n=15). In jurisdictions outside of Canada, convenience samples of family physicians were used (n=64).	n/a	Fifteen Canadian family physicians reported 95 total errors, and 64 physicians outside Canada reported a collective 413 errors (from June to December 2001). In total, physicians from within or outside Canada reported similar proportions of errors resulting from health system dysfunction and gaps in skills or knowledge. The majority of errors were reported at a family physician's office (69.1% in Canada, 62.9% in other countries), and only affected a single patient. Additionally, in most reports (73.3% in Canada, 59.7% in other countries), physicians reported already knowing the affected patients fairly or very well.
Identifying poor performance in a national medical workforce (17)	<p><i>Publication date:</i> 2014</p> <p><i>Jurisdiction studied:</i> United Kingdom</p> <p><i>Methods used:</i> Retrospective analysis of performance-related concerns</p>	Physicians with referrals for concerns to the National Clinical Assessment Service from April 2001 to March 2012 (n=6,179)	n/a	Physicians whose first medical qualification was earned outside the United Kingdom were shown to be twice as likely to be referred as those who received qualification in the United Kingdom. Additionally, male physicians were found to be twice as likely to be referred as females, and doctors late in their careers were approximately six times as likely to be referred as physicians early in their careers. When examining specialties, the highest rates of referrals were observed among psychiatrists and obstetricians/gynecologists (i.e., 3.5 times higher risk of referral than the three lowest referral rate specialty groups).

Identifying Risk and Protective Factors for Quality Clinical Practice

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
Characteristics of physicians disciplined by professional colleges in Canada (1)	<p><i>Publication date:</i> 2011</p> <p><i>Jurisdiction studied:</i> Canada</p> <p><i>Methods used:</i> Retrospective data analysis</p>	Canadian physicians disciplined by provincial licensing authorities from 2000 to 2009 (n=606)	n/a	Of the identified physicians disciplined over the course of the study period, approximately 51 (9%) were subject to more than one disciplinary action at separate times. The majority of disciplined physicians were independent practitioners (99%), male (92%), and Canadian medical graduates (67%). For all physicians, the mean time from medical school graduation to disciplinary action was 28.9 (standard deviation = 11.3) years. Among the most common specialties for disciplined physicians were family medicine (62%), psychiatry (14%), and surgery (9%). The most frequent violations included sexual misconduct (20%), standard-of-care issues (19%), and unprofessional conduct (16%).
Characteristics of psychiatrists disciplined by professional colleges in Canada (11)	<p><i>Publication date:</i> 2012</p> <p><i>Jurisdiction studied:</i> Canada</p> <p><i>Methods used:</i> Retrospective cohort review</p>	Canadian psychiatrists disciplined by provincial licensing authorities from 2000 to 2009 (n=82)	n/a	Psychiatrists represented 14% of all Canadian physicians disciplined by provincial licensing authorities over the study period, which was approximately two times the national proportion of psychiatrists in the same timeframe. Of disciplined psychiatrists, 91.4% were male, whereas the national proportion of male psychiatrists was 71%. With respect to the characteristics of disciplined psychiatrists versus non-psychiatrists, similar proportions were observed for sex, international medical graduates, and resident trainees. The mean number of years of practice until conviction for psychiatrists was 33 (standard deviation = 11) years. Additionally, psychiatrists were found to be more likely to be disciplined than other physicians for sexual misconduct (odds ratio = 3.62; 95% confidence interval, 2.45-5.34), fraudulent behaviour (odds ratio = 2.32; 95% confidence interval, 1.20-4.40), and unprofessional conduct (odds ratio = 3.1; 95% confidence interval, 1.95-4.95).
Characteristics and rates of disciplinary findings among anesthesiologists by professional colleges in Canada (12)	<p><i>Publication date:</i> 2013</p> <p><i>Jurisdiction studied:</i> Canada</p> <p><i>Methods used:</i> Retrospective cohort review; database analysis</p>	Disciplinary cases against Canadian physicians by provincial and territorial regulatory colleges from 2000 to 2011 (n=721)	n/a	In total, 11 of the 721 disciplinary findings addressed cases with anesthesiologists. All 11 involved males, and 10 (91%) involved independent practitioners. Additionally, seven (64%) of these cases involved international medical graduates. Among offences committed by other physicians, 653 (92%) involved males, and nearly all were by independent practitioners (99%). The mean number of years of practice before a disciplinary finding was 29.2 (standard deviation = 11) years among the complete sample, and 31.9 (standard deviation = 12.9) years for anesthesiologists. The most common disciplinary findings among anesthesiologists addressed cases of standard of care issues (i.e., lack of skill, judgment or knowledge), inappropriate prescribing, and fraudulent behaviour.
Junior doctors' perceptions of their self-efficacy in prescribing, their prescribing errors and the possible causes of errors (18)	<p><i>Publication date:</i> 2013</p> <p><i>Jurisdiction studied:</i> Scotland</p> <p><i>Methods used:</i> Cross-sectional questionnaire study</p>	Physicians in their first (F1) or second year (F2) of postgraduate medical training working in Scottish hospitals from October 2010 to	n/a	Among the total sample, 514 respondents (94%) estimated their day-time prescribing error rate (number of prescriptions with errors per 100 prescriptions completed), and 432 (79%) estimated their night-shift error rate (which was shown to be higher than day-time rates). The difference in error rate between F1s and F2s was not significant. Among all physicians, 250 errors (49%) were due to an unintentional action, 111 errors (22%) were caused by a failure or lack of expertise, and 26 (5%) were deliberate violations. A larger proportion of F1s described having insufficient skills in

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Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
		January 2011 (F1 – n=353, F2 – n=195)		prescribing as a cause for error. Additionally, physicians in the sample commonly identified workload, interruptions while prescribing, and pressure from other staff as factors contributing to errors. Though there was no difference in overall self-efficacy scores for prescription writing between the groups, F2s reported higher scores in all aspects of decision-making (i.e., deciding appropriate doses, duration, timing, route of administration, and formulation).
Causes of prescribing errors in hospital inpatients (19)	<p><i>Publication date:</i> 2002</p> <p><i>Jurisdiction studied:</i> U.K.</p> <p><i>Methods used:</i> Pharmacists prospectively identified prescribing errors, and face-to-face/telephone interviews with prescribers</p>	41 doctors (22 senior house officers, 15 junior house officers, three consultants, three specialist registrars and one medical student) in one U.K. training hospital from October 1999 to December 1999	n/a	In total, pharmacists identified 88 serious errors. All medical and surgical specialties were represented. The study identified potential causes of errors, including: latent conditions (e.g., organizational and management decisions), error-producing conditions (e.g., work environment, team, individual health, patient disease complexity), and active errors (e.g., slips, memory lapses, mistakes). Skill-based slips (57%) or lapses were frequent, with fewer in rule-based mistakes (17%) and violations (4%). Some doctors mentioned a busy schedule and interruptions contributed to their errors. The authors reported that most of the physicians were unaware of having made errors before.
Prevalence of pharmacologically inappropriate prescriptions for elderly patients in general practice (21)	<p><i>Publication date:</i> 2008</p> <p><i>Jurisdiction studied:</i> Norway</p> <p><i>Methods used:</i> Retrospective database analysis</p>	454 general practitioners attending continuous medical education groups in Southern Norway; 85,836 patients ≥70 years who received any prescription from the GPs during the one-year study period	n/a	In total, 15,790 patients (18.4%) received inappropriate prescriptions from their GPs during the one-year study period. Factors that are associated with an increase of inappropriate prescriptions include doctors being older and working alone with many elderly patients. There were no significant differences among inappropriate prescriptions based on the doctor's gender. The study also found doctors who are generally younger and working in a group practice with fewer elderly patients were correlated with a lower proportion of inappropriate prescriptions.



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