STRATEGIC OPPORTUNITIES FOR EFFECTIVE OPTIMAL PRESCRIBING AND MEDICATION MANAGEMENT

Ingrid S Sketris[1,2], Ethel M Langille Ingram[2], Heather L Lummis[3]

[1]Faculty of Medicine and [2]College of Pharmacy, Dalhousie University, Halifax, Nova Scotia, Canada
[3]Capital District Health Authority, Halifax, Nova Scotia, Canada

Corresponding Author: *Ingrid.Sketris@dal.ca*

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ABSTRACT

Background
Canadians receive over 422 million prescriptions and spend over $26 billion annually on drugs. Yet, we do not systematically capture information on whether the right drugs reach the right people with the intended benefits, while avoiding unintended harm. It is important to identify and understand the effectiveness of approaches used to improve prescribing and medication use.

Objective
To discuss the medication-use system, identify factors affecting prescribing, and assess effectiveness of interventions.

Methods
A literature review was conducted using electronic databases, federal agencies', provincial health departments', health service delivery organizations' and Canadian health research organizations' websites, the Internet, and some hand searching. Interventions identified were categorized according to the Effective Practice and Organization of Care Group (EPOC) classification, with effectiveness based on the literature.

Results
Factors affecting prescribing relate to the patient and society, medication, prescriber, practice environment and organization, available information and other external factors. Interventions reported as generally effective are multi-faceted interventions, academic detailing, and reminders. Interventions reported as sometimes effective are audit and feedback or physician profiling, local opinion leaders, drug utilization review, and local consensus guidelines. Passive dissemination of educational materials is deemed generally ineffective.

Conclusions
No single approach is appropriate for every prescribing problem, health professional prescriber practice or health care setting. Interventions to improve prescribing in community and institutional settings have variable effect sizes. Effectiveness is related to content, delivery mechanisms, intensity, intervention's context, and implementation environment. Even an intervention with a small effect size (< 10%) may yield important changes in drug use when applied on a population basis. Further research and evaluation is needed to determine how or why the interventions work and identify barriers to effective implementation.

Key Words: *Prescribing behaviour; drug utilization; prescribing practice; medication management; drug use evaluation*

Canadians receive over 422 million prescriptions each year[1] and spend over $26 billion annually on drugs in the community setting.[2] Yet, we do not systematically capture information that can tell us whether the right drugs are reaching the right people with the intended benefits, while avoiding unintended harm. In their *10-Year Plan to Strengthen Health Care* in 2004, the First Ministers identified nine elements of a proposed National Pharmaceuticals Strategy (NPS),[3] which were reaffirmed in the *National Pharmaceuticals Strategy Progress Report* of June 2006.[4] That report highlighted key challenges to appropriate prescribing and identified them as threats to the health of Canadians and cost drivers to the system.
These challenges include:

- *improper drug selection,*
- *inappropriate dosage,*
- *adverse drug reactions,*
- *drug interactions,*
- *therapeutic duplication, and*
- *patient non-compliance.*

This paper summarizes some opportunities to address these challenges, focusing from a system perspective on interventions to improve prescribing practices and medication management. It provides a review of the evidence on effectiveness for various strategies and describes the complex landscape in which prescribing currently functions in Canada, including our medication-use system and factors that affect prescribing.

It explores the sixth element of the NPS: *"enhance action to influence prescribing behaviour of health professionals so that drugs are used only when needed and the right drug is used for the right problem."* It also relates to two other elements: "*strengthen evaluation of real-world drug safety and effectiveness*" and "*broaden the practice of e-prescribing through accelerated development and deployment of the Electronic Health Record.*"[4]

METHODOLOGY

This paper is based on a broad review of the literature conducted for the Health Council of Canada. The primary focus of the review was material in the public domain, including peer-reviewed journals, textbooks, databases, selected Internet sites, newsletters, and relevant proposals, presentations and reports published by foundations and government organizations. PubMed, CINAHL, Embase and International Pharmaceutical Abstracts (IPA) were searched systematically, using the following key terms: prescribing behavior/behaviour (or behavior*/behaviour*), drug use evaluation and drug utilization (limits: 1995-2006, human and English). The Internet was searched using the following search engines: Google and Google Scholar using the following terms: prescribing behavior/behaviour (or behavior*/ behaviour*), prescribing practice, medication prescribing, and financial incentives. Federal agencies', provincial health departments', health services delivery organizations' and Canadian health research organizations' websites were also included in the search as were reports accessible through the New York Academy of Medicine Library Grey Literature Reports. The Cochrane Database of Systematic Reviews, which reviews randomized controlled trials, was searched to examine the effectiveness of interventions to improve prescribing. The Canadian Agency for Drugs and Technologies in Health (CADTH) *Rx for Change* was also searched. References identified in papers and those in authors' files were also examined. The selection of studies and relevant material from systematic reviews and various heterogeneous sources was broad. Some details concerning specific interventions were accessed through information requests. Search strategies and synthesis were strategic for a narrative synthesis,[5] with highlighted themes relevant to optimal prescribing and medication-use in Canada. Selected articles published since the preparation of the review for the Health Council of Canada have been added to this paper.

Canadian literature has been integral to the discussion in this paper, and where possible, Canadian prescribing interventions have been included as examples.* Behavioral and system change theory,[6-10] although important to the topic of optimal prescribing, was beyond the scope of this paper. Financial incentives, organizational

* An index of Cochrane Reviews that address the areas of prescribing is provided at http://www.healthcouncilcanada.ca (Accessed November 21, 2007) and on the CADTH Rx for Change website www.cadth.ca/index.php/en/compus/optimal-ther-resources/interventions(accessed February 12, 2008).

approaches and patient mediated strategies were discussed in the original report but they are not included in this paper.

RESULTS

A. CANADA'S MEDICATION-USE SYSTEM

From bench research to patient use, prescription drugs travel a long journey. The drug development, regulation, financing, prescribing, and use system in Canada is very broad and includes both pre-marketing and post-marketing activities. This paper focuses on specific aspects of the post-marketing phase - prescribing, medication-use, and monitoring. Ideally the prescribing of drugs by professionals, the provision of care by pharmacists, the use of drugs by patients, and other elements of the medication-use system would all work together to provide patients with good health outcomes at an affordable cost to society.[11]

Prescribing

Physicians and other licensed practitioners prescribe medications to promote health and prevent, ameliorate, or cure disease. In 2006, there were approximately 62,000 physicians[12] in Canada making prescribing decisions for their patients. The role of prescriber is evolving - with the goal of enhancing collaboration between physicians and other health care providers to potentially increase accessibility, choice, and quality of care for patients.[13] The ranks of prescribers now also include dentists, nurse practitioners, pharmacists, midwives, optometrists, podiatrists, registered nurses, and clinical assistants.

Pharmacy Services

Prescription drugs are provided to ambulatory patients primarily through pharmacies located in their communities or accessed via the Internet or by mail order. Canada has approximately 7,900 community pharmacies.[14] Drug purchases by Canadian hospitals and pharmacies (i.e. wholesale spending for prescription and over-the-counter products) reached approximately $19 billion in 2007.[15]

Pharmacists may provide other professional or cognitive services, such as referring patients to physicians or other health care providers, in-store screening or risk assessments for chronic diseases, trial prescriptions, refill reminders, educational seminars, and disease management.[16-20] Cognitive services have demonstrated positive patient outcomes in some studies,[16, 21-26] but no measured effect in others.[27, 28]

The Patient's Role in Medication Use

Patients and their caregivers are becoming increasingly involved in their care decisions.[29-35] They have a role to play in safe, cost-effective use of medication by taking and monitoring drug therapy as negotiated with and prescribed by their health care provider.

B. CHALLENGES TO OPTIMAL PRESCRIBING

(a) Key challenge for individual prescribers: keeping current on information from research and other sources and applying it.

It is a daunting task for prescribers to remain current with the medical literature, and medications are only one of many areas in which health care providers need to keep pace with new research evidence. Consider this snapshot of the complex world of prescribing for Canadian physicians in 2005:

- 322 million office-based patient visits, of which 94% resulted in handwritten paper records;[36]
- Approximately 400 million prescriptions dispensed in pharmacies, 81% of them prescribed by general practitioners;[37]
- 22,000 human drug products on the market in Canada;[38]
- 24 active substances received market authorization and 16 new active substances were reported by PMPRB;[38] and
- 1.8 million new medical papers published (in 2004) in 20,000 journals from 300,000 clinical trials.[36]

To further complicate matters, there are a myriad of information sources available to prescribers - sources they must assess to determine if the information is valid, reliable and relevant to their patient setting. Prescribers receive information provided to them (sometimes referred to as "push") and they retrieve information when they need it ("pull"). Information varies by delivery

method (e.g., print, e-mail, website, or personal visit), source (e.g., government, industry, or professional society), quality, relevance, and timeliness. (See http://www.healthcouncilcanada.ca).

Improved methods are needed to help prescribers remain current on relevant literature and to ensure they have the skills to appraise and apply the literature in an increasingly complex health care environment. One approach is to have articles reviewed by quality, topic and relevance; then physicians can select those, which they would like to receive.[39]

(b) Key challenge for the health care system: evaluating the quality of prescribing and the appropriateness of drug use and developing strategies to improve use.

Scales and measures have been developed to determine the effectiveness and efficiency of the medication-use system, including prescribing;[40-45] but, their relationship to patient outcomes requires further study. Appropriateness of prescribing that can be measured by process or outcome measures are explicit (drug and disease focus) or implicit (patient focus).[45] The predictive validity of measures of inappropriate prescribing require study as process measures do not necessarily have a direct relationship to outcome measures.[45]

While various research projects have documented suboptimal prescribing in Canada, there is limited capacity for the measurement of prescribing and its outcomes. Suboptimal prescribing has led to regional variations in drug use, unnecessary and inappropriate drug use, dangerous drug combinations, missed opportunities for beneficial therapy, and unintended harm. However, the extent of suboptimal prescribing in Canada and its effects on patient outcomes and health care system costs, including the affordability of prescription drugs, are not thoroughly captured.

A systematic approach is required to evaluate the appropriateness of prescribing in Canada and to monitor quality improvement as changes in practice occur. Avorn suggests, *"assessing prescribing quality should be woven into the fabric of the delivery system, performed on an ongoing basis, and tightly linked to educational strategies to improve care."*[46]

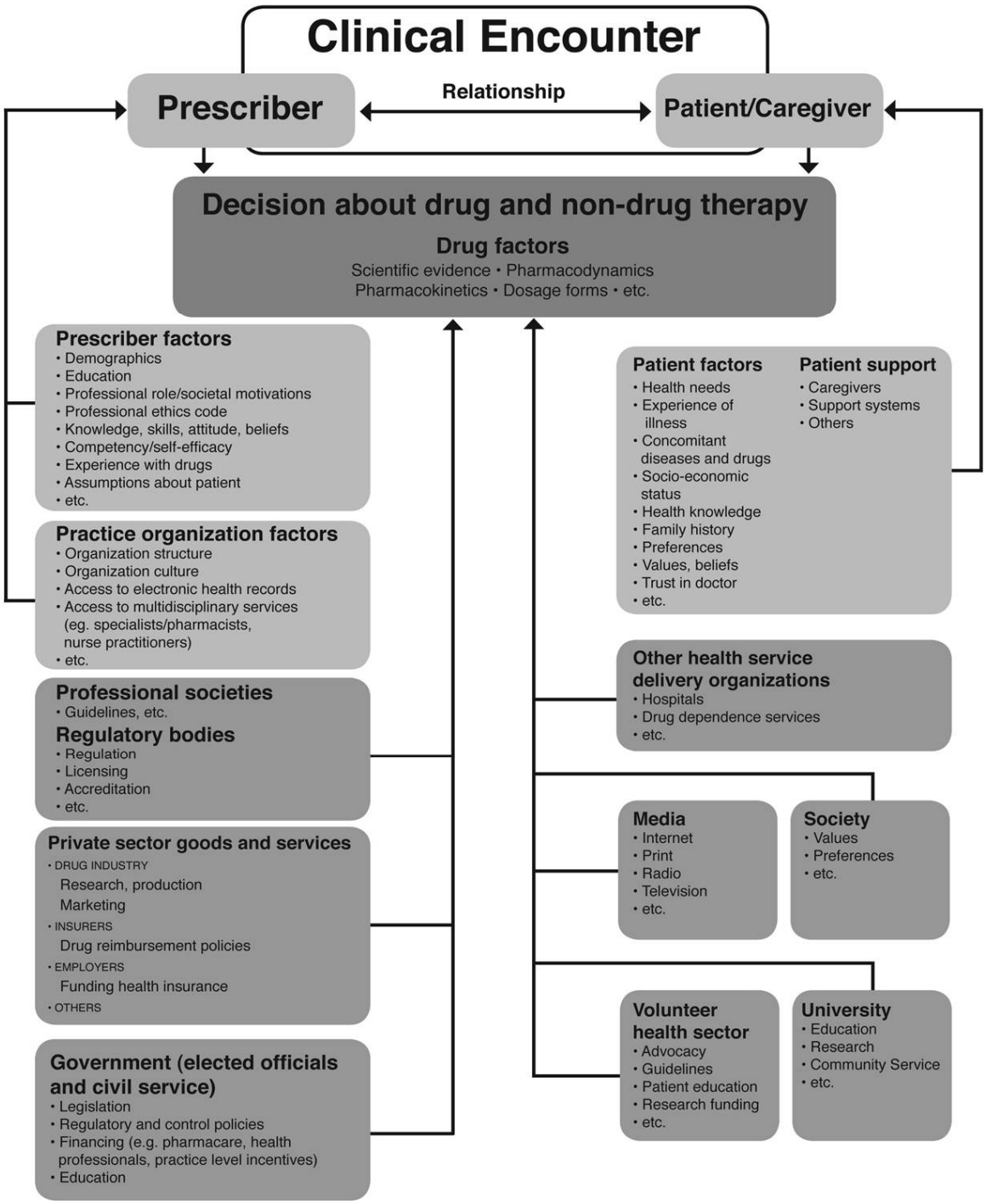
C. FACTORS AFFECTING PRESCRIBING

In order to promote safe, effective and efficient drug use, it is important to recognize the many interacting factors, which influence decision-making in the medication-use system. A 2005 Cochrane Review of tailored interventions to change professional health care practice[47] used the Cochrane Effective Practice and Organization of Care Group (EPOC)[48] classification of barriers:

1) information management, clinical uncertainty;
2) sense of competence;
3) perceptions of liability;
4) patient expectations;
5) standards of practice;
6) financial disincentives;
7) administrative constraints; and
8) others.

Improving the medication-use system may need to influence several factors, including the professional, organizational and social contexts and settings.[10,49] Spinewine et al suggest *"prescribing can be regarded as a function of the patient, prescriber and environment"*.[45] Figure 1 illustrates the complexity of influences on prescribing during a clinical encounter, and several of these factors are explored below.

Figure 1: Factors Affecting Prescribing During the Clinical Encounter



Source: With permission: Sketris I, Langille Ingram E, Lummis H. Optimal Prescribing and Medication-Use in Canada: Challenges and Opportunities. Report prepared from Health Council of Canada (Diagram informed by Wirtz et al. 2006[33]; Denig et al. 1988[73]; Haaijer-Ruskamp FM, Hemminki E. 1993[214])

Patient and Societal-related Factors

The patient's family and medical history (including undifferentiated or multiple illnesses), lifestyle, use of medication and natural health products, and the physician's knowledge of, and feelings towards, a patient may influence prescribing.[50-54] Many physicians embrace shared decision-making models with patients that incorporate the patient's values, preferences, and attitudes towards benefits and risks, experience of illness, socio-economic factors and support systems.[31,55-57] For antibiotics in respiratory tract infections, a systematic review suggested that general practitioners are concerned that if patients do not get the drug they want, they will switch doctors.[58,59] For antibiotics, however, doctors may over-estimate the pressure by patients to prescribe.[60,61]

The dominant responsibility for physicians is to their individual patients. Societal demand for medicines also has a role to play, as do societal values.[62,63] For example, when prescribing antibiotics, physicians may need to weigh the treatment success for individual patients against the loss of effectiveness for future patients due to antimicrobial resistance.[64]

Medication-related Factors

The inherent properties of drugs (e.g., factors such as pharmacology, pharmacokinetics, pharmaco-dynamics, dosage, formulation, taste, and ease of administration) are important in prescribing decisions. Prescribers and patients also examine the scientific evidence about a drug's safety, effectiveness, medication cost, and other factors.[65]

Prescriber-related Factors

Physicians' knowledge, attitude, and skills related to prescribing are important influences on their prescribing practices. Their underlying beliefs and values, as well as their perceptions of innovation and the benefits and risks of drugs, matter as well.[66-70] Also important are physicians' information-seeking behaviour, their own experiences and those of their peers.[71,72] Habit plays a role—with some authors suggesting that physicians have an "evoked set" of drugs with which they are familiar.[67,68,73-75]

The effect of physician demographics on prescribing has been studied with varied results. Some studies suggest age, gender, location of practice (urban versus rural), experiences at medical school, and specialty versus generalist care may all play a role, but findings have not been consistent.[53,76-80]

Practice Environment and Organization-related Factors

Physicians are influenced by their peers, group norms, specialists, and opinion leaders. Jacoby et al. suggest that "low prescribers" (physicians who prescribed three or fewer of eight index drugs during the study period, compared to five or more for "high prescribers") conform more strongly to group norms, have a shared view of prescribing, and are cost-conscious.[81] Practice environments may have technical support (e.g., electronic health records, and electronic drug information resources) and human resource supports (e.g., nurses, pharmacists, educators, dieticians, psychologists, and health informatics experts) to improve prescribing. Organizational factors (e.g., type of group practice, the length and frequency of patient visits, access to specialists, and diagnostic procedures) may also affect prescribers' behaviours.[82]

Information and other External Factors

The myriad of sources of drug information for prescribers in Canada[71,83-93] are captured in a background document[94] accessible on the Health Council of Canada website http://www.healthcouncilcanada.ca (See appendix B). The most significant industry source is detailing (i.e., office visits and "cyberdetailing", also called e-detailing and web-based detailing) to physicians and the provision of drug samples.[95,96] Direct-to-consumer advertising also has an influence.[97-102] While Canada does not permit direct-to-consumer advertising of prescription drugs, Canadians do have access to American television, as well as to the Internet and US print media. Mintzes et al. reported that in a study of 748 individuals surveyed in primary care in Vancouver, 87.4% had seen a prescription drug advertisement and 3.3% requested the advertised drug.[98] Annual spending on this type of promotion in the US was $2.5 billion US in 2000, a small proportion of total marketing efforts by the pharmaceutical industry.[96] Drug companies also use targeted mailings, websites, call centres and

sponsored conferences to present their message to prescribers.

Other external factors that can affect prescribing include: media stories, drug reimbursement policies of government and private drug plans and the associated workload for prescribers, government policies on physician remuneration, standards of practice from professional organizations, prescribers' concerns about legal liability, regulatory and control measures, and political considerations.[63,103-107]

D. INTERVENTIONS TO IMPROVE PRESCRIBING PRACTICES

Various interventions have been used to influence physician prescribing. These include health professional, patient, financial, organizational, and regulatory and control interventions. The Effective Practice and Organization of Care (EPOC) group of The Cochrane Collaboration[†] reviews interventions to improve professional practice primarily from randomized controlled trials (RCTs).[106] These interventions have been described and critiqued in the Cochrane Reviews, other narrative reviews, and individual studies.[47,49,88,108-119] CADTH also highlights interventions in their *Rx for Change* Database, available at www.cadth.ca..

The effect size of interventions is often small (a 10% improvement in prescribing is typical), and limited evidence is available to determine which intervention to choose in which context. Initiatives to improve prescribing and medication use can focus on interventions to modify the behavior of physicians; on financial incentives for physicians, patients or the system; and on interventions affecting the health care system. The educational and behavioral change interventions, as shown in Table 1, can be categorized as generally effective, mixed effect and generally low effectiveness.[120]

[†] A description of The Cochrane Collaboration, EPOC and relevant Cochrane Reviews is available at http://www.healthcouncilcanada.ca [Accessed March 4, 2008] as Appendix D of the background report "Optimal Prescribing and Medication Use in Canada: Challenges and Opportunities".

TABLE 1 The Effectiveness of Educational and Behavioral Strategies to Change Prescribing Targeted to Health Professionals

Levels of Effectiveness*	Strategies	Examples of Reported Median Effect Size(s)
Generally effective	Multifaceted interventions	Wide variation, e.g., 3.0% (range -3.0% to +10.0%) median absolute difference for educational materials and educational meetings, 17.0% (range 1.3% to 25.1%) median absolute difference for reminders and patient-mediated interventions.[122]
	Academic detailing	5.1% (range -6.5% to +9.5%)[139] and 4.6% (range 3.0% to 6.5%) median adjusted risk difference.[140]
	Reminders, decision supports	14.1% (range -1.0% to +34.0%) median effect in absolute improvement in performance[122]
Mixed effect (sometimes effective and sometimes not)	Audit and feedback	4.0% (range -16% to +32%) for dichotomous outcomes and 11.9% (range -10.3% to +67.5%) median adjusted percentage change for continuous outcomes[124]
	Local opinion leaders	10.0% (range -6% to +25%) median adjusted risk difference[174]
	Drug utilization review (DUR)	Limited data exists on effect size for either prospective or retrospective DUR.[181, 182,187,188]
	Local consensus groups/processes	Rx for Change (www.cadth.ca) reports there are no high quality reviews which focus on the effects of local consensus processes on professional practice; however, there is a Cochrane protocol [215] indicating a review is in process.
Generally low effectiveness	Dissemination of education materials	8.1% (range 3.6% to 17.0%) median effect in absolute improvement in performance[122]
	Educational meetings	9.1% (range 0.27% to 21.6%) median effect size[139] as reported in Rx for Change (www.cadth.ca)

Adapted from Grimshaw J, Eccles M, Tetroe J. (2004). Implementing clinical guidelines: current evidence and future implications. *The Journal of Continuing Education in the Health Professions*; 24: S31-S37. Grol R, Wensing M. (2005). Selection of Strategies [Table 8.1] in Grol R, Wensing M, Eccles M. (Editors). *Improving Patient Care: The Implementation of Change in Clinical Practice.* Edinburgh: Elsevier.

*Context, design of strategy and method of implementation are key to determine effectiveness

1. Generally Effective Interventions

(i). Multi-faceted interventions

What is it?

Multi-faceted interventions are defined as including two or more distinct interventions, for example, education programs for patients combined with changes to criteria for the reimbursement of drug costs.[121-124] Combining two or more interventions may sometimes be appropriate as different barriers can be targeted.[122] These models of intervention often focus on enlisting a "trusted source" (such as a respected colleague or a university's continuing medical education department) to help distill evidence and provide tools. For example, the Drug Evaluation Alliance of Nova Scotia targeted physicians, pharmacists and patients in their intervention to promote the switch from wet nebulization respiratory medications to portable inhalers.[121]

Does it work?

Multi-faceted interventions in some settings produce improvements in the quality of physician prescribing.[122,123,125] Grimshaw et al. found a wide variation in the effect sizes, depending on the combination of interventions studied.[122] For educational materials combined with educational meetings, the median effect size was 3.0% (range -3.0% to +10.0%) for 5 comparisons found. For reminders and patient-mediated interventions, the median effect size was 17.0% (range +1.3% to +25.1%), again from 5 different studies. However, the same review found that multi-faceted interventions had an overall smaller effect size than single interventions.[122] Documenting barriers (e.g., higher costs associated with combined strategies) and the context (e.g., national policies) prior to intervention implementation has been found to be useful to tailor interventions.[123,126] It is also important to determine cost effectiveness of implementation strategies and the best way to implement multiple strategies.[122] While evaluating multifaceted interventions (e.g., complex) more use could be made of the delayed trial design.[127]

(ii). Academic detailing

What is it?

Academic detailing (also called counter detailing or educational outreach visits) is an educational approach, funded by government or a health care organization, in which, a trained educator (often a health professional) visits a physician or a group of physicians in their practice setting, and at a time convenient to them. Several key messages are delivered relevant to their practice with accompanying written information. In Canada, academic detailing programs are delivered by continuing health professional education departments in five provinces: Alberta, British Columbia, Manitoba, Nova Scotia and Saskatchewan. The Canadian Academic Detailing Collaboration, a coalition of these groups, works together to improve effectiveness and efficiency of therapies.[128-130] There is a vast difference between budgets and staffing for publicly funded academic detailing programs compared to the detailing efforts of the pharmaceutical industry.[131]

Does it work?

Based on the limited information available, academic detailing programs have been found to be mainly, but not always, effective.[112,119,128,130,132-138] For example, two recent Cochrane Reviews report small improvements in prescribing from educational outreach visits. Arnold et al (2005) examining antibiotic prescribing report a median effect size of 5.1% (range -6.5% to 9.5%) based on 6 studies[139] and O'Brien et al (2007) examining prescribing of various drugs report a median adjusted risk difference of 4.8% (range 3.0% to 6.5%) for 17 trials where the goal was to decrease inappropriate prescribing.[140] Other studies demonstrated larger improvements (24%-45%).[134,135] However, Eccles et al (2007) found no significant effect of untargeted outreach visits on prescribing of antidepressants in a controlled trial of 72 practices.[132] Although academic detailing shows promise, it is expensive and its effectiveness and cost-effectiveness require further study.[45,141-143] For example, the context and environment of the intervention, such as the disease or drug targeted, level of intervention intensity, size of practice, resources used (e.g., physician time and implied dollar costs as well as intervention cost) are factors to consider.[45,144] The

existence of barriers means that not all physicians will embrace this model.[45,145,146] In Nova Scotia, where approximately 50% of physicians see an academic detailer,[130] non-users identify the use of office time for continuing medical education as a significant barrier.[146] This is similar to the Australian experience.[136,147-149] Strategies of targeted outreach visits to high prescribers may provide the greatest capacity for changing behavior.[8,141] An osteoarthritis initiative targeted at general practitioners (GPs) in Nova Scotia was delivered by the Continuing Medical Education (CME) Division of Dalhousie University. The CME Division is viewed as a trusted source by the GPs and the initiative follows a process that is independent and objective. The educational materials were also reviewed by local experts to ensure relevance. This initiative noted a 23% decrease in utilization of cyclooxgenase-2 inhibitors during the 3 months following the intervention.[150]

(iii). Reminders

What is it?

Electronically generated (e.g., linked to an electronic health record) or paper-based reminders (e.g., a note in the chart) alert health care providers to recommended prescribing practices or cautions related to a patient's history. Standing orders, often used in hospitals, are a method of reminding physicians about appropriate care for specific diseases. They are usually given before or during patient contact.

Does it work?

A systematic review by Grimshaw et al (2004) indicated that reminders, the most frequently evaluated single intervention, may have a moderate effect on improving physician prescribing according to guidelines and subsequent patient outcomes.[122] For example, the review found that in 12 cluster randomized clinical trials the median effect size was +14.1% (range -1.0% to +34.0%).[122] Automatic reminders, or computerized decision support systems,[88] may work if physicians believe in the prescribing behaviour, if they have "forgotten" a concept or rule, if they are busy multitasking, or if their practice setting lacks coordination. However, many clinical situations are complex and the alerts may be ignored if they are not sophisticated enough to fit physicians' practices and patients' needs.[63,151] Reminders need to be tailored to the patient's unique needs and multiple reminders need to be priorized. Their effectiveness may depend on physician characteristics (including age, gender, education, experience, etc.) and characteristics of their clinical environment.[152] It may also depend on whether the physician thinks their patient would be willing to change prescriptions[45] or discontinue therapy prescribed by another physician.[153] Databases with patient relevant information (e.g., visits from other health professionals and laboratory and other diagnostic tests) need to be accessed and presented to the physician in a user-friendly manner.

2. Mixed Effects: Sometimes Effective and Sometimes Not

(i). Audit and feedback / physician profiling

What is it?

In an audit and feedback process, physicians examine their own practice to inform their future prescribing decisions. Physicians can compare their prescribing pattern with that of their peers, or against a standard to inform future prescribing. Such audits can be carried out at the individual patient, physician, practice and health care organization level.[88] Audit and feedback studies have attempted to increase the rate of generic drug prescribing, to move prescribing towards a specific drug or to increase conformance with clinical practice guidelines.[154,155] Audit can be conducted using medical charts, electronic data or visual observation. A group of physicians in Quebec implemented an interesting audit system for family practitioners[156] to improve patients' outcomes and physicians' practices by using morbidity and mortality audits. Some authors have observed that *"active feedback or reminders contain an implicit or explicit judgment of the practice observed and sometimes also advice about the preferred clinical practice."*[152]

One approach is to use physician profiling, a feedback method that focuses on patterns of care, not on individual clinical decisions.[157,158] Profiling can be used alone or in combination with other continuing professional development activities.

Issues related to the profile produced include: the type of patients and criteria used; the source, messenger and method of profile delivery; the availability and nature of data; and the frequency and type of profiles.

Does it work?

The effectiveness of audit and feedback is variable.[119,124,152] A Cochrane review concluded the effects of audit and feedback on professional practice are small to moderate, with larger relative effects more likely when baseline adherence to recommended practice is low and when there is more intensive feedback given. For example, audit and feedback alone compared to no intervention had a median adjusted risk difference of 4% (range –16% to +32%) for dichotomous outcomes such as the number of tests prescribed.[124] For continuous outcomes, such as mean tests per patient hospitalization, the median adjusted percentage change was 11.9% (range -10.3% to +67.5%). Audit and feedback as part of a multifaceted intervention versus no intervention was considered generally effective with a median risk difference of 5.7% (range –9% to +70%) for dichotomous outcomes and a median adjusted percentage change of 23.8% (range +3 % to +60%) for continuous outcomes.[124] A study in Ontario suggested that confidential feedback to prescribers, along with educational materials, improved physician prescribing of antibacterials.[159] However, other Canadian studies did not show effectiveness. A study in Nova Scotia that evaluated the use of mailed unsolicited profiles from government on prescribing of topical corticosteroids found this strategy was not effective in decreasing potency or expenditures.[154] Similarly, a study in Ontario demonstrated that the provision of educational materials and confidential feedback to Ontario primary care physicians related to their benzodiazepine prescribing for elderly patients was not effective.[160] In general, the conditions that lead to the effectiveness of audit and feedback in changing physician behaviour are uncertain.[142,161-164]

One reason for the uncertainty is that it is hard to match the individual complexities of a patient practice with the simplicity of a rating scale.[165] The Australian audit and feedback model is interesting. It allows physicians to self audit, providing information to the National Prescribing Service (NPS) and then be critiqued on their practice. This process is done in confidence and physicians are reimbursed for a specific set of activities.[136,147,148]

The UK Audit Commission[166] suggests that general practitioners should have access to support staff to provide data analysis related to prescribing. One example of where this is occurring is in North Staffordshire, United Kingdom. The University of Keele facilitates data collection and dissemination on the effectiveness of drug utilization to achieve defined outcome targets agreed to by the pharmaceutical industry and the National Health Service.[167] Benefits can be generated through routine feedback to GPs on indicators of appropriate prescribing based on guideline recommendations.[165]

One of the benefits of physician profiling is to motivate physicians to change by creating cognitive dissonance (i.e., an uneasy feeling that accompanies the recognition of a discrepancy between new information or a new interpretation and existing information or beliefs).[10,168] The challenges of profiling primary care physicians' prescribing practices include the diverse patient population and few patients with the same diagnosis. There are also issues related to privacy, confidentiality and data security.[163,169,170]

(ii). Local opinion leaders

What is it?

One of the preferred methods of learning by physicians is communication with peers.[171,172] Local opinion leaders (also known as educational influentials, gatekeepers, informal leaders, or informal educators) are respected peers of prescribers, deemed to understand the local context.[119] Their roles may include endorsing written educational material, providing lectures, chairing meetings and visiting physicians. Opinion leaders can be engaged in this work by drug companies, government, hospitals, universities and others.

Does it work?

Local opinion leaders may influence clinical practice.[108,171,173-175] Some studies concluded that local opinion leaders have a small positive effect,

while other studies find they have no effect at all;[119,173] but, they can influence prescribing and assist with guideline implementation.[176-179] A recent Cochrane review of 12 studies, which assessed effects of opinion leaders on professional behavior and patient outcomes, reported a median adjusted risk difference of 10% (range -6% to +25%) and noted that few studies have assessed the effects of opinion leaders in prescribing outcomes.[174] There is concern that approaches used by local opinion leaders to synthesize evidence are not always consistent,[180] and benefits may be disease specific.[175]

(iii). Drug utilization review programs

What is it?

Drug utilization reviews (DUR) evaluate the use of drugs in patient populations or in individuals using a structured process and approved evaluation criteria.[181,182] The reviews can be performed by institutions, health insurance companies and other organizations. DUR programs attempt to improve the understanding of prescribing patterns so that changes can be made to enhance patient outcomes and control costs.[181,183] Drug utilization reviews have been conducted retrospectively in order to improve prescribing in the future. Concurrent or prospective DUR occurs at the time of clinical encounter, when the patient can still benefit.[181, 184]

Does it work?

Retrospective DUR programs generally do not work well, although concurrent DUR methods may be effective.[182,184-186] A lack of effect size for DUR in the literature may be related to the researchers' lack of access to clinical data, particularly in the community setting, and heterogeneity of study designs and intervention methods.[182] Hennessy et al. reported the effect of retrospective DUR for US Medicaid recipients using computers that screened prescription data to determine if prescribing met criteria. If violations occurred these were termed exceptions and if deemed valid, the prescribing physician was notified. Retrospective DUR did not reduce the number of exceptions identified (rate increase, 0.064 exceptions per 1000 prescriptions per month, 95% CI -0.006 to 0.133).[185] The authors also found no effect on all-cause hospitalizations (odds ratio 0.99, 95% CI 0.98 to 1.00).[185] In a study of three hospitals in Quebec, Gregoire et al. examined the quality of prescribing cisapride, a gastrointestinal prokinetic agent, by comparing the effect of retrospective DUR, concurrent DUR, and a control hospital with no DUR. The study showed that the concurrent DUR program significantly improved the appropriateness of prescription for indication, whereas, the retrospective DUR did not.[184] Cisapride was withdrawn from the market in 2000, after the study was completed. In another concurrent DUR study, specially trained geriatric pharmacists telephoned prescribers to recommend changes based on computerized alerts.[186] Effect sizes varied by drug alert; 40% of prescriptions for long-acting benzodiazepines were changed, 33% for chlorpropamide, 19% for narcotic analgesics, and 7% for nonsteroidal anti-inflammatory drugs in patients with a history of peptic ulcer disease.[186] Further research is needed in this area.[181,182,187-189]

(iv). Local consensus process, care pathways, and guidelines

What is it?

Evidence generated from clinical trials must take into account the local context. In a local consensus process, health care providers respond to expert recommendations on appropriate management of a clinical problem. Consensus processes have been used to generate care pathways and local guidelines, with the goal of promoting the local uptake of specific health care practices. Care pathways, also referred to as critical paths, clinical pathways and care paths, are multidisciplinary management tools that are patient-focused and based on current evidence.[190] Local guidelines are developed by local teams, including physicians, other health care providers, and managers, to care for patients with specific health conditions.

Does it work?

The effectiveness of these strategies is unclear, particularly in identifying the levers required to change processes within the health care system or to reallocate funding or human resources. Karuza et al. used a small group consensus process to increase adoption of an influenza vaccination guideline for adults.[191] The physicians who

participated in the consensus process increased their vaccination rate by 34% compared to the control group. All (100%) physicians in the intervention group increased their vaccination rates, compared to only 54% of control physicians.[191] However, Sommers et al. found that the consensus process to set medical audit criteria did not improve adherence to guidelines for treatment of low hemoglobin in the hospital setting.[192] Three groups of physicians were randomized to either set criteria and review audit results, review audit results only, or no intervention. In the second phase, all groups received concurrent reminders of the guidelines. The group that set criteria and reviewed audit results achieved 56% compliance in phase 2, compared to 77% compliance by the control group (p=0.004).[192]

An example of a consensus process is found in the UK. There, four Bradford Primary Care Trusts (PCTs) jointly funded the Promoting Action on Clinical Effectiveness (PACE) program, which develops evidence-informed guidelines on a select number of topics each year (e.g., improving prescribing practice in diabetes, psychosis, and heart failure). Participants in the consensus group include general practitioners, pharmacists, hospital consultants, nurses, social service workers, and patient representatives. Some PACE goals include: building teamwork within practices; developing experience in action planning; reaching agreement to share audit data, action plans and ideas with other practices and with the PCT; and enhancing knowledge of best clinical practice based on the latest medical evidence.[166,193-195] The availability of funding to assist general practitioners and other practice staff to attend education events based on the guidelines developed builds capacity at the practice level; and the evaluation of PACE through re-audit of the guidelines, amongst other techniques, provides a measure of effectiveness (www.bradford.ac.uk/health/research/pace/index.php accessed September 11, 2008). Many reasons are proposed for the failure of guidelines to promote change in prescribing. These include lack of awareness of guidelines, lack of knowledge of guideline recommendations, disagreement with the content of the guidelines, personal characteristics of providers (e.g., concern about autonomy), lack of self-efficacy, logistic and financial barriers to implementation, and inertia.[177,196-199] Guidelines do not exist for all patients' conditions and they often address only single diseases, whereas, many patients have multiple diseases; or, patients may not want the therapy recommended by the guidelines. In addition, drugs recommended in the guidelines may not be affordable to the patient or the system. Both reporting systems and communities of practice (groups of people with a common concern who interact regularly to improve their work) assist the educational process.[200,201]

3. Generally Ineffective

(i). Passive dissemination of print and electronic educational materials

What is it?

Educational materials include clinical practice guidelines, drug cost comparisons, and overviews of key clinical trials, among others. Clinical practice guidelines are systematically developed statements (often with the level of evidence assigned to each statement) designed to assist both physicians and patients in making appropriate health care decisions.[202] Such guidelines combine scientific knowledge with professional consensus,[203] and can be developed by governments, professional societies, voluntary health organizations, industry, and others. Guidelines vary in quality, are difficult to keep up to date, and do not always examine the cost-effectiveness of the interventions or their impact on expenditures if implemented.[204]

Does it work?

Distributing educational materials not requested by physicians has been shown to produce either small changes in prescribing or none; but, this intervention can be cost-effective if changes result.[113,120,122,125,203,205] Grimshaw et al. found the median effect size for dissemination of educational materials to be 8.1% (range 3.6% to 17.0%) from four cluster randomized comparisons.[122] The source of the information, the method of providing the information and the nature of the drug affect the usefulness of the intervention. For example, a study on the impact of a series (12) of regular, printed, educational

Therapeutics Letters (an initiative of British Columbia's Therapeutics Initiative) to 499 physicians in British Columbia found that physicians who received the Letters prescribed the recommended drug more often than physicians who did not receive the Letters. The authors' interpretation was that "*the combined effect of an ongoing series of printed letters distributed from a credible and trusted source can have a clinically significant effect on prescribing to newly treated patients.*"[206]

(ii). Educational meetings

What is it?

Educational meetings for health professionals have been used by academia, government, the voluntary health sector, and the pharmaceutical industry. Educational meetings can take the form of large didactic lectures or small group participatory seminars. These often involve experts providing their knowledge of the field, including literature and experience. Sometimes they involve small groups of physicians or multidisciplinary teams during which barriers and facilitators to prescribing are addressed.[207,208] Videoconferencing and the Internet can also be used as a forum for meetings.[87,125,209-212]

Does it work?

The effectiveness of large didactic lectures is variable, with many showing no effect.[125,213] Grimshaw et al. found three cluster randomized trials that had positive effects, but concluded this type of intervention on its own is likely to have minimal effectiveness.[122] Small group participatory educational meetings have been shown to be effective in some studies and appear promising, but further research is needed.[119] Educational meetings do help confirm knowledge and reinforce current norms of practice to physicians. Educational meetings may also be successfully combined with other interventions to improve prescribing.[124,140]

CONCLUSIONS

Interventions to improve prescribing in community and institutional settings have variable effect sizes. No single approach is appropriate for every prescribing problem, prescriber practice or health care setting. Their effectiveness relates not only to their content, delivery mechanisms and intensity, but also to the context for the interventions and the environment for implementation. Even though the effect size may be small (< 10%), the intervention may lead to important changes in drug use when applied on a population basis. Currently, most interventions involve physician prescribers. However, the prescribing environment will become more complex as provincial legislation enables additional health professionals to prescribe. Within this environment, it will be important to monitor and evaluate patient outcomes arising from interventions to improve prescribing.

Further research is needed to determine how or why the interventions work and identify barriers to effective implementation. The safety, effectiveness, cost-effectiveness, acceptability, and social and ethical aspects of interventions to improve prescribing and medication use need real world evaluation. This is especially critical for broad national or province-wide approaches. Based on this information, interventions could be better customized for individual prescribers taking into account their knowledge base and practice context. Since multiple interventions are often implemented, it is important to determine the best way to utilize them. In addition, an evaluation process should be included with any intervention implementation to ascertain effectiveness of both process and outcomes and its cost effectiveness.

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