Clinical practice guideline dissemination and a new approach using Haddon matrix as a conceptual framework of evidence-based implementation strategies

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ABSTRACT: To err is human. Clinical practice guidelines (CPGs) are often not followed and lead to adverse outcomes. The issue on implementation of CPG is complex. A review of CPG implementation is done to identify the barriers and enablers. For the first time, a fishbone diagram is used to delineate the root-causes. And Haddon matrix is applied to help understand the complexity of evidence-based implementation (EBI) strategies.

KEY WORDS: Clinical practice guideline; Implementation; Barriers; Enablers


DO WE FOLLOW CLINICAL PRACTICE GUIDELINES?

In health care, invention is hard, but dissemination is even harder. CPGs are systematically developed statements that assist practitioners to provide appropriate evidence-based care. CPG usage may differ at national level. Ian Graham et al[1] reported that more than 70% of Canadian and UK emergency physicians applied Ottawa rules compared with less than one third of US, French, and Spanish physicians. Evidence-based management guidelines are prepared by authoritative parties and disseminated to members to minimize practice variation and maintain a standard quality of care. Problems arise during CPG dissemination, implementation and adherence. It is dangerous if members do not follow CPG. According to a newly published German study of 25 250 patients, only half of the patients were assigned appropriate LDL cholesterol targets.[2] If all doctors simply adhered to CPG, it could result in an estimated 50-80 fewer heart attacks, strokes and cardiovascular deaths per 1 000 patients over a 10 year period. In Israel, ACS patients with impaired physical and cognitive status had received less aspirin, clopidogrel, platelet glycoprotein IIb/IIIa receptor antagonists, statins, beta-blockers, and even less PCI. Subsequent mortality rate increased.[3] In another survey by Fanny Ko et al, 2010, over 45% of Hong Kong doctors used long-acting beta-2 agonist alone (LABA monotherapy) without inhaled corticosteroid to treat asthma. Such practice is considered dangerous as it is associated with increased mortality. Asthma management practice of Hong Kong doctors falls short of the standards recommended by international guidelines.[4]

Problems may also occur even though CPG is followed. Hong Kong has a population of 7 million. Over 95% acute hospitalization of the public will go to 16 designated hospitals under the hospital authority while the rest go to the private market. The public sector faces increasing demand with rising patients' expectations. In each hospital, there is Accident and Emergency Department (AED) with a case-mix of staffs, including non-trainees, trainees, and fellows. There exists practice variation. And the chiefs will meet together each month and form a COC (Co-ordination of Chiefs). In 2003, there was an incident of a young man of 40 who came to A&E Unit, with a complaint of epigastric pain. He was treated with buscopan and discharged the same day. Few hours later, he came back with acute myocardial infarction(AMI). After that, the COC issued a CPG in 2004. The CPG took 6 months to finish. There were two panelists. It started with collections of local and foreign CPGs, opinions seeking from local champions, literature searching and feedbacks from COC. Inside the 6 pages
CPG, a chest pain evaluation flow chart of A4 size was drawn and it was designed to be user-friendly. In view of clinical expertise that juniors may lack of, the authors intended to simplify the paragraph on the clinical differentiation of atypical chest pains, and moved straight to management of suspected ACS. According to the authors, CPG was not difficult to prepare because the available evidences were not in wide discrepancy. And frontlines, who often deal with chest pain patients in their daily practice, found no difficulty at all, to follow CPG. Although CPG was followed, problems still occurred. For the juniors, they did the right job, as usual; but they did not do the job right. They tended to over-investigate to avoid litigating of missing a single case of AMI. The clinical history taking and examination for differentiation of atypical chest pain were often inadequate. Subsequent length of stay (LOS) at AED became longer. They admitted inappropriate patients to Observation Ward or Emergency Medicine Ward.

From the above examples, we understand that implementation of CPG is a complex issue. To update, the Cochrane Effective Practice and Organization of Care (EPOC) group has published a summary of 44 systematic reviews of implementation interventions. EPOC has reviewed a series of methods of implementing CPGs, but none is reliably effective in all settings and circumstances. Scottish Intercollegiate Guidelines Network (SIGN) has published a chapter on implementation, as well. To ease the complexity and understand the multi-factorial inter-relationship, I propose for the first time in the press that we use a fishbone diagram for root-cause analysis and Haddon Matrix for evidence-based implementation (EBI) strategies.

EXPERTS’ COMMENTS
To begin with, a realist review at CPG implementation is undertaken. Emails and phone calls have been made to champions in Canada, Singapore and local experts. Voices from frontlines are also heard. A thorough literature searching using keyword "guideline implementation" is followed.

Below are some clips from champions......

1) Here are my comments: 1. Build up awareness and an EBM culture in your department. 2. Good communication is the key to buy-in from all stakeholders. Show them why there is a need to change. 3. Conduct regular audits. 4. Tie bonus or have a carrot and stick system to ensure adherence. 5. No matter what you do, there will always be a spectrum of people in your dept; some are early adopters, others are laggards.

2) The processes of innovation and dissemination have their own rules and their own pace. Health care leaders should understand innovation and how it spreads, respect the diversity in change itself (e.g. reinvention), and draw on the best of social science for guidance. Seven recommendations: 1. Find sound innovations; 2. Find and support "innovators"; 3. Invest in "early adopters"; 4. Make early adopter activity observable; 5. Trust and enable reinvention; 6. Create a slack for change; 7. Lead by example.

3) Great barriers especially those concerning doctors. This includes guidelines for clinical problems and instructions for routines. We do not have a system to check continuously the performance of our staff whether the guidelines are followed and if deviated, the reasons. This requires recourses for the audit and we are tied up with daily clinical work.

4) Not easy to explain through email. Call me or arrange a time to meet.

5) In terms of guideline implementation, this is a very interesting and timely topic, especially in knowledge translation. It is clear that simply publishing guidelines will not lead to adoption. The following elements, and they need to be implemented non-linearly (not in sequence but flexibly) would affect outcome in north America: 1. Strong opinion leaders in the practice environment that champion the guidelines. 2. A mechanism for the guidelines to be translated into the local practice workflow (if the guidelines are not translated into practical steps and left to individuals to interpret, slower or no change). 3. A change management process to get everyone on board. 4. Opportunities for people that implement the guidelines to discuss issues of implementation, and learn from each other as to what successful steps were and what were challenges (an environment for knowledge exchange and discussion at the frontline level). 5. The results and improvements are demonstrated rapidly so that people get feedback on the effects that the changes have made. This is very important to encourage sustainability of changed behaviors. 6. It would be very helpful to have a place where the changes and positive gains get recognized (either as a research abstract, a publication, an award, or a public forum where the changes are highlighted and people involved congratulated). This would really galvanize the group's resolve to maintain change. 7. The upper management (director of ED, health authorities, governments) needs to have full buy in into these guidelines implementation, and be part of the change process.

6) The COC guideline is a guideline on chest pain suspected of cardiac origin. Chest pain is a symptom that can come up with many diagnoses, ACS is already a diagnosis. It needs a tedious history taking and some basic investigations to tell the likelihood of ACS or not. What
I found is an over ordering troponin I in our colleagues, a guideline prepared to guide them to order test appropriately has turned out that the guideline justifies their over ordering of tests with no attention to good history taking. Troponin I itself, raised or not, does not tell ACS or not. Without a good history, doctors other than taking blood will put the chest pain subjects into Observation Ward for senior disposal. On the one hand, it is safe. On the other hand, it is a behavior of pushing away risk by avoiding giving proper clinical judgments; this will markedly increase the LOS in A&E and the occupancy of the Observation Ward and EM Ward. Guidelines well written is a pre-requisite, but, even well written could become a tool for defensive medicine after skillfully avoiding clinical judgments. Finally, that is to say, a well written guideline only helps those who are willing to practice instead of avoid good clinical judgments.

7) From the frontline's perspective, I think there are many guidelines and people tend to forget especially the clinical situation is not common. Guidelines for dog-bite e.g. have better adherence as there are more cases and the guidelines are not complicated. Guidelines for sexual assault have slight problem as residents are not so familiar with the whole process. A simple flow chart reminder seems to help.

**HAVE A CHAT WITH FRONTLINES**

Frontlines will be delighted to follow CPGs, especially if CPGs are (a)related to important clinical consequences such as mortality, (b)fully understood and accepted, (c)user-friendly and flexible, (d)without resources constraints such as manpower, facilities and time. Individual CPG may have many recommendations. Some recommendations may be followed, especially those with outcome expectancy. And some recommendations will just be ignored, especially under stressful working environment. "I have no time", "I am too busy", or "Too many guidelines" are often heard during the dialogue. For those clinical situations that are rare, CPGs will be easily forgotten and the contents will not be remembered correctly.

To the frontlines, role modeling from seniors is the most important trigger to galvanize their obedience, followed by communication channel to voice out their opinions.

**A REVIEW OF THE EXISTING LITERATURE**

Problems of implementation exist in public sector and private sector, and happen in medical fields and non-medical fields. J.S. Oakland and S.J. Tanner present a survey on 28 organizations' respondents from a variety of industries to gain their insights on how to manage change successfully. The research leads to two main domains, readiness for change and implementing change. And surprisingly, the results are just similar to evidences collected from medical literature. The research shows that successful change focuses on both strategic and operational issues. The key link between the strategic objectives and operational improvement is the core processes, which need to be understood, measured and improved. If the link is broken, then the change is ineffective.

As early in 1997 and 1999, Davis et al[7] and Cabana MD et al[8] published a systematic review and "Why don't physicians follow CPGs?". 293 potential barriers were identified. France Legare et al[9] conducted a "before and after" survey on primary care professionals on barriers and facilitators to the implementation of the Ottawa Decision Support Framework. The results provided insight and suggested that effective strategies needed to address a broad range of factors at the levels of the health professionals, the patients and the health care system. And Ian Graham's qualitative case study on the use of electronic fetal monitoring and labour support, emphasized a careful tailoring of interventions during implementation and be prepared for unanticipated effects.[10]

Literatures on implementation of CPG are limited and come from doing surveys, "before and after" cluster RCTs, and reviews.[11, 12] A systematic review from Jeremy Grimshaw et al[13] 2004 stated that there was an imperfect evidence base to support decisions about which CPG dissemination and implementation strategies were likely to be efficient under different circumstances. It illustrated the complexity of implementation barriers. Robbie Foy et al[14] conducted a before and after study and noticed a highly inconsistent clinical care of mild hypertension in pregnancy. The lack of intervention effect may be related to the complexity of CPG recommendations and the nature of the implementation strategy. To the extreme, the reasons for lack of impact of CPG remained unclear, as concluded in a study by Yogesh Chadha et al[15] on CPG in menorrhagia and urinary incontinence.

Examples of successful EBI strategies include multifaceted strategy (such as interactive educational meetings, local consensus process, audits and feedbacks, use of local opinion leaders)[16,17,18,19] and memory aids,[20] patient-tailoring strategies.[21] Another example is the CRUSADE Initiative (Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation of ACC/AHA Guidelines). CRUSADE attempts to improve the adherence to the
ACC/AHA guidelines to optimize care for patients with non-ST-elevation acute coronary syndrome. It is an ongoing, voluntary, observational data collection with quarterly webcast, and quality improvement initiative.\(^2\)

It is amazing that every 10% increase in adherence of guidelines among recruited organizations would decrease 10% in mortality.

However there are also conflicting evidences in the area of computerized guidelines,\(^{23, 24, 25}\) multifaceted strategy,\(^{26, 27}\) and chart reminders.\(^{28}\)

**ROOT CAUSE ANALYSIS USING FISHBONE DIAGRAM TO ILLUSTRATE BARRIERS**

Mark Doggett from Humboldt State University\(^{29}\) presents three tools namely, the cause-and-effect diagram (Fishbone diagram) (Figure), the interrelationship diagram, and the current reality tree to identify potential root causes of problems. And the fishbone diagram is commonly employed. It develops groups of probable causes as the main branches. Minor causes are then drawn as twigs on the branches. The advantage of fishbone diagram is that breaking down causes into more detailed helps organize and relate the factors. The disadvantage is that the final form is highly dependent on the person constructing it, and small causes of variation may be overlooked. And there is not a concern on weights. Using the chest pain CPG as an example, a fishbone diagram on barriers of implementation is shown below. And we label Misuse of CPG, Inappropriate Admission, Length of Stay (LOS) at A&E Unit, and Costing as the outcomes. The roots are categorized into four domains, namely Policy Makers, End-Users, Guideline Characteristics, and Environment (physical and social).

A. Policy makers are both obstacles, as well as facilitators during implementation and dissemination of CPG. Team spirit is important and policy makers should get all stakeholders aboard the same boat. Both medical and nursing leadership may encourage or discourage the use of CPG. They should identify local champions and early adopters. Role-modeling affects the majority late adopters and even laggards. In contrary, a lack of understanding of the internal drivers to change among policy makers themselves, as well as a communication breakdown with frontlines, especially constructive noises from early adopters, will jeopardize the implementation. Policy makers should anticipate unforeseen barriers during implementation. A pilot test before final protocol and dissemination of guideline may also help.

B. End-users should be involved during CPG set-up, especially tailor-made change of interventions during implementation phase. In Chinese, we have an idiom "上有政策，下有对策" (counter-measures vs. policies). Staffs may have resistance to change (status quo), as well as, their own concern of doctor autonomy. Only a minority may become early adopter; while the majorities are late adopters. Litigation is another concern that needs to be reassured. Applying the Pathman pipeline of knowledge translation,\(^{30}\) end-users need to be well informed to get aware of CPG, get familiar, and also to agree with CPG. Multi-faceted interventions including education outreach teams which may ease frontlines’ self-efficacy, memory aids and reminders, computerized decision support, audit and feedbacks, may facilitate CPG adherence.

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**Figure.** Fishbone diagram for RCA of Chest Pain Evaluation CPG implementation barriers.
C. Guideline characteristics: Quality of CPG, Clinical importance with prioritization of topics, and User-friendly format are the three crucial elements of a successful CPG. A CPG with wide discrepancy in evidence exerts a negative effect on acceptance, same for CPG with no outcome expectancy. A cookbook is not useful in complex clinical situation. CPG should be flexible. Too many CPGs and rare occasions' CPGs are frontlines' excuses of not using guideline.

D. Environment (physical and social): CPG need to be adapted with considerations of local culture, patients' preferences and social marketing, cost efficacy, resources of manpower and time, availability of facilities, and local clinical situations. Internal driving forces come from own hospital and unit and they should be well recognized and reacted to. External driving forces may come from other stakeholders such as government bodies, and mass media.

HADDON MATRIX TO ILLUSTRATE EVIDENCE-BASED IMPLEMENTATION (EBI) STRATEGIES

Although CPG implementation is complex, it is more easily recognized and understood by Haddon Matrix which simply categorizes EBI strategies into pre-implementation phase, implementation phase, and post-implementation phase. The Table is self-explanatory and serves as a general framework for CPGs. However different CPGs need to be tailor-made. Within each CPG, every recommendation has its own unique pattern of barriers and facilitators.

CONCLUSION

To err is human. There is a chasm of what we know and what we do. CPG implementation is complex. The evidences are limited for the different implementation strategies. Barriers and facilitators may interchange in different studies. Doing research by usual quantitative approach is not efficient because it answers only a single formulated question. And it is even harder, as well, to show a definitive gain of clinical outcome for a change in implementation strategy. For the first time in press, this review applies Haddon Matrix to help understanding the complexity of CPG dissemination. Impact analyses with tailored-made EBI strategies, and by combining quantitative and qualitative designs, as well as outcome measures studies, become the future trend of research.

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