CHALLENGES AND OPPORTUNITIES FOR INTELLIGENT TOOLS TO SUPPORT THE CONDUCT OF LARGE COMPLEX SYSTEMATIC REVIEWS

JEREMY GRIMSHAW
SENIOR SCIENTIST AND PROFESSOR
CANADA RESEARCH CHAIR IN HEALTH KNOWLEDGE TRANSFER AND UPTAKE

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@GRIMSHAWJEREMY
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DIABETES CANADA

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Effects of Quality for Type 2 Diabetes A Meta-Regression Analysis

Kaveh G. Shojania, MD
Sumant R. Ranji, MD
Kathryn M. McDonald, MM
Jeremy M. Grimshaw, MChB, PhD
Vandana Sundaram, MPH
Robert J. Bushkoff, MD
Douglas K. Owens, MD, MS

Diabetes mellitus has reached epidemic proportions in the United States. Despite well-established processes of care to reduce morbidity associated with diabetes, widespread quality problems exist. The literature contains numerous reports of interventions designed to remedy these problems, but their effectiveness remains unclear.

Previous systematic reviews of quality improvement (QI) strategies for diabetes have provided only qualitative analysis or have focused on single types of interventions, leaving the relative effectiveness of different strategies unknown. This is particularly problematic, since many interventions include components of multiple QI strategies. Thus, some of the same trials may appear in reviews of pa...
INCLUSION CRITERIA – TYPES OF INTERVENTIONS

- Audit and feedback
- Case management
- Team changes (provider role changes)
- Electronic patient registry
- Clinician education
- Clinician reminders
- Facilitated relay of information to clinicians
- Patient education*
- Promotion of self-management*
- Patient reminder systems
- Continuous quality improvement
- Financial incentives

(* Only included if part of a multifaceted intervention including professional targeted interventions)
## INCLUSION CRITERIA – OUTCOMES OF INTEREST

<table>
<thead>
<tr>
<th>Domain</th>
<th>Process measure</th>
<th>Intermediate outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycemic control</td>
<td>HbA1c measurement</td>
<td>HbA1c levels</td>
</tr>
<tr>
<td>Vascular risk factor management</td>
<td>Patients on ASA, statins, anti</td>
<td>Lipid levels</td>
</tr>
<tr>
<td></td>
<td>hypertensives</td>
<td>BP</td>
</tr>
<tr>
<td>Retinopathy screening</td>
<td>Patients screened</td>
<td></td>
</tr>
<tr>
<td>Foot screening</td>
<td>Patients screened</td>
<td></td>
</tr>
<tr>
<td>Renal function</td>
<td>Patients monitored</td>
<td></td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>Patients on NRT</td>
<td>Patients successfully quitting</td>
</tr>
</tbody>
</table>
RESULTS: STUDY FLOW

5592 titles and abstracts

3440 excluded:
- 2064 Not a randomized trial
- 1376 Not an evaluation of quality improvement interventions

2152 full-text articles reviewed

1990 excluded:
- 617 Not an evaluation of quality improvement interventions
- 498 Not a randomized trial
- 358 Excluded topic
- 259 No component of clinician or organizational change
- 134 Not diabetes care
- 109 Did not report eligible outcomes or usable data
- 15 English translation unavailable

162 included randomized trials:
- 48 cluster randomized trials plus 6 companion reports
- 94 patient randomized trials plus 14 companion reports

2,538 clusters and 84,865 patients
38,664 patients
# RESULTS: HBA1C META-REGRESSION

<table>
<thead>
<tr>
<th>Quality Improvement Strategy</th>
<th># RCTs</th>
<th>MD</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Changes</td>
<td>47</td>
<td>0.52</td>
<td>0.00, 1.04</td>
</tr>
<tr>
<td>Facilitated Relay</td>
<td>31</td>
<td>0.49</td>
<td>0.02, 0.96</td>
</tr>
<tr>
<td>Promotion of Self-management</td>
<td>57</td>
<td>0.45</td>
<td>0.04, 0.87</td>
</tr>
<tr>
<td>Case Management</td>
<td>52</td>
<td>0.41</td>
<td>0.00, 0.82</td>
</tr>
<tr>
<td>Patient Education</td>
<td>52</td>
<td>0.40</td>
<td>0.00, 0.80</td>
</tr>
<tr>
<td>Electronic Patient Register</td>
<td>28</td>
<td>0.39</td>
<td>0.00, 0.78</td>
</tr>
<tr>
<td>Clinician Reminders</td>
<td>16</td>
<td>0.35</td>
<td>0.00, 0.70</td>
</tr>
<tr>
<td>Patient Reminders</td>
<td>20</td>
<td>0.31</td>
<td>0.00, 0.62</td>
</tr>
<tr>
<td>Audit and Feedback</td>
<td>9</td>
<td>0.22</td>
<td>0.00, 0.44</td>
</tr>
<tr>
<td>Clinician Education</td>
<td>12</td>
<td>0.16</td>
<td>0.01, 0.33</td>
</tr>
<tr>
<td><strong>All Interventions</strong></td>
<td><strong>117</strong></td>
<td><strong>0.33</strong></td>
<td><strong>0.01, 0.65</strong></td>
</tr>
</tbody>
</table>

Favours Control |  Favor Intervention

Post-intervention reduction in HbA1c%
Effectiveness of quality improvement strategies on the management of diabetes: a systematic review and meta-analysis

Andrea C Tricco, Noah M Ivers, Jeremy M Grimshaw, David Moher, Lucy Turner, James Galipeau, Ilana Halperin, Brigitte Vachon, Tim Ramsay, Braden Manns, Marcello Tonelli, Kaveh Shojania

Summary
Background The effectiveness of quality improvement (QI) strategies on diabetes care remains unclear. We aimed to assess the effects of QI strategies on glycated haemoglobin (HbA1c), vascular risk management, microvascular complication monitoring, and smoking cessation in patients with diabetes.

Methods We identified studies through Medline, the Cochrane Effective Practice and Organisation of Care database (from inception to July 2010), and references of included randomised clinical trials. We included trials assessing 11 predefined QI strategies or financial incentives targeting health systems, health-care professionals, or patients to improve management of adult outpatients with diabetes. Two reviewers independently abstracted data and appraised risk of bias.

Findings We reviewed 48 cluster randomised controlled trials, including 2538 clusters and 84,865 patients, and 94 patient randomised controlled trials, including 38,664 patients. In random effects meta-analysis, the QI strategies reduced HbA1c by a mean difference of 0.37% (95% CI 0.28–0.45; 120 trials), LDL cholesterol by 0.10 mmol/L (0.05–0.14; 47 trials), systolic blood pressure by 3 mm Hg (2.13–4.96; 65 trials), and diastolic blood pressure by 1.55 mm Hg (0.95–2.15; 61 trials) versus usual care. We noted larger effects when baseline concentrations were greater than 8.5% for HbA1c, 2.59 mmol/L for LDL cholesterol, and 80 mm Hg for diastolic and 140 mm Hg for systolic blood pressure. The effectiveness of QI strategies varied depending on baseline HbA1c control. QI strategies increased the likelihood that patients received aspirin (11 trials; relative risk [RR] 1.33; 95% CI 1.21–1.45), antihypertensive drugs (ten trials; RR 1.17, 1.01–1.37), and screening for retinopathy (23 trials; RR 1.22, 1.13–1.32), renal function (14 trials; RR 1.25, 1.13–1.44), and foot abnormalities (22 trials; RR 1.27, 1.16–1.39). However, statin use (ten trials; RR 1.12, 0.99–1.28), hypertension control (18 trials; RR 1.01, 0.96–1.07), and smoking cessation (13 trials; RR 1.13, 0.99–1.29) were not significantly increased.
A CASE STUDY IN COMPLEXITY

Challenges

- Firstly, programs are usually complex, involving multifaceted approaches that may contain a mix of effective and ineffective (or even harmful) component KT/QI interventions that may (or may not) be interdependent and that may (or may not) interact synergistically (or antagonistically).

- Identifying the effective (and ineffective) components within programs is necessary to ensure sustainability and to facilitate replication.
A CASE STUDY IN COMPLEXITY

Challenges

- Secondly, the effects of complex KT/QI programs are likely modified by poorly recognised and ill-defined contextual factors making judgements about the applicability of the effects of interventions in different contexts more challenging.

- Traditional meta-analyses estimate the ‘average’ effect across studies, ignoring effect modification by contextual factors, which is of vital importance to health system decision makers trying to assess the applicability of the results of a systematic review to their context.
A CASE STUDY IN COMPLEXITY

Challenges

- Thirdly, the mechanisms of action of KT/QI programs (and component interventions) are poorly understood, resulting in lack of consensus about terminology.

- Authors of syntheses often develop pragmatic (somewhat arbitrary) definitions of programs and interventions of interest.

- However that misclassification of interventions may lead to “noise” in a meta-analysis by artificially increasing the observed heterogeneity of comparisons by including studies testing different programs and/or reducing precision by artificially excluding studies that evaluate the same program from a comparison.
Challenges

- Fourthly, these issues are exacerbated by poor reporting of interventions and contextual factors in primary studies.
Seeing the forests and the trees—innovative approaches to exploring heterogeneity in systematic reviews of complex interventions to enhance health system decision-making: a protocol

Noah Ivers, Andrea C Tricco, Thomas A Trikalinos, Issa J Dahabreh, Kristin J Danko, David Moher, Sharon E Straus, John N Lavis, Catherine H Yu, Kaveh Shojania, Braden Manns, Marcello Tonelli, Timothy Ramsay, Alun Edwards, Peter Sargious, Alison Paprica, Michael Hillmer and Jeremy M Grimshaw
SEEING THE FOREST AND THE TREES

- Challenge 1 (better specification of effects of components) and challenge 2 (better specification of effect modifiers)

  Synthesis with hierarchical regression

- Challenge 4 (poor reporting)

  Author survey

- Challenge 3 (intervention description)

  Author survey, alternative taxonomies
DIABETES QI: A RAPIDLY EVOLVING FIELD

1982-2006
JAMA 2006
66 included studies

2003-2010
Lancet 2010
162 included studies

2010-2014
Forest and Trees 2017
278 included studies

Effects of Quality Improvement Strategies for Type 2 Diabetes on Glycemic Control: A Meta-Regression Analysis

Effectiveness of quality improvement strategies on the management of diabetes: a systematic review and meta-analysis

Seeing the forests and the trees—innovative approaches to exploring heterogeneity in systematic reviews of complex interventions to enhance health system decision-making: a protocol
### Number of trials over time

![Graph showing the number of trials over time](image)

<table>
<thead>
<tr>
<th>Time period</th>
<th># Published papers</th>
<th>Annual rate of publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire sample (1982-2014)</td>
<td>278</td>
<td>8.4 publications/year</td>
</tr>
<tr>
<td>Last 15 years (2000-2014)</td>
<td>243</td>
<td>16.0 publications/year</td>
</tr>
<tr>
<td>Last 10 years (2005-2014)</td>
<td>184</td>
<td>18.3 publications/year</td>
</tr>
</tbody>
</table>
Living Systematic Reviews are systematic reviews which are continually updated, incorporating relevant new information as it becomes available.
OPPORTUNITIES FOR INTELLIGENT TOOLS

- Enhanced primary studies (linked data, curation)

- Detailed planning (registration, protocol development)

- Screening
  - Study design
  - All inclusion criteria

- Data abstraction
  - Risk of Bias
  - Broader data (inclusion criteria, context, results)

- Translation of primary studies

- Intervention classification/specification
OPPORTUNITIES FOR INTELLIGENT TOOLS

- Automated author survey
- Automated analyses (within living systematic reviews)
- Structured (data linked) write up
- Data linkage
- Curation and discoverability
- Customisable front ends
- Translation/linguistic accessibility

- Improved review quality
- Improved co-ordination of field
OPPORTUNITIES FOR INTELLIGENT TOOLS

RESEARCH ARTICLE

Epidemiology and Reporting Characteristics of Systematic Reviews of Biomedical Research: A Cross-Sectional Study

Matthew J. Page¹,², Larissa Shamseer³,⁴, Douglas G. Altman⁵, Jennifer Tetzlaff⁶, Margaret Sampson⁶, Andrea C. Tricco⁷,⁸, Ferrán Catalá-López⁹,¹⁰, Lun Li¹⁰, Emma K. Reid¹¹, Rafael Sarkis-Onofre¹², David Moher³,⁴*

¹ School of Public Health and Preventive Medicine, Monash University, Melbourne, Victoria, Australia, ² School of Social and Community Medicine, University of Bristol, Bristol, United Kingdom, ³ Clinical Epidemiology Program, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada, ⁴ School of Epidemiology, Public Health and Preventive Medicine, Faculty of Medicine, University of Ottawa, Ottawa, Ontario, Canada, ⁵ Centre for Statistics in Medicine, University of Oxford, Oxford, United Kingdom, ⁶ Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada, ⁷ Li Ka Shing Knowledge Institute of St. Michael’s Hospital, Toronto, Ontario, Canada, ⁸ Epidemiology Division, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada, ⁹ Department of Medicine, University of Valencia/INCLIVA Health Research Institute and Centro de Investigación en Red de Salud Mental, Valencia, Spain, ¹⁰ First Clinical College, Lanzhou University, Lanzhou, China, ¹¹ Department of Pharmacy, Vancouver General Hospital, Vancouver, British Columbia, Canada, ¹² Graduate Program in Dentistry, Federal University of Pelotas, Pelotas, Brazil

Citation: Page MJ, Shamseer L, Altman DG, Tetzlaff J, Sampson M, Tricco AC, et al. (2016) Epidemiology and Reporting Characteristics of Systematic Reviews

* dmoher@ohri.ca

8,000 systematic reviews published annually
CHALLENGES FOR INTELLIGENT TOOLS

- It’s difficult!
- Need tools that likely work across wide range of review questions - multiple, large diverse learning sets
- Promote innovation, reduce risks - standards
- Adapting to diverse and evolving SR methods
- Funding models – majority of review authors do not use SR tools
- Co-ordination of field – efficient production of systematic reviews
Jeremy Grimshaw
jgrimshaw@ohri.ca
@GrimshawJeremy

Kristin Danko
kdanko@ohri.ca

Centre for Implementation Research
@TOH_CIR
http://www.ohri.ca/cir/