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Antimicrobial Stewardship in Primary Care: Audit and Feedback to Improve Antibiotic Prescribing

April 16, 2024

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Assistant Professor, Dalla Lana School of Public Health, University of Toronto

Disclosures

- No COIs

Objectives

1. Identify the important public health threat from antimicrobial resistance (AMR)
2. Describe the risks of antibiotic overuse
3. Interpret recent data on the effectiveness of antibiotic audit and feedback in primary care
4. Discuss the implications for incorporating antibiotic audit and feedback into AMR action plans and antimicrobial stewardship

Antimicrobial Resistance (AMR)

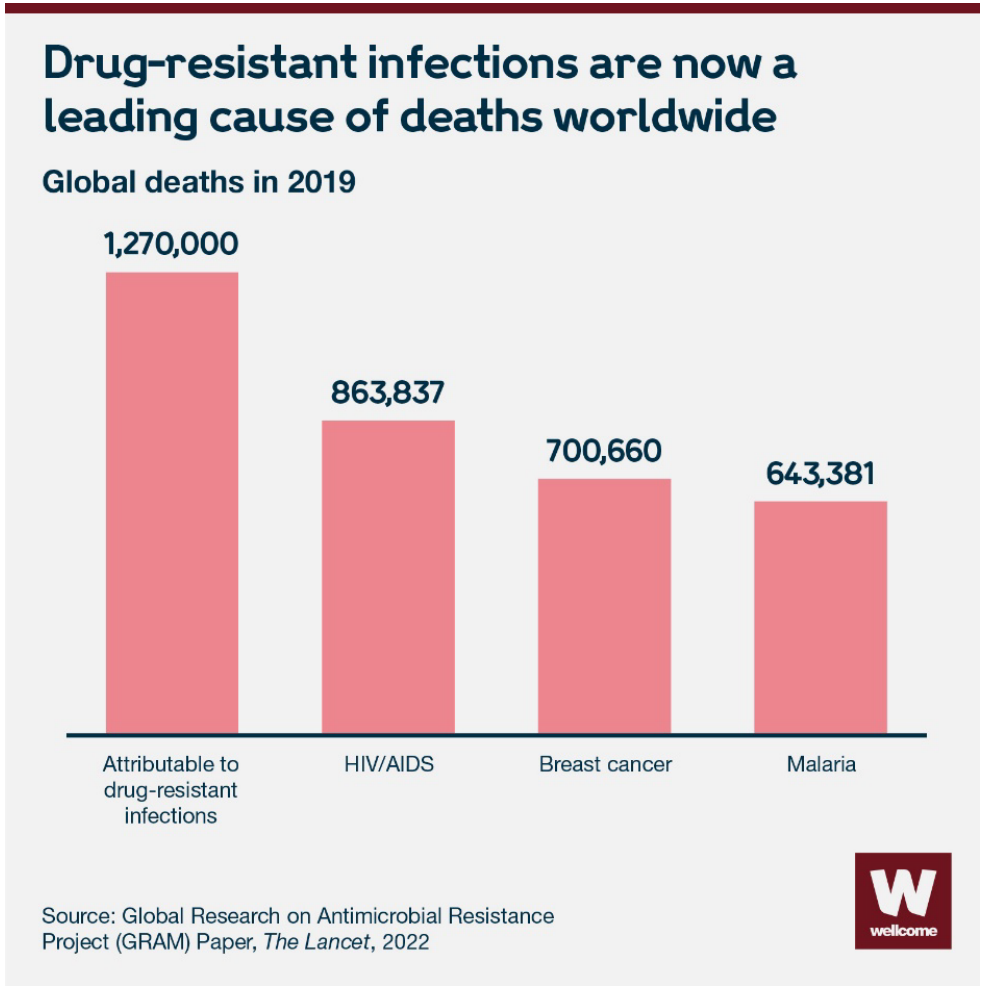
"AMR is a slow tsunami that threatens to undo a century of medical progress"

Dr. Tedros, Director-General, WHO

AMR Has Many Devastating Impacts

AMR and Mortality

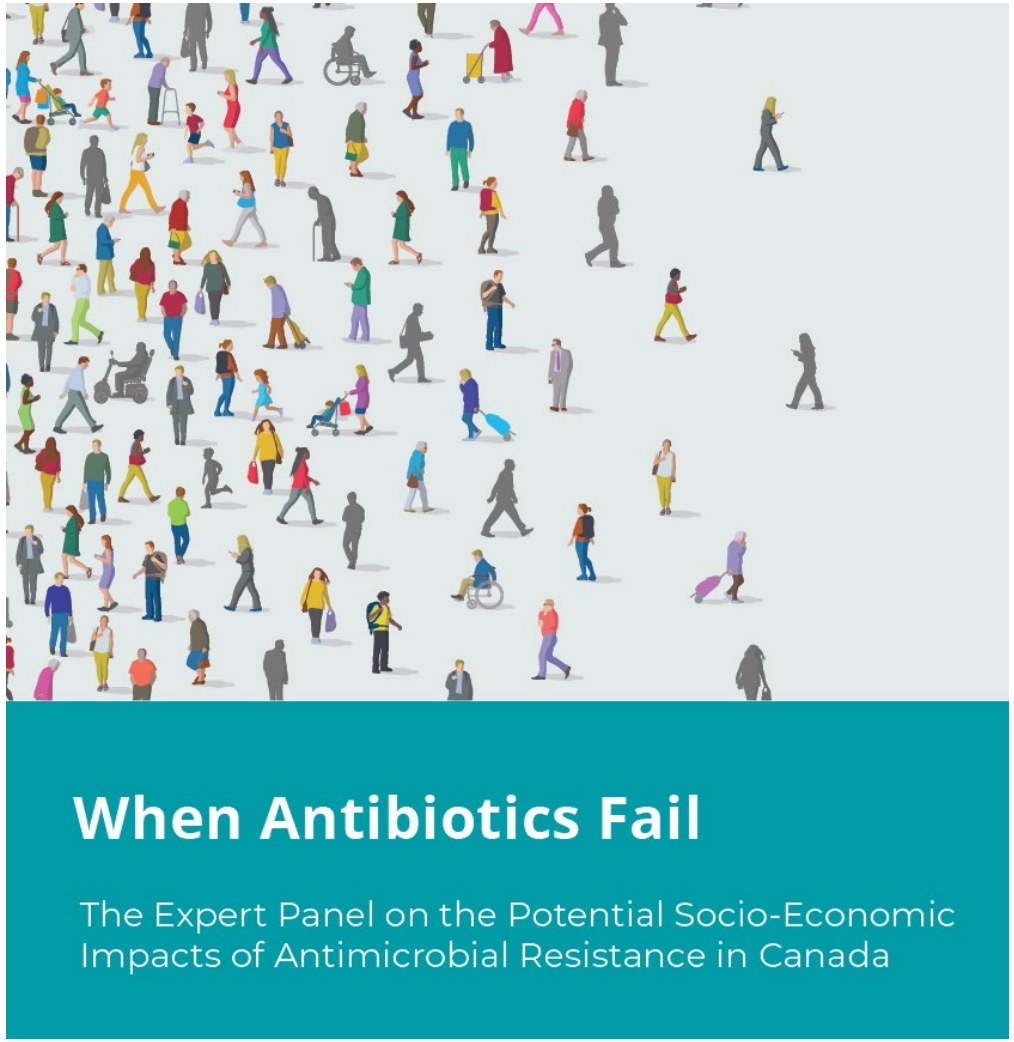
- 4.95 million deaths associated with bacterial AMR in 2019
- 1.27 million deaths attributable to bacterial AMR



Murray CJL, Shunji Ikuta K, Sharana F, Swetschinski L, Robles Aquilar G, Gray A, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. Lancet. 2022;399(10325):629-55. Available from: https://doi.org/10.1016/S0140-6736(21)02724-0

In Canada

- **26%** resistance to 1st line antimicrobials
- Projected to reach **40%** by 2050
- GDP decline of **$388** billion
- 6 deaths per day in Ontario attributable to AMR



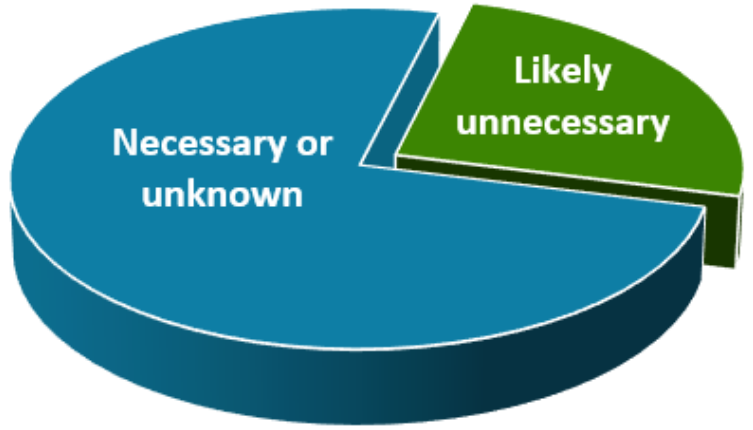
Council of Canadian Academies. When antibiotics fail. Ottawa, ON: Expert Panel on the Potential Socio-Economic Impacts of Antimicrobial Resistance in Canada; 2019. Available from: https://www.cca-reports.ca/wp-content/uploads/2023/05/Updated-AMR-report_EN.pdf

Antibiotic Prescribing

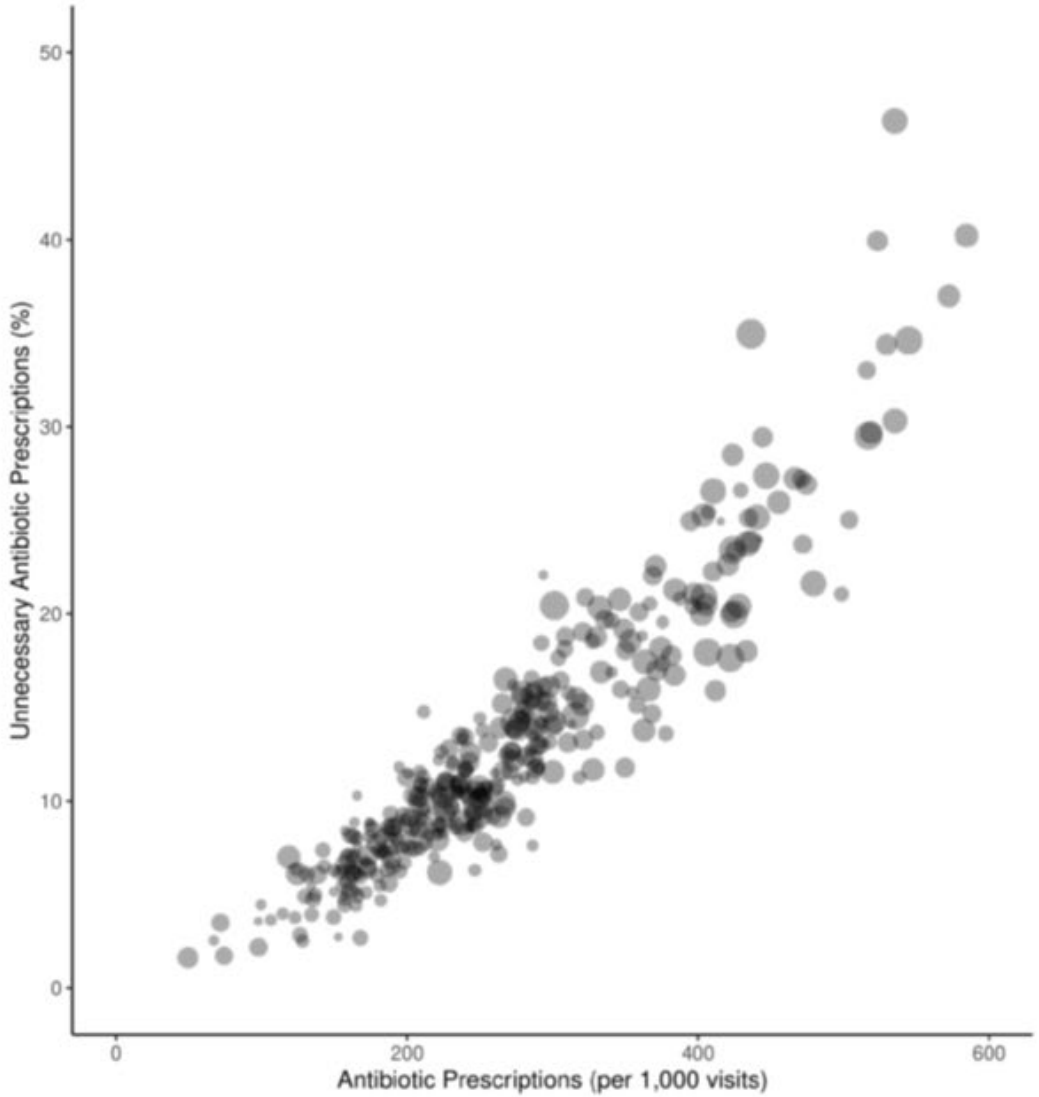
Antibiotic Prescribing in a Canadian Primary Care Setting

Unnecessary Antibiotic Prescribing in a Canadian Primary Care Setting: A Descriptive Analysis Using Routinely Collected Electronic Medical Record Data

Figure 2: Percentage of all antibiotics prescribed, by tier classification system.[19] Tier 1 = conditions for which antibiotics are always indicated (expected prescribing rate 100%), tier 2a = conditions for which antibiotics are frequently indicated (expected prescribing rate 51%–99%), tier 2b = conditions for which antibiotics are sometimes indicated (expected prescribing rate 21%–50%), tier 2c = conditions for which antibiotics are rarely indicated (expected prescribing rate 1%–20%), tier 3 = conditions for which antibiotics are never indicated (expected prescribing rate 0%). *These antibiotics were not associated with an encounter included in the study.



Schwartz KL, Langford BJ, Daneman N, Chen B, Brown KA, McIsaac W, et al. Unnecessary antibiotic prescribing in a Canadian primary care setting: a descriptive analysis using routinely collected electronic medical record data. CMAJ Open. 2020;8(2):E360-E369. Available from: https://doi.org/10.9778/cmajo.20190175



Clinical Infectious Diseases

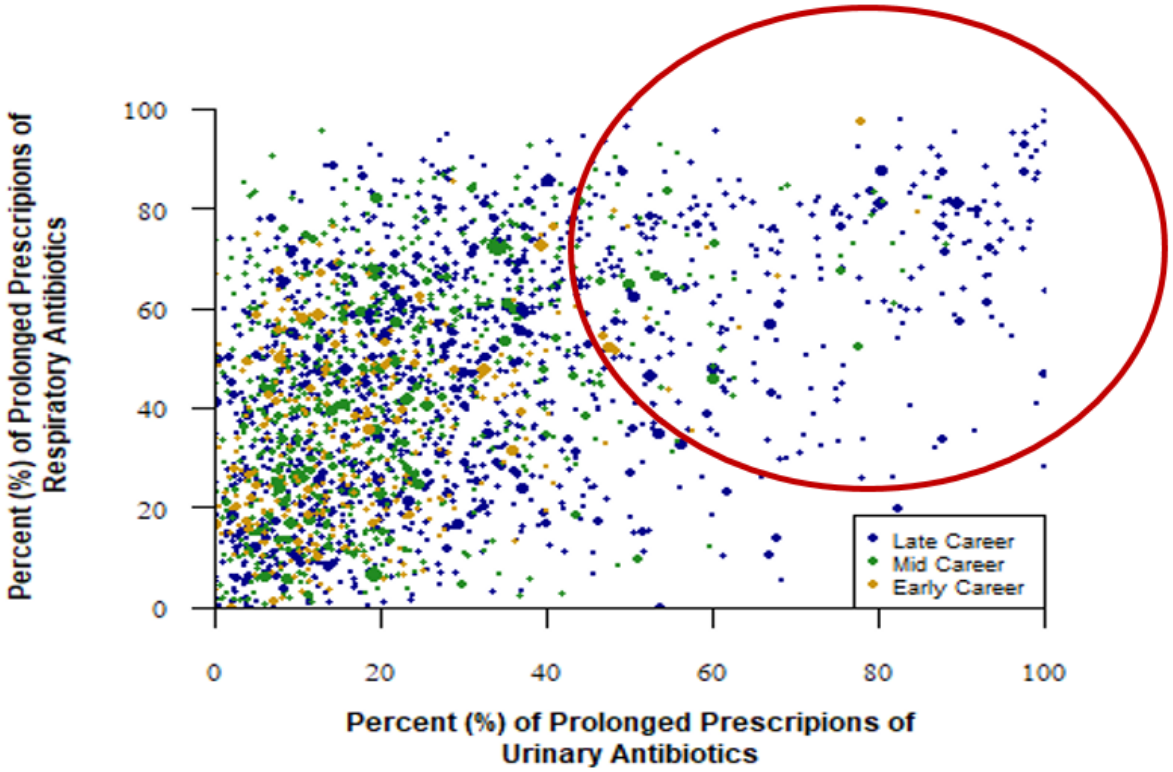
MAJOR ARTICLE

The Association Between High and Unnecessary Antibiotic Prescribing: A Cohort Study Using Family Physician Electronic Medical Records

Visits
1000
2000
3000
4000
5000

Kitano T, Langford BJ, Brown KA, Pang A, Chen B, Garber G. The association between high and unnecessary antibiotic prescribing: a cohort study using family physician electronic medical records. Clin Infect Dis. 2021;72(9):e345-e351. Available from: https://doi.org/10.1093/cid/ciaa1139

Antibiotic are Prescribed for Too Long



Recommended duration for antibiotics based on latest evidence

Syndrome	Evidence-based-recommended duration*
Acute sinusitis	5 days
Pneumonia	5 days
Cellulitis	5 days
Otitis Media	5 days (10 days in children <2 years)
Cystitis	3-5 days (depending on drug)
Acute exacerbation of COPD	5 days

Shuldinger J, Schwartz KL, Langford BJ, Ivers NM. Optimizing responsiveness to feedback about antibiotic prescribing in primary care: protocol for two interrelated randomized implementation trials with embedded process evaluations. Implementation Sci. 2022;17(17). Available from: https://doi.org/10.1186/s13012-022-01194-8.1093/cid/ciy1130

Fernandez-Lazaro CI, Brown KA, Langford BJ, Daneman N, Garber G, Schwartz KL. Late-career physicians prescribe longer courses of antibiotics. Clin Infect Dis. 2019;69(9):1467-75. Available from: https://doi.org/10

Antibiotic Use → AMR

AMU ≈ AMR at individual and population levels

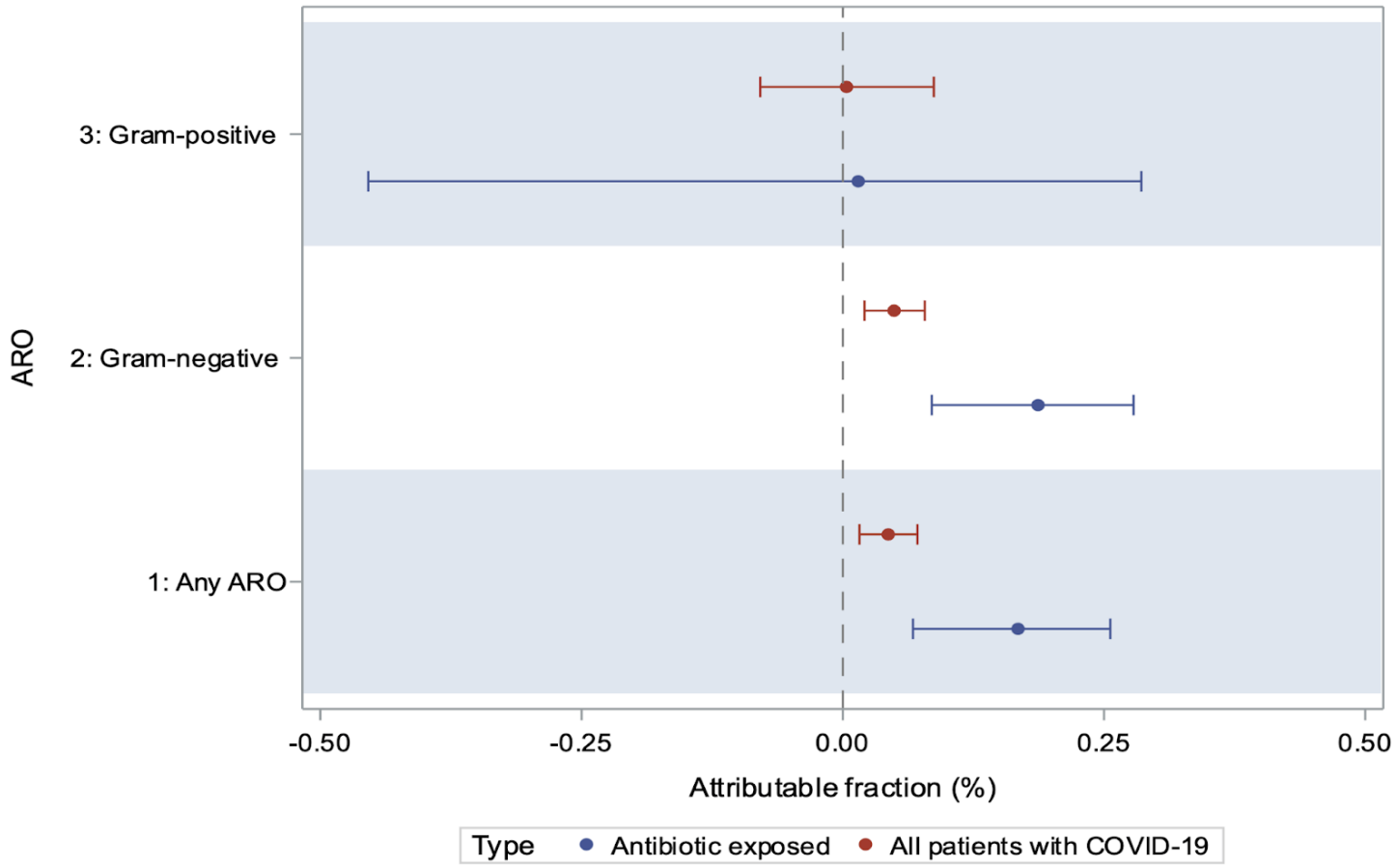
- Systematic review and metaanalyses
  - 24 studies in individuals who received antibiotics, OR=2.5 (95%CI; 2.1-2.9)
  - 243 studies on population level, OR=2.3 (95%CI; 2.2-2.5)
- Neighbourhood fluoroquinolone use and FQ resistant E. coli

Costellow C, Metcalfe C, Lovering A, et al. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. BMJ 2010;340:c2096. Available from: doi:10.1136/bmj.c2096

Bell BG, Schellevis F, Stobberingh E, et al. A systematic review and meta-analysis of the effects of antibiotic consumption on antibiotic resistance. BMC Infectious Diseases 2014;14:13. Available at: http://www.biomedcentral.com/1471-2334/14/13

Low M, Neuberger A, Hooton TM, Green MS, Raz R, Balicer RD. Association between urinary community-acquired fluoroquinolone-resistant *Escherichia coli* and neighbourhood antibiotic consumption: a population-based case-control study. Lancet Infect Dis. 2019;19(4):P419-428. Available from: https://doi.org/10.1016/S1473-3099(18)30676-5

COVID-19 Antibiotic Prescribing and AMR



- **17%** attributable fraction of AMR
- **4%** population attributable fraction

McFadden DR, Langford BJ, Leung EL, et al. The impact of peri-COVID-19 antibiotic prescribing on downstream antimicrobial resistance in older adults: a population-wide cohort study. Forthcoming.

Estimating Daily Antibiotic Harms

Umbrella Review and Meta-Analysis

Public Health Ontario | Santé publique Ontario

35 Systematic Reviews

71 Short vs. Long Antibiotic Duration Trials

92% studies evaluated respiratory tract and urinary tract infections

23,174 patients evaluated

* Non-statistically significant difference

Source: Curran J et al. Estimating daily antibiotic harms: An Umbrella Review with Individual Study Meta-analysis Clin Micro Infect. 2021

Ontario Agency for Health Protection and Promotion / Agence de protection et de promotion de la santé

Curran J, Lo J, Leung V, Brown K, Schwartz KL, Daneman N, Garber G, et al. Estimating daily antibiotic harms: an umbrella review with individual study meta-analysis. Clin Micro Infect. 2022;28(4):P479-490. Available from: https://doi.org/10.1016/j.cmi.2021.10.022

Poll

Who is responsible for antimicrobial stewardship in the community?

1. Government (e.g. MOH)
2. Public Health Agencies (e.g. PHAC, PHO)
3. Public Health Units (e.g. TPH)
4. Physician offices
5. 1, 2, 3 and 4
6. Someone else
7. I don’t know

Core Elements of Outpatient Antibiotic Stewardship

Core Elements of Outpatient Antibiotic Stewardship

The *Core Elements of Outpatient Antibiotic Stewardship* follow and are summarized in a clinician checklist (Figure 1) and a facility checklist (Figure 2):

Commitment
Demonstrate dedication to and accountability for optimizing antibiotic prescribing and patient safety.

Action for policy and practice
Implement at least one policy or practice to improve antibiotic prescribing, assess whether it is working, and modify as needed.

Tracking and reporting
Monitor antibiotic prescribing practices and offer regular feedback to clinicians, or have clinicians assess their own antibiotic prescribing practices themselves.

Education and expertise
Provide educational resources to clinicians and patients on antibiotic prescribing, and ensure access to needed expertise on optimizing antibiotic prescribing.

Sanchez GV, Fleming-Dutra KE, Roberts RM, Hicks LA. Core elements of outpatient antibiotic stewardship. MMWR Recomm Rep. 2016;65(RR-6):1-12. Available from: https://www.cdc.gov/antibiotic-use/community/pdfs/16_268900-A_CoreElementsOutpatient_508.pdf

Factors Influencing Antibiotic Over Prescribing by Primary Care Physicians

Rose J, Crosbie M, Stewart A. A qualitative literature review exploring the drivers influencing antibiotic over-prescribing by GPs in primary care and recommendations to reduce unnecessary prescribing. Perspect Public Health. 2021;141(1):19-27. Available from: https://doi.org/10.1177/1757913919879183

Audit and Feedback

Audit and Feedback = Measuring an individuals professional practice compared to standards or targets.

Audit and feedback: effects on professional practice and healthcare outcomes (Review)

Ivers N, Jamtvedt G, Flottorp S, Young JM, Odgaard-Jensen J, French SD, O'Brien MA, Johansen M, Grimshaw J, Oxman AD

Ivers N, Jamtvedt G, Flottorp S, Young JM, Odgaard-Jensen J, French SD, et al. Audit and feedback: effects on professional practice and healthcare outcomes. Cochrane Database Syst Rev. 2012;(6):CD000259. Available from: https://doi.org/10.1002/14651858.CD000259.pub3

Mailed Antibiotic Feedback Trial - 2018

Public Health Ontario | Santé publique Ontario | SGFP — Tools and resources from: Choosing Wisely Ontario

November 23, 2018

Dr. Jane Smith
123 Family Doctor Ave.
Toronto, ON
M1N 2O3

Dear Dr. Smith

Every day, family doctors like you are doing everything you can to help your patients become and stay healthy. Choosing when and how you prescribe antibiotics is a crucial decision-making step, especially during flu season. That's why we're writing to you personally, to support you in prescribing antibiotics appropriately for your patients.

Across care settings, research has shown that practice habits and expectations around antibiotic prescribing are leading causes of over-prescription. Knowing where each of us are on the spectrum of prescribing habits provides a chance to reflect and consider changes.

How you prescribe antibiotics compared to your peers

You are receiving this letter because you prescribe more antibiotics than 75% of your peers.

As context, it might be useful for you to be aware that **you're one of the 25% of primary care physicians who prescribe 65% of antibiotics.** Reviewing the reasons why that may be happening, and considering how unnecessary prescriptions can be avoided are important ways to improve the health of your patients. Enclosed, you'll find tools and information to help reduce antibiotics safely.

Aside from the immediate risks of adverse reactions, research shows us that antibiotics are overprescribed for many respiratory infections, and this is contributing to growing antibiotic resistance in many of our communities. We're putting patients and families at risk when we over-prescribe antibiotics. Each time you're faced with the choice, you'll now have options that make our communities' future safer, so we have antibiotics that still work when we really need them.

Public Health Ontario | Santé publique Ontario | SGFP — Tools and resources from: Choosing Wisely Ontario

With your own eyes, you've seen how medical treatments have come a long way in recent decades. New and growing bodies of evidence give us more reassurance that we're doing the right thing when we choose to avoid or delay initiating antibiotics. **Enclosed you'll find a quick reference guide from Choosing Wisely Canada with tools and information to help you decide if you need to initiate antibiotics in clinical settings.** This gives you options to help safely reduce the medication and side effect burden for your patients.

By taking on the challenges to improve their care for patients, family physicians have shown incredible adaptive skills and abilities. We see the evidence in the greater depth and breadth of care you provide every day. Your commitment to assess and improve the quality of care your patients receive can be seen in your daily efforts, and there are resources to support you to achieve that goal.

How can you receive a confidential practice report from Health Quality Ontario to support you in caring for your patients?

As of right now, 3000+ of your peers have signed up to receive MyPractice Primary Care reports. If you're a non-salaried family physician, visit this website to sign up and see what indicators are currently available for your practice.
Use this link or scan the barcode with your smart phone
www.hqontario.ca/pc-sign-up.

Thanks for all you do to keep improving the care you provide for your patients! Each step you take in our shared fight against antimicrobial resistance helps to improve outcomes for our patients and communities.

Sincerely,

Dr. Gary Garber MD FRCPC
Chief, Infection Prevention and Control
Public Health Ontario

Dr. Asad Razzaque, MD CCFP
Family Physician
Chair, OMA Section on General and Family Practice

The data for this letter is derived from IQVIA Xponent™. If you have questions about this letter or wish to opt-out of future letters please email the Public Health Ontario antimicrobial stewardship team: asp@oahpp.ca

Page 2 of 3

Schwartz KL, Ivers N, Langford BJ, Tajaard M, Neish D, Brown KA, et al. Effect of antibiotic-prescribing feedback to high-volume primary care physicians on number of antibiotic prescriptions: a randomized clinical trial. JAMA Intern Med. 2021;181(9):1165-73. Available from: https://doi.org/10.1001/jamainternmed.2021.2790

Mailed Antibiotic Feedback Trial - 2018

Public Health Ontario | Santé publique Ontario | SGFP | Tools and resources from: Choosing Wisely Ontario

How can you optimize antibiotic prescribing for acute uncomplicated respiratory infections?

Here's some helpful tips endorsed by Choosing Wisely Canada. For more information and resources, visit: **choosingwiselycanada.org/antibiotics**

Syndrome	Criteria for antibiotics in Canadian primary care settings
Otitis media in vaccinated children >6 months	Perforated tympanic membrane with purulent discharge or a bulging tympanic membrane with either: • fever ≥39°C OR • moderately or severely ill OR • symptoms lasting > 48 hours
Pharyngitis	Centor score is ≥ 2 AND throat swab culture (or rapid antigen test if available) confirms presence of Group A Streptococcus. Don't perform throat swabs at all for patients with Centor score ≤ 1, OR if there are symptoms of a viral infection such as rhinorrhea, oral ulcers or hoarseness.
Sinusitis	Patient has at least 2 of the below PODS symptoms, one of those being O or D AND • Symptoms lasting greater than 7-10 days OR • The symptoms are severe OR • There is no response after a 72 hour trial with nasal corticosteroids. **P:** Facial Pain/pressure/fullness; **O:** Nasal Obstruction; **D:** Purulent/ discolored nasal or postnasal Discharge; **S:** Hyposmia/anosmia (Smell)
Pneumonia	Objective evidence on a chest x-ray if available.
Upper respiratory infection (Common cold)	Not indicated unless there is clear evidence of secondary bacterial infection (see the recommendations for otitis media, pharyngitis, sinusitis, pneumonia).
Bronchitis/asthma	Not indicated
Acute exacerbation of Chronic Obstructive Pulmonary Disease	Increase in sputum purulence with either increase in sputum volume and/or increased dyspnea.

Public Health Ontario | Santé publique Ontario | SGFP | Tools and resources from: Choosing Wisely Ontario

How can you optimize antibiotic prescribing durations?

Antibiotics are often prescribed for too long. As you may know, unnecessarily prolonged courses of antibiotics lead to antibiotic related side effects (e.g., diarrhea, allergic reactions) and resistance. The majority of bacterial infections can be treated with 7 days of antibiotics or less, however more than one third of antibiotic prescriptions by primary care physicians in Ontario are for more than 7 days.

These are the recommended antibiotic durations for treating uncomplicated bacterial infections based on most current evidence for the majority of patients:

Syndrome	Recommended duration
Acute sinusitis	5 days
Pneumonia	5 days
Cellulitis	5-7 days
Otitis Media	5 days (10 days in children <2 years)
Cystitis	3-5 days
Pyelonephritis	7 days
Acute exacerbation of Chronic Obstructive Pulmonary Disease	5 days

Feedback Letter Impact

↓147,000 antibiotic prescriptions

↓84,000 prolonged duration prescriptions

↓$2,700,000 in drug costs

MyPractice
Primary Care

A tailored report for quality care

Version Release: March 2023
PRIVATE AND CONFIDENTIAL

Dr. Sample Report

Reporting Period: March 31, 2022

Release: March 2023

Group program type: FHG

Group ID: ABCD

Physician LHIN: Toronto Central

Rurality Index of Ontario Score: 2 - Major Urban (0 to 9)

IC/ES

Ontario Health

MyPractice: Primary Care Report

Antibiotic Section | Antibiotic Initiation

Data as of March 31, 2022

What was my antibiotic initiation rate for patients aged 66 and older?

- As of March 31, 2022, my antibiotic initiation rate was 68.9 per 1,000 encounters. My group and LHIN rates are 71.5 and 59.7, respectively.
- My antibiotic initiation rate is **lower than** the provincial rate of 69.8.

Number of antibiotic treatment episodes prescribed by me within the last 6 months

39

Did you know?

Most antibiotics in the community are prescribed by primary care physicians and 25 to 50 percent are likely unnecessary. (1-3) Primary Care physicians are key partners for antimicrobial stewardship.

Consider the benefit of using a viral prescription pad to encourage no antibiotics when appropriate.

Ontario Health

Can We Improve Audit and Feedback?

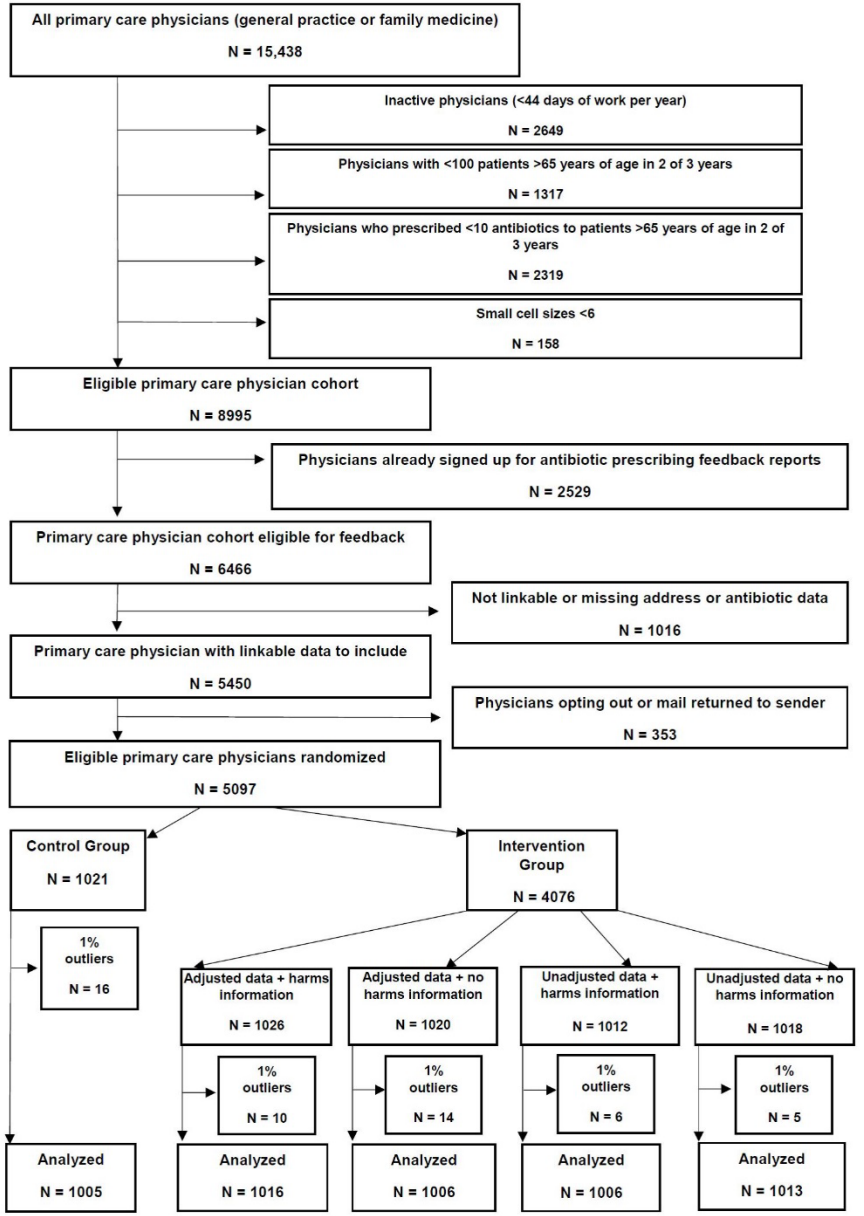
Response to feedback

“my patients are different”

Imbalance of risk

“I prescribe antibiotics just to be safe”

Mailed Audit and Feedback Letter Trial #2



Schwartz KL, Shuldiner J, Langford BJ, et al. Mailed antibiotic prescribing feedback to primary care physicians for patients 65 years of age and older: A pragmatic factorial randomized controlled trial. BMJ. Forthcoming.

Mailed Audit and Feedback Letter Trial #2

Mailed Audit and Feedback Letter Trial #2

Shorter is better

If you must prescribe, keep in mind that most community-acquired infections should be treated for ≤ 7 days. Long durations of treatment in primary practice may be necessary for complicated infections, such as osteomyelitis, endocarditis or deep undrained abscesses.

34% of your antibiotic prescriptions were for >7 days duration.

Recommended duration for antibiotics based on latest evidence

Syndrome	Evidence-based-recommended duration*
Acute sinusitis	5 days
Pneumonia	5 days
Cellulitis	5 days
Otitis Media	5 days (10 days in children <2 years)
Cystitis	3-5 days (depending on drug)
Acute exacerbation of COPD	5 days

**References: see page 7. Reassessment is important to ensure patients are following the expected course. These recommended durations assume clinical improvement at this time point.*

Communication tips

Most patients do not expect antibiotics – they want to feel better. Here are some ways to talk to those patients who are asking for antibiotics.[9]

If your patient says...	Evidence-based communication tips[10]*
I always get antibiotics for my bronchitis... it worked last time	**State your examination findings:** I can see you are not feeling well, *Virtual Visit*: however, based on what you have told me / *In-person visit*: but my examination of your throat, ears and chest was normal. **State your diagnosis:** I understand this may feel similar to bronchitis you may have experienced before, but it is more likely that your chest cold right now is caused by a virus and not bacteria. **Provide recommendations:** The latest research tells us that antibiotics will not help you get better faster and could cause side-effects. The best way to treat a chest cold is with plenty of rest and fluids. You can also try honey to relieve coughing or lozenges for throat pain. You can ease pain and reduce fever with Acetaminophen or Ibuprofen. **Create a follow-up plan:** A chest cold typically last 1-3 weeks. If your illness takes longer or if you are worsening, we should arrange a follow-up visit.

**Communicating these key messages in this order, including negative (e.g., you do not need antibiotics) and positive (e.g., honey to relieve cough) recommendations has been demonstrated to reduce unnecessary antibiotic use, improve patient satisfaction, and reduce clinic visit time[10]*

Antibiotic prescribing, virtual care, and COVID-19

In the era of COVID-19, virtual care is common. Fortunately, the majority of acute respiratory tract infections (RTIs) are viral and can be managed via virtual visits. For those RTIs that may be bacterial, a physical examination is recommended to confirm the diagnosis (e.g., to assess the tympanic membrane or to perform a Strep test) prior to prescribing an antibiotic. If you frequently prescribe antibiotics for RTIs after virtual assessments alone, you may be overprescribing.

Scan here to learn more.

Viral prescription pads

Enclosed is a viral prescription pad. You can also easily integrate it into your EMR in several languages: http://bit.ly/abx-prescriptions

There are a number of ways to provide a patient with a viral prescription virtually:

- Verbally review the viral prescription with your patient.
- Fill it in and email it directly to your patient (if it is in your EMR).
- Scan/take a photo of it and email it to your patient

Scan here to learn more.

The pad, e-forms and accompanying instructions were co-developed by OntarioMD, Choosing Wisely Canada, Rx Files and the CFPC.

Are you interested in receiving feedback electronically? You may be eligible for Ontario Health (Quality) MyPractice reports. They are confidential documents that give family physicians an informative perspective of their individual practice. To learn more, visit their website at www.hqontario.ca/pc-sign-up.

You can find Choosing Wisely materials that can help with antibiotic prescribing at http://bit.ly/abx-pc.

For questions about this report or to opt out of future reports, you may contact us at asp@oahpp.ca.

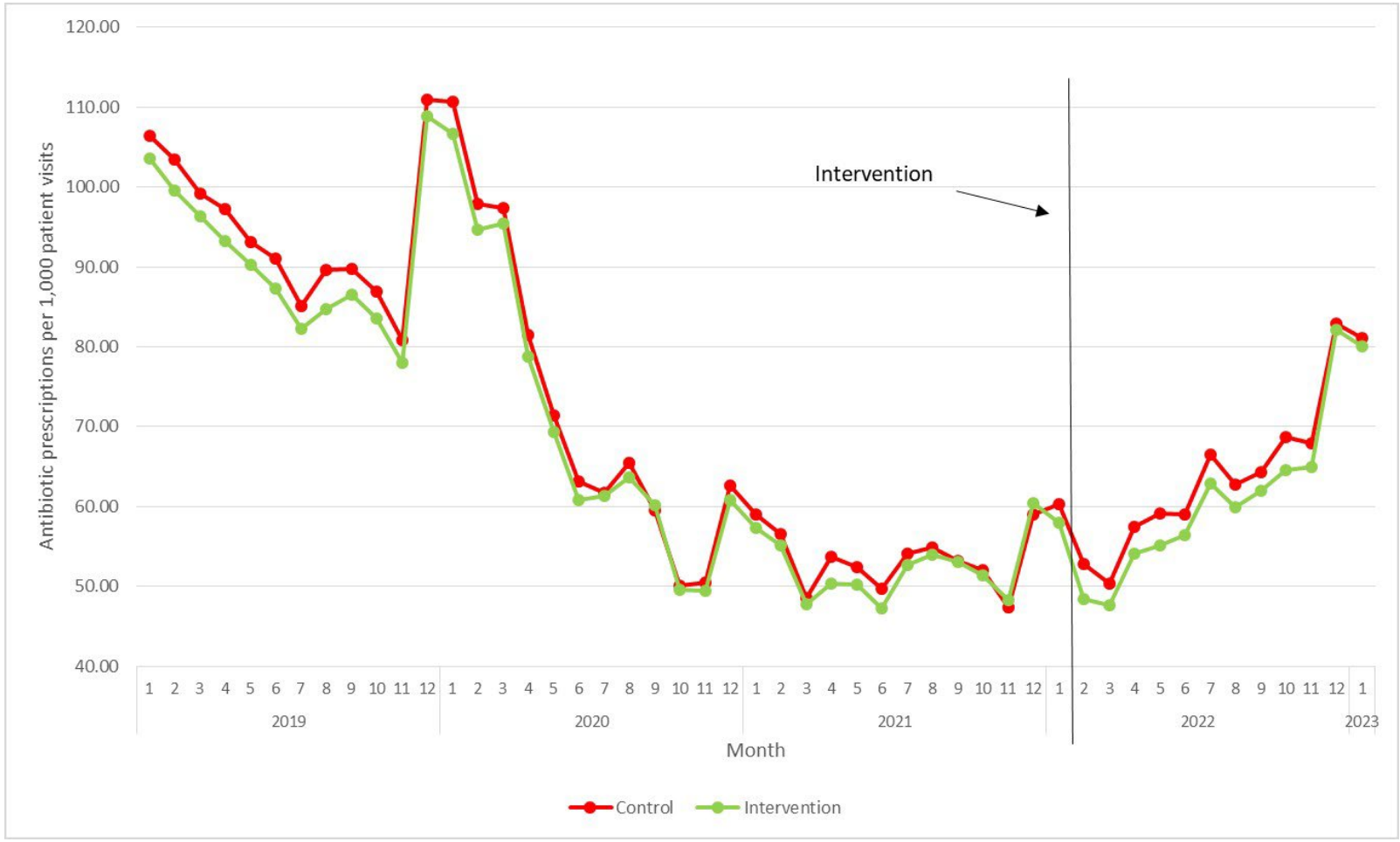
Sincerely,

Dr. Kieran Moore MD FRCPC
Ontario Chief
Medical Officer of Health

Dr. Jennifer Young MD CFPC
Past president
Ontario College of Family Physicians

Dr. Wendy Levinson MD
Chair
Choosing Wisely Canada

Results


120.00
110.00
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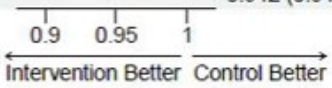
60.00
50.00
40.00
Antibiotic prescriptions per 1,000 patient visits
Intervention
1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1
2019
2020
2021
2022
2023
Month
Control
Intervention

Comparison of Prescribing Outcomes at 6-months

Outcome	Pre-intervention, mean (SD)		6-months post intervention, mean (SD)		Relative Rate* RR (95% CI)
Primary analysis: Mailed letter compared to no letter					
	Control	Intervention	Control	Intervention	
Antibiotic prescribing rate/1000 visits	55.2 (35.2)	54.1 (33.1)	59.4 (42.0)	56.0 (39.2)	**0.948 (0.937, 0.959)**
Antibiotic prescribing rate for viral illnesses /1000 visits	5.5 (5.8)	5.4 (5.9)	8.6 (9.9)	7.5 (9.2)	**0.888 (0.861, 0.916)**
Long duration antibiotic prescribing rate/1000 visits	15.7 (14.4)	15.2 (14.3)	16.5 (16.1)	13.7 (15.5)	**0.848 (0.829, 0.867)**
Broad spectrum antibiotic prescribing rate/1000 visits	25.1 (19.5)	24.3 (17.7)	28.4 (25.1)	26.0 (21.7)	**0.936 (0.920, 0.951)**
Case-mix adjusted feedback compared to standard feedback					
	Standard feedback	Case-mix adjusted feedback	Standard feedback	Case-mix adjusted feedback	
Antibiotic prescribing rate/1000 visits	54.4 (33.1)	53.9 (33.1)	56.0 (36.9)	55.9 (41.3)	**1.014 (1.003, 1.025)**
Antibiotic prescribing rate for viral illnesses /1000 visits	5.3 (5.7)	5.4 (6.1)	7.4 (9.0)	7.6 (9.5)	1.012 (0.982, 1.042)
Long duration antibiotic prescribing rate/1000 visits	14.9 (13.3)	15.5 (15.3)	13.2 (14.3)	14.1 (16.3)	**1.033 (1.011, 1.056)**
Broad spectrum antibiotic prescribing rate/1000 visits	24.3 (17.5)	24.2 (17.9)	25.9 (20.4)	26.2 (23.0)	**1.024 (1.008, 1.040)**
Harms messaging compared to no harms messaging					
	No harms messaging	Harms messaging	No harms messaging	Harms messaging	
Antibiotic prescribing rate/1000 visits	53.6 (32.4)	54.7 (33.8)	55.7 (39.1)	56.3 (39.2)	0.996 (0.985, 1.007)
Antibiotic prescribing rate for viral illnesses /1000 visits	5.4 (5.7)	5.4 (6.1)	7.6 (8.9)	7.4 (9.6)	0.990 (0.961, 1.019)
Long duration antibiotic prescribing rate/1000 visits	15.1 (14.0)	15.4 (14.7)	13.6 (15.0)	13.7 (15.8)	0.996 (0.975, 1.018)
Broad spectrum antibiotic prescribing rate/1000 visits	24.1 (17.7)	24.4 (17.8)	25.8 (21.7)	26.2 (21.8)	1.010 (0.994, 1.026)

Outcome	Baseline Control mean (sd)	Baseline Intervention mean (sd)	6-months Control mean (sd)	6-months Intervention mean (sd)	Adjusted RR (95% CI)*
Years in practice					
25+	51.8 (34.7)	50.8 (32.3)	55.1 (40.6)	52.7 (37.5)	0.964 (0.949, 0.979)
11–24	57.4 (34.4)	57.6 (34.2)	63.2 (40.7)	59.0 (41.7)	0.921 (0.901, 0.941)
<11yrs	68.1 (36.3)	61.5 (31.7)	73.5 (47.9)	63.8 (38.7)	0.940 (0.912, 0.969)
Sex					
F	52.5 (30.2)	54.4 (32.9)	56.8 (36.8)	56.0 (39.6)	0.960 (0.941, 0.980)
M	56.5 (37.4)	54.0 (33.1)	60.7 (44.3)	55.9 (38.9)	0.943 (0.929, 0.956)
Neighbourhood income quintile of physician practice					
1–Low	53.2 (37.5)	53.4 (34.2)	57.0 (43.5)	55.1 (41.2)	0.960 (0.940, 0.980)
2–	56.0 (35.3)	54.0 (30.9)	60.4 (40.1)	55.6 (36.8)	0.944 (0.922, 0.966)
3–	55.2 (32.0)	52.6 (34.6)	59.9 (38.5)	53.9 (38.2)	0.949 (0.923, 0.975)
4–	51.2 (30.5)	54.8 (31.4)	57.9 (41.2)	57.5 (37.0)	0.914 (0.888, 0.942)
5–High	66.3 (38.0)	57.6 (33.9)	66.8 (47.9)	59.5 (41.9)	0.972 (0.939, 1.007)
Visit volume					
2–High	47.6 (31.4)	45.5 (27.9)	51.7 (36.4)	47.7 (30.6)	0.938 (0.923, 0.953)
1–Medium	61.8 (35.2)	64.7 (34.3)	69.3 (40.5)	66.3 (38.5)	0.958 (0.937, 0.979)
0–Low	78.0 (39.7)	74.0 (38.2)	82.7 (59.6)	78.5 (63.2)	0.970 (0.942, 1.000)
Continuity score					
2–High	48.7 (30.1)	49.7 (29.3)	54.4 (38.5)	51.2 (32.5)	0.931 (0.913, 0.949)
1–Medium	55.4 (35.9)	52.4 (30.0)	57.3 (38.9)	54.1 (33.2)	0.974 (0.956, 0.993)
0–Low	64.6 (39.1)	63.2 (39.9)	72.3 (50.0)	66.8 (53.3)	0.937 (0.916, 0.958)
Percent of 65+ patient population over age 85					
2–High	54.0 (35.9)	54.0 (32.4)	56.0 (41.2)	56.1 (38.4)	0.983 (0.964, 1.002)
1–Medium	55.2 (35.0)	53.4 (31.9)	61.2 (42.3)	55.3 (39.3)	0.921 (0.902, 0.939)
0–Low	56.9 (34.5)	55.4 (35.2)	62.1 (42.5)	56.6 (39.8)	0.937 (0.917, 0.957)
Rural practice					
Y	78.6 (41.4)	75.0 (34.0)	84.7 (51.0)	78.1 (43.2)	0.947 (0.935, 0.958)
N	53.5 (34.2)	52.7 (32.5)	57.8 (40.8)	54.4 (38.3)	0.962 (0.925, 1.000)
* Baseline abx prescribing rate					
2–High	105.5 (32.0)	100.8 (26.0)	112.7 (46.1)	100.4 (44.9)	0.931 (0.915, 0.947)
1–Medium	56.4 (8.4)	56.4 (8.5)	61.0 (22.4)	58.9 (21.2)	0.965 (0.945, 0.984)
0–Low	27.0 (9.5)	26.8 (9.9)	30.9 (15.0)	29.6 (15.8)	0.961 (0.938, 0.984)
Baseline abx prescribing rate from virtual visits					
2–High	80.2 (35.0)	77.8 (29.5)	85.4 (43.9)	78.5 (37.7)	0.942 (0.926, 0.958)
1–Medium	46.5 (21.4)	47.4 (23.2)	51.0 (26.5)	49.8 (29.8)	0.961 (0.941, 0.981)
0–Low	38.4 (33.5)	39.2 (33.2)	42.0 (41.4)	41.1 (39.8)	0.942 (0.919, 0.965)

Abbreviations: CI=confidence interval, RR=rate ratio, sd = standard deviation



*$P_{interaction}$=0.018

Fidelity Assessment

- Up to 2 phone calls to 135 randomly selected physicians
- 76 (56.3%) could not be reached
- 41 (30.4%) either did not receive or were unsure if they received the intervention
- Only 18 (13.3%) confirmed receipt

Limitations

- Implemented post COVID with rising antibiotic use
- Excluded MDs already interested in feedback
  - Generalizable to relatively unengaged group of physicians
- Contamination possible between factors
  - Not powered for factorial trial
- Did not evaluate safety of antibiotic reduction
- Data limited to patients 65+

Re-analyzing Trial Results in All Age Groups

Cohort/age group	Relative Rate (RR) (95%CI)
ICES 65+	**0.948 (0.937-0.959)**
IQVIA	
All ages	0.938 (0.935 0.942)
<18 years male	0.976 (0.955- 0.997)
<18 year female	0.915 (0.896-0.935)
18-64 year male	0.920 (0.913- 0.928)
18-64 year female	0.959 (0.953- 0.965)
65+ year male	0.962 (0.951-0.973)
65+ year female	0.960 (0.952- 0.969)

Not published – Courtesy of Dr. Kiran Saqib

Visual Abstract

Mailed antibiotic prescribing feedback to primary care physicians: a randomized trial

SUMMARY

Peer comparison audit and feedback letters reduced antibiotic prescribing with no added benefit to harms messaging or adjustment based on patient population.

DESIGN

Randomized controlled trial with embedded 2x2 factorial design to assess added benefit of emphasizing antibiotic harms and providing risk-adjusted antibiotic use metrics.

ANTIBIOTIC PRESCRIBING FEEDBACK LETTER

January 2022
For Dr. XYZ

- ✓ Data on antibiotic prescriptions/1000 visits
- ✓ Proportion of duration longer than 7 days
- ✓ Population median and lowest quartile target
- ✓ Education, strategies and communication tools
- ✓ Co-signed by provincial leaders

COMPARISON

5,097 general practice physicians

- n=4041 audit/feedback letter
- n=1056 no letter

RELATIVE IMPACT ON ANTIBIOTIC USE

↓ 5%	Overall prescribing
↓ 11%	Unnecessary prescribing
↓ 15%	Antibiotic Duration > 7 days
↓ 6%	Broad spectrum prescribing

No added benefit was seen for including emphasis on antibiotic harms or patient population risk adjustment

Schwartz KL et al. Mailed antibiotic prescribing feedback to primary care physicians: A pragmatic factorial randomized controlled trial. BMJ. 2024

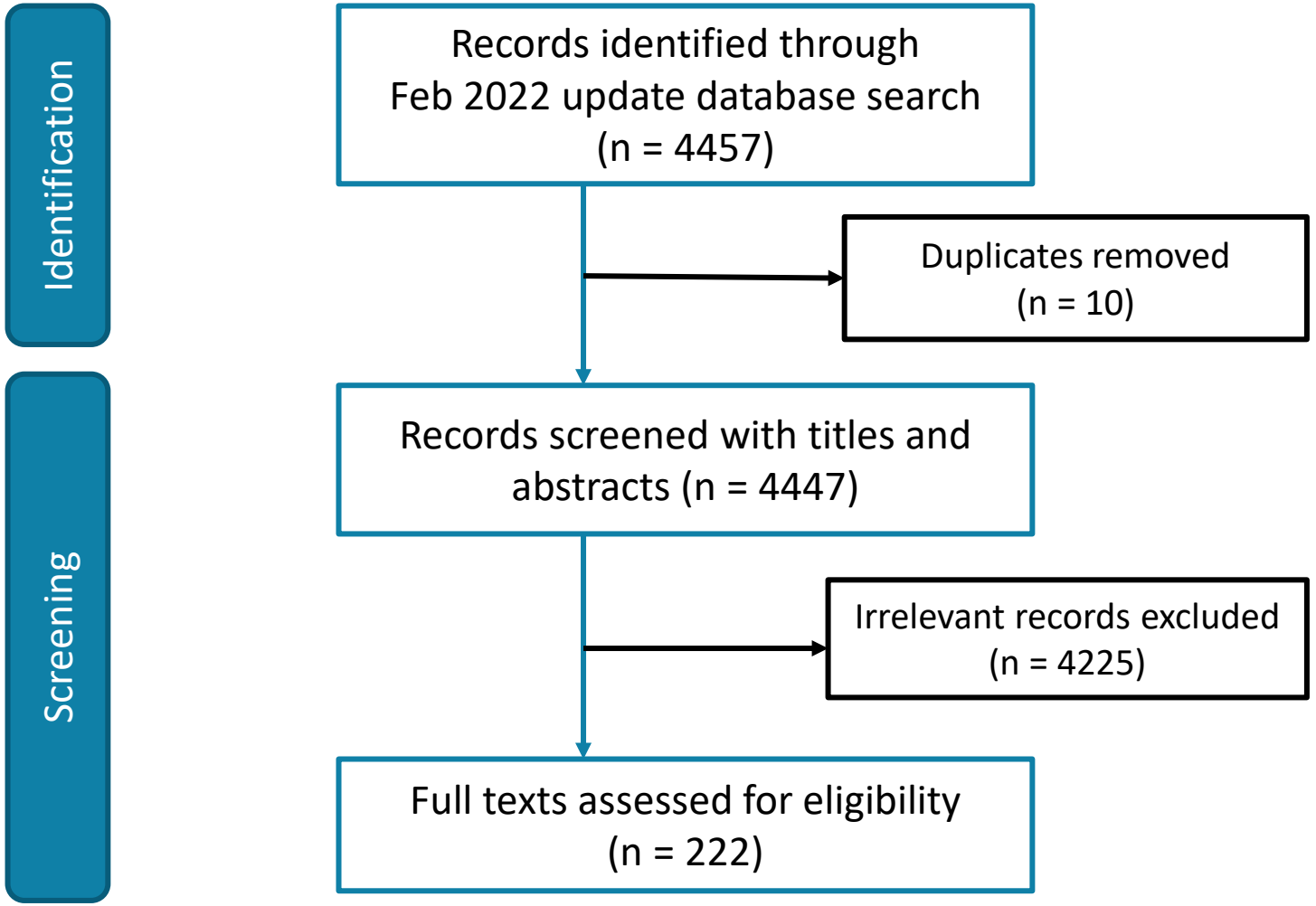
CIHR IRSC
Canadian Institutes of Health Research | Instituts de recherche en santé du Canada
Public Health Ontario | Santé publique Ontario
IC/ES

Discussion

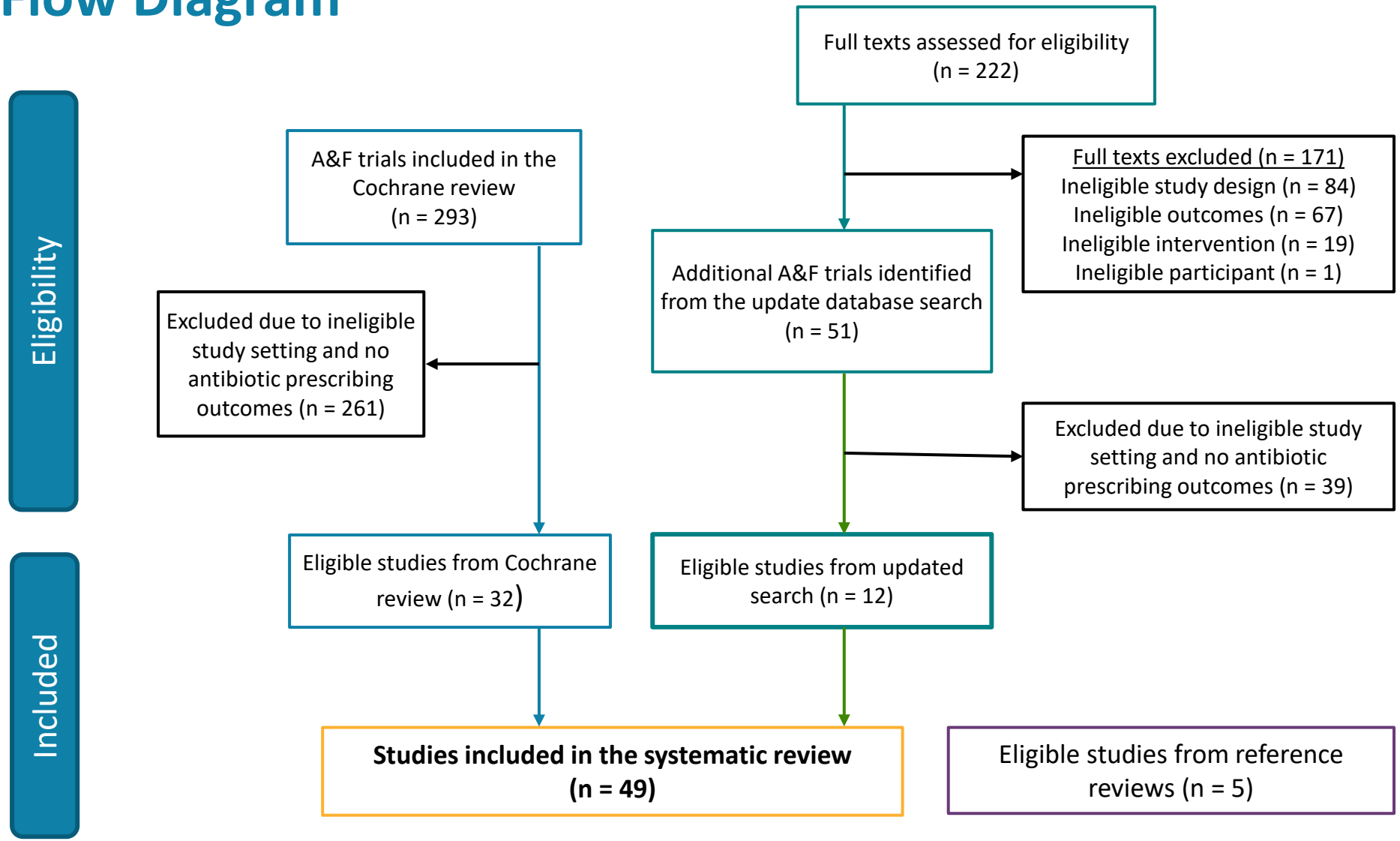
- Significant reduction in prescribing
- Low engagement
- Intervention modifications unsuccessful
  - Adjusted data too complex?
  - Paradoxically reinforce cognitive bias?
  - Harms messaging not new or provocative enough?

Systematic Review and Meta-analysis

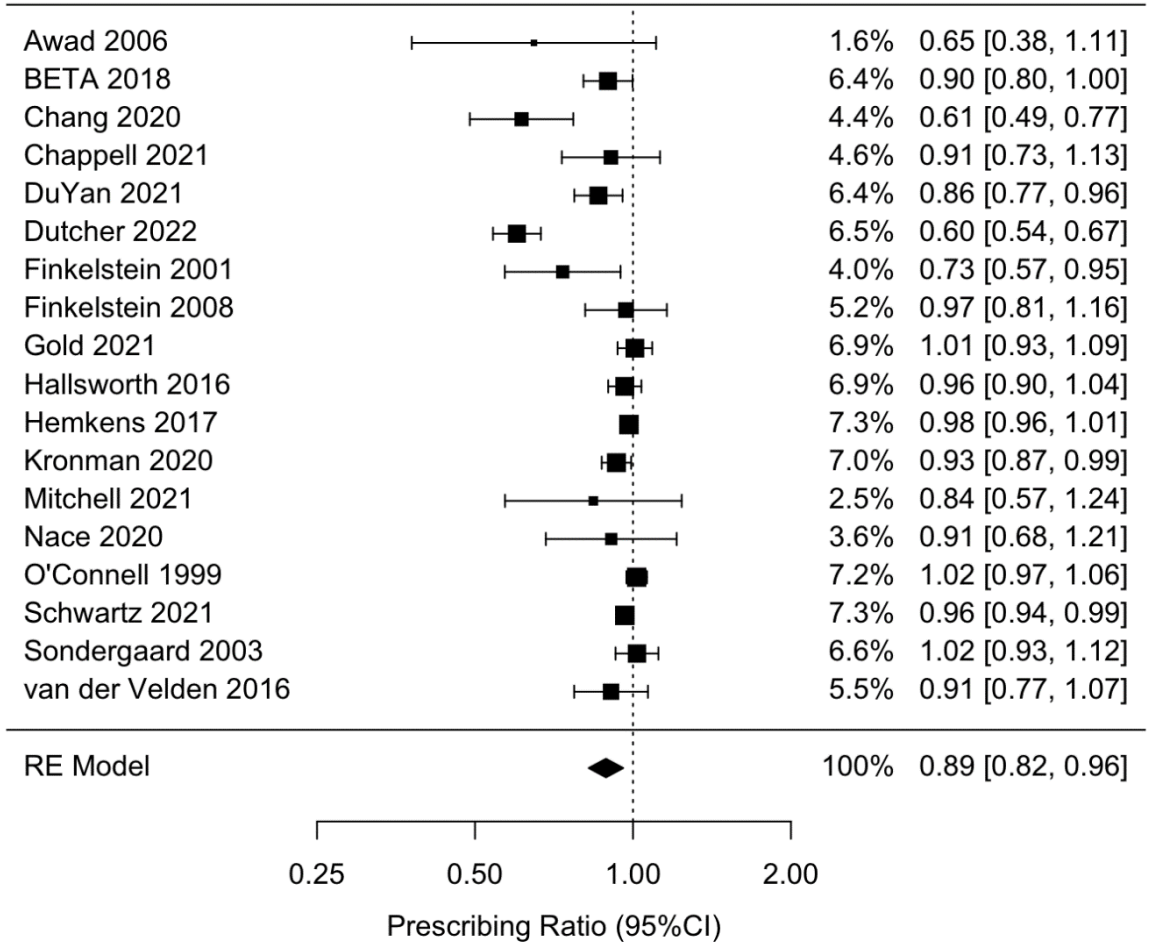
PRISMA Flow Diagram



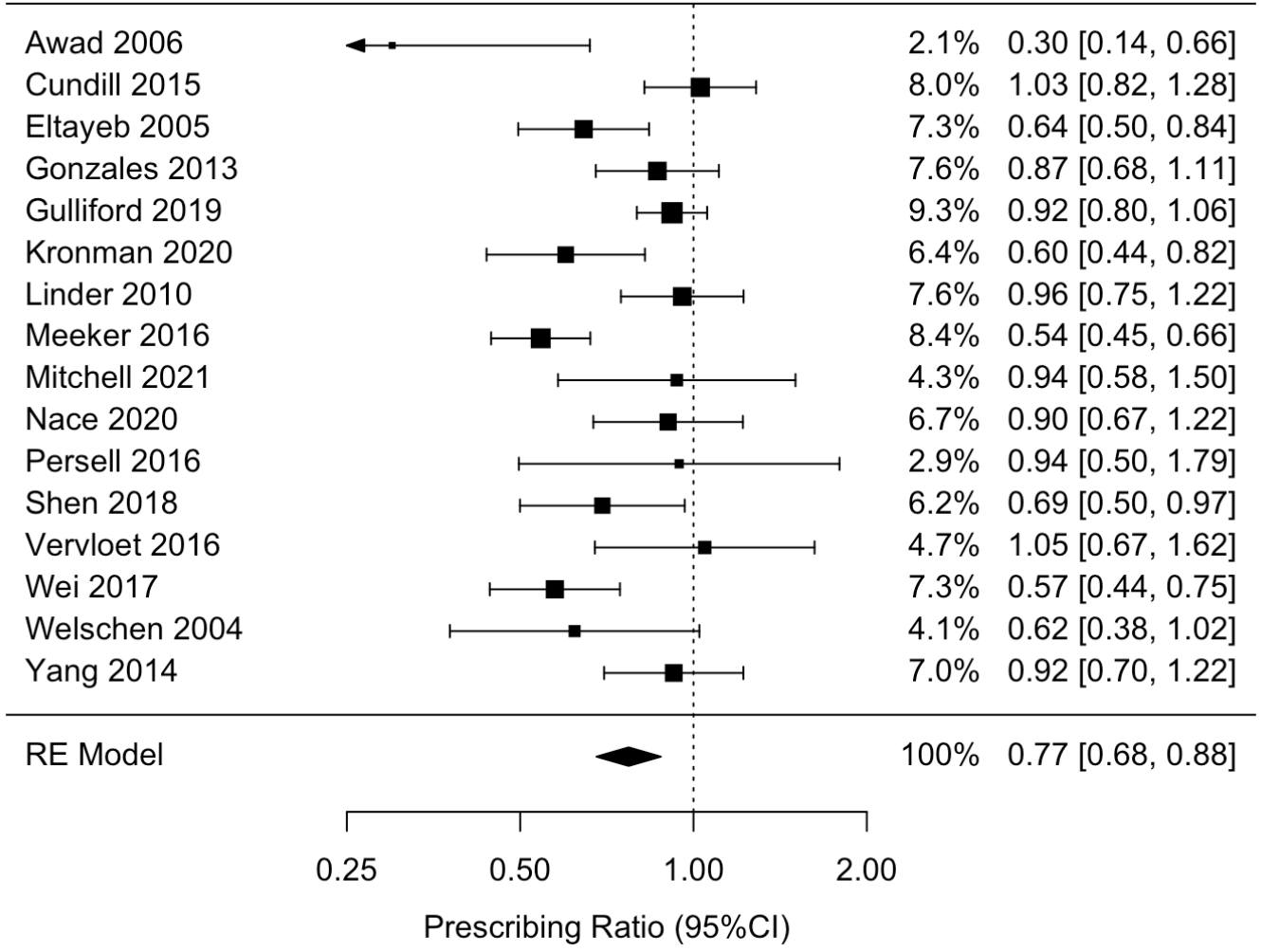
PRISMA Flow Diagram



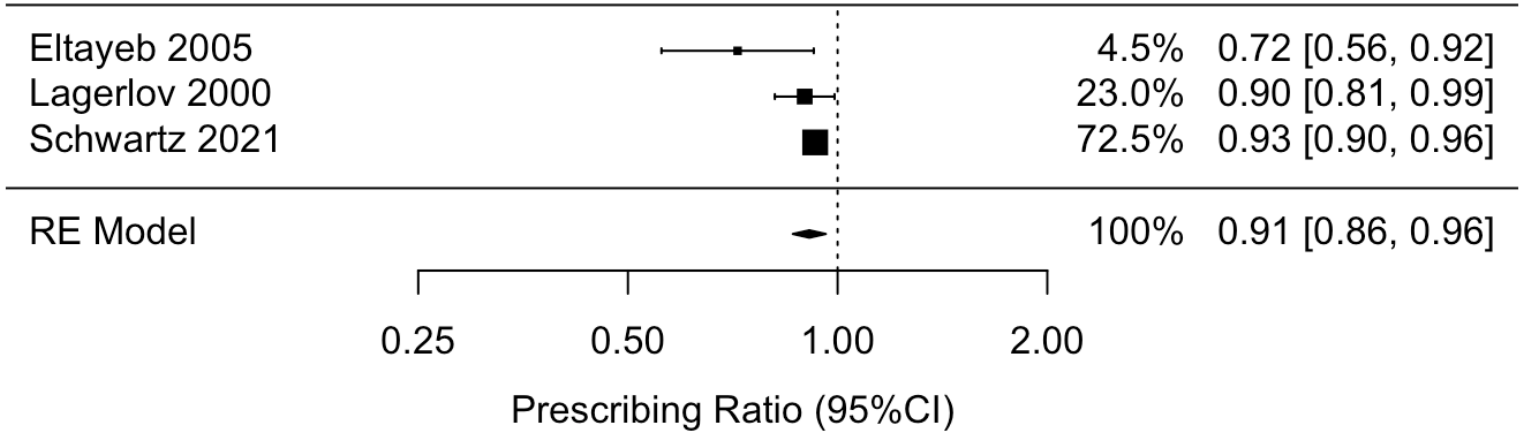
Results: Total Prescribing Volume (n=18)



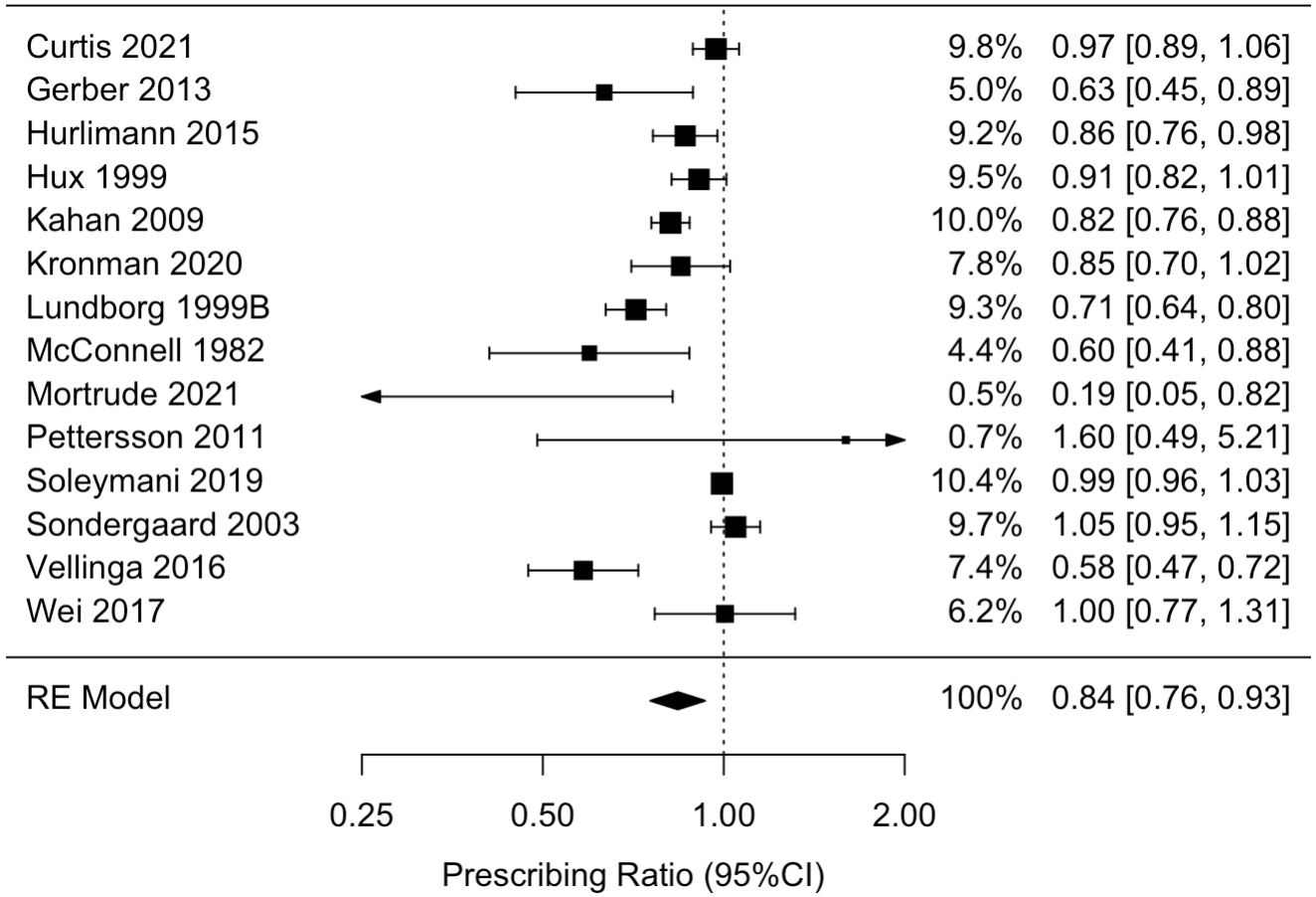
Results: Inappropriate Initiation (n=16)



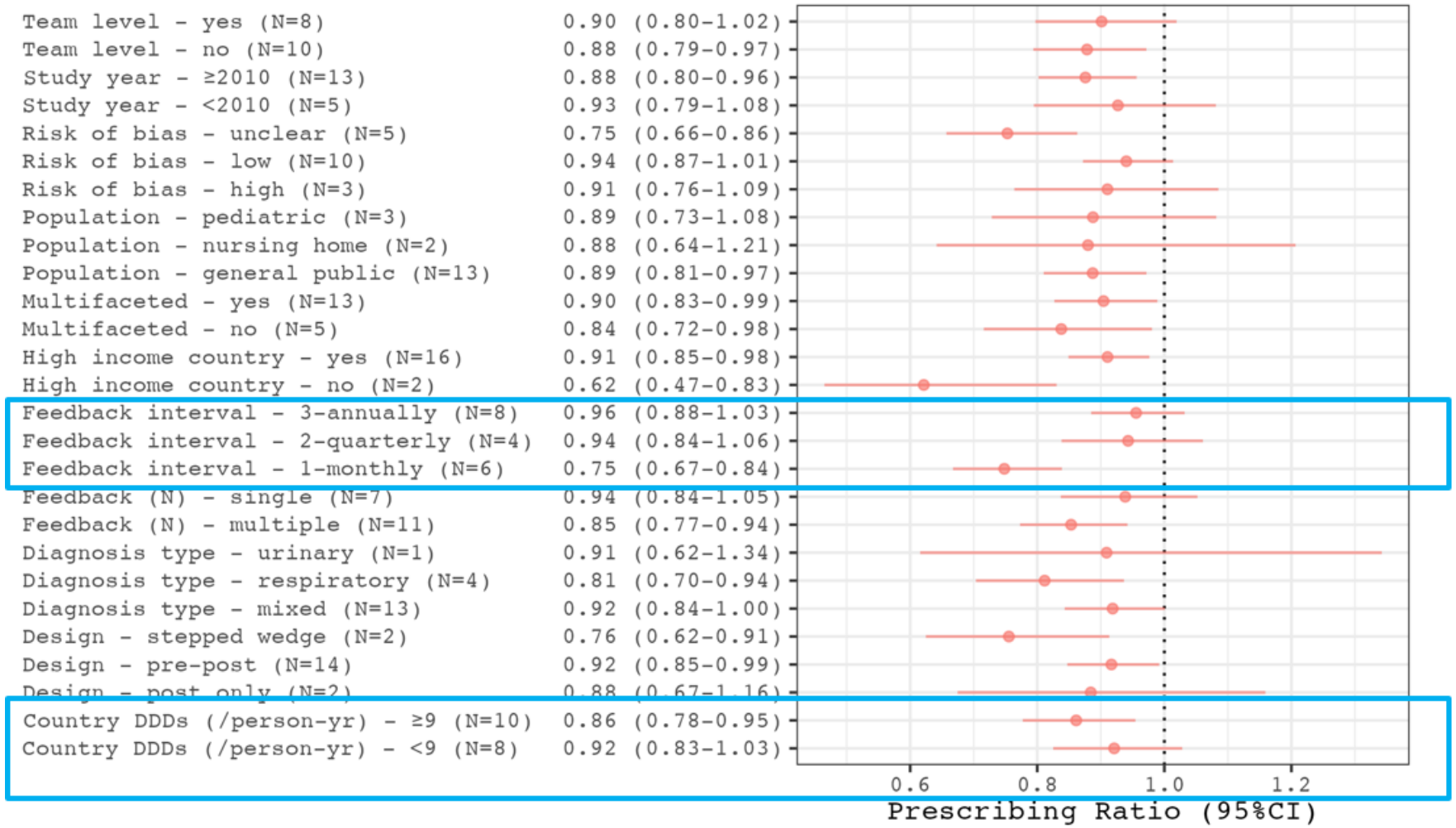
Results: Prolonged Duration (n=3)



Results: Broad-spectrum Antibiotic Selection (n=14)



Results: Stratified Effect Estimates



Summary of Key Findings

42 studies directly compared A&F vs. no A&F → included in the meta-analyses

- Total volume of antibiotic prescriptions
  - N=18, adjusted RR=0.89, 95%CI 0.82, 0.96
- Inappropriate antibiotic initiation
  - N=16; adjusted RR = 0.77, 95% CI 0.68 to 0.88
- Prolonged antibiotic prescription
  - N=3; adjusted RR = 0.91, 95%CI 0.86 to 0.96
- Broad-spectrum antibiotic selection
  - N=14; adjusted RR = 0.84, 95%CI 0.76 to 0.93

Conclusion

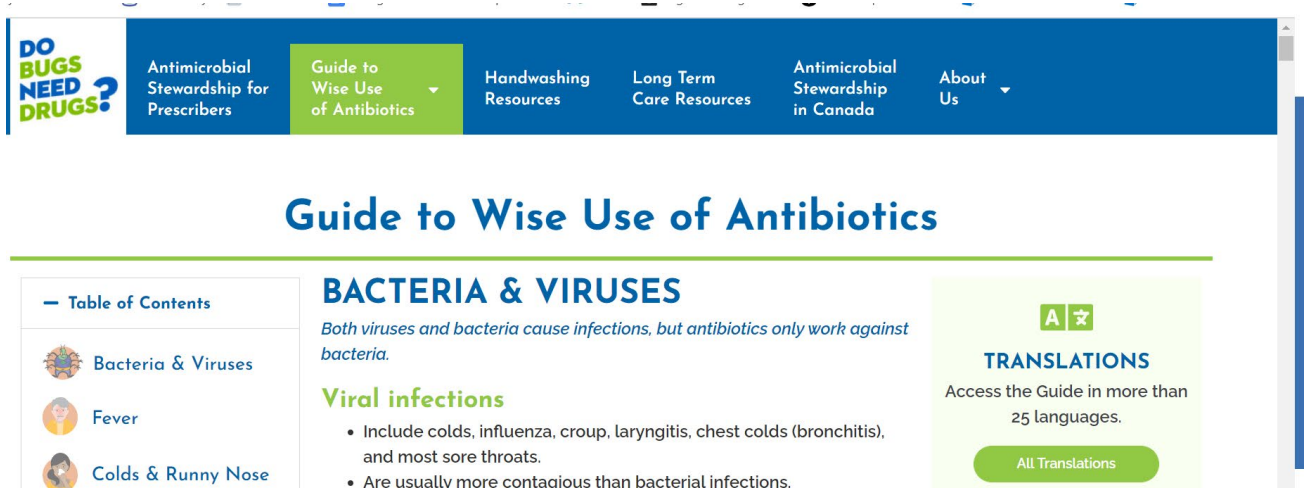
Antibiotic prescribing feedback should be a routine quality improvement expectation for all primary care prescribers

Outstanding Questions

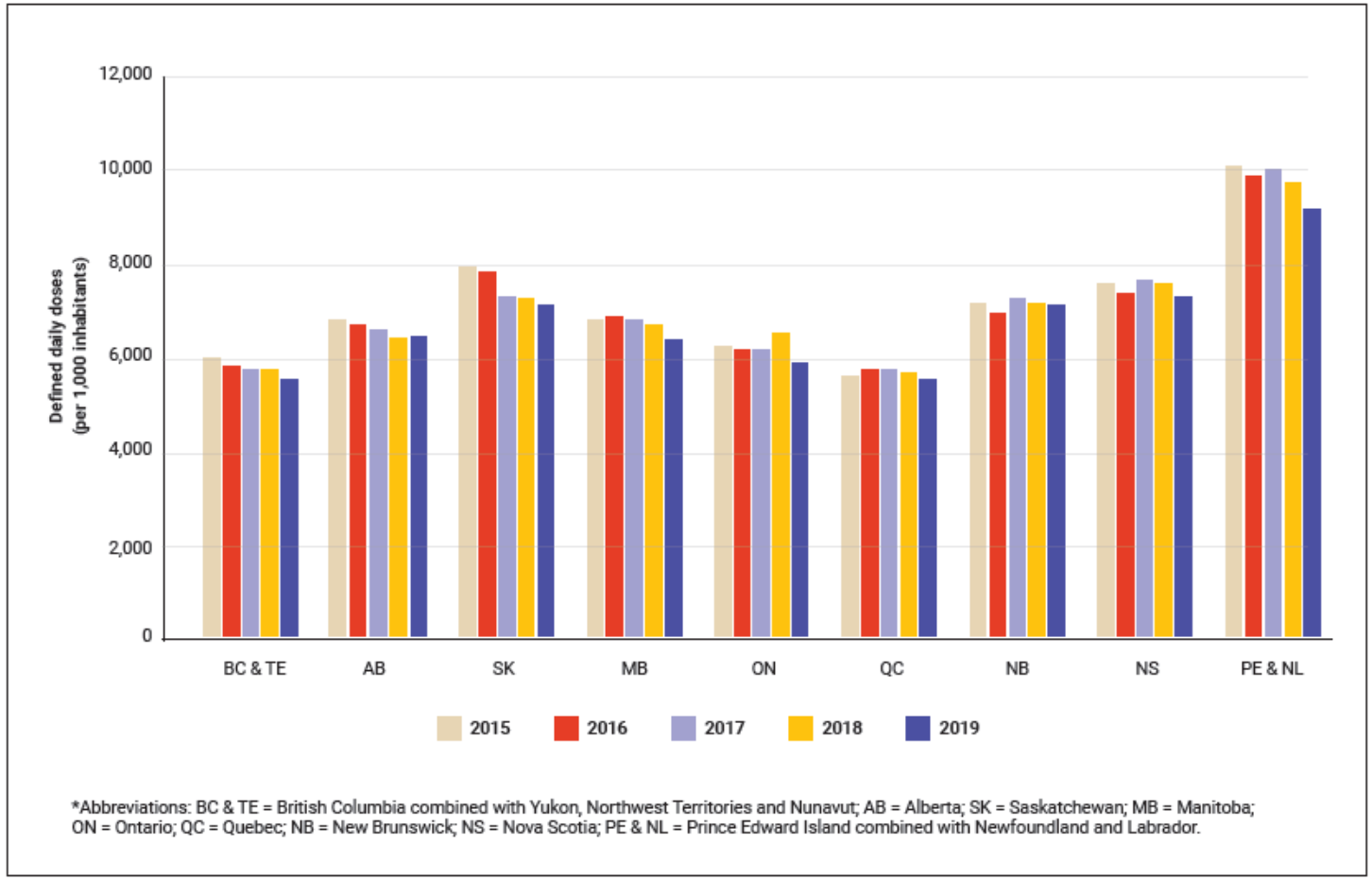
- Improving audit and feedback
  - How can we improve engagement?
- Co-interventions
- Integrating into policy

Co-interventions and Building an Antimicrobial Stewardship Program

Do Bugs Need Drugs?



BC Has the Lowest Antibiotic Use in Canada



Public Health Agency of Canada. Canadian antimicrobial resistance surveillance system report. Ottawa, ON: Her Majesty the Queen in Right of Canada, as represented by the Minister of Health; 2021. Available from: https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/drugs-health-products/canadian-antimicrobial-resistance-surveillance-system-report-2021/canadian-antimicrobial-resistance-surveillance-system-report-2021.pdf

Public Communications

J Antimicrob Chemother 2017; **72**: 975–987
doi:10.1093/jac/dkw520 Advance Access publication 19 December 2016

Journal of Antimicrobial Chemotherapy

Systematic review of public-targeted communication interventions to improve antibiotic use

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Received 20 July 2016; returned 15 September 2016; revised 19 October 2016; accepted 7 November 2016

Background: Excessive use of antibiotics accelerates the acquisition/spread of antimicrobial resistance. A systematic review was conducted to identify the components of successful communication interventions targeted at the general public to improve antibiotic use.

Methods: The databases MEDLINE, EMBASE, CINAHL, Web of Science and Cochrane Library were searched. Search terms were related to the population (public, community), intervention (campaign, mass media) and outcomes (antibiotic, antimicrobial resistance). References were screened for inclusion by one author with a random subset of 10% screened by a second author. No date restrictions were applied and only articles in the English language were considered. Studies had to have a control group or be an interrupted time-series. Outcomes had to measure change in antibiotic-related prescribing/consumption and/or the public's knowledge, attitudes or behaviour. Two reviewers assessed the quality of studies. Narrative synthesis was performed.

Results: Fourteen studies were included with an estimated 74–75 million participants. Most studies were conducted in the United States or Europe and targeted both the general public and clinicians. Twelve of the studies measured changes in antibiotic prescribing. There was quite strong ($P < 0.05$ to ≥ 0.01) to very strong ($P < 0.001$) evidence that interventions that targeted prescribing for RTIs were associated with decreases in antibiotic prescribing; the majority of these studies reported reductions of greater than −14% with the largest effect size reaching −30%.

Conclusion: Multi-faceted communication interventions that target both the general public and clinicians can reduce antibiotic prescribing in high-income countries but the sustainability of reductions in antibiotic prescribing is unclear.

- 14 controlled studies
- Range of 14% to 30% reduction in antibiotic use for respiratory tract infections

Cross ELA, Tolfree R, Kipping R. Systematic review of public-targeted communication interventions to improve antibiotic use. J Antimicrob Chemother. 2017;72(4):975-87. Available from: https://doi.org/10.1093/jac/dkw520

CRP to Reduce Antibiotic Prescribing

- 13 trials
- >10,000 participants
  - 23% children
- 12/13 CRP POCT
- 23% relative reduction
  - RR=0.77 (95%CI; 0.69-0.86)
- No difference in time to symptoms recovery or mortality
- Uncertain cost-effectiveness (D'hulster JAC 2023)

Cochrane Library

Cochrane Database of Systematic Reviews

Biomarkers as point-of-care tests to guide prescription of antibiotics in people with acute respiratory infections in primary care (Review)

Smedemark SA, Aabenhus R, Llor C, Fournaise A, Olsen O, Jørgensen KJ

Smedemark SA, Aabenhus R, Llor C, Fournaise A, Olsen O, Jørgensen KJ. Biomarkers as point-of-care tests to guide prescription of antibiotics in people with acute respiratory infections in primary care. Cochrane Database Syst Rev. 2022;10(10):CD010130. Available from: https://doi.org/10.1002/14651858.CD010130.pub3

Impacting Policy and Next Steps

Pan Canadian Action Plan

Public Health Agency of Canada. Pan-Canadian action plan on antimicrobial resistance. Ottawa, ON: His Majesty the King in Right of Canada, as represented by the Minister of Health; 2023. Available from: https://www.canada.ca/en/public-health/services/publications/drugs-health-products/pan-canadian-action-plan-antimicrobial-resistance.html

CANBUILD-AMR

CIHR IRSC Canadian Institutes of Health Research / Instituts de recherche en santé du Canada

To **support and build capacity** for a coordinated nationwide programme of provincial or territorial-level antibiotic prescribing feedback in primary care.

JPIAMR - PAAN

Joint Programming Initiative on AntiMicrobial Resistance

Primary Care Antibiotic Audit and Feedback Network (JPIAMR-PAAN)

About | Research Outputs | Members | Upcoming Events

JPIAMR-PAAN

An international collaboration on best practices for the delivery of antibiotic prescribing feedback to community clinicians using behavioural science. This collaboration includes 30+ experts from fields of antimicrobial stewardship, primary care, and implementation science (audit and feedback).

Network Objectives

1. To develop best practice resources directed to antimicrobial stewardship programs for the conduct and evaluation of antibiotic audit and feedback (A&F) interventions in primary care.

2. To develop research priorities specific to advancing the field of antibiotic A&F

JPIAMR-PAAN Coordinators

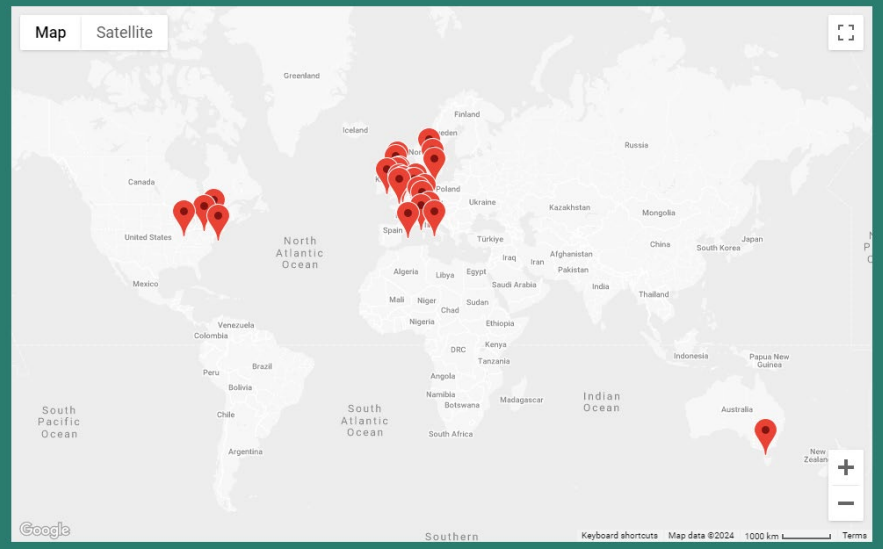
Alice Yu, MPH

Dr. Kevin Schwartz
Antimicrobial Stewardship Lead

Dr. Morten Lindbæk
Primary Care Lead

Dr. Noah Ivers
Implementation Science Lead

Members



Schwartz *et al.*
Antimicrobial Resistance & Infection Control (2023) 12:72
https://doi.org/10.1186/s13756-023-01279-z

Antimicrobial Resistance
and Infection Control

RESEARCH Open Access

Best practice guidance for antibiotic audit and feedback interventions in primary care: a modified Delphi study from the Joint Programming Initiative on Antimicrobial resistance: Primary Care Antibiotic Audit and Feedback Network (JPIAMR-PAAN)

Kevin L. Schwartz[1,2,3*], Alice X. T. Xu[1,2], Sarah Alderson[4,5], Lars Bjerrum[6], Jamie Brehaut[7], Benjamin C. Brown[8], Heiner C. Bucher[9], An De Sutter[10], Nick Francis[11], Jeremy Grimshaw[12], Ronny Gunnarsson[13,14,15], Sigurd Hoye[16], Noah Ivers[17], Donna M. Lecky[18], Morten Lindbæk[16], Jeffrey A. Linder[19], Paul Little[20], Benedikte Olsen Michalsen[16], Denise O'Connor[21], Celine Pulcini[22,23], Pär-Daniel Sundvall[13,14,15], Pia Touboul Lundgren[24], Jan Y. Verbakel[25,26] and Theo J. Verheij[27]

Abstract

Background Primary care is a critical partner for antimicrobial stewardship efforts given its high human antibiotic usage. Peer comparison audit and feedback (A&F) is often used to reduce inappropriate antibiotic prescribing. The design and implementation of A&F may impact its effectiveness. There are no best practice guidelines for peer comparison A&F in antibiotic prescribing in primary care.

Objective To develop best practice guidelines for peer comparison A&F for antibiotic prescribing in primary care in high income countries by leveraging international expertise via the Joint Programming Initiative on Antimicrobial Resistance—Primary Care Antibiotic Audit and Feedback Network.

Methods We used a modified Delphi process to achieve convergence of expert opinions on best practice statements for peer comparison A&F based on existing evidence and theory. Three rounds were performed, each with online surveys and virtual meetings to enable discussion and rating of each best practice statement. A five-point Likert scale was used to rate consensus with a median threshold score of 4 to indicate a consensus statement.

Results The final set of guidelines include 13 best practice statements in four categories: general considerations (n = 3), selecting feedback recipients (n = 1), data and indicator selection (n = 4), and feedback delivery (n = 5).

JPIAMR-PAAN 13 best practice recommendations on antibiotic audit and feedback interventions

General considerations

1. Antibiotic audit and feedback interventions in primary care should be framed as quality improvement projects within a supportive environment

2. Prior to initiating an antibiotic audit and feedback intervention in primary care, consider potential barriers to success such as local data availability, data validity, expected engagement of feedback recipients, perceived patient expectations for antibiotics, and other situational factors

3. Strategies to optimize reach and engagement of an antibiotic audit and feedback intervention in primary care include; utilizing an opt-out approach to delivery of feedback reports, offering of continuing medical education credits, financial incentives, and facilitated peer group discussions

Selecting feedback recipients

4. All primary care prescribers, regardless of practice type or prescribing volume, should be included in antibiotic prescribing audit and feedback interventions

Data and indicator selection

5. Feedback indicators for antibiotic prescribing in primary care should target reductions in antibiotic initiations, prolonged antibiotic duration, and/or unnecessary broad-spectrum antibiotics

6. Antibiotic feedback reports in primary care should enable and support behaviour change by providing guidance and educational resources

7. The optimal data source for antibiotic audit and feedback in primary care is credible, valid, routinely collected, and comprehensive for the region; ideally containing prescription, diagnostic, and clinical data

8. Benchmarks or achievable targets for peer comparisons for antibiotic prescribing in primary care should be indicator specific and based on national and/or local performance data of high performing peers

Feedback delivery

9. Antibiotic audit and feedback in primary care should be displayed such that recipients can understand their performance and desired actions within seconds

10. Antibiotic audit and feedback reports in primary care should be repeated with updated data over time. The optimal frequency is not known but can depend on local factors such as data availability and seasonality of prescribing

11. Antibiotic feedback in primary care should be ideally delivered by multiple strategies including verbal, paper, and/or electronic means

12. Antibiotic feedback should be delivered to primary care prescribers from a respected authority figure or colleague

13. Individual-level antibiotic feedback should be delivered confidentially to primary care prescribers, and the opportunity for peer discussion should be provided and encouraged

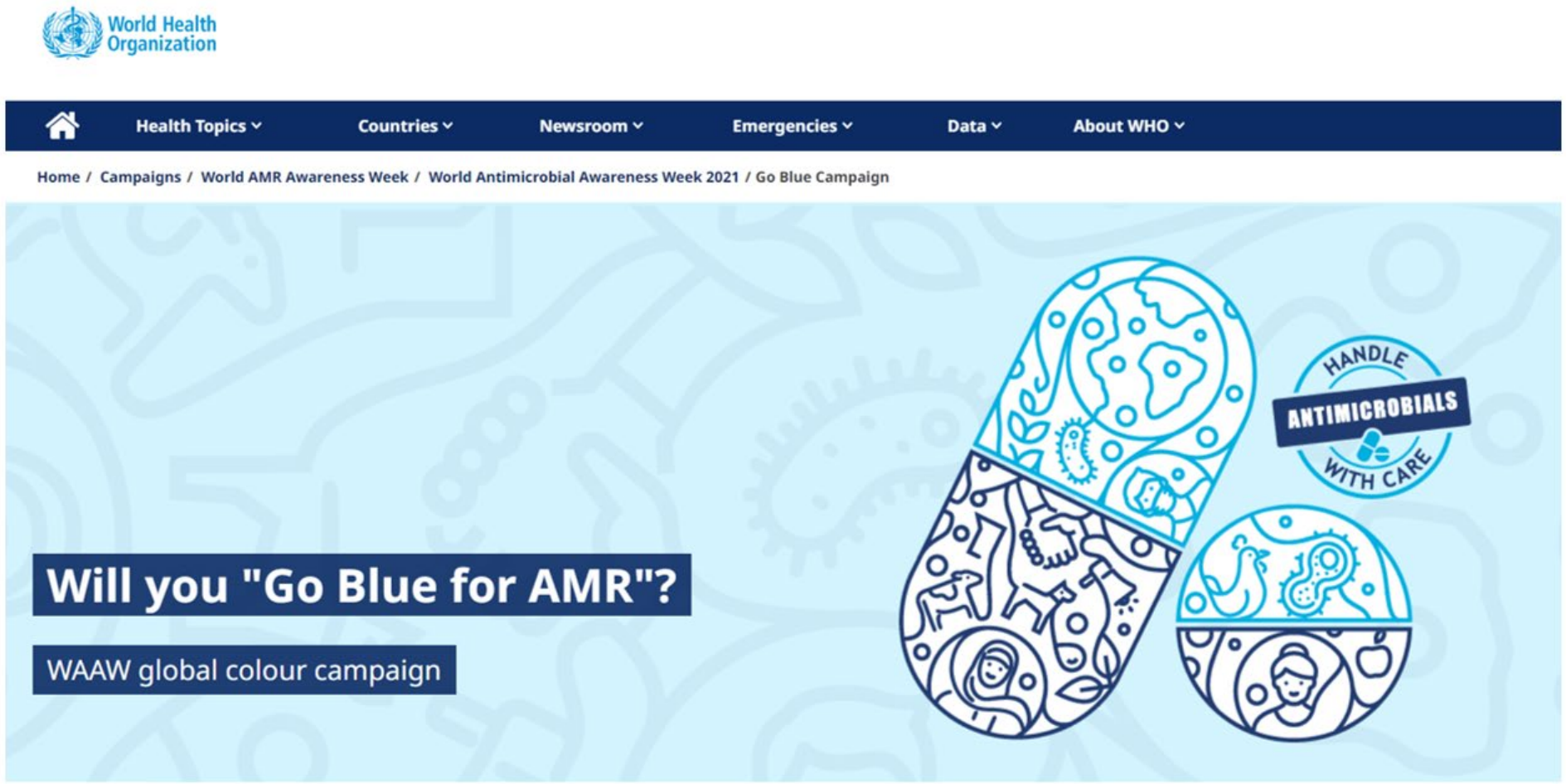
Joint Programming Initiative on Antimcrobial Resistance-Primary Care Antibiotic Audit and Feedback Network (JPIAMR-PAAN). About [Internet]. Olso: University of Olso; 2023 [cited 2024 Apr 12]. Available from: www.jpiamr-paan.org

Schwartz KL, Xu AXT, Alderson S, Bjerrum L, Brehaut J, Brown BC, et al. Best practice guidance for antibiotic audit and feedback interventions in primary care: a modified Delphi study from the Joint Programming Initiative on Antimicrobial resistance: Primary Care Antibiotic Audit and Feedback Network (JPIAMR-PAAN). Antimicrob Resist Infect Control. 2023;12:72. Available from: https://doi.org/10.1186/s13756-023-01279-z

Evidence-To-Policy

- Knowledge mobilization
- Policy briefs
- Opt out approach
- World AMR Awareness Week

World AMR Awareness Week November 18-24



World Health Organization (WHO). Go blue campaign [Internet]. Geneva: WHO; 2024 [cited 2024 Apr 12]. Available from: https://www.who.int/campaigns/world-antimicrobial-awareness-week/2021/go-blue-campaign

Partnerships

Summary

- AMR is a public health threat causing morbidity, increased mortality, and economic loss for Canadians
- Most antibiotics are prescribed in primary care, and ¼ prescriptions are unnecessary which is contributing to rising AMR
- Prescriber audit and feedback with peer comparison is effective at reducing antibiotic prescribing in primary care and is cost saving
- Antimicrobial stewardship is about improving quality of care, should be multifaceted, and requires diverse stakeholder engagement

Acknowledgements

Xu A, Shuldiner J, Langford BJ, Brown KA, Schultz S, Leung, V, Daneman N, Tadrous M, Witteman, H, Garber G, Grimshaw JM, Leis JA, Presseau, J, Silverman MS, Taljaard M, Gomes, T, Lacroix M, Brehaut J, Thavon K, Gushue S, Friedman L, Zwarenstein M, Ivers N

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PHO Antimicrobial Stewardship Program: asp@oahpp.ca

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