

# BMJ Open Quality Improving antibiotic initiation and duration prescribing among nursing home physicians using an audit and feedback intervention: a theory-informed qualitative analysis

Celia Laur <sup>1</sup>, Thivja Sribaskaran,<sup>1</sup> Michelle Simeoni,<sup>1</sup> Laura Desveaux <sup>1</sup>, Nick Daneman,<sup>2</sup> Cara Mulhall,<sup>3</sup> Jonathan Lam,<sup>3</sup> Noah Michael Ivers <sup>1,4</sup>

**To cite:** Laur C, Sribaskaran T, Simeoni M, *et al*. Improving antibiotic initiation and duration prescribing among nursing home physicians using an audit and feedback intervention: a theory-informed qualitative analysis. *BMJ Open Quality* 2021;**10**:e001088. doi:10.1136/bmjopen-2020-001088

► Additional material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2020-001088>).

Received 2 July 2020  
Revised 25 November 2020  
Accepted 13 January 2021



© Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

<sup>1</sup>Women's College Hospital Institute for Health System Solutions and Virtual Care, Women's College Hospital, Toronto, Ontario, Canada

<sup>2</sup>Division of Infectious Diseases, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada

<sup>3</sup>Ontario Health, Toronto, Ontario, Canada

<sup>4</sup>Family and Community Medicine, University of Toronto, Toronto, Ontario, Canada

## Correspondence to

Dr Celia Laur;  
[Celia.Laur@wchospital.ca](mailto:Celia.Laur@wchospital.ca)

## ABSTRACT

**Background** In nursing homes, 25%–75% of antibiotic days of treatment are inappropriate or unnecessary and are often continued for longer durations than necessary. In Ontario, physicians can receive a provincial audit and feedback report that provides individualised, confidential, data about their antibiotic prescribing. Objectives of this study were to explore antibiotic prescribing of nursing home physicians and the influence of the report.

**Methods** All physicians who received a personalised *MyPractice: Long-Term Care* report from Ontario Health (Quality) (OH(Q)) in January 2019 (n=361) were eligible to participate in semistructured telephone interviews that were recorded then transcribed verbatim. Recruitment emails were sent from OH(Q) until saturation of ideas. Analysis was conducted by two team members inductively, then deductively using the theoretical domains framework, a comprehensive, theory-informed framework to classify determinants of specific behaviours.

**Results** Interviews were conducted with n=18 physicians; 78% (n=14) were men, practising for an average of 27 years, with 18 years of experience working in nursing homes. Physicians worked in a median of 2 facilities (range 1–6), with 72% (n=13) in an urban setting. 56% (n=10) were medical directors for at least one home. *Professional role and identity* impacted all aspects of antibiotic prescribing. Key roles included being an 'Appropriate prescriber', an 'Educator' and a 'Change driver'. For antibiotic initiation, these roles interacted with *Knowledge, Skills, Beliefs about consequence, Beliefs about capabilities*, and *Social influence* to determine the resulting prescribing behaviour. When considering the impact of interacting with the report, participants' perceived roles interacted with *Reinforcement, Social influence*, and *Intention. Environmental context and resources* was an overarching domain.

**Conclusion** This theory-informed approach is being used to inform upcoming versions of existing audit and feedback initiatives. Appealing to the role that prescribers see themselves offers a unique opportunity to encourage desired changes, such as providing tools for physicians to be Educators and facilitating, particularly medical directors, to be Change drivers.

## INTRODUCTION

Antibiotic use in nursing homes is an increasing concern, where as much as 25%–75% of antibiotic days of treatment may be inappropriate or unnecessary.<sup>1–4</sup> Antibiotic treatment is uniquely challenging in this population as elderly patients are prone to both infection-related and antibiotic-related complications.<sup>3</sup> Cognitive impairment and difficulty distinguishing infectious illness from comorbidity contribute to the challenge of appropriate antibiotic prescribing in this sector.<sup>1,4</sup> The increased use of antibiotics in prescribing endangers not only the individual receiving treatment but all residents due to the increased risk of serious antibiotic-related harms such as *Clostridium difficile* and antibiotic resistant pathogens.<sup>3,5</sup> Even in cases where antibiotics are indicated, they are often continued for unnecessary durations.<sup>6</sup> Shorter duration antibiotic treatments (7 days or less) are as effective as longer treatments for common infections in nursing homes,<sup>6</sup> yet prescribing patterns suggest many physicians remain largely unaware of this evidence. With the numerous challenges associated with antimicrobial resistance worldwide,<sup>7–10</sup> physicians need to be aware of their prescribing practices and be supported to change, particularly in nursing homes.

A well-studied strategy for improving guideline-concordant clinical behaviour—including antibiotic prescribing practices—is audit-and-feedback (A&F).<sup>11,12</sup> Providing healthcare professionals with a systematic measurement of their current clinical performance may overcome barriers to self-assessment, help identify suboptimal practices and motivate quality improvement efforts.<sup>11</sup> Furthermore, A&F can incorporate numerous behaviour change techniques (BCTs) to



target a range of underlying determinants of behaviour, including cognitive and affective attitudes, normative beliefs, and self-efficacy.<sup>13,14</sup> A Cochrane systematic review found A&F to be associated with a median-adjusted risk difference of 4.3% absolute increase in healthcare professional compliance with targeted behaviours. Importantly, the benefit was even greater for studies of prescribing behaviour.<sup>11</sup> Therefore, a well-designed and behaviourally targeted A&F intervention has the potential to support guideline-concordant antibiotic prescribing in nursing homes and consequently reduce antibiotic-related harms.

The *Feedback to Improve Rational Strategies of Antibiotic Initiation and Duration in Long Term Care* (FIRST AID-LTC) trial (ClinicalTrials.gov Identifier: NCT03807466) is a large active trial, with one section focusing on the impact of implementing different types of A&F interventions on physician antibiotic prescribing practices in nursing homes. To supplement the trial, an embedded process evaluation was conducted to examine the interactive processes and contextual features to help explain the overarching context of nursing homes in which this trial is based.<sup>15</sup> In this manuscript, we describe the findings from interviews of nursing home physicians conducted as part of this process evaluation. Specifically, we used a theory-driven approach to explore how and why nursing home physicians receiving an A&F report may (or may not) change their antibiotic prescribing in response to the report.

## METHODS

### Study design

A qualitative approach with one-on-one semistructured telephone interviews was used to gain a more nuanced understanding of how the intervention (the report) was perceived by those that engaged with it. A social constructionist paradigm<sup>16</sup> (p. 336–337), indicating that realities are shaped through our experiences and our interactions with others, guided the collection of the qualitative data through interviews with physicians who practise in nursing homes in Ontario. This study received ethics approval from the Women's College Hospital Research Ethics Board, REB #2018-0166-E.

### Setting

As of February 2019, there were 626 licensed nursing home facilities in Ontario. Adult residents live permanently in these facilities and have access to 24-hour nursing and personal care.<sup>17</sup> Fifty-eight per cent of these homes were privately owned, 24% were non-profit/charitable and 16% were municipal.<sup>18</sup> Many physicians work in multiple facilities with an interdisciplinary care team to monitor residents and bring in physicians as needed. In Canada, the Long Term Care Homes Act (2007) requires each home to have a medical director who is a physician.<sup>19</sup> The medical director's role is to advise on matters of medical care and consult with the director of care and other health professionals.<sup>19</sup>

## Intervention

Ontario Health (Quality) (OH(Q)), formerly known as Health Quality Ontario, provides physicians who practise in nursing homes in Ontario with quarterly A&F via their *MyPractice: Long-Term Care* report (referred to as 'the report'; online supplemental 1). These confidential practice reports are disseminated online to physicians who voluntarily register to receive the feedback. The reports describe resident characteristics, personal prescribing trends for high-risk medications in nursing homes (eg, antipsychotics, benzodiazepines and so on), and antibiotic initiation and duration. Peer comparison against the overall prescribing trends across Ontario nursing homes are included. The reporting includes two pages of 'change ideas' that present strategies and resources designed to support physicians who are interested in changing their own, or their team's, antibiotic prescribing behaviour.

## Recruitment

All physicians in Ontario who received and engaged with their personalised report were eligible to be interviewed. When recruitment began in March 2019, n=361 physicians who work in nursing homes had signed up to receive the report. In this iteration of the FIRST AID-LTC trial, half (n=182) of the eligible participants received a standard PDF version of the report and the other half (n=179) received a new, interactive, online version. Perceived differences about the impact of the type of report received will be published with the results of the FIRST AID-LTC trial, while general insights about the impact of the report and the nursing home context are provided here.

To recruit participants, a statement was included in an OH(Q) online feedback survey sent to all physicians who received the report, which yielded no participants. OH(Q) then sent a dedicated recruitment email to all eligible physicians. Although recruitment was conducted by OH(Q), interested physicians contacted the research team to maintain confidentiality. Prior to the interview, all physicians received an information letter and signed a consent form. If written consent was not obtained, verbal consent was documented before the interview. Each interview participant received an \$150 honorarium.

## Data collection

The objectives and interview questions (online supplemental 2) were guided by the theoretical domains framework (TDF).<sup>20</sup> The TDF is a validated framework of 84 determinants across 14 domains that is based on psychological theory and used to identify determinants of individual behaviour.<sup>21</sup> It is used to inform the design of complex healthcare interventions and helps to categorise known barriers and facilitators to practise change and select implementation strategies.<sup>20</sup> In addition to the behavioural approach guided by the TDF, leading A&F theory was used to enhance comprehensiveness, including the 15 suggestions for optimising A&F effectiveness from

Brehaut and colleagues,<sup>22</sup> and the clinical performance feedback intervention theory.<sup>22–23</sup> The questions were piloted on two physicians with expertise in conducting A&F studies. Demographic questions were asked ahead of the interview, including gender, role, setting (urban, rural), years in practice, years working in a nursing home, number and type of homes, number of residents per home, and whether they work in other settings, such as primary care.

Interviews were conducted by one female postdoctoral researcher (CL) with a background in health services research. As the interviewer did not have a clinical background, physicians were asked to clarify clinical responses. The interviewer did not have a relationship with the participants prior to the interview. Interviews were audio recorded then transcribed verbatim by an external third party. Any identifiable information (ie, names of individuals or institutions) was removed to ensure confidentiality. No repeat interviews were conducted.

### Data analysis

A codebook was created through an iterative process during coding of the transcripts on NVivo V.12 by two researchers (CL and TS). Independent inductive coding was used first, followed by deductive coding mapping to the TDF. A framework analysis<sup>24</sup> was applied as a final step to explore the potential differences between participants who were or were not a medical director. Results were summarised into tables, which were reviewed by the

research team, including a representative from OH(Q). Field notes were taken throughout the interview process. Member checking was conducted to confirm results by sending a summary of findings to participants who had agreed to further contact (n=16).

### Patient and public involvement

Lived experience advisors provide input to all projects conducted with this funding, including providing initial direction to focus on antibiotic prescribing. Advisors were not directly involved in the conduct or recruitment for this study. Results are shared with the advisors and discussions are underway with researchers and advisors to inform dissemination plans and future interventions.

## RESULTS

Interviews were conducted with 18 physicians who practise in nursing homes; 78% (n=14) were men, practising for an average of 27 years, with 18 years in nursing homes. These physicians worked in a median of 2 facilities (range 1–6), with 72% (n=13) in an urban setting. Just over half (n=10) were medical directors for at least one facility. This sample is comparable to the overall sample of physicians who receive the Report (table 1). Interviews lasted between 21 and 60 min (average=36 min).

*Social/Professional role and identity*, which refers to ‘a coherent set of behaviours and displayed personal qualities of an individual in a social or work setting’,<sup>20</sup>

**Table 1** Demographic information of interview participants and of all physicians who receive the *MyPractice: Long-term Care* report from Ontario Health (Quality)

Demographic information	Interviews, n (%/mean)	Physicians who receive the long-term care report from Ontario Health (Quality)
# of participants	18	361
Gender		
Female	4 (22%)	113 (31.3%)
Male	14 (78%)	248 (68.7%)
Medical director (in at least one facility)	10 (56%)	–
Years in practice (mean)	2.5–52 years (27)	29 years (mean)
Years working in nursing homes (mean)	2–52 years (18)	–
# of homes (mean)	1–6 (2)	–
Setting		–
Urban	13 (72%)	
Rural	4 (22%)	
Both	1 (6%)	
# of residents	64–350	–
Work in another setting	15 (83%)	–
# of reports received to date		
Since the report began	4 (22%)	
1–2 years	6 (33%)	
A few years	8 (44%)	

impacted all aspects of antibiotic prescribing among nursing home physicians. Three distinct roles were identified: (1) Appropriate prescriber, (2) Educator and (3) Change driver; these self-perceived roles were distinct from any formalised job responsibilities. These roles were also not static over time or consistent across settings; each role interacted with other domains to affect antibiotic initiation and duration and how they interacted with the report. Participant behaviours were considered within an overarching theme of *Environmental context and resources* which helped explain antibiotic prescribing behaviours in nursing homes.

### Perceived professional roles and their impact on decreasing antibiotic initiation and duration

Table 2 summarises how each role could affect antibiotic initiation and duration.

#### Appropriate prescriber

All physicians reported their role to provide appropriate treatment to achieve ‘good patient care and outcomes’ 004 (medical director). Participants considered many factors to determine appropriate initiation, including clinical features, lab test results, patient/family preferences, and care goals. Consideration of antibiotic duration (specifically, shorter durations) was not common practice for many participants, and some needed to verify the evidence (ie, asking a pharmacist) before considering changing their practice. A few physicians saw their role as an Appropriate prescriber to prescribe for the shortest duration possible, however, it was not always clear what was meant by ‘shortest’.

[I] always write the prescription initially as a low duration or slow duration. Not only does that help conserving antibiotics, but it kind of is a reminder to myself and to staff to reassess the patient, because we have to decide whether or not to increase the length of the prescription. 017

An identified knowledge gap (*Knowledge and Skills*) for upper respiratory tract infections negatively interacted with (and challenged the integrity of) the Appropriate prescriber role.

We’ve had tons of focus on reducing the antibiotics for UTIs, for instance, in long-term care, but there’s not a really great approach to deciding whether to treat upper respiratory symptoms with antibiotics. 013 (medical director)

The ability to apply existing *Knowledge and Skills* in line with the evidence was influenced by *Social influence* and *Beliefs about consequences*. Physicians described navigating a tension between appropriate prescribing, maintaining good relationships with families and staff (who often advocated for antibiotic use), considering resident wishes regarding receipt of treatment, and applying comfort measures during end of life care. Most physicians felt it was more important to avoid the negative consequences

of inappropriate prescribing (*Beliefs about consequences*) than the potential negative consequences of not following the pressure from staff and family to prescribe (*Social influence*), although participants reported occasionally succumbing to the pressure.

When a nurse calls with a lab report of a positive urine culture they’re expecting me to order a prescription, to order an antibiotic to treat it and if I determine that isn’t required, sometimes they don’t want to believe me. They try to convince me, but I don’t—I stick to my guns. 006 (medical director)

Physicians typically felt capable (*Belief about capabilities*) of appropriately initiating an antibiotic prescription, however, a lack of access to diagnostic resources (*Environmental context and resources*) made it more challenging to determine whether an infection was viral or bacterial. Furthermore, poor continuity of care or a lack of access to relevant information impeded the ability to make an informed decision, thereby reducing confidence in prescribing decisions.

I’m literally on call from eight nursing homes over a weekend, so it’s sometimes physically impossible to go see all the patients I’m being called about; so those physically not always seeing the patient and as well having physicians not familiar with the patients, those lead to I think sometimes inappropriate prescribing. 007

#### Educator

Some physicians saw it as part of their role to be an Educator, by informing and training other staff to improve patient care, and thus decreasing the pressure physicians felt from staff to prescribe. Physicians also reported pressure from families and residents, which they felt could be mitigated through education provided by either themselves or the staff. Many physicians had standard language they used with families to help reframe prescribing decisions as a careful use of antibiotics to avoid unnecessary harms. Many challenges to education for staff and families were expressed, including contextual factors such as high staff turnover and lack of time for education (*Environmental context and resources*).

The one [spiel] with the family is just a reminder honestly about antibiotic resistance and about their need to make sure that when they really do need antibiotic that they work, ... so just explain to them the importance of making sure we’re using antibiotics judiciously. 007

*Beliefs about consequences* amplified the Educator role, with these physicians believing educating their colleagues would have a positive impact on resident care and antibiotic prescribing. Physicians who did not see their role as an Educator still felt education of staff and families was important but did not see it as their role to deliver that education. When educating families, physicians with the

**Table 2** Connecting Social/Professional role and identity to initiation and duration, and how they are considered within the Ontario Health (Quality) report

Social/Professional role and identity		Role of the report		
Behaviours	Appropriate prescriber	Educator	Change driver	
Decreasing the initiation of antibiotic prescriptions	<p>'I'm looking at treating the patient and not the lab test.' 006 (medical director)</p> <p>'I always worry though that when you have a frail elderly patient who's coughing and you can hear it's deep in their chest and they not eating and drinking well, that if you don't treat them you will, and they had pneumonia, the chance is that they're not going to do well. ... I don't think I can, not treat them.' 004 (medical director)</p>	<p>'They (conversations with patients and families) seem to go well and it's better than not having them because families feel more involved and keeping in the loop ... There's lots of room for families to input. Not just for the nurses, but with me and a nurse practitioner.' 010 (medical director)</p> <p>'My impression has been that very little works. If I explain to one nurse the reason why I'm not prescribing an antibiotic, I may get a call the next day from somebody else with the same thing. ... Education has to be ongoing and a lot of times it isn't.' 006 (medical director)</p>	<p>'As the individual physician I'm not sure how much ... one individual is going to impact in the home especially homes that are run by other organisations just if the person isn't a medical director.' 007</p> <p>'I view the physician as kind of the lead or the guide. I don't feel like I need a distinction between what I'm doing and what the team's doing, because in the end I'm responsible for all of it. So if I want the team to be doing something, I'm the one that has to initiate that.' 017</p>	<p>Physicians did not think the report would have much impact on their antibiotic initiation. They were already aware of the need to decrease initiation.</p> <p>The report encouraged avoiding treatment of asymptomatic bacteriuria of which physicians were already aware. The report also encourages implementation of programmes to reduce unnecessary urine culturing and discontinuation of routine annual urine screening. However, these programmes were already set up. The report discourages prescribing for upper respiratory tract infections (URTI). Prescribing for URIs is where there seems to be gaps in knowledge and room for improvement.</p>
Decreasing the duration of antibiotic prescriptions	<p>'My job is to be there and treat the patient and their family and not to just write the prescription easily because it would have been a lot faster honestly to just say, 'Fine here's another 3 days or 7 days or whatever', but that wasn't the appropriate thing to do.' 007</p>	<p>(Education seemed to focus more on initiation, and more about an individual physician increasing their own knowledge, less about the duration knowledge of others).</p>	<p>'I think you can probably have the pharmacy involved and so, for example, the physician writes a 10-day prescription, the pharmacy could bounce that back and say, 7 days is sufficient.' 011 (medical director)</p> <p>'Most physicians only show up once a week, shortening the course of the antibiotic treatment for 2 days, you're not going to possibly even remember to do that, unless you have the staff onboard to do it ... To help you do that.' 001 (medical director)</p>	<p>The report shows the physician's own prescribing practice for antibiotics prescribed 7+ days and provides suggestions for practice change.</p> <p>The report encourages practice change by prescribing shorter courses when appropriate (this is new information for some) including specific conditions and how long to prescribe along with some resources.</p>

Educator role saw the beneficial effects of taking the time to speak with them, further reinforcing their role.

They [conversations with patients and families] seem to go well and it's better than not having them because families feel more involved and keeping in the loop ... There's lots of room for families to input. Not just for the nurses, but with me and a nurse practitioner. 010 (medical director)

#### Change driver

The few physicians who were Change drivers saw it as their role to initiate systematic changes in the facility to decrease inappropriate initiation and longer duration of antibiotics. This role was most apparent when discussing the need to decrease use of routine urine testing for urinary tract infections. These physicians would typically involve other staff, such as having pharmacists send reminders about decreasing the duration of some antibiotics. Another physician described using the OH(Q) report as a teaching tool and felt it was their role to educate other providers and change facility practices. It is important to note that not all Change drivers held the position of medical director.

As a medical director I was in a position where I was able to tell them [staff] what I wanted them to do. Whereas, as an attending physician, I'm not really, I'm not as able to do that or a physician might not feel as empowered to change something. But the medical director does have to go to these meetings with the management team and so, then having this can be helpful for them to offer those change ideas. 011 (medical director)

*Belief about consequence* interacted with the Change driver role as some physicians also saw the benefit of changing facility level practices on patients and preventing general antimicrobial resistance, which motivated them to act as a Change driver in their home(s).

I'm seeing the consequences of, the downside of antibiotics. So, I think it's important that we use them wisely. I think that's what made me a [antibiotic] champion. 004 (medical director)

Change drivers leveraged *Social influence* by using a team approach, such that the positive attitudes and team collaboration were needed in order to make facility level changes. It was also reported that the team approach was needed for appropriate prescribing in this type of care setting, given that the physician was not in the facility often and thus relied on the team to monitor and report appropriate signs and symptoms (*Environmental context and resources*). Trust in the staff to know the patient and recognise the right factors played an important role in their ability to be a Change driver and Appropriate prescriber.

If I don't feel I can trust my nursing staff to be aware of symptoms or to be able to recognize when things

change quickly, then I feel again that I'm more likely to prescribe just because I'm a little bit more worried that things will get missed. 017

#### Impact of the OH(Q) MyPractice: Long-term Care report

How physicians responded to data regarding their prescribing practices could be understood by examining how the report interacted with each role in terms of *Reinforcing* behaviour and generating *Intention*. Physicians who identified as an Appropriate prescriber were interested in understanding their own prescribing and working towards individual improvement. Educators and Change drivers went beyond individual improvement in an attempt to influence the prescribing practices of others, including attention to organisational processes. Additional features of the impact of the report on antibiotic initiation and duration are included in [table 2](#).

#### Reinforcement

To understand their own prescribing and increase the probability of change, physicians needed to trust the data in the report. Physicians typically trusted the source of the data, although some needed to work through a process first, such as reading through how they came to the numbers, the source of the original data and so on.

The fact that it was independent. You know, data was not being generated by a pharmaceutical company for example. It was a neutral source, that was good. I thought it was reasonably unbiased, so I trusted it. 018 (medical director)

Some physicians saw the report as reinforcement of their individual usual practice as an Appropriate prescriber, and less about how to impact the prescribing of others or the overall home as an Educator or Change driver. For some, this was driven by the belief that they could not impact the prescribing patterns of others.

I do think it's still helpful to see at the individual level. I think it's more helpful at the home level for sure because I can only impact on those, I can't impact prescribing [of] anyone else. 007

The change idea pages were designed to support those who were interested in improving their practice, however, of those that did read that section, most physicians reported they were already familiar with, or already doing, all of those suggestions. The resulting inaction highlighted that the report may be reinforcing the physicians' beliefs that they were already doing what was needed, even when this may not be the case.

#### Intention

Overall, physicians' intentions when understanding themselves as an Appropriate prescriber was to see how they were doing in comparison to others and decide if they needed to change. The comparison to other physicians in the report data did motivate some to change their practice when the numbers did not meet their expectations,

such as when they prescribed higher (worse) than average or were at the average but wanted to do better. The intention for change was generally to 'do better' and decrease the initiation and duration of their prescribing, although very few mentioned setting an explicit goal. Furthermore, for those who were at levels they expected, there was little motivation to read the change idea pages or make specific plans for improvement.

Intentions to change the practices of others or facility practices as an Educator or Change driver were typically non-specific as well, unless they related to urinary tract infections which had specific intentions.

Team goals would be to understand better what the diagnosis of urinary tract infection looks like in that the frail, elderly and the dementia population and to understand the risks of overtreatment of—overuse of antibiotics. 016 (medical director)

### Social influence

Social comparisons led to intentions to improve as described above. However, physicians rarely had the opportunity to speak to others about their data. One medical director even asked: 'Who am I going to discuss it (the report) with?' 008 (medical director). Some Educators with an interest in discussing and sharing the report had plans to speak to others but had not done so yet, even though most had been receiving the report for several years. One physician (non-medical director) described sharing the data and using the report as a teaching tool with new practitioners, thus filling their role as an Educator and Change driver.

## DISCUSSION

This study highlights the perceived *Professional role and identity* of nursing home physicians as a significant driver of antibiotic prescribing and clinical decision making in this setting. All physicians saw themselves as Appropriate prescribers, while only some physicians also saw themselves as Educators or Change drivers. Lack of time, high staff turnover, lack of access to diagnostic equipment, and provision of care to several homes at one time leading to a high number of residents to care for and teams to work with (*Environmental context and resources*), made it challenging for physicians to fill all roles. Even among those who were motivated to improve their prescribing, few had the capabilities and opportunities needed to work with team members to achieve this practice change in a sustainable way. While the A&F report supported physicians to understand their own prescribing practices, it did not appear to reinforce behaviour change, suggesting that A&F may provide more benefit when applied with other strategies.

Antibiotic prescribing in nursing homes has been shown to be driven by prescriber factors rather than infection prevalence or antimicrobial stewardship initiatives.<sup>4</sup> This aligns with our findings that what physicians believe (ie,

their perceived *Professional role, Beliefs about capabilities and Beliefs about consequences*) drive their antibiotic prescribing behaviour. Suggested strategies to address prescriber factors have included goal setting, education, and A&F.<sup>25</sup> When asked about changing their prescribing practices, few of the interviewed physician mentioned setting goals or any perceived benefit of goal setting. Education for staff and patients was suggested by many physicians, however, they did not necessarily see the benefit of further education for themselves. This is consistent with the results indicating there did not appear to be a *Knowledge or Skills* gap regarding initiation of antibiotics.

Our findings also suggest the A&F report did not reinforce behaviour change, indicating that A&F may not be effective as a standalone strategy when prescriber beliefs are such a strong determinant and *Environmental context and resources* has such a strong negative impact. Our results are consistent with the evidence for moving beyond education and individual interventions to explicitly address team functioning and communication,<sup>26 27</sup> as well as system-level changes, such as optimising staffing models. When a team approach is used in combination with system-level changes, it may allow physicians to fulfil their clinical and professional role and support improved antibiotic prescribing. Developing a culture where data are collected and shared openly among colleagues, including administrators, may be more amenable to quality improvement,<sup>27 28</sup> however, future studies are needed to understand how to enable this culture in nursing homes. Suggestions were also made to have physician reports shared with the care home manager, however, to protect physician privacy, this would be at the discretion of the physician rather than having OH(Q) share the report directly with the manager.

Physicians need, and in theory are trained, to be communicators, collaborators, leaders, health advocates, scholars, and professionals, as outlined in the CanMEDS framework.<sup>29</sup> Many physicians in our study did not perceive themselves as having a role as an Educator or Change driver, highlighting a gap in the realisation of the full complement of CanMEDS roles in practice. Programmes such as TeamSTEPPS 2.0 (*Team Strategies and Tools to Enhance Performance and Patient Safety*) for Long Term Care include evidence based strategies to improve collaboration and communication within nursing homes.<sup>30–33</sup> For example, one study found the effective implementation of SBAR (Situation, Background, Analysis and Recommendation), a communication format to promote a structured conversation between nurses and physicians, decreased the odds of a prescription being written for asymptomatic bacteriuria.<sup>34</sup> These communication strategies have been shown to improve team leadership, communication, situational monitoring, mutual support and overall teamwork,<sup>30</sup> and align with the skills needed by physician to fulfil their roles.

## Implications for interventions to reduce antibiotic prescribing

Our findings echo those of similar initiatives to influence prescribing in nursing homes,<sup>25 26 35</sup> particularly regarding the impact of team functioning on prescribing.<sup>26</sup> Physician prescribers in this setting must move from 'letting it happen' to 'making it happen'.<sup>36</sup> To achieve this shift, the use of the TDF in this study provides an opportunity to map the key drivers of behaviour to Behaviour Change Techniques (BCTs), informing an evidence-based intervention to improve antibiotic prescribing that is tailored to the problem at hand. For example, increased opportunity for communication between nursing home physicians with similar resident populations across Ontario may encourage more *Social influence*, as physicians in our study mentioned minimal opportunity to discuss their values or practice with others. Implementation of communication strategies, such as those mentioned above, may also impact *Social influence* and *Belief about capabilities* if physicians are able to effectively communicate with staff and thus decrease the perceived pressure to prescribe. Interventions addressing *Knowledge* and *Skills* may also be helpful for improving (reducing) antibiotic prescribing *durations*, but less so for antibiotic *initiation*. Interventions that focus on *Professional role*, such as training on effective communication or how to educate others, may be more applicable in this setting, however, are difficult to enact without system-level change when lack of time and high staff turnover remain significant barriers to an effective team approach.

## Limitations

As interviews were only conducted with nursing home physicians who engaged with the OH(Q) report and agreed to participate, results may not be transferable to all nursing home physicians, nor to other A&F reports. The antibiotic prescribing patterns of the participants was unknown by the authors, which means comparison between those that were and were not meeting recommendations was not possible. This lack of comparison also means that when physicians perceive their role as an Appropriate prescriber this does not necessarily mean the physician is meeting recommendations.

As perceived Appropriate prescribers, many of those who felt they should improve their prescribing practice after reading the report, either because they were close to or worse than average, felt they were already following the suggested change ideas mentioned in the report. It is unclear to what extent the physicians were already doing those activities, however, this perceived disconnect between needing to change and already following the change ideas may have reinforced their current prescribing behaviour.

As interviews were part of a process evaluation exploring the impact of the physician-directed A&F reports on nursing home physicians, interviews with other providers, staff and residents were not possible, yet would have provided a more comprehensive view. Physicians were

from several types of home (for-profit, not for-profit and so on) and locations (urban, rural and so on). Suggestions were made regarding potential difference between homes; however, this could not be confirmed in the analysis. Analysis from the FIRST AID-LTC trial will show if there is quantitative impact of the report on antibiotic prescribing over time and between those who did and did not receive the report, and if there are factors correlated to prescribing, such as type of home. Lack of access to this data before publication limited triangulation of findings.

## CONCLUSION

Improving antibiotic prescribing is a priority to prevent antimicrobial resistance, especially in vulnerable populations such as those living in nursing homes. For physicians to improve their antibiotic prescribing in this setting, they must go beyond a perceived role of Appropriate prescriber and embrace the roles of Educator and Change driver. To achieve this, a focus on teamwork and communication is encouraged. *Environmental context and resources* had a strong negative impact and may be preventing physicians from fulfilling their roles. This theory-informed understanding of antibiotic prescribing in nursing homes can inform future interventions to support sustainable improvements in practice in this context.

**Twitter** Celia Laur @Celia\_Laur, Laura Desveaux @lauradesveaux and Noah Michael Ivers @Noahlvers

**Acknowledgements** The authors wish to thank all participants who completed the interviews. Thanks also to Gail Dobell and Heming Bai for their contributions to this work.

**Contributors** CL led this study, including conducting the interviews, analysis and writing the manuscript. TS was the second coder in the analysis and contributed to development of themes. MS assisted with recruitment, overall coordination and development of themes. LD provided input to initial study conception, verify themes and finalising the manuscript. ND leads the FIRST-AID trial and was involved in initial study conception and final interpretation. CM and JL represent Ontario Health, which develops and sends the reports, and were involved in recruitment and verifying themes. NMI provided senior oversight during data collection, analysis, theme development and writing.

**Funding** This project was funded by the Feedback to Improve Rational STRategies of Antibiotic Initiation and Duration in Long Term Care (FIRST AID-LTC) trial (ClinicalTrials.gov Identifier: NCT03807466), which is funded by the Canadian Institutes of Health Research (CIHR). CL is supported by the CIHR Health System Impact Fellowship (Postdoctoral). NMI is supported by a Canada Research Chair (Tier 2) in implementation of evidence based practice and as a clinician scholar by the Department of Family and Community Medicine at the University of Toronto.

**Competing interests** None declared.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data sharing not applicable as no datasets generated and/or analysed for this study. To maintain confidentiality of interviewed participants, interview transcripts are not available.

**Supplemental material** This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.



**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

#### ORCID iDs

Celia Laur <http://orcid.org/0000-0003-4555-1407>

Laura Desveaux <http://orcid.org/0000-0003-3429-1865>

Noah Michael Ivers <http://orcid.org/0000-0003-2500-2435>

## REFERENCES

- Nicolle LE, Bentley DW, Garibaldi R, *et al*. Antimicrobial use in Long-Term-Care facilities. *Infect Control Hosp Epidemiol* 2000;21:537–45.
- Katz PR. Antibiotic use in the nursing home. *Arch Intern Med* 1990;150:1465.
- Daneman N, Bronskill SE, Gruneir A, *et al*. Variability in antibiotic use across nursing homes and the risk of antibiotic-related adverse outcomes for individual residents. *JAMA Intern Med* 2015;175:1331–9.
- Daneman N, Gruneir A, Bronskill SE, *et al*. Prolonged antibiotic treatment in long-term care: role of the prescriber. *JAMA Intern Med* 2013;173:673–82.
- Baur D, Gladstone BP, Burkert F, *et al*. Effect of antibiotic stewardship on the incidence of infection and colonisation with antibiotic-resistant bacteria and *Clostridium difficile* infection: a systematic review and meta-analysis. *Lancet Infect Dis* 2017;17:990–1001.
- Rafailidis PI, Pitsounis AI, Falagas ME. Meta-Analyses on the optimization of the duration of antimicrobial treatment for various infections. *Infect Dis Clin North Am* 2009;23:269–76.
- Casey B. *A study on the status of antimicrobial resistance in Canada and related recommendations: report of the standing Committee on health*, 2018.
- US Centers for Disease Control. *Antibiotic resistance threats in the United States*, 2019.
- World Health Organization. *Global action plan on antimicrobial resistance*, 2015.
- Government of Canada. *Canadian Antimicrobial Resistance Surveillance System - Update 2018*, 2018.
- Ivers N, Jamtvedt G, Flottorp S, *et al*. Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev* 2012:CD000259.
- Dorobisz MJ, Parente DM. Antimicrobial stewardship metrics: prospective audit with intervention and feedback. *R I Med J* 2018;101:25–8.
- Michie S, Johnston M, Abraham C, *et al*. Making psychological theory useful for implementing evidence based practice: a consensus approach. *Qual Saf Health Care* 2005;14:26–33.
- Presseau J, Ivers NM, Newham JJ, *et al*. Using a behaviour change techniques taxonomy to identify active ingredients within trials of implementation interventions for diabetes care. *Implement Sci* 2015;10:55.
- Davidoff F, Dixon-Woods M, Leviton L, *et al*. Demystifying theory and its use in improvement. *BMJ Qual Saf* 2015;24:228–38.
- Braun V, Clarke V. *Successful qualitative research. 1. publ*. Los Angeles: SAGE, 2013.
- Long-Term care overview | Ontario.ca. Available: <https://www.ontario.ca/page/about-long-term-care>
- Ontario Ministry of Health and Long-Term Care. *Long-Term care utilization report*. Canada, 2019.
- Government of Ontario. *Long-Term care homes act, 2007, S.O. 2007, c. 8*, 2007.
- Atkins L, Francis J, Islam R, *et al*. A guide to using the theoretical domains framework of behaviour change to investigate implementation problems. *Implement Sci* 2017;12:77.
- Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implement Sci* 2012;7:37.
- Brehaut JC, Colquhoun HL, Eva KW, *et al*. Practice feedback interventions: 15 suggestions for optimizing effectiveness. *Ann Intern Med* 2016;164:435.
- Brown B, Gude WT, Blakeman T, *et al*. Clinical performance feedback intervention theory (CP-FIT): a new theory for designing, implementing, and evaluating feedback in health care based on a systematic review and meta-synthesis of qualitative research. *Implement Sci* 2019;14:40.
- Gale NK, Heath G, Cameron E, *et al*. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol* 2013;13:117.
- Fleming A, Bradley C, Cullinan S, *et al*. Antibiotic prescribing in long-term care facilities: a qualitative, multidisciplinary investigation. *BMJ Open* 2014;4:e6442.
- Desveaux L, Halko R, Marani H, *et al*. Importance of team functioning as a target of quality improvement initiatives in nursing homes: a qualitative process evaluation. *J Contin Educ Health Prof* 2019;39:21–8.
- Crnich CJ, Jump R, Trautner B, *et al*. Optimizing antibiotic stewardship in nursing homes: a narrative review and recommendations for improvement. *Drugs Aging* 2015;32:699–716.
- Boström A-M, Cranley LA, Hutchinson AM, *et al*. Nursing home administrators' perspectives on a study feedback report: a cross sectional survey. *Implement Sci* 2012;7:88.
- The Royal College of Physicians and Surgeons of Canada. *CanMEDS framework*, 2020.
- Agency for Healthcare Research & Quality. *TeamSTEPPS® 2.0 for long-term care*. Rockville, MD: Agency for Health Research and Quality, 2019.
- Agency for Healthcare Research & Quality. *eamSTEPPS 2.0 for long-term care*. Rockville, MD, 2019.
- Buljac-Samardzic M, Doekhie KD, van Wijngaarden JDH. Interventions to improve team effectiveness within health care: a systematic review of the past decade. *Hum Resour Health* 2020;18:2.
- King H, Battles J, Baker D. *TeamSTEPPS™. Team Strategies and Tools to Enhance Performance and Patient Safety. Advances in Patient Safety: New Directions and Alternative Approaches (Vol. 3: Performance and Tools)*. Agency for Healthcare Research and Quality, 2008.
- McMaughan DK, Nwaiwu O, Zhao H, *et al*. Impact of a decision-making aid for suspected urinary tract infections on antibiotic overuse in nursing homes. *BMC Geriatr* 2016;16:81.
- Desveaux L, Saragosa M, Rogers J, *et al*. Improving the appropriateness of antipsychotic prescribing in nursing homes: a mixed-methods process evaluation of an academic detailing intervention. *Implement Sci* 2017;12:71.
- Greenhalgh T, Robert G, Macfarlane F, *et al*. Diffusion of innovations in service organizations: systematic review and recommendations. *Milbank Q* 2004;82:581–629.