Original Article

A recipe for antimicrobial stewardship success: Using intervention mapping to develop a program to reduce antibiotic overuse in long-term care

Andrea Chambers PhD[1], Sam MacFarlane RN[1], Rosemary Zvonar BSc(Pharm)[2], Gerald Evans MD[1,3],
Julia E. Moore PhD[4], Bradley J. Langford PharmD[1,5], Anne Augustin MLT, CIC[1], Sue Cooper MLT, CIC[1],
Jacquelyn Quirk MPH[1], Liz McCreight CIC[6] and Gary Garber MD[1,2,7,8]

[1]Public Health Ontario, Toronto, Ontario, Canada, [2]The Ottawa Hospital and The Ottawa Hospital Research Institute, Ottawa, Ontario, Canada, [3]Department of Medicine, Queens University, Kingston, Ontario, Canada, [4]The Center for Implementation, Toronto, Ontario, Canada, [5]St. Joseph's Health Centre, Toronto, Ontario, Canada, [6]Mount Sinai Hospital, Toronto, Ontario, Canada, [7]Department of Medicine, University of Toronto, Toronto, Ontario, Canada and [8]Department of Medicine, University of Ottawa, Ottawa, Ontario, Canada

Abstract

Objective: To better understand barriers and facilitators that contribute to antibiotic overuse in long-term care and to use this information to inform an evidence and theory-informed program.

Methods: Information on barriers and facilitators associated with the assessment and management of urinary tract infections were identified from a mixed-methods survey and from focus groups with stakeholders working in long-term care. Each barrier or facilitator was mapped to corresponding determinants of behavior change, as described by the theoretical domains framework (TDF). The Rx for Change database was used to identify strategies to address the key determinants of behavior change.

Results: In total, 19 distinct barriers and facilitators were mapped to 8 domains from the TDF: knowledge, skills, environmental context and resources, professional role or identity, beliefs about consequences, social influences, emotions, and reinforcements. The assessment of barriers and facilitators informed the need for a multifaceted approach with the inclusion of strategies (1) to establish buy-in for the changes; (2) to align organizational policies and procedures; (3) to provide education and ongoing coaching support to staff; (4) to provide information and education to residents and families; (5) to establish process surveillance with feedback to staff; and (6) to deliver reminders.

Conclusions: The use of a stepped approach was valuable to ensure that locally relevant barriers and facilitators to practice change were addressed in the development of a regional program to help long-term care facilities minimize antibiotic prescribing for asymptomatic bacteriuria. This stepped approach provides considerable opportunity to advance the design and impact of antimicrobial stewardship programs.

(Received 4 July 2018; accepted 28 September 2018; electronically published 5 November 2018)

Reducing unnecessary antibiotic use is an obvious target for public health intervention. Overuse and inappropriate use of antibiotics have been associated with antibiotic-resistant organisms, increased risk of *Clostridium difficile* infection, and other adverse drug reactions.[1–5] One common target for antimicrobial stewardship programs is the treatment of asymptomatic bacteriuria (ASB), defined as the presence of bacteria in the urine without clinical signs and symptoms of a urinary tract infection (UTI).[7,8] Asymptomatic bacteriuria is common among residents in long-term care facilities (LTCFs),[9] and antibiotics are often prescribed,[6] despite strong evidence demonstrating no clinical benefit to treating ASB with antibiotics and guidelines discouraging this practice.[10]

A number of factors contribute to challenges in diagnosing UTIs in LTCF residents, including communication difficulties and the presence of concurrent illnesses with associated nonspecific symptoms.[11–13] Nonspecific symptoms are often attributed to a UTI and are used to guide treatment decisions,[14] despite recommendations to the contrary.[7,8] In addition, prescribing behaviors do not align with current evidence, and a number of complex factors contribute to the overtreatment of ASB. To support sustainable improvements in prescribing practices, antimicrobial stewardship programs should systematically address these complex factors contributing to the overtreatment of ASB. Although multipronged approaches are commonly employed to address ASB, the inclusion of multiple strategies does not necessarily mean better outcomes if the proposed strategies

Author for correspondence: Andrea Chambers, Public Health Ontario, 480 University Avenue, Suite 300, Toronto, ON, Canada, M5G 1V2. E-mail: Andrea.Chaplin@oahpp.ca

Table 1. Targeted Evidence-Based Practice Recommendations to Minimize Treatment for Asymptomatic Bacteriuria

Practice Recommendation	Description of the Practice Recommendation
Screening for bacteriuria	Discontinue routine urine screening (eg, at admission and annually) unless residents have clinical signs and symptoms[a] of a UTI.[8,10] Accepted clinical signs and symptoms of a UTI are defined as: new difficult or painful urination (acute dysuria) alone or 2 or more of the following: fever, new flank or suprapubic pain, new or increased urinary frequency/urgency, gross hematuria, and acute onset of delirium in residents with advanced dementia.[11,12,19]
Diagnostic tools	Discontinue use of dipsticks to diagnose a UTI. Clinical symptoms of a UTI (defined above) and a positive culture are required for a UTI diagnosis.[8,20]
When to collect a urine sample for culture	Obtain urine cultures only when residents have been determined to have accepted clinical signs and symptoms of a UTI.[8]
How to collect a urine sample	Obtain urine cultures using proper technique to avoid contamination. This includes the use of a clean catch or midstream collection or in/out catheterization and adherence to aseptic technique. Store urine cultures under refrigeration if transport is not immediate.
When to prescribe antibiotics	Prescribe antibiotics only when clinical criteria for UTI are present (as defined above). Review and reassess when urine culture and susceptibility results are received. A bacterial count greater than or equal to 10^8 CFU/L with typical signs or symptoms of a UTI is considered diagnostic.[8] If antibiotics are started empirically, the physician or nurse practitioner should reassess the need for, choice, and duration of antibiotic therapy based on the culture and susceptibility report.

Note. UTI, urinary tract infection. CFU, colony-forming units.
[a]Accepted clinical signs and symptoms of a UTI were based on the Loeb 2005 criteria[19] and additional considerations to reflect challenges in diagnosing residents who have advanced dementia.[11,12]

address similar determinants of behavior change or focus on a common barrier to practice change (eg, knowledge gaps). It is important to understand the mechanisms by which various strategies are intended to influence behavior change.

The theoretical domains framework (TDF), which was developed to examine the factors that influence healthcare professional behaviors when implementing evidence-based practice recommendations, is based on a synthesis of 33 behavior-change theories.[15,16] The TDF includes 14 domains: knowledge, skills, memory, attention and decision processes, behavioral regulation, social or professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, intentions, goals, reinforcement, emotions, environmental context and resources, and social influences.[16] The TDF helps the user categorize known barriers and facilitators to practice change and select implementation strategies.

The Infection Prevention and Control Department at Public Health Ontario set out to develop a program using intervention mapping approaches to assist LTCFs to minimize antibiotic prescribing for asymptomatic bacteriuria, focusing on barriers and facilitators to practice change. This department at Public Health Ontario supports the dissemination and implementation of best practices in infection prevention and control and antimicrobial stewardship across healthcare settings in Ontario. This article describes the data sources and processes used to develop a program to reduce antibiotic overuse in long-term care.

Methods

A multidisciplinary team was established, composed of 2 physicians with specialization in infectious diseases, a pharmacist with specialization in antimicrobial stewardship, infection control specialists with backgrounds in nursing and medical laboratory sciences, and staff with expertise in evaluation, behavioral science, and implementation science.

An intervention mapping approach was used to develop the program drawing on methods that incorporate the TDF.[17] This

stepped approach to developing evidence and theory-informed programs provides a guide to selecting strategies to address known barriers and facilitators to practice change. Several applications of this stepped approach have been described in the literature, with a focus on improving the implementation of clinical practice recommendations.[18] An integrated knowledge translation approach was also incorporated to involve LTCF stakeholders in the program development process.

Identification of barriers and facilitators

Following the selection of the key areas for practice improvement (Table 1), barriers and facilitators to aligning with the practice recommendations were identified from the literature,[14,21–23] and through an online survey. The survey was distributed to 643 infection control practitioners in long-term care in 2014 using a stakeholder relationship management database maintained by Public Health Ontario. Recipients were encouraged to forward the invitation to anyone in their LTCF involved in the prevention, identification, diagnosis, and/or treatment of UTIs. The survey included structured questions about current practices around the assessment and management of UTIs in addition to open-ended questions to obtain additional information on issues and other contextual information that influenced assessment and prescribing practices. This article reports the analysis of excerpts from the open-ended questions related to barriers and facilitators to aligning with best practices to help the project team understand why antibiotics are overprescribed in this setting.

Analysis of barriers and facilitators

We used a descriptive coding process to summarize information from relevant excerpts in the online survey using descriptive codes and an open and inductive coding process. Three members of the team reviewed, discussed, and mapped each barrier or facilitator statement to the TDF.[24,25] Some of the barrier and facilitator statements were mapped to >1 domain. The team also indicated whether each barrier or facilitator statement was related

to an organizational, healthcare provider, or resident/family level to better target the selection of strategies. The mapping process was reviewed by an external implementation scientist (J.M.) for additional validation.

Selection of program strategies

The Rx for Change database was used as a source of information on implementation strategies.[26] This database, developed by the Canadian Agency for Drugs and Technologies in Health, summarizes evidence-based implementation strategies designed to improve drug prescribing practices and is based on the Cochrane Effective Practice and Organization of Care (EPOC) taxonomy of implementation strategies.[27,28] Strategies regarding the use of the Rx for Change database were reviewed in the context of relevance to the desired barriers/facilitators and the feasibility of implementation by LTCFs. Strategies were excluded if they could not be delivered by LTCFs, including financial or regulatory strategies, as well as those requiring external personnel (eg, educational outreach visits). Each implementation strategy was then mapped to relevant determinants from the TDF, with external review (conducted by J.M.) for validation.

Stakeholder consultation

An integrated knowledge translation approach informed 2 stages of program development: (1) validating and contributing additional information on barriers and facilitators and (2) assisting in further development of the program implementation strategies and resources. Staff from 2 LTCFs that had previously expressed interest in making improvements in the overuse of antibiotics participated in 3 separate meetings followed by a focus group. Staff from a large corporate LTCF included a nurse practitioner, the director of care, the infection control lead, a physician, and a registered practical nurse. Staff from a small privately owned LTCF included the director of care, 2 registered nurses, and a staff member responsible for the coordination of data reporting and quality improvement initiatives.

Field notes were used to document the discussions and were uploaded into NVivo 9, a qualitative data management and analysis software (QSR International, Melbourme, Australia). A descriptive coding process was used to summarize contextual information that could be used to better understand the challenges associated with aligning with current practice recommendations in addition to perspectives on the acceptability and implementability of the recommended strategies.

Results

Identification of barriers and facilitators

In total, 381 responses were captured from the online survey representing multiple different positions in the LTCF: administrators and directors or associate directors of care (50%); registered nurses and registered practical nurses (12.3%); nurse practitioners, physicians and medical directors (3.7%); infection control practitioners (15.2%) (although other roles included infection control responsibilities); and other (18.4%). Moreover, 64 unique excerpts referring specifically to barriers or facilitators to aligning with best practice for the management of UTIs were captured in open-text comments. The most predominant theme (41% of the excerpts) centered around the role of families in influencing decisions to prescribe antibiotics in the absence of clinical signs and symptoms of a UTI. For example, comments included remarks such as "doctors feel their hands are tied as families demand to have loved ones on antibiotics" and "in long-term care, families often push hard for testing and treatment." Several comments also referred to specific knowledge gaps and the value of additional resources to guide the assessment and management of UTIs. In addition to gaps in awareness and resources, several comments also referred to practices that contribute to the contamination of urine specimens, including improper urine collection and storage.

An important observation made by stakeholders was how LTCFs may be receiving conflicting advice across external programs and services. One perception was that current best practice for assessing changes in cognition or behavior in residents involve ruling out a UTI, which prompts the collection of a urine specimen in the absence of urinary symptoms. Ongoing practices that reinforce the treatment of ASB were also highlighted, including the labeling of residents as having "recurrent UTIs" and conflicting practices of other health services. Another observation was that it is common for residents who are sent to the emergency department for assessment to return with a prescription for antibiotics for a UTI. As one respondent stated, "Everyone sent to emergency for whatever reason comes back with a recommendation for antibiotics." The comments also captured staff concerns about not treating nonspecific symptoms, including fears that an infection will develop or be missed. For example, one respondent commented, "… the condition in elderly deteriorates really fast if treatment is delayed." Other comments stressed the importance of focusing on establishing buy-in or acceptance among certain healthcare workers on current practice recommendations and of considering the need for culture change within facilities.

During the meetings with the 2 LTCF staff members, all barriers and facilitators listed were found to be relevant and additional insights were captured. For example, one physician noted that not only families but also healthcare staff influence physicians to prescribe antibiotics. A complete list of the identified barriers and facilitators to following best-practice recommendations to minimize treatment of ASB in LTCFs can be found in Table 2. Table 2 also includes results from the process of mapping each barrier or facilitator to the domains from the TDF. Of the 14 domains, the mapping process identified 8 factors relevant to practice change. This process demonstrated that strategies to support practice change should address the following domains: knowledge, skills, environmental context and resources, social or professional role or identity, social influences, beliefs about consequences, emotions, and reinforcement.

Selection of strategies

In total, 9 implementation strategies were selected to address the identified barriers and facilitators: 7 strategies were informed by the Rx for Change database and 2 additional implementation strategies, 'coaching' and 'champions,' were added to address outstanding barriers. Coaching was added for LTCFs to address challenges in reaching all staff when delivering formal education sessions to provide reassurance and support for more difficult cases (eg, residents with communication difficulties), and to monitor practice improvements. Champions were added to encourage LTCFs to select an individual dedicated to leading the overall implementation of the program and who could strengthen buy-in and overcome challenges as they emerge.

Table 2. Results of Mapping of Barriers/Facilitators to the Theoretical Domains Framework

Theoretical Domains Framework (TDF)	Barriers and Facilitators to Practice Change

Knowledge
(an awareness of the existence of something)
	Antibiotic overuse:
	• Awareness among residents, families and healthcare workers of asymptomatic bacteriuria (ASB) and that antibiotics are overused for this indication.
	• Awareness among residents, families and healthcare workers of the risks and consequences of unnecessary use/overuse of antibiotics.
	
	Assessment of UTIs:
	• Knowledge among healthcare workers regarding:
	  ○ Clinically relevant signs and symptoms of a urinary tract infection (UTI)
	  ○ When to collect the urine culture
	  ○ Use and interpretation of dipstick, urinalysis and culture results
	  ○ How to manage cases where residents have communication difficulties and nonspecific symptoms
	  ○ What contributes to the contamination of urine specimens.

Skills (an ability or proficiency acquired through practice)	Urine specimen collection and analysis: • Skills associated with the collection of a proper urine specimen. UTI surveillance: • Skills to support a UTI surveillance system, including data collection, management and analysis.
Environmental context and resources (any circumstance of a person's situation or environment that discourages or encourages the development of skills and ability, independence, social competence and adaptive behavior)	Communication: • The need to improve communication amongst the care team (verbal and/or documented) on resident symptoms. Organizational culture: • The existing organizational culture has supported nursing staff in sending urine cultures for testing even when a resident does not have indicated clinical signs and symptoms of a UTI. Process and procedures: • Absence of policies and procedures on recommended practices or not aligned with current best practices • Urine specimens left at room temperature, which can result in false positives • Absence of information on the need for change (extent to which practice is misaligned) because data is not routinely collected Resources: • Staff do not have access to adequate supports to provide education to residents/families. • Lack of resources to guide UTI assessment and management practices External services and programs: • Alignment of practice recommendations with other programs is an important facilitator. A perception that existing approaches to examine behavioral changes in residents involve ruling out a UTI prompts the collect of a urine specimens in the absence of indicated clinical signs and symptoms of a UTI.
Social/professional role and identity (A coherent set of behaviours and displayed personal qualities of an individual in a social work setting.)	Role clarity: • Lack of clarity about the roles and responsibilities of the care team around the assessment and management of UTIs Acceptance: • Lack of acceptance by front line nursing, nurse practitioners, or physician for the practice changes
Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors.)	Family pressure: • Families influence decisions to prescribe antibiotics in the absence of indicated clinical signs and symptoms of a UTI.
Beliefs about consequences (Acceptance of the truth, reality, or validly about outcomes of a behavior in a given situation.) **Emotions** (A complex reaction pattern, involving experiential, behavioral, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)	Concerns about outcomes: • Concerns about the consequences of not providing antibiotics to residents with nonspecific symptoms or asymptomatic bacteriuria including fears that an infection will develop or be missed
Reinforcement	
(Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)	Reinforcing current practice: • Some residents are labelled as having "recurrent UTIs." When there is a change in the residents' behavior or urine characteristics, it is assumed they have a UTI based on this label. • It is common to see urine specimens being collected for culture and susceptibility in the absence of clinical signs and symptoms of a UTI. Because of the high incidence of ASB, elevated levels of bacteria in the urine are often detected. Due to the persistent belief that antibiotics are required to treat ASB, positive urine culture results can continue to reinforce the practice of collecting urine in the absence of clinical signs and symptoms of a UTI. • Conflicting practices of other organizations can reinforce poor practice. A common barrier described by LTCFs to not treating ASB occurs when residents are sent to the emergency department for assessment and return with a prescription for antibiotics for a UTI in the absence of specific signs and symptoms of a UTI.

The LTCF staff that were consulted provided insight on how the strategies could be designed and delivered. For example, they emphasized that the program should allow for different formats for education, such as shorter sessions or huddles to accommodate time constraints, to reach more staff. The LTCF staff members felt that all proposed strategies would be appropriate and feasible to execute. The 2 LTCFs also provided feedback including proposed changes to resources developed to support each implementation strategy.

Table 3 summarizes the implementation strategies (with definitions) selected for the program, the target audience, the timing of delivery, and the applicable resources developed by Public Health Ontario to support the strategy. A program implementation guide was developed to support LTCFs in tailoring and implementing the program within their facility.[29]

Discussion

A systematic and stepped approach was used to develop a new provincial program to help LTCFs identify symptomatic UTIs and minimize the treatment of ASB. A description of the results

Table 3. Description of Implementation Strategies for the UTI Program

Implementation Strategy	Description	Target Audience/Details on Delivery	Rationale and Benefits
Organizational policies & procedures	Align policies and procedures with the 5 practice recommendations	Target audience: Staff involved in the assessment and management of UTIs When/How often: At program initiation Applicable PHO resources: Guidance and sample policy for the assessment and management of UTIs	• Ensures that LTCF policies and procedures align with recommended practice changes • Eliminates outdated practices • Helps address barriers around role clarity • Establishes documentation processes for resident symptoms • Demonstrates an organizational commitment to support practice changes • Supports frontline staff communicate the new practice changes • Supports a sustained commitment to best practice when new staff are brought into the organization
Champions	Select staff members who will dedicate themselves to supporting and facilitating practice change implementation; help overcome resistance and engaging other staff to strengthen buy-in	Target audience: Administrative staff (eg, director of care) and staff involved in the assessment and management of UTIs When/How often: Ongoing Applicable PHO resources: Assessment algorithm for UTI in medically stable non-catheterized residents, fact sheets	• Individual dedicated to help staff overcome challenges and resistance to practice changes related to concerns about the consequences of not providing antibiotics • Supports improvements to communication practices • Supports new policies and procedures • Helps establish a supportive organizational culture • Ensures practice changes are sustained following educational sessions, including updating new staff that are brought into the organization
Local opinion leaders	Individuals perceived to have influence within the facility (eg, physicians, nurse practitioners); involve leaders in supporting practice change	Target audience: Administrative staff and frontline staff When/How often: Ongoing Applicable PHO resources: Local opinion leaders have access to a range of program resources (eg, Assessment algorithm for UTIs in medically stable noncatheterized residents, fact sheets, and Frequently Asked Questions resource).	• Dedicated role that can help establish buy-in to the practice changes amongst staff in the organization • Supports new processes such as defining who is responsible for the assessment of symptoms • Helps establish a supportive organizational culture for the practice changes • Provides a trusted source of leadership to help others overcome concerns about the consequences of not providing antibiotics and manage concerns related to ongoing pressures to prescribe antibiotics in the absence of accepted signs and symptoms of a UTI.
Local consensus processes	Identifying opportunities (eg, meetings, events) to discuss the problem and practice changes with staff to ensure agreement	Target audience: Administrative staff and staff providing care to residents in the assessment and management of UTIs When/How often: Ad hoc (eg, aligned with existing staff meetings) Applicable PHO resources: Program educational resources (eg, assessment algorithm for UTIs in medically stable noncatheterized residents, fact sheets, and Frequently Asked Questions resource) can be used to support consensus processes.	• Provides opportunities to increase staff knowledge on the problem, best practices (can involve staff who are missed by classroom education), and new procedures • Address beliefs and concerns about the consequences of not providing antibiotics to residents with nonspecific symptoms • Reviews practices that may be contributing to the overuse of antibiotics for ASB • Helps establish a supportive organizational culture for practice changes and secures buy-in to the practice recommendations

Table 3. (Continued)

Implementation Strategy	Description	Target Audience/Details on Delivery	Rationale and Benefits
Classroom education	Delivering education about the issues of treating ASB and desired practice changes.	Target audience: Education would serve frontline staff (eg, personal support workers, nursing staff) When/How often: Delivered once at program initiation Applicable PHO resources: LTCF staff deliver their own education with resource support (ie, assessment algorithm for UTIs in medically stable noncatheterized residents, fact sheets, literature summary resources, Frequently Asked Questions resource, and PowerPoint slides).	Provides dedicated time to increase staff knowledge on the problem and best practices • Helps to secure buy-in to the practice recommendations • Supports staff skill in the proper collection of urine specimens • Increases awareness of new policies and procedures including documentation and communication of resident symptoms and roles and responsibilities • Addresses beliefs and concerns about the consequences of not providing antibiotics to residents with nonspecific symptoms • Reviews practices that may be contributing to the overuse of urinary antibiotics
Providing information and education to families	Distributing resources and providing education to families and residents (eg, family council)	Target audience: LTCF residents and families When/How often: Includes formal sessions on an ad-hoc basis (aligned with existing family council meetings) and as opportunities arise to educate and share resources with families. Applicable PHO resources: Frequently Asked Questions for residents and families, resident and family communication form, and communication for family newsletter	• Addresses family pressures to prescribe antibiotics despite the absence of accepted signs and symptoms of a UTI • Supports opportunities to increase knowledge on the problem, best practices and organizational policies and procedures • Addresses beliefs and concerns about the consequences of not providing antibiotics to residents with nonspecific symptoms and emphasizes ongoing monitoring of the resident and the risks of unnecessary antibiotics
Coaching	Selecting front-line staff to provide one-on-one education, feedback and support to peers	Target audience: All frontline staff within the LTCF When/How often: Ongoing Resources: Coaching for beliefs and consequences resource, assessment algorithm for UTIs in medically stable noncatheterized residents, fact sheets, and Frequently Asked Questions resource	• Supports opportunities to reinforce education on the problem, best practices (can involve staff who are missed by classroom education), and any new procedures • Helps others address beliefs and concerns about the consequences of not providing antibiotics to residents with nonspecific symptoms • Helps secure buy-in to the practice recommendations • Aids the monitoring of adherence to best practices • Helps establish a supportive organizational culture for the practice changes
Process surveillance	A process that involves documenting resident symptoms, whether a urine specimen was collected, and whether antibiotics were prescribed; reviewing the data for alignment with practice changes; and providing feedback to staff on opportunities for improvement	Target audience: Staff providing care to residents in the assessment and management of UTIs When/How often: Monitoring practice and providing feedback should be done regularly during program initiation. Improvements to overall documentation of symptoms and communication is an ongoing process. Applicable PHO resources: Process surveillance form	• Supports improved communication amongst the care team regarding resident symptoms and helps support UTI surveillance activities • Can be used to monitor and make ongoing improvements to practice changes
Distributing educational resources as reminders	Redistribution and posting of program resources (eg, "when to collect a urine specimens" fact sheet) to remind staff about practice changes	Target audience: Staff providing care to residents in the assessment and management of UTIs When/How often: Ad-hoc when reminders needed Applicable PHO resources: A number of PHO program resources can be used as reminders to support practice change, eg, "when to collect a urine specimen," assessment algorithm for UTIs in medically stable noncatheterized residents, Frequently Asked Questions, and fact sheets	• Provides an additional opportunity to increase staff knowledge and/or remind staff on best practices, addressing beliefs about the consequences of not providing antibiotics to residents with nonspecific symptoms, and reminding staff about new policies and procedures for documenting and communicating resident symptoms

Note. LTCF, long-term care facility; PHO, physician hospital organization; ASB, asymptomatic bacteriuria; UTI, urinary tract infection.

from the first evaluation of this program demonstrate promising results in reducing antibiotic use in LTCFs.[30] Programs are more likely to influence practice if they target underlying barriers to change.[31] The intervention mapping approach described has practical implications for guiding implementation of the program because it produces a clear rationale for why each strategy is important (ie, what specific barriers are being addressed), which can help LTCFs decide how to prioritize the implementation of the recommended strategies.

The project team was able to consult with a specialist that delivers training on the use of knowledge translation approaches, including implementation process models and frameworks. However, most of the work was conducted by project team members without previous experience with these approaches. Several accessible resources were available to guide this work that could support other teams follow a similar process.[17,32]

Existing reviews describing studies of interventions that aim to reduce antibiotic prescribing for ASB have documented evidence of practice change[31]; however, the average effect sizes are underwhelming considering the magnitude of inappropriate prescribing of antibiotics in long-term care.[6] Different approaches are needed to develop more impactful, sustainable antimicrobial stewardship programs. Programs have also targeted a narrow range of barriers and have placed a strong focus on addressing knowledge barriers.[33] However, studies that have explored barriers to practice change around antibiotic prescribing practices have demonstrated that the issue is complex and requires a multifaceted approach to address a broader range of behavioral constructs to support change (eg, beliefs, emotions, reinforcement, environmental context and resources).[14,21–23] Providing education and resources alone is often insufficient to support sustainable practice change. This report of a cross-sectional survey plus focus groups contributes to the literature that has focused on understanding the root causes of overprescribing antibiotics in long-term care.

In reflecting on the steps used to develop this program and lessons learned, a few limitations should be considered during future pilot studies and iterations of the program. The program missed the opportunity to interact more directly with residents and families to inform a better understanding of their concerns around the management of UTIs and the types of support and resources they would have found valuable. A stakeholder survey was foundational for identifying several barriers and facilitators to practice change in this area; however, findings from this survey might not have been representative of challenges faced across all LTCFs interested in this program. A comprehensive evaluation plan that supports multiple iterations of this program can provide guidance on how it can be implemented in long-term care, what impact it can have, and how it can be improved to support LTCFs across the province that have identified a need to improve practice in this area.

In conclusion, a number of important barriers relate to the overtreatment of ASB in LTCFs: gaps in knowledge and skills, lack of resources to guide decision making, poor documentation and communication of symptoms, absence of clear policies and procedures, lack of acceptance of best practice recommendations, fears that an infection will be missed, and a number of common practices that are reinforcing ongoing treatment of ASB. An intervention mapping approach using the TDF can be useful to identify multimodal approaches tailored to the population to advance the design and impact of antimicrobial stewardship initiatives.

References

1. 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;175:1331–1339.
2. Nicolle LE, Bentley DW, Garibaldi R, Neuhaus EG, Smith PW. Antimicrobial use in long-term-care facilities. SHEA Long-Term-Care Committee. *Infect Control Hosp Epidemiol* 2000;21:537–545.
3. Shehab N, Patel PR, Srinivasan A, Budnitz DS. Emergency department visits for antibiotic-associated adverse events. *Clin Infect Dis* 2008;47:735–743.
4. Rotjanapan P, Dosa D, Thomas KS. Potentially inappropriate treatment of urinary tract infections in two Rhode Island nursing homes. *Arch Intern Med* 2011;171:438–443.
5. Daneman N, Gruneir A, Bronskill SE, et al. Prolonged antibiotic treatment in long-term care: role of the prescriber. *JAMA Intern Med* 2013;173:673–682.
6. Flokas ME, Andreatos N, Alevizakos M, Kalbasi A, Onur P, Mylonakis E. Inappropriate management of asymptomatic patients with positive urine cultures: a systematic review and meta-analysis. *Open Forum Infect Dis.* 2017. doi: 10.1093/ofid/ofx207.
7. Smith PW, Bennett G, Bradley S, et al. SHEA/APIC guideline: Infection prevention and control in the long-term care facility. *Am J Infect Control* 2008;36:504–535.
8. Nicolle LE, Bradley S, Colgan R, et al. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. *Clin Infect Dis* 2005;40:643–654.
9. Nicolle LE. Asymptomatic bacteriuria in the elderly. *Infect Dis Clin North Am* 1997;11:647–662.
10. Zalmanovici Trestioreanu A, Lador A, Sauerbrun-Cutler M, Leibovici L. Antibiotics for asymptomatic bacteriuria. *Cochrane Database Syst Rev* 2015;4:009534.
11. Nace DA, Drinka PJ, Crnich CJ. Clinical uncertainties in the approach to long-term care residents with possible urinary tract infection. *J Am Med Dir Assoc* 2014;15:133–139.
12. D'Agata E, Loeb MB, Mitchell SL. Challenges in assessing nursing home residents with advanced dementia for suspected urinary tract infections. *J Am Geriatr Soc* 2013;61:62–66.
13. Nicolle LE, SHEA Long-Term-Care-Committee. Urinary tract infections in long-term care facilities. *Infect Control Hosp Epidemiol* 2001;22:167–175.
14. Walker S, McGeer A, Simor AE, Armstrong-Evans M, Loeb M. Why are antibiotics prescribed for asymptomatic bacteriuria in institutionalized elderly people? A qualitative study of physicians' and nurses' perceptions. *CMAJ* 2000;163:273–277.
15. 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.
16. 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.
17. French SD, Green SE, O'Connor DA, et al. Developing theory-informed behaviour change interventions to implement evidence into practice: A systematic approach using the theoretical domains framework. *Implement Sci* 2012;7:38.
18. Phillips CJ, Marshall AP, Chaves NJ, et al. Experiences of using the theoretical domains framework across diverse clinical environments: a qualitative study. *J Multidiscip Healthc* 2015;8:139–146.

19. Loeb M, Brazil K, Lohfeld L, *et al.* Effect of a multifaceted intervention on number of antimicrobial prescriptions for suspected urinary tract infections in residents of nursing homes: cluster randomised controlled trial. *BMJ* 2005;331:669.

20. Beveridge LA, Davey PG, Phillips G, McMurdo ME. Optimal management of urinary tract infections in older people. *Clin Interv Aging* 2011;6:173–180.

21. Lohfeld L, Loeb M, Brazil K. Evidence-based clinical pathways to manage urinary tract infections in long-term care facilities: a qualitative case study describing administrator and nursing staff views. *J Am Med Dir Assoc* 2007;8:477–484.

22. Schweizer AK, Hughes CM, Macauley DC, O'Neill C. Managing urinary tract infections in nursing homes: a qualitative assessment. *Pharm World Sci* 2005;27:159–165.

23. van Buul LW, van der Steen JT, Doncker SM, *et al.* Factors influencing antibiotic prescribing in long-term care facilities: a qualitative in-depth study. *BMC Geriatr* 2014;14:136.

24. Michie S, Atkins L, West R. *The behaviour change wheel book: a guide to designing interventions*. London: Silverback; 2014.

25. Moore JE, Mascarenhas A, Marquez C, *et al.* Mapping barriers and intervention activities to behaviour change theory for Mobilization of Vulnerable Elders in Ontario (MOVE ON), a multi-site implementation intervention in acute care hospitals. *Implement Sci* 2014;9:160.

26. Weir MC, Ryan R, Mayhew A, *et al.* The Rx for Change database: a first-in-class tool for optimal prescribing and medicines use. *Implement Sci* 2010;5:89.

27. Effective Practice and Organisation of Care (EPOC). EPOC Taxonomy. https://epoc.cochrane.org/epoc-taxonomy. Published 2015. Accessed June 26, 2018.

28. Rx for Change. Canadian Agency for Drugs and Technologies in Health website. https://www.cadth.ca/rx-change. Published 2011. Accessed June 26, 2018.

29. About: Urinary tract infection (UTI) program. Public Health Ontario website. https://www.publichealthontario.ca/en/BrowseByTopic/IPAC/Pages/UTI.aspx. Published 2018. Accessed May 25, 2018.

30. Brown KA, Chambers A, Quirk J, Langford B, Leung V, MacFarlane S, Bedkowski H, Schartz K. Impact of Public Health Ontario's urinary tract infection program on the use of antibiotics in long-term care: an antimicrobial stewardship intervention. Association of Medical Microbiogy and Infectious Disease Canada. May 5, 2018. Vancouver, BC. Abstract 0163.

31. Michie S, Johnston M, Francis J, Hardeman W, Ecceles M. From theory to intervention: Mapping theoretically driven behavioural determinants to behaviour change techniques. *Apply Psychol* 2008;57:660–680.

32. Michie S, Atkins L, West R. *The Behaviour Change Wheel: A Guide to Designing Interventions*. London: Silverback; 2014.

33. Nicolle LE. Antimicrobial stewardship in long term care facilities: what is effective? *Antimicrob Resist Infect Control* 2014;3. doi: 10.1186/2047-2994-3-6.

34. McElligott M, Welham G, Pop-Vicas A, Taylor L, Crnich CJ. Antibiotic stewardship in nursing facilities. *Infect Dis Clin N Am* 2017;31:619–638.