Program Evaluation of Implementation Science Outcomes From an Intervention to Improve Compliance With Chlorhexidine Gluconate Bathing

A Qualitative Study

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Background and Objectives: Evaluation of implementation science research is warranted to better understand and determine the success of translating evidence-based infection prevention practices at the bedside. The purpose of this program evaluation was to evaluate implementation outcomes from the perspectives of nurses and nursing leaders regarding a previously conducted chlorhexidine gluconate (CHG) bathing implementation science study among 14 critical care units.

Methods: Focus groups and interviews, using semistructured interview questions, were conducted to examine the perceptions of nurses who participated in a CHG bathing implementation science study. A deductive qualitative analysis using Proctor and colleagues' implementation outcomes framework was used. Transcripts were analyzed and categorized using the framework as a predetermined code list to structure the implementation outcomes of acceptability, appropriateness, adoption, feasibility, and sustainability.

Findings: A total of 19 nurses and nurse leaders participated in a focus group or interview. Participants noted that both implementation strategies used in the initial study (educational outreach and audit and feedback) were acceptable and appropriate and expressed that the evidence-based CHG bathing practice was feasible to integrate into practice and was being adopted.

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Discussion: The program evaluation identified strengths and opportunities for improvement related to the implementation strategies and evidence-based CHG bathing protocol. Findings can inform future studies that seek to implement CHG bathing protocols in the critical care setting using audit and feedback and educational outreach strategies.

Keywords: Central-line associated bloodstream infections, Chlorhexidine gluconate bathing, Critical care units, Evidence-based practice, Implementation science, Program evaluation

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Central line–associated bloodstream infections (CLABSIs) are a serious, preventable health care–associated infection that can increase morbidity and mortality rates, unnecessary antibiotic usage, hospital length of stay, and health care costs.[1-3] Patients that are critically ill, such as those admitted to the intensive care unit (ICU), are at higher risk for CLABSIs due to the use of invasive central venous access devices and high acuity.[4] As CLABSIs are preventable patient harm, they are a major quality focus among health care systems.[1] There are many evidence-based practices that can decrease a patient's risk of CLABSI, such as the Institute for Healthcare Improvement's CLABSI prevention insertion and maintenance bundles.[5] One effective CLABSI prevention practice is the use of 2% prepackaged chlorhexidine gluconate (CHG) cloths for daily patient bathing in the ICU setting.[6-8]

In 2013, the Agency for Healthcare Research and Quality published a protocol for the appropriate process of completing a CHG bath, including bathing from the patient's jawline to toes, cleaning over transparent central line dressings and 6 inches of the line, and around the perineal area and down 6 inches of indwelling urinary catheter tubing, if present.[9] Although CHG bathing is well supported in the literature to significantly reduce the risk of CLABSI in the ICU setting, there was poor adoption of the practice per the Agency for Healthcare Research and Quality protocol at 2 large health systems in the Southeastern United States.[10] The benefits of daily CHG bathing cannot accrue unless there is an effective implementation of the protocol.

In health care, there is a gap between best practices found in the literature and their incorporation into daily practice, mainly because of a lack of implementation programs and evidence-based strategies.[11] There is a dearth of evidence on implementation studies showing how to successfully implement CHG bathing in the ICU setting, underscoring the need for further implementation science research. The field of implementation science is growing, and several models and frameworks have been developed to help understand and evaluate the translation of evidence into practice. Process models provide guidance on the implementation process, helping to facilitate evidence into practice. Evaluation frameworks, on the other hand, measure implementation outcomes, which help provide a structure for assessing the implementation's success.[12] According to Garcia-Cardenas and colleagues,[11(p615)] "Implementation outcomes enable empirical assessment of the success of strategies used to implement new interventions or services and to compare their effectiveness. This allows optimization of the service benefits, stimulates dissemination of findings into other settings, and promulgates sustainability." Many implementation science studies assess implementation success solely using clinical outcomes data and fail to measure implementation outcomes — or the success of strategies and methods used during an implementation science study.[11,13,14]

AIMS

This article describes part of a larger study that used a stepped-wedge cluster randomized design to evaluate the effectiveness of a CHG bathing implementation program that used 2 implementation strategies (audit and feedback and educational outreach visits) (see Table 1 for a detailed description of the strategies). The full study methods and clinical outcomes data have been reported previously.[10] The purpose of this study was to conduct a program evaluation of the CHG bathing implementation science study to understand nurses' and nurse leaders' perceptions of the success of the strategies and methods used during the initial implementation science study. Implementation outcomes, as defined by Proctor and colleagues,[15] served as a guide for the study (Table 2). The specific aims are as follows:

- To evaluate the implementation strategies (audit and feedback and educational outreach visits) regarding the implementation outcomes of *acceptability* and *appropriateness*

TABLE 1 Description of Implementation Strategies Used in the Initial CHG Bathing Implementation Science Study

Implementation Strategy	Description
Educational outreach visits	• Infection prevention experts completed brief in-service sessions with nursing staff to review the following: ○ Importance of CHG bathing ○ AHRQ protocol for the correct way to bathe patients ○ Answer any staff questions • Scripts were developed to ensure consistent messaging between team members • Sessions were presented separately and lasted approximately 5 to 15 min
Audit and feedback	• Documentation and process compliance audits were completed throughout the study ○ Documentation audits were completed by 2 study team members ○ Process compliance audits were completed by unit-based CLABSI champions • During the active intervention phase, units received weekly feedback on their documentation and process compliance measures via email and flyers posted on the unit • Each piece of feedback included the following: ○ A run chart showing the unit's progress over time ○ A "Kudos" section that acknowledged staff members who had provided a CHG bath appropriately

Abbreviations: AHRQ, Agency for Healthcare Research & Quality; CHG, chlorhexidine gluconate; CLABSI, central line–associated bloodstream infection.

- To evaluate the evidence-based CHG bathing protocol regarding the implementation outcomes of *acceptability*, *appropriateness*, *adoption*, *feasibility*, and *sustainability*
- To identify barriers and facilitators to using the CHG bathing protocol in practice

METHODS

Implementation Evaluation Framework

Proctor and colleagues[15] recommended measuring *implementation outcomes* following an implementation science study; these outcomes serve as indicators of the success of the implementation.[15] Distinct from process and outcome measures, *implementation outcomes* evaluate how well the study design and methodology support the effectiveness of implementation strategies used during a study. These outcomes improve understanding of the implementation processes used and can inform future implementation science research. As noted by Garner and colleagues,[16] implementation outcomes help researchers understand why interventions are effective (or not effective). Without measuring implementation outcomes, if an intervention is found ineffective, it is difficult to know if this is due to limitations of the intervention or if the intervention was not implemented well.[16]

Implementation Evaluation Methods

A program evaluation was conducted to assess the implementation outcomes from the CHG bathing implementation science study using qualitative methods. According to Arseven and Arseven,[17] program evaluation is a complex process, which requires detailed, in-depth data that can only be obtained by means of qualitative methods. As such, focus groups and interviews were conducted in August and September 2020, 1 year following the initial implementation science study. Two PhD-prepared authors with previous qualitative experience conducted the focus groups and interviews (S.R., P.W.). The first author (S.R.)

TABLE 2 Definition of Implementation Outcomes

Implementation Outcome	Definition
Acceptability	The perception that the implementation strategy (audit and feedback, educational outreach visits) or evidence-based practice (CHG bathing protocol) is suitable or satisfactory
Appropriateness	The perceived fit or value of the strategy (audit and feedback, educational outreach visits) or practice (CHG bathing protocol)
Adoption	The intention of stakeholders to use the evidence-based practice (CHG bathing protocol)
Feasibility	The extent to which the new practice (CHG bathing protocol) can be successfully performed in a specific setting
Sustainability	The extent to which a new practice (CHG bathing protocol) is maintained within a particular setting

Abbreviation: CHG, chlorhexidine gluconate.

served as an infection prevention clinical nurse specialist and the second author (P.W.) served as a director of nursing research. Both authors were part of the research team for the initial implementation science study, and the participants were familiar with them. Infection prevention champions who assisted with data collection for the implementation science study, as well as nursing leaders (managers and clinical team leads) from the 14 participating units, were invited via email to participate in the focus groups. Focus groups were scheduled in large hospital conference rooms on various days and times. Only the researcher and participants were present. Focus groups were audio-recorded and transcribed verbatim; no identifying information was included. Semistructured questions were developed using implementation outcomes identified by Proctor et al[15] as a guide (Table 3). This study was approved by the institutional review board as exempt (Pro00101819).

Analysis

For this descriptive, deductive qualitative analysis, a predetermined code list from Proctor and colleagues' implementation outcomes framework guided qualitative analysis.[15] In deductive qualitative analysis, also known as *direct content analysis*,[18] categories or codes are determined a priori on the basis of existing theoretical frameworks or knowledge before line-by-line review of the data are completed; data are then matched to these predetermined categories. This type of analysis is selected and used when concepts are already known in the literature.[19,20] Consistent with recommendations from Miles and Huberman,[21] we used a deductive coding approach, with predetermined codes derived from the implementation outcomes framework. During the analysis, we mapped the qualitative data to the following codes deductively: *acceptability*, *appropriateness*, *adoption*, *feasibility*, and *sustainability*.[21]

In qualitative research, it is important to establish the trustworthiness of the data; this was completed using the criteria of credibility, reliability, and confirmability.[22,23] Credibility was established through data saturation and the detailed analysis of the qualitative transcripts; field notes were also made during the focus group sessions. Using the implementation outcomes framework as a guide, the investigator completed a comprehensive review of the transcripts. The predetermined codes were confirmed through an audit trail of 2 experts in qualitative research analysis and 4 clinical experts. Using an audit trail method from previous studies,[21,22] audit trail participants were asked to rate how well each quote supported the overall code using a 4-point Likert scale (1, not at all representative; 4, very representative). For each quote, an average rating was calculated; included in the Findings section are the quotes with the highest rating for each predetermined code. Participation in the qualitative study was voluntary, and we received widely varied perceptions and ideas from participants, which helped to establish the confirmability of the data.[22,23] NVivo qualitative software was used to manage the data.

FINDINGS

Sample

Sixty-one individuals were invited to participate in the focus groups, with a total of 19 individuals participating (31% participation rate). Because of scheduling conflicts

TABLE 3 Semistructured Interview Questions (Derived From Proctor et al[15])

Implementation strategies:
1. Acceptability:
   a. What did you or your unit's staff like/dislike about the audit and feedback strategy?
   b. What did you or your unit's staff like/dislike about the educational outreach visits strategy?
2. Appropriateness:
   a. Do you feel that staff found the audit and feedback strategy valuable and appropriate? Why?
   b. Do you feel that staff found the educational outreach visits strategy valuable and appropriate? Why?
   c. What suggestions do you have for improving these strategies?

CHG bathing protocol:
1. Acceptability: How acceptable do you feel nursing staff find the CHG bathing protocol?
2. Appropriateness: Do you feel nursing staff were convinced that CHG bathing is an appropriate intervention to reduce CLASBIs? Why?
3. Adoption: How well do you think nursing staff on your unit *intentionally* decided to adopt the CHG bathing protocol?
4. Feasibility:
   a. How feasible do you think it is for nursing staff to administer the CHG bathing protocol daily to every patient?
   b. Do you think this practice is something that is compromised by adequate resources or training requirements? Why or why not?
5. Sustainability: Going forward, what do you think needs to be done to sustain or strengthen this practice?
6. What are your main barriers or concerns related to CHG bathing?

Abbreviations: CHG, chlorhexidine gluconate; CLABSI, central line–associated bloodstream infection.

and the ongoing COVID-19 pandemic, some scheduled focus group sessions only had 1 participant in attendance (n = 2), or participants (n = 6) requested that individual interviews with the researcher be scheduled via videoconference on a day and time convenient to them. Three focus group sessions occurred with 2, 3, and 6 participants in attendance. Of the 14 units included in the study, there were participants from 11 units (7 of 8 from the academic hospital and 4 of 6 from the community hospital). All individuals participated in only 1 focus group or interview. Nine of the participants were infection prevention champions, and 10 were nurse leaders. All participants were white and non-Hispanic, and most were female (89%, n = 17). The mean age of participants was 43.2 years (SD, 11.5), with an average of 9.7 years (SD, 10.7) of experience in their current roles. Each focus group or interview lasted approximately 25 minutes (range, 15-45 minutes), and following completion, data saturation was achieved.[24]

Implementation Strategies

Focus group and interviews were conducted to evaluate implementation outcomes as outlined by Proctor and colleagues.[15] Implementation outcomes of *acceptability* and *appropriateness* focused specifically on the implementation strategies used during the study (audit and feedback, educational outreach visits). Overall, participants found both strategies to be very *acceptable* (ie, how palatable the implementation strategies were). The audit and feedback strategy was particularly helpful because the research team had an active role in providing compliance data directly to the units. One participant stated, "I liked how it was done for us [audit data provided]. We didn't have to search for the data and compile it, so that was helpful because then we could just share with staff." In addition, participants appreciated that the audit and feedback data included a run chart showing progress over time and a "Kudos" section to acknowledge staff who appropriately completed a CHG bath. One participant noted:

> It was great to be able to give staff some positive reinforcement and recognize good behavior. Seems like all we do is talk about what needs to be improved. This let us balance all the negative stuff with positive recognition, and staff really appreciated it.

Participants also found the educational outreach visits to be *acceptable*, as they were an informal, nonintimidating way to provide targeted education, and staff were able to ask questions:

> Anytime you can touch staff and help them understand why it's so important, you can't go wrong. If they have to watch another video, it doesn't mean as much to them. But if someone's coming around to say, "Ask me your questions. What are your concerns? Tell me how you do this. Let me show you how to do this better," that is always a good thing.

In addition, participants appreciated that the CHG bathing experts were internal to the organization and willing to work around the nurses' busy schedules.

Participants were asked how *appropriate* they felt the implementation strategies were. This implementation outcome focuses on the perceived fit or value of the strategies. Both strategies were felt to be very valuable for the study. Participants appreciated that the audit and feedback strategy provided a quantifiable way to measure their progress. One nursing leader stated, "I think it is very useful. It gives them feedback and lets them know what they need to improve on and what they don't."

Participants were asked to provide suggestions for improving the implementation strategies. Most participants (n = 17) did not have recommendations and stated that the strategies worked well and that there was no need for improvement. One night shift nurse commented that for the educational outreach visits, it may be helpful to provide specific timeframes of when visits will occur:

> I don't know if there's a perfect time to come and talk to nursing staff that are actively taking care of patients. I think maybe just giving a heads up what the timeframe for the education is, just so people would know when you would be on the unit. And maybe dispersing the time on the night shift.

CHG Bathing Protocol

During the focus groups and interviews, the implementation outcomes of *acceptability, appropriateness, adoption, feasibility,* and *sustainability* were used to evaluate the evidence-based practice (CHG bathing protocol) that was implemented during the study. For *acceptability,* participants were asked about their perception of how suitable the CHG bathing protocol was on their unit. Some nurses noted that staff were concerned with the CHG bathing protocol, as it required them to clean over the patient's central line dressings and 6 inches of tubing; however, after receiving education on the importance of this piece, most participants felt that the CHG bathing protocol was acceptable for staff and easy to implement. One participant explained, "Initially the protocol caused some concern, but as they've seen that it's not causing the dressing to come off, it's been a lot easier to do and accept." One comment stood out because it was patient-focused rather than staff-focused:

> I think staff are more acceptable to the CHG bathing protocol. There's still a little bit of angst when the patient complains about the sticky feeling but we've gotten much better too. If patients want to take a real bath, we let them, and we just do a CHG wipe down when they get out. I think the patients feel good that they got a real bath and then we still wipe them down when they get out. The nurses like that.

Next, participants were asked about their perceptions on the *appropriateness,* or the perceived value, of the CHG bathing protocol to reduce CLABSI rates. Participants noted that staff were beginning to see a correlation between CHG bathing and a reduction in CLABSI rates, which helped them to perceive CHG bathing as an appropriate intervention.

Adoption, or the intention of staff to use the evidence-based CHG bathing protocol, was also evaluated. When asked about the extent to which they felt that staff had intentionally decided to adopt the practice, most participants expressed that CHG bathing was well adopted on their unit and that bathing had become more of a priority among staff. However, the newer practice of cleaning over the central line dressing and 6 inches of the tubing was more challenging for staff to adopt:

> I think people definitely stopped using basins for baths, and I think we're automatically getting the CHG cloths. As far as actually wiping over the central line dressing, I think that was probably a little bit harder to adopt.

Staff were asked 2 questions about the *feasibility* of the CHG bathing protocol. The first question focused on their perceptions of how feasible it is for staff to administer the CHG bathing protocol daily to every patient. All participants noted that CHG bathing is feasible and easy to complete each day; the major barrier was that pediatric or independent patient populations may not want a CHG bath. Participants were also asked how daily CHG bathing may be compromised by inadequate resources (*feasibility*). Most participants noted that resources were a function of strong leadership support (both nursing and physician), and that having nursing assistants prioritize CHG bathing can influence CHG bathing compliance.

Sustainability was also evaluated by participants. Nurses and leaders were asked what could be done to sustain or strengthen the CHG bathing practice. Most participants responded that implementing ongoing education for patients and nurses and specifically integrating it into new hire orientation would be beneficial. One participant noted the importance of educating physicians so they could actively participate in patient education about CHG bathing. Participants stated, "Teach the staff to explain to the families that it's a treatment, more so than a bath; families respond better to this as a treatment," and "I like the idea of the booster sessions, every so often just bring it back up in the staff meetings or huddles."

Finally, participants were asked about major concerns or barriers related to CHG bathing. Information from this question can help future research identify priority areas for improving CHG bathing compliance. Several participants noted that patients complain of the sticky residue left on the skin by the CHG cloths. Another frequently mentioned barrier was that some individuals do not feel that CHG cloths provide a "real" bath. As 1 participant noted:

> I think the biggest barrier is that patients want to just get a real shower. We've got much better at saying, "That's okay, but when you get out, we still have to do the CHG wipe down," and they're accepting that. It was more of a perception that true soap and water is better and smells wonderful.

A facilitator that was noted to help with prioritizing CHG bathing was changing the verbiage from a "bath" to an "antimicrobial treatment" applied to the full body. One champion noted that this change in terminology helped with CHG bathing compliance: "I think turning it into a CHG bath 'treatment' has helped. We've got some good scripting and have been able to handle most patient refusals."

DISCUSSION

This study evaluated the implementation outcomes of *acceptability, appropriateness, adoption, feasibility,* and *sustainability* regarding the implementation strategies and the CHG bathing protocol. Findings highlighted both the strengths and opportunities for improvement for future implementation science studies. In addition, recommendations were provided by participants on how to sustain the gains made from the initial study.

Implementation Strategies

Two implementation strategies were used for the CHG bathing study: audit and feedback and educational outreach visits. Participants noted that both of these strategies were *acceptable* and *appropriate* for implementing the CHG bathing protocol. Audit and feedback strategies have been widely used to implement evidence-based practices with variable impact.[13,14] Several articles support our findings and have shown that audit and feedback strategies are effective.[25,26] Similar to our study, previous research found that feedback was more effective if it used user-friendly measures through easily read charts and was "pushed" to recipients, rather than requiring them to "pull" the data.[25-27] Feedback was rejected if clinicians' felt that the purpose was punitive and did not support positive change, or if it was delivered by a person perceived to have an inappropriate level of knowledge or skill.[25,27]

Educational outreach visits have also been found to significantly impact clinicians' behavior.[28,29] One study found that clinicians felt educational outreach visits to be the most valuable implementation strategy, as having experts visit clinicians in their own practice setting saved clinicians' time.[30] Several studies found that although educational outreach visits are an effective strategy to improve clinicians' compliance with evidence-based practices, they are very time consuming and resource intensive.[28,31]

Quanbeck and colleagues[32] evaluated the use of a bundle of implementation strategies, including audit and feedback, educational outreach visits, and external facilitation. They found these strategies to be feasible, acceptable, and effective in implementing and adopting clinical practice guidelines for opioid prescribing in primary care. Similar to our study, Quanbeck et al[32] identified that the research team being familiar to the organization's context was a facilitator to the strategy's effectiveness. Likewise, Reynolds et al[28] used an implementation bundle of educational outreach, printed educational materials, and local opinion leaders to implement evidence-based stroke and spinal cord injury guidelines within a neurosurgical intensive care unit. An evaluation of these programs showed that these strategies were appropriate and acceptable.[28] Clinicians appreciated the face-to-face educational outreach visits that provided a nonintimidating venue to receive information and ask questions to experts. In addition, clinicians supported future booster sessions to assist with the sustainability of the improvements made.[28] Audit and feedback and educational outreach visits are 2 strategies that can have a significant positive impact on implementing evidence-based practices.[13] Our evaluation study showed that clinicians found both strategies to be acceptable and appropriate to implement the CHG bathing protocol, which is consistent with previous research.

CHG Bathing Protocol

Clinicians in our study felt that CHG baths are easy to do within the nurses' workflow. Caya and colleagues[33] found similar results; when surveyed, 76% (79/104) of nurses agreed that CHG baths could be accomplished in a timely manner during the nurses' shift. Initially, clinicians were uncomfortable cleaning over the central line dressing and tubing; however, after education, they became more comfortable with this practice. This is consistent with findings from Knobloch and colleagues[34] that found cleaning over tubing and lines was the most frequently missed component of the CHG bathing protocol; this could have been caused by similar discomfort with this practice by the clinicians.

A barrier that participants noted in our study was that patients complained of a sticky residue after CHG cloths were applied. In addition, patients may not want to be bathed with CHG cloths, but rather may want a "real" soap-and-water bath. Similar results were found by Knobloch and colleagues[34] when interviewing staff nurses on the implementation of CHG bathing. Caya et al[33] found differing results; when patients were surveyed, 99% (68/69) stated they felt clean after a CHG bath. Several facilitators to the use of CHG bathing were noted. Most participants felt that staff perceived the CHG bathing protocol to be effective for decreasing CLABSIs, which is consistent with other research evaluating registered nurses' perceptions of CHG bathing.[35] In addition, using the term CHG "treatment" rather than "bath" helped to increase the priority given to CHG bathing by clinicians. This verbiage has been adopted by other institutions.[33,34]

Our study found that further education should be given to providers, as well as during orientation for newly hired nurse graduates, to help sustain the CHG bathing practice. Although the importance and need for patient education was not brought up by our participants, several other studies have found patient education to be a barrier to CHG bathing implementation.[34-36] As such, future research aiming to sustain or improve provision of CHG bathing should also include patient education.

In addition, during our qualitative focus groups and interviews, we asked those in nursing leadership roles (nurse managers and clinical team leaders) additional questions as to how their involvement in the larger study may have impacted the nurse managers' competencies, as outlined by the American Organization of Nurse Leaders. Leaders felt that after their unit was involved in the implementation science study, they were better able to promote evidence-based practices, influence their staff, and grow in their own professional leadership role. Further details of this additional study have been previously published.[37] Furthermore, rich data were obtained from these additional questions; however, the overlapping experience of being included in both studies may have influenced their responses.

Limitations

Many helpful perceptions were shared by our participants that can inform future research. We felt that data saturation was reached; however, 19 participants is a relatively small sample and can affect transferability of findings. In addition, our intent was to have small focus groups with 3 to 5 participants each; however, because of scheduling issues and physical distancing requirements due to the COVID-19 pandemic, several focus groups had only 1 participant and thus were not a group but rather an interview. In these instances, rich information normally retrieved by allowing participants to consider and discuss ideas and topics together was lost. Additional focus groups with more participants may yield differing results.

Furthermore, the 2 individuals who conducted the focus groups were part of the original research team and were familiar to participants; therefore, participants may have provided more positive information because of potential bias than they would have provided to independent researchers. Finally, participation in the study was voluntary. Although individuals participated from most of the units included in the original study (11 of 14 units), only those who provided positive feedback may have felt comfortable sharing their thoughts. Individuals with potentially negative comments may not have participated because of concerns regarding possible loss of anonymity.

CONCLUSION

This study added to the growing body of literature seeking to evaluate implementation outcomes from a large implementation science study. The 2 implementation strategies used (audit and feedback, educational outreach visits) were well supported by the participants. Participants provided helpful information about the evidence-based CHG bathing protocol regarding the *acceptability, appropriateness, adoption, feasibility,* and *sustainability* of the practice. The findings have implications for practice, as we provide further support for the 2 implementation strategies as well as the CHG bathing protocol. Evaluation findings provide recommendations for future implementation science researchers to help anticipate and mitigate potential barriers to successfully implementing CHG bathing. Finally, following implementation science studies, further evaluation research is warranted to understand the use of strategies and practices and to improve future implementation science research.

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