

Nudge for Environmental Restructuring in Diabetes Self-Management: Comment on Existing Systematic Reviews

Health Services Insights
Volume 16: 1–3
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DOI: 10.1177/11786329231174337



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ABSTRACT: Diabetes self-management education and support are necessary for all people living with diabetes, but its accessibility is limited worldwide. Nudge strategies have been proposed as an environmental outreach for diabetes management. This article provides further insights regarding environmental restructuring nudges into the cumulative evidence on diabetes self-management interventions from existing systematic reviews that classified primary trials using the behavior change technique taxonomy (BCTTv1). Among the 137 relevant articles searched through the bibliographic databases until 2022, three systematic reviews were scrutinized. Environmental restructuring nudges have been tested in interpersonal communications for diabetes self-management. Although nudge-based techniques were used with other types of behavior techniques in various trial contexts, the independent effects of social restructuring nudges were not denied in previous meta-analyses. Environmental restructuring nudges may be feasible in diabetes management, but they are still controversial with internal and external validation. Considering care accessibility for diabetes management, social restructuring nudges applied to healthcare providers are expected to complement healthcare systems. For future implementation, the rationale for the practice should be explicit in the conceptualization and evidence synthesis of diabetes-specific nudge interventions based on global sources.

KEYWORDS: Nudge, Health Services Accessibility, Diabetes, Self-Management, Review

RECEIVED: February 2, 2023. **ACCEPTED:** April 15, 2023.

TYPE: Redesign for Health Service Improvement – Commentary

FUNDING: The author disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by the Japan Society for the Promotion of Science JSPS KAKENHI [grant number: JP20K18871].

DECLARATION OF CONFLICTING INTERESTS: The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Environmental Outreach for Diabetes Self-Management

Diabetes self-management education and support are essential for all people living with diabetes. However, its accessibility is limited owing to the scarcity of healthcare resources in the current worldwide situation.¹

Considering global health disparities, nudge has been proposed as a public health strategy. In line with behavioral economics, a nudge is defined as “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives.”²

Among the various types of nudges, environmental restructuring is known to facilitate individual decision-making and behavior change.³ Such environmental outreach is necessary for the many people who are unlikely to access diabetes care.¹

It is important to capture specific nudge interventions and their findings to implement nudge strategies for diabetes management. Several studies have already suggested the potential effects of nudges on modifying health behaviors in this field.^{4,5} However, “nudge” is not clearly identified in the context of diabetes self-management. It seems like a generic term to reclassify existing methods for diabetes management. Hence, previous systematic reviews have required extensive literature searches to explore the nudge elements. The inclusive “nudge” consequently caused further confusion in interpreting the results. The evidence is still inconclusive and unavailable for practical implementation.

Although the concept of nudging in diabetes self-management remains ambiguous, nudge-based interventions can be

identified by using certain frameworks. Because the effectiveness of diabetes self-management interventions is assessed based on patients’ behavioral changes, an expert classification of behavior change techniques (BCTs) may be available to conceive relevant nudges.^{6–8}

Through our previous systematic review regarding diabetes self-management interventions, I came to notice that the application of environmental restructuring in the interventions is identifiable based on the behavior change technique taxonomy (BCTTv1). BCTTv1 is the widely used classification where 93 BCTs are clustered into 16 groups. One of the 16 groups labeled “Antecedents” involves “Change the environment in order to facilitate the target behavior.”⁶ This definition may be useful for identifying environmental restructuring nudge in diabetes self-management. Therefore, we applied the following specific BCTs that clustering in “Antecedents”: “Restructuring the physical environment” and “Restructuring the social environment.” (Supplemental Appendix 1).

Overview of Environmental Restructuring Nudges From Systematic Reviews

To date, there are systematic reviews, including our previous review, summarizing diabetes self-management interventions classified through BCTTv1. If a primary trial peer-reviewed in the existing systematic reviews was coded with the specific BCTs by previous review authors using BCTTv1, we interpreted it as a trial with an environmental restructuring nudge.



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The purpose of this review was to clarify the findings of nudge interventions focusing on environmental restructuring from relevant systematic reviews in the following aspects:

- Systematic reviews of randomized controlled trials (RCTs)
- Participants are adults aged over 18 years with type 1 or type 2 diabetes
- Intervention aims at behavioral changes in diabetes self-management
- Intervention contents coded by BCTTv1 with specific BCTs of “Antecedents”

In contrast, the following articles were excluded:

- Not systematic reviews of primary RCTs
- No topics on diabetes self-management
- Did not use BCTTv1
- None of the intervention contents were coded with specific BCTs of “Antecedents”

Literature searches were performed up to 2022 via MEDLINE, CINAHL, Cochrane Library, Web of Science, and PsycINFO using search syntax combining Medical Subject Headings and keywords. The Boolean operator was refined by consulting librarians and adding search terms according to the data sources (Supplemental Appendix 2). The reference lists of relevant articles were searched manually. Keyword searches via Google Scholar and Web of Science were conducted for citations of original works by Michie et al.⁶ Based on the eligible criteria, relevant systematic reviews were detected through dual screening and consensus by 2 reviewers. As a result, 3 systematic reviews were identified that applied nudge-based BCTs for environmental restructuring to primary trials (Supplemental Figure 1).

One systematic review analyzed the effect of dietary intervention for type 2 diabetes on glycemic control and body weight changes.⁹ This review included 54 RCTs, in which applied 3 RCTs with “*Restructuring the physical environment*” and 2 RCTs with “*Restructuring the social environment.*” Another review of 66 RCTs assessed the attendance rate of eye screening among patients with diabetes. The study applied 17 trials for patients and 23 for healthcare providers with “*Restructuring the social environment.*”¹⁰ Remaining was our previous review including 12 RCTs to identify the effectiveness of diabetes self-management education for newly diagnosed patients, and 2 primary trials were applied with environmental restructuring BCTs¹¹ (Supplemental Table 1).

The 3 systematic reviews provide effect estimates of specific BCTs for environmental restructuring by meta-analysis. One of them shows the dietary interventions with “*Restructuring the physical environment*” were not clinically significant on glycated hemoglobin A1c (HbA1c) compared with control groups.⁹

Another review reported HbA1c reduction -0.21% (95% confidence interval, $-0.38, -0.04$) by self-management education for newly diagnosed type 2 diabetes with “*Restructuring the*

social environment.”¹¹ The other study presents the result of subgroup sensitivity analysis that the significant effects for attending eye screening when “*Restructuring the social environment*” was applied to healthcare providers as the risk difference 0.19 (95% confidence interval, 0.12, 0.26), and was applied to patients as 0.17 (95% confidence interval, 0.10, 0.24).¹⁰ These nudge-based techniques have been used with other types of BCTs in various trial contexts, whereas the independent effects of “*Restructuring the social environment*” were not denied in previous meta-analyses.

Feasibility of Nudge Strategies for Diabetes Management

To ensure the feasibility of nudge strategies for diabetes management, it is necessary to provide key concepts for nudge interventions in this field. For instance, the features of primary trials can be classified by trial context, mode of delivery, and target behaviors, following the use of BCTTv1.¹² Although our knowledge is based on a small number of systematic reviews and their partial primary trials, the 4 primary trials cited in the systematic reviews allowed us to scrutinize them¹³⁻¹⁶ (Supplemental Table 2).

The primary trials indicate that environmental restructuring nudges were used in interpersonal communication for diabetes self-management. The BCT “*Restructuring the physical environment*” was feasible when changing any physical location or setting in the trial arm aimed at facilitating target behaviors.¹³ This like physical restructuring has been already verified in previous studies.⁸ However, those may be too restricted experimental designs to be widely used. Another BCT “*Restructuring the social environment*” was applicable to healthcare providers working in prompt or repeated educational sessions and also reminder calls.¹⁴⁻¹⁶ The social restructuring for diabetes management seemed to be a reconstructed healthcare system for care access. If such resource persons are available, the mode of delivery should be adjusted to each clinical context. One of the suggestions is care delivery via a digital pathway.³

As further insights into the cumulative evidence on diabetes management, under the trial interventions were no longer a choice architecture for the study participants. We should notice that the nudge-based interventions would be eventually an inevitable and unintentional inducement for patients. The previous review study indicated that environmental dietary interventions regarding how to meal supply tended to have higher dropout rates in both intervention and control groups than studies for patient-centered education.⁹ Thus, such a passive approach applying directly to target population may raise ethical concerns rather than active, intensive patient-centered interventions for diabetes self-management.² Nevertheless, for those who have difficulty accessing the interventions, environmental outreach is crucial.

For better accessibility to diabetes self-management education and support, healthcare systems should be optimized with environmental restructuring nudges. Because people may need

“nudge” when they have difficulty making decisions in an unfamiliar situation or translating the situation into their own context to understand.² The reviewed primary trials represent exactly such a situation. Patients have to make decisions on any aspect of diabetes self-management for their lives. Environmental restructuring nudges may help individuals to go on the way with less attention to complex choices and decisions for diabetes management. This overview of existing systematic reviews suggests that environmental restructuring nudges can be applied not only to alter default physical circumstance, but also to interaction between patients and healthcare providers in a healthcare system. Well-designed healthcare systems involving healthcare providers as nudges are expected to resolve the accessibility of diabetes management in respective cultural and social backgrounds.

The present review assumed that specific BCTs clustering “Antecedents” in the BCTTv1 imply nudge elements as following the methodological suggestion.^{6–8} Hence, the findings from 3 systematic reviews are not absolute and should be verified through other classifications. Besides, depending on English publications and their synthesis are not sufficient to consider the gap among diverse practical backgrounds. Future implementation of nudge-based interventions should be closely discussed based on global sources, especially in overcoming costly and complex issues. Lastly, coding strategies using the BCTTv1 varied among systematic reviews. Accurate BCT coding based on sufficient trial reports is also required. Despite several challenges, the use of a standardized classification method such as BCTTv1 may contribute to resolving ambiguous issues in this field. A quality assessment of BCTs coding will be necessary for future evidence synthesis.

In summary, existing systematic reviews suggest the effectiveness of “Restructuring the social environment” in diabetes management. For better accessibility to diabetes self-management interventions, social restructuring nudges applied to healthcare providers may help to complement healthcare systems other than physical environmental restructuring. However, those are still controversial with internal and external validation of a choice architecture. The rationale for the practice should be explicit in the conceptualization and evidence synthesis of diabetes-specific nudge interventions based on global sources.

Acknowledgements

We thank the Research Administration/Management Office at the University of Tsukuba (<https://ura.sec.tsukuba.ac.jp/ura/en/>) for the support in preparing the first draft. We also thank the librarians at the University of Tsukuba Medical Library for their technical assistance with the literature search. Shinobu Watanabe from the Department of Nursing, School of Health

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Author Contributions

Rie Tanaka was responsible for the concept, design, draft, and revision of this article.

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SUPPLEMENTAL MATERIAL

Supplemental material for this article is available online.

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