

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Is there sufficient evidence regarding signage-based stair-use interventions? A sequential meta- analysis
AUTHORS	Bauman, Adrian; Milton, Karen; Kariuki, Maina; Fedel, Karla; Lewicka, Mary

VERSION 1 - REVIEW

REVIEWER	Mary Eckhardt Alumna of University of Texas School of Public Health University of Texas Health Science Center at Houston Houston, Texas United States of America No longer affiliated with an academic institution.
REVIEW RETURNED	30-May-2016

GENERAL COMMENTS	<p>Overall, I thought the paper was very well done. My full review with specific comments is below. Thank you.</p> <p>"Is there sufficient evidence regarding signage-based stair-use interventions? A sequential meta-analysis"</p> <p>This article discusses a sequential meta-analysis of research in the area of stair-use interventions using point-of-choice signage. The meta-analysis included papers from 1980 through 2014. There were a total of 50 studies included, with 57 unique estimates of stair use. Data were pooled from all of the studies, and the pre- and post-signage rates of stair use were analyzed. The results found that the pooled odds ratios showed that individuals were 52% more likely to take the stairs after exposure to stair promotion signs. Further analysis showed that sufficient evidence for the effectiveness of point-of-decision signs has been in place since 2005. This study showed that the body of research provides evidence for the effectiveness of these types of sign interventions, but also discusses how the research needs to move forward to more translational, population-level research. This type of research will provide information on implementation and best practices for policy-makers.</p> <p>Importance of Subject</p> <p>The authors made a good case for the importance of this topic. Lack of physical activity is a huge issue in our society, and finding ways to increase activity in daily tasks, like stair climbing, is a great way to tackle this. Specifically, stair-promoting signs are an easy</p>
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way to increase stair use, and thus increase physical activity. Knowing more about the effectiveness of these signs and how to implement them is beneficial.

Furthermore, it is important not just to know that these types of signs are effective, but how to implement them on a population level. This paper discusses how the research so far has focused on small, short-term studies that prove the effectiveness of signs in stair-use interventions. However, there is a lack of research on broader-scale, looking at topics like scalability, adoption, and fidelity. It is important for the research in this field to move forward. This is also important for policy-makers. Policy-makers need to know what to look for when considering ways to promote physical activity in different settings. This study provides additional information to consider when looking at the full body of research. Therefore, the authors have discussed an important topic in this paper. This topic will be most important for researchers, educators, and policy-makers.

Originality

This article is original. Based on a preliminary search using Google Scholar, I did not find any other systematic reviews looking at stair-use interventions and point-of-choice prompts, other than what the authors cited in this paper. These are listed below. Furthermore, as the authors stated, this paper also included a policy-focused approach.

- Webb OJ, Eves F, Kerr J. A statistical summary of mall-based stair-climbing interventions. *Journal of Physical Activity and Health* 2011;8 (4):558-565.
- Soler RE, Leeks KD, Buchanan LR, et al. Point-of-decision prompts to increase stair use. A systematic review update. *Am J Prev Med* 2010;38(2S): S292–S300.
- Nocon M, Müller-Riemenschneider F, Nitzschke K, et al. Review Article: Increasing physical activity with point-of-choice prompts--a systematic review. *Scand J Public Health* 2010;38(6):633-638.
- Bellicha A, Kieusseian A, Fontvieille AM, et al. Stair-use interventions in worksites and public settings - A systematic review of effectiveness and external validity. *Prev Med* 2014;70:3-13.

Scientific reliability

1. Research Question: The objectives questions are clearly defined at the end of the Introduction section. They are also answered appropriately throughout the rest of the paper.

2. Study Design: The study design of the meta-analysis was described clearly and was appropriate for the aims of this study.

In the Introduction section, Page 4, Lines 23-26, the authors state, "These interventions involve the short-term installation of a poster or stair-rise banners, to encourage people to take the stairs rather than an adjacent escalator". However, some of the studies cited in this paper, or included in the meta-analysis, compared the stairs to an elevator, not escalator. Some examples, although not exhaustive, are listed below. The statement could be edited to say "adjacent escalator or elevator".

- Meyer P, Kayser B, Kossovsky MP, et al. Stairs instead of elevators at workplace: cardioprotective effects of a pragmatic intervention. *Eur J Cardiovasc Prev R* 2010;17: 569.
- Houweling ST, Stoopendaal J, Kleefstra N, et al. Use of stairs in a hospital increased by sign near the stairs or the elevator. *Ned Tijdschr Geneesk* 2005;149(52):2900-2903.
- Eckhardt MR, Kerr J, Taylor WC. Point-of-decision signs and stair use in a university worksite getting: General versus specific messages. *Am J Health Promot* 2014; 29(5):291-293.

3. Methods: The methods of this study were appropriate to address the research objectives. The study selection process for the meta-analysis was described well and shown clearly in Figure 1. The data analysis methods were also appropriate for the sequential meta-analysis. I found no ethical problems with this study. A completed PRISMA checklist was attached to the end of the paper.

One limitation to the study methods is on Page 9, Lines 10-12, where the authors stated, "For studies which did not differentiate ascending and descending stair use, the overall stair use data were used." If any of these studies were situations where both ascending and descending stair use were combined, then using this overall stair data could compare ascending and descending stair use for some studies with only ascending stair use in other studies. This could potentially affect the results. I understand that this method may have been necessary due to lack of information in the included studies, but it would be helpful to know how many studies didn't differentiate ascending/descending and list this as a possible limitation of the study.

4. Results: The presentation of the results was well done. The results clearly answered the research objectives listed in the Introduction section. Figures 2 and 3 were appropriately used.

5. Discussion and Conclusion: In the discussion and conclusion, the

	<p>authors did a good job of extrapolating the results of this study to the broader policy and practice implications. They explain how the results of the meta-analysis show areas where population-level research is lacking and the type of research that would be most beneficial to policy makers. They also discuss potential areas where future research would be most helpful for policy decisions, based on the results of the analysis.</p> <p>6. References: To my knowledge, the references were up-to-date and relevant. I did not see any egregious omissions.</p> <p>7. Abstract/summary/key messages/what this paper adds: The abstract of this paper appropriately summarized the main points of the paper. I did not see any additional sections of "Summary", "Key Messages", or "What This Paper Adds" included.</p> <p>8. Documents in Supplemental Files: The PRISMA checklist and Appendix are appropriately included in the Supplemental Files. I do not see any omissions of other documents that should be included.</p> <p>Overall, I thought this paper was very well done. I would recommend it to be accepted.</p>
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REVIEWER	Frank F. Eves University of Birmingham, UK
REVIEW RETURNED	20-Jun-2016

GENERAL COMMENTS	<p>This interesting paper reports pooled results for the effects of simple signage on stair climbing and a sequential meta-analysis to estimate the point in time at which effectiveness for stair climbing interventions was established (2005). The analysis is novel to me but clearly reported.</p> <p>Where this paper differs from previous reviews is a call to researchers to move away from yet another test of an intervention, to the investigation of the scaling of this simple intervention to population levels. This point about policy implication is well made and timely. A strength of this review is that, unlike others, it only includes data relating to stair climbing, allowing a much clearer picture of effectiveness on the targeted behaviour of choice. The paper is clear and well written.</p>
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REVIEWER	Karen Glanz University of Pennsylvania USA
REVIEW RETURNED	29-Jun-2016

GENERAL COMMENTS	<p>This is an interesting, provocative, and potentially important review of signage based stair use interventions. The authors have done an excellent job with analyzing and communicating the gap between what is known and how it is translated into practice.</p>
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	<p>However, there is one key gap in their manuscript that needs to be addressed before the paper can achieve its potential impact - and be clear for readers. That is, there needs to be a clear definition of the outcome "stair use rate". The authors excluded studies that only used self-report, but there is not a clear explanation of what 'objective' (observed, non-self-report) measure or indicator could be included to represent stair use rates. What is the data collection method, and what is the denominator (which is needed for a "rate")? Is it observed people going from one floor to another, either by stairs or by elevator/escalator? Are observations independent or can the same person, using the stairs repeatedly, contribute to the numerator more than once? What about surveys using self-report - which provide a "rate" based on the population (respondent) denominator, and count each person only once?</p> <p>At any rate, this all needs to be clarified for readers. I have an impression that the authors were careful about using comparable indicators of 'stair use rates', but I, and the readers, need more information to understand what was analyzed.</p>
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REVIEWER	Lifeng Lin University of Minnesota, USA
REVIEW RETURNED	07-Aug-2016

GENERAL COMMENTS	<p>This paper presents an interesting meta-analysis on the effect of motivational signs on the likelihood of stair use. The authors also performed a sequential analysis to illustrate the history of the collected studies. I think the manuscript is well-written.</p> <p>My major concern is the extremely high heterogeneity between the collected studies; that is, the I-squared measures were 97.5% (overall), 97.6% (1980–2007), and 97.4% (2008–2014). These can indicate that the 57 results (from 50 studies) are too heterogeneous and thus may not be suitable to be pooled together. One possible reason of the high heterogeneity could be due to some studies with extreme odds ratios. For example, two results of Kerr et al. (2001) lead to odds ratios 159.68 and 349.73; many studies between 2008 and 2014 also have extreme odds ratios and the authors cannot even properly display them in the forest plot (Figure 2). The authors may discuss the huge study heterogeneity as a limitation of this meta-analysis, instead of stating “Strengths of this study included the methods that enabled pooling of estimates despite study heterogeneity” in the section “Strengths and Limitations”. In addition, the authors may consider performing a sensitivity analysis by excluding those studies with extreme odds ratios (say, >50), which may be deemed as outliers.</p> <p>Minor comments:</p> <p>(1) Page 9, which studies reported ascending and descending stair use separately, and which did not differentiate ascending and descending stair use? Since the authors used only the ascending values for the former studies, while merged values were used for the latter ones, is this a possible reason that the studies are too heterogeneous?</p> <p>(2) Page 13, in Figure 2, change “p = 0.000” to “p < 0.001”.</p> <p>(3) Page 14, in Figure 3, does the dotted horizontal line represent z-score = 1.96? However, this dotted line seems to be a little above z-</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Overall, I thought the paper was very well done. My full review with specific comments is in the attached file. Thank you.

This article discusses a sequential meta-analysis of research in the area of stair-use interventions using point-of-choice signage. The meta-analysis included papers from 1980 through 2014. There were a total of 50 studies included, with 57 unique estimates of stair use. Data were pooled from all of the studies, and the pre- and post-signage rates of stair use were analyzed. The results found that the pooled odds ratios showed that individuals were 52% more likely to take the stairs after exposure to stair promotion signs. Further analysis showed that sufficient evidence for the effectiveness of point-of-decision signs has been in place since 2005. This study showed that the body of research provides evidence for the effectiveness of these types of sign interventions, but also discusses how the research needs to move forward to more translational, population-level research. This type of research will provide information on implementation and best practices for policy-makers.

The authors have discussed an important topic in this paper. This topic will be most important for researchers, educators, and policy-makers.

This article is original. Based on a preliminary search using Google Scholar, I did not find any other systematic reviews looking at stair-use interventions and point-of-choice prompts, other than what the authors cited in this paper. Furthermore, as the authors stated, this paper also included a policy-focused approach.

The objectives questions are clearly defined at the end of the Introduction section. They are also answered appropriately throughout the rest of the paper. The study design of the meta-analysis was described clearly and was appropriate for the aims of this study.

In the Introduction section, Page 4, Lines 23-26, the authors state, "These interventions involve the short-term installation of a poster or stair-rise banners, to encourage people to take the stairs rather than an adjacent escalator". However, some of the studies cited in this paper, or included in the meta-analysis, compared the stairs to an elevator, not escalator. The statement could be edited to say "adjacent escalator or elevator".

RESPONSE: We are grateful to the reviewer for this this observation and suggestion. We have now changed this in the paper.

The methods of this study were appropriate to address the research objectives. The study selection process for the meta-analysis was described well and shown clearly in Figure 1. The data analysis methods were also appropriate for the sequential meta-analysis. I found no ethical problems with this study. A completed PRISMA checklist was attached to the end of the paper.

One limitation to the study methods is on Page 9, Lines 10-12, where the authors stated, "For studies which did not differentiate ascending and descending stair use, the overall stair use data were used." If any of these studies were situations where both ascending and descending stair use were combined, then using this overall stair data could compare ascending and descending stair use for some studies with only ascending stair use in other studies. This could potentially affect the results. I understand that this method may have been necessary due to lack of information in the included

studies, but it would be helpful to know how many studies didn't differentiate ascending/descending and list this as a possible limitation of the study.

RESPONSE: There were fourteen studies which did differentiate ascending and descending stair use, and we have now listed these papers in the methods section of the manuscript.

The presentation of the results was well done. The results clearly answered the research objectives listed in the Introduction section. Figures 2 and 3 were appropriately used.

In the discussion and conclusion, the authors did a good job of extrapolating the results of this study to the broader policy and practice implications. They explain how the results of the meta-analysis show areas where population-level research is lacking and the type of research that would be most beneficial to policy makers. They also discuss potential areas where future research would be most helpful for policy decisions, based on the results of the analysis.

To my knowledge, the references were up-to-date and relevant. I did not see any egregious omissions.

Abstract/summary/key messages/what this paper adds: The abstract of this paper appropriately summarized the main points of the paper. I did not see any additional sections of "Summary", "Key Messages", or "What This Paper Adds" included.

Documents in Supplemental Files: The PRISMA checklist and Appendix are appropriately included in the Supplemental Files. I do not see any omissions of other documents that should be included.

Overall, I thought this paper was very well done. I would recommend it to be accepted.

RESPONSE: We are grateful to the reviewer for these positive comments

Reviewer: 2

This interesting paper reports pooled results for the effects of simple signage on stair climbing and a sequential meta-analysis to estimate the point in time at which effectiveness for stair climbing interventions was established (2005). The analysis is novel to me but clearly reported.

Where this paper differs from previous reviews is a call to researchers to move away from yet another test of an intervention, to the investigation of the scaling of this simple intervention to population levels. This point about policy implication is well made and timely. A strength of this review is that, unlike others, it only includes data relating to stair climbing, allowing a much clearer picture of effectiveness on the targeted behaviour of choice. The paper is clear and well written.

RESPONSE: We thank the reviewer for these positive comments.

Reviewer: 3

This is an interesting, provocative, and potentially important review of signage based stair use interventions. The authors have done an excellent job with analyzing and communicating the gap between what is known and how it is translated into practice.

However, there is one key gap in their manuscript that needs to be addressed before the paper can

achieve its potential impact - and be clear for readers. That is, there needs to be a clear definition of the outcome "stair use rate". The authors excluded studies that only used self-report, but there is not a clear explanation of what 'objective' (observed, non-self-report) measure or indicator could be included to represent stair use rates. What is the data collection method, and what is the denominator (which is needed for a "rate")? Is it observed people going from one floor to another, either by stairs or by elevator/escalator? Are observations independent or can the same person, using the stairs repeatedly, contribute to the numerator more than once? What about surveys using self-report - which provide a "rate" based on the population (respondent) denominator, and count each person only once?

At any rate, this all needs to be clarified for readers. I have an impression that the authors were careful about using comparable indicators of 'stair use rates', but I, and the readers, need more information to understand what was analyzed.

RESPONSE: The included studies typically used direct observation using multiple researchers to count occurrences of stair use versus escalator use, with one count recorded each time an individual took the stairs or escalator from one floor to another. The denominator is total observations, and the primary outcome is the proportion of stair usage pre-post intervention. We have now added an explanation of this to the paper.

Reviewer: 4

This paper presents an interesting meta-analysis on the effect of motivational signs on the likelihood of stair use. The authors also performed a sequential analysis to illustrate the history of the collected studies. I think the manuscript is well-written.

My major concern is the extremely high heterogeneity between the collected studies; that is, the I-squared measures were 97.5% (overall), 97.6% (1980–2007), and 97.4% (2008–2014). These can indicate that the 57 results (from 50 studies) are too heterogeneous and thus may not be suitable to be pooled together. One possible reason of the high heterogeneity could be due to some studies with extreme odds ratios. For example, two results of Kerr et al. (2001) lead to odds ratios 159.68 and 349.73; many studies between 2008 and 2014 also have extreme odds ratios and the authors cannot even properly display them in the forest plot (Figure 2). The authors may discuss the huge study heterogeneity as a limitation of this meta-analysis, instead of stating "Strengths of this study included the methods that enabled pooling of estimates despite study heterogeneity" in the section "Strengths and Limitations". In addition, the authors may consider performing a sensitivity analysis by excluding those studies with extreme odds ratios (say, >50), which may be deemed as outliers.

RESPONSE: We have now undertaken sensitivity analysis, repeating each analysis after the removal of 19 studies that had extreme odds ratios (≥ 7) (now marked "†" in Table A1). Sensitivity analysis reduced the effect sizes of the outcome and revealed that the initial studies actually had the power to show evidence on intervention effect sizes. We have now added this to the paper.

Minor comments:

(1) Page 9, which studies reported ascending and descending stair use separately, and which did not differentiate ascending and descending stair use? Since the authors used only the ascending values for the former studies, while merged values were used for the latter ones, is this a possible reason that the studies are too heterogeneous?

RESPONSE: Fourteen out of the 50 included studies reported stair 'usage' as opposed to stair

'ascent' or stair 'climbing'. Thus it is possible that these studies also included counts for people descending on the stairs. We have now listed these papers in the methods. Papers reporting stair 'usage' covered both the earlier and later intervention periods, but reflect a minority of the included estimates.

RESPONSE: The majority of studies with extreme odds ratios were those which recorded ascending stair use only, thus it appears that the inclusion of studies which did not differentiate ascending and descending stair use is not a contributory factor to the high heterogeneity observed.

(2) Page 13, in Figure 2, change "p = 0.000" to "p < 0.001".

RESPONSE: This has now been amended.

(3) Page 14, in Figure 3, does the dotted horizontal line represent z-score = 1.96? However, this dotted line seems to be a little above z-score = 2 in the plot.

RESPONSE: Thank you for this observation. The graph has now been corrected.

VERSION 2 – REVIEW

REVIEWER	Karen Glanz University of Pennsylvania USA
REVIEW RETURNED	06-Oct-2016

GENERAL COMMENTS	The authors have adequately revised the manuscript and responded to review comments/critiques. I believe this paper is now acceptable for publication.
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REVIEWER	Lifeng Lin Division of Biostatistics, University of Minnesota, USA
REVIEW RETURNED	19-Sep-2016

GENERAL COMMENTS	The authors have successfully addressed all my concerns for the previous version. I appreciate their effort in the revision.
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