



UvA-DARE (Digital Academic Repository)

When is it time to revise or adapt our prevention programs? Introduction to Special Issue on using baseline target moderation to assess variation in prevention impact

Howe, G.; Leijten, P.

DOI

[10.1007/s11121-022-01456-3](https://doi.org/10.1007/s11121-022-01456-3)

Publication date

2023

Document Version

Final published version

Published in

Prevention Science

License

Article 25fa Dutch Copyright Act (<https://www.openaccess.nl/en/in-the-netherlands/you-share-we-take-care>)

[Link to publication](#)

Citation for published version (APA):

Howe, G., & Leijten, P. (2023). When is it time to revise or adapt our prevention programs? Introduction to Special Issue on using baseline target moderation to assess variation in prevention impact. *Prevention Science*, 24(2), 199-203. <https://doi.org/10.1007/s11121-022-01456-3>

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.



When Is It Time to Revise or Adapt Our Prevention Programs? Introduction to Special Issue on Using Baseline Target Moderation to Assess Variation in Prevention Impact

George Howe¹ · Patty Leijten²

Accepted: 14 October 2022 / Published online: 15 November 2022
© Society for Prevention Research 2022

Abstract

Adaptation of preventive interventions to increase their impact can be advanced by identifying subgroups or specific contexts where program effects appear stronger or weaker. But how do we know where to look for effect heterogeneity in ways that will inform successful adaptation? This paper introduces a special issue that brings together research across prevention science sub-disciplines that adopted baseline target moderated mediation (BTMM) designs to search for effect heterogeneity and guide adaptation of established prevention programs. For this special issue intervention scientists analyzed data from randomized trials using BTM and BTMM models, evaluating evidence for variation in intervention impact for trials spanning different health outcomes, different developmental periods, and different social units. This introduction provides a brief summary of the various patterns of effect reported in these papers, noting that the most common pattern involved compensatory effects (those beginning the trial with greater risk or fewer protective factors benefit the most), but other patterns including rich-get-richer and partially iatrogenic effects were also detected. This paper ends with a discussion of methodological and substantive implications of these findings for future prevention research, including next-generation prevention trials.

Keywords Baseline target moderated mediation · Trials design

Decades of rigorous prevention science have yielded many empirically supported interventions to prevent social, physical, and mental health problems. These range from community interventions to prevent substance abuse (Rowland et al., 2022) to parenting interventions to prevent child maltreatment (Eddy & Sneddon, 2020) to school interventions to prevent cyberbullying (Doty et al., 2021). There is increasing interest in how to adapt preventive interventions to increase their impact. This can be done by identifying subgroups or specific contexts where program effects appear stronger or weaker. But how do we know where to look for effect heterogeneity in ways that will inform successful adaptation? This special issue brings together research across prevention science sub-disciplines that adopted baseline target moderated mediation (BTMM) designs to search

for effect heterogeneity and guide adaptation of established prevention programs.

Preventive interventions aim to change mechanisms theorized to increase risk for later distress or disorder, as well as mechanisms thought to protect against that risk. These risk and protective targets, derived from research on etiology, include characteristics of individuals and families, but can also involve contextual factors. Howe et al. (2016) suggested that selection of specific targets often reflects implicit hypotheses about variation in program impact. The most common hypotheses involve compensatory effects. Assuming that the intervention does alter those targets, participants who enter the program with higher levels of targeted risk factors or lower levels of targeted protective factors will benefit more than those who enter with lower risk or greater protection. That is, sample variation in a baseline target will moderate the impact of the intervention on later health outcomes, and this effect will be mediated through differential impact on that target. The first effect was called baseline target moderation (BTM), the second referred to as baseline target moderated mediation (BTMM). Howe (2019b) found examples of BTM analyses supporting compensatory effects

✉ George Howe
ghowe@gwu.edu

¹ George Washington University, 2103 H Street NW,
Washington, DC 20052, USA

² University of Amsterdam, Amsterdam, The Netherlands

in the prevention and education literature, but also noted reports of other patterns. These included rich-get-richer effects (those who enter the study with fewer risk and more protective factors benefit, while those at greater risk do not), crossover effects (those at greater risk do worse, those at low risk do better), or iatrogenic effects (those at greater risk do worse, those at low risk show no effects).

For this special issue intervention scientists were invited to analyze data from existing randomized trials using BTM and BTMM models, evaluating evidence for variation in intervention impact. The eight trials described in this special issue span different health outcomes including depression, obesity, and substance use; different developmental periods (early childhood, adolescence, adulthood); and different social units (individuals, parents and children, couples). The trial targets range from health promotion to universal, selective, or indicated prevention, and one trial involves treatment of existing conditions. Evidence for BTM and BTMM effects varied markedly across the trials. Here we provide a brief summary of these patterns of impact and then discuss the implications of these findings for future prevention research, including next-generation prevention trials. The special issue concludes with commentaries by Frances Gardner and Ruben Parra-Cardona, who provide important critical perspectives on the state of these findings and future directions for these methods.

Evidence for Variation in Impact

BTMM Effects

Tests of moderated mediation must satisfy two conditions: intervention impact on the target must vary by baseline levels of that target and variation in the target must be associated with subsequent variation in more distal outcomes. This may also lead to moderation of intervention impact on the distal outcome, although it is possible to find significant indirect effects in the absence of such moderation (Kenny & Judd, 2014).

Four of the eight studies in this special issue report evidence of BTMM effects for at least some targets. Brincks et al. (this issue), in a universal prevention trial of the Familias Unidas program, found stronger intervention effects on reducing youth internalizing for those families with mothers reporting lower social support, mediated through increases in social support. Myers et al. (this issue), in their trial of the health-promoting Fun For Wellness program, found stronger impact on well-being for those adults reporting lower occupational and psychological self-efficacy at baseline, mediated by increases in those targets. Zhang et al. (this issue), in their test of the ADAPT program for military families, found the program had stronger impact on father's

reactive-coercive parenting behavior at 12-month follow-up for those fathers with more emotion regulation difficulties at baseline, mediated by increases in emotion regulation. Rojas et al. (this issue), in their integrative data analysis combining data from four trials of Familias Unidas, found stronger impact on youth internalizing for families with a baseline latent profile of poor family functioning, mediated by impact on that functioning. These all involve compensatory effects, with interventions having stronger mediated impact for those who began the trial with lower levels of targeted protective factors.

However, these studies also found that some intervention targets did not fit a BTMM model, and four other studies found no full BTMM effects. Findings reflected other forms of intervention impact: outcome moderation without moderated mediation and target mediation without moderation.

Outcome Moderation Without Moderated Mediation

Myers et al. (this issue) also found that baseline target levels for community, occupational, and physical well-being moderated the direct intervention effect on changes in well-being self-efficacy. This fit a rich-get-rich pattern, such that those with higher levels of well-being at the beginning of the intervention benefited more than those with lower levels.

Howe (this issue), in a trial testing a program for couples coping with recent job loss, found that baseline target levels moderated intervention impact on both individual and couple outcomes, with no evidence for mediation of impact through those targets. Job seekers reporting lower motivation and less job search behavior at baseline showed stronger positive impact of the intervention on depression, following a compensatory model. However, this trial also found iatrogenic effects: intervention partners in couples with more positive and less negative communication at baseline showed more increases in depression compared to controls.

Helland et al. (this issue), in a treatment trial of a CBT program for children with anxiety disorders, found evidence for a crossover effect, such that those children with fewer problems in emotional control at baseline benefited while those children with more problems at baseline did worse than controls. There was no evidence for moderated mediation through this specific target, although there was evidence for unmoderated mediation.

Target Mediation Without Moderation

Some studies found no evidence for variation in impact across baseline levels of specific targets, even in the presence of target mediation. Smith et al. (this issue), testing the Family Checkup 4 Health program, a selective intervention for children in pediatric care with elevated body mass, did not find evidence of baseline target moderation for 10 of 11 target

variables, although prior reports of this trial had noted simple mediation effects for several of those factors. Weeland et al. ([this issue](#)) combined data from four indicated or selective trials of the Incredible Years program, resulting in a sample with high levels of disruptive behavior. Integrated data analyses did not find any evidence for baseline target moderation based on latent classes of parenting behavior, although one of the individual studies had documented simple mediation effects for changes in parenting behavior on child outcomes (Posthumus et al., 2012).

Types of BTMM Effects

The most common pattern identified in the studies in this special issue was compensatory effects. This finding is encouraging, because it suggests prevention programs are able to serve those most in need. However, rich-get-richer effects, crossover effects, and iatrogenic effects were also found. Rich-get-richer effects suggest that some interventions reinforce existing adaptive interaction patterns, rather than helping those participants who are more at risk learn new skills. Such programs may benefit from first targeting more foundational skills necessary for making productive use of the intervention protocol.

Crossover and iatrogenic effects provide strong evidence that some programs need to be revised to reduce potential harm and to increase positive impact. Both trials reporting these effects also found that the intervention had no impact on those factors being targeted. Howe ([this issue](#)) suggested that this may reflect problems in intervention dosage, given evidence that briefer couples interventions have been found to be ineffective. Helland et al. ([this issue](#)) suggested that CBT interventions for anxiety may need to be conducted differently for those children who have substantial difficulty with emotion regulation.

Findings of BTM in the absence of mediation may also be a product of moderational confounding (Howe, 2019a). Moderation is in fact present, but may be due to unobserved factors that covary with the baseline target. The commentary by Parra-Cardona ([this issue](#)) suggests that such factors may involve contextual factors such as exposure to discrimination or structural racism that dampen the impact of preventive interventions. They may also reflect baseline levels of unobserved mediators, pointing towards the exploration of variables that correlate with baseline targets as possible mediators to be tested in next-generation trials.

Two trials find evidence for mediation with no target moderation. We speculate that this may reflect several possible scenarios. Risk based on a particular target may in fact be universal, such that any change in a target will decrease risk, regardless of how much risk the participant began with (a “floats all boats” effect). It is also possible that baseline

moderation is present but cannot be detected when the distribution of the baseline target is sparse in the tails. If there are few participants at high risk or at low risk, tests of moderation can be under-powered for detecting effects. Range restrictions on the baseline target, more likely in selected or indicated prevention trials, can also reduce power to detect moderation for the same reason.

Novel Insights and Paths Forward

Across studies, several insights emerge. Both commentaries note that compensatory impacts provide evidence that interventions are helping to address health inequities. However, although compensatory patterns are most commonly hypothesized, different patterns (e.g., compensatory and rich-get-richer effects) can arise even within the same intervention program. Myers et al. ([this issue](#)) found compensatory effects for some intervention targets and rich-get-richer effects for others, while Howe ([this issue](#)) found compensatory effects for job seekers but moderated iatrogenic effects for their partners. This suggests that heterogeneity in intervention effects is complex and that a thorough understanding of these effects requires that we look beyond single effect modifiers. This might explain why it has proven difficult to identify consistent moderators of intervention effects (e.g., McMahon et al., 2021). Systemic use of BTMM modeling may prove useful in disentangling heterogeneous patterns of intervention effects.

Second, some studies suggest that differential benefit is more easily detected when more precise, rather than more global, assessments are used. Helland et al. ([this issue](#)) found that initial levels of overall emotion regulation did not impact intervention benefits, but that baseline levels of specifically emotional control did. Myers et al. ([this issue](#)) found different patterns for different areas of well-being. If heterogeneity is indeed complex in the sense that effects might be positive for some specific baseline targets and negative for others, we need to assess more specific baseline characteristics to identify underlying patterns—broader assessments may mask specific patterns that cancel each other out.

Third, Brincks et al. ([this issue](#)) found post hoc evidence for cascades of effects where change in one intervention target preceded change in other intervention targets (i.e., multiple sequenced mediators). Identifying cascades can improve our understanding of the mechanisms through which interventions work and allow us to test how the theories of change underlying our intervention are born out in practice. Most traditional intervention evaluation designs (e.g., randomized controlled trials) typically include one pre-intervention assessment and one or multiple post-intervention assessments. Although these assessments are sufficient to identify overall effects, they do not easily allow for identifying

cascades of effects. More intensive measurement with frequent assessments (e.g., after each intervention session) may be needed to identify such cascades in more detail and to inform adaptive intervention designs, where intervention content can be adjusted to individual needs in an evidence-based way.

Fourth, detecting BTMM or BTM effects may depend on the nature of the intervention sample. Smith et al. ([this issue](#)) note that indicated and selective interventions require sample restrictions that can substantially reduce variability in baseline target levels, reducing power to detect moderator effects.

Finally, Gardner ([this issue](#)) raises important concerns about the lack of consistency across these studies, noting that BTMM or BTM effects were not found for many targets. She concludes that revising next-generation interventions based on such findings may be premature and calls for more rigorous tests of such effects before we move to revising intervention programs.

Recommendations for Future Research

Based on this rich set of findings and the commentaries by Gardner and Parra-Cardona, we offer several recommendations for future research. The standards of evidence developed by the Society for Prevention Research (Gottfredson et al., 2015) recommend that all prevention trials include measures of hypothesized mediators of intervention impact. Given that proximal targets of preventive interventions are always hypothesized mediators, we suggest extending this recommendation in several ways. Targets should always be measured at baseline, prior to randomization. Mediation hypotheses should be specified a priori as part of the design (preferably when trials are initially registered), and this should include hypotheses concerning BTM and BTMM. All mediation hypotheses should be tested and reported, regardless of findings (see Gonzales et al., 2012, for an excellent example.)

For both primary and secondary analyses, we also recommend that investigators conduct thorough moderation analyses that test both BTM and BTMM. Based on the analyses reported in this set of papers, we suggest beginning with full BTMM analyses testing whether the impact of intervention on change in targets is moderated by baseline target levels, and whether variation in target change is associated with a change in more distal health outcomes. If findings are not consistent with BTMM, we suggest following up with tests of BTM on outcomes and tests of basic unmoderated mediation.

For investigators developing new trials, we recommend careful consideration of both measurement and sampling methods and their likely impact on power to detect BTM or

BTMM. More precise measurement of baseline targets can reduce measurement error and increase sensitivity. Oversampling participants who begin with fewer targeted protective factors or more targeted risk factors can also increase the power to detect target moderation.

All studies in the special issue used secondary data analyses, capitalizing on the rich data available through decades of rigorous intervention research in prevention science. In addition, Rojas et al. ([this issue](#)) and Weeland et al. ([this issue](#)) combined data from multiple prevention trials, allowing for a larger sample with subgroups sizeable enough for consistent patterns to emerge. Insights into how data from different trials can be synthesized are rapidly developing (e.g., special issue on innovations and applications of integrative data analysis in *Prevention Science* edited by Morgan-López, Musci, and Bradshaw). The commentary by Gardner ([this issue](#)) explains the benefits of combining data from multiple trials for BTMM analyses, including testing the robustness of findings across settings and bringing together expertise from different teams, in addition to increased statistical power.

Summary

This special issue shows that BTMM designs can be used to explain intervention effect heterogeneity and guide adaptation of established prevention programs, but their detection may require careful attention to sampling, measurement, and systematic analysis. We gratefully refer to the commentaries by Parra-Cardona ([this issue](#)) and Gardner ([this issue](#)) for thoughtful considerations of how findings from BTMM designs, as applied in the studies in this special issue, can be used to adapt interventions in ways that increase program effectiveness and contribute to positive intervention effects on equity and social justice.

Funding Patty Leijten was partly supported by grants from the Netherlands Organization for Health Research and Development (#636320007) and the Dutch Research Council (#VI.Vidi.201.065).

Declarations

Ethics Approval N/A for this introduction.

Consent to Participate N/A for this introduction.

Conflict of Interest The authors declare no competing interests.

References

Brincks, A., Perrino, T., Howe, G., Estrada, Y., Robles, N., & Prado, G. (this issue). Familias Unidas prevents youth internalizing symptoms: A baseline target moderated mediation (BTMM) study. *Prevention Science*. <https://doi.org/10.1007/s11121-021-01247-2>

- Doty, J. L., Girón, K., Mehari, K. R., Sharma, D., Smith, S. J., Su, Y. W., Ma, X., Rijo, D., & Rousso, B. (2022). The dosage, context, and modality of interventions to prevent cyberbullying perpetration and victimization: A systematic review. *Prevention Science*, 23, 523–537. <https://doi.org/10.1007/s11121-021-01314-8>
- Eddy, J. M., & Sneddon, D. (2020). Rigorous research on existing child maltreatment prevention programs: Introduction to the special section. *Prevention Science*, 21(1), 1–3. <https://doi.org/10.1007/s11121-019-01058-6>
- Gonzales, N. A., Dumka, L. E., Millsap, R. E., Gottschall, A., McClain, D. B., Wong, J. J., Germán, M., Mauricio, A. M., Wheeler, L., Carpentier, F. D., & Kim, S. Y. (2012). Randomized trial of a broad preventive intervention for Mexican American adolescents. *Journal of Consulting and Clinical Psychology*, 80, 1–16. <https://doi.org/10.1037/a0026063>
- Gottfredson, D. C., Cook, T. D., Gardner, F. E. M., Gorman-Smith, D., Howe, G. W., Sandler, I. N., & Zafft, K. M. (2015). Standards of evidence for efficacy, effectiveness, and scale-up research in prevention science: Next generation. *Prevention Science*, 16, 893–926. <https://doi.org/10.1007/s11121-015-0555-x>
- Helland, S. S., Baardstu, S., Kjøbli, J., Aalberg, M., & Neumer, S. P. (this issue). Exploring the mechanisms in cognitive behavioural therapy for anxious children: does change in emotion regulation explain treatment effect? *Prevention Science*. <https://doi.org/10.1007/s11121-022-01341-z>
- Howe, G. W. (2019a). Preventive effect heterogeneity: Causal inference in personalized prevention. *Prevention Science*, 20, 21–29. <https://doi.org/10.1007/s11121-017-0826-9>
- Howe, G. W. (2019b). Using baseline target moderation to guide decisions on adapting prevention programs. *Development and Psychopathology*, 31, 1777–1788. <https://doi.org/10.1017/S0954579419001044>
- Howe, G. W. (this issue). Heterogeneity in the effects of interventions to prevent depression in couples facing job loss: Studying baseline target moderation of impact. *Prevention Science*. <https://doi.org/10.1007/s11121-022-01410-3>
- Howe, G. W., Beach, S. R., Brody, G. H., & Wyman, P. A. (2016). Translating genetic research into preventive intervention: The baseline target moderated mediator design. *Frontiers in Psychology*, 6, 1911. <https://doi.org/10.3389/fpsyg.2015.01911>
- Kenny, D. A., & Judd, C. M. (2014). Power anomalies in testing mediation. *Psychological Science*, 25, 334–339. <https://doi.org/10.1177/0956797613502676>
- McMahon, R. J., Goulter, N., & Frick, P. J. (2021). Moderators of psychosocial intervention response for children and adolescents with conduct problems. *Journal of Clinical Child & Adolescent Psychology*, 50(4), 525–533. <https://doi.org/10.1080/15374416.2021.1894566>
- Myers, N. D., Prilleltensky, I., McMahon, A., Brincks, A. M., Lee, S., Prilleltensky, O., Pfeiffer, K. A., & Bateman, A. G. (this issue). Mechanisms by which the fun for wellness intervention may promote subjective well-being in adults with obesity: A reanalysis using baseline target moderation. *Prevention Science*. <https://doi.org/10.1007/s11121-021-01274-z>
- Parra-Cardona, R. (this issue). BTM and BTMM approaches: Reflections on cultural adaptation and social justice. *Prevention Science*.
- Posthumus, J. A., Raaijmakers, M. A. J., Maassen, G. H., van Engeland, H., & Matthys, W. (2012). Sustained effects of Incredible Years as a preventive intervention in preschool children with conduct problems. *Journal of Abnormal Child Psychology*, 40, 487–500. <https://doi.org/10.1007/s10802-011-9580-9>
- Rojas, L. M., Brincks, A., Brown, E. C., Bahamon, M., Estrada, Y., Lee, T. K., Prado, G., & Pantin, H. (this issue). Family functioning in Hispanic parents of adolescents: Who benefits most from a family-based HIV and substance use preventive intervention? *Prevention Science*.
- Rowland, B. C., Kremer, P., Williams, J., Kelly, A. B., Patton, G., & Toumbourou, J. W. (2022). A component evaluation of a randomised control community intervention to reduce adolescent alcohol use in Australia. *Prevention Science*, 23, 36–47. <https://doi.org/10.1007/s11121-021-01310-y>
- Smith, J. D., Carroll, A. J., Fu, E., & Berkel, C. (this issue). Baseline targeted moderation in a trial of the Family Check-Up 4 Health: Potential explanations for finding few practical effects. *Prevention Science*. <https://doi.org/10.1007/s11121-021-01266-z>
- Weeland, J., Leijten, P., Orobio de Castro, B., Menting, A. T. A., Overbeek, G., Raaijmakers, M., Jongerling, J., & Matthys, W. (this issue). Exploring parenting profiles to understand who benefits from the incredible years parenting program. *Prevention Science*. <https://doi.org/10.1007/s11121-022-01364-6>
- Zhang, J., Zhang, N., Piehler, T. F., & Gewirtz, A. H. (this issue). Emotion regulation difficulties in military fathers magnify their benefit from a parenting program. *Prevention Science*. <https://doi.org/10.1007/s11121-021-01287-8>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.