Letter to the editor

Tanya M. Halliday, Diana M. Thomas, Cynthia O. Siu & David B. Allison

Published online: 08 Dec 2017.

Submit your article to this journal ⎘

View related articles ⎘

View Crossmark data ⎘

Journal of Women & Aging

Routledge
Taylor & Francis Group

Check for updates

Letter to the editor

Concerning Tomisek, A., Flinn, B., Balsky, T., Gruman, C., & Rizer, A. M. (2017). Strong, healthy, energized: Striving for a healthy weight in an older lesbian population. *Journal of Women & Aging*, 29(3), 230–242.

Failing to account for regression to the mean results in unjustified conclusions

An article recently published by Tomisek, Flinn, Balsky, Gruman, and Rizer (2017)in this journal reported on preliminary findings from the Strong. Healthy. Energized (SHE) program. SHE addressed an important topic, testing a 12-week "healthy weight intervention" designed specifically for lesbian women 60 years of age and above with overweight/obesity. The stated goals of this program were to (a) decrease the average waist circumference by 5%; (b) increase the average number of steps per day by 2,000; (c) decrease the percentage of participants consuming sugar-sweetened beverages daily by 25%; and (d) increase the percentage of participants meeting fruit and vegetable intake guidelines by 25%. The authors conclude that the SHE program should be adopted by senior centers and lesbian, gay, bisexual, and transgender (LGBT) centers as it demonstrated "effectiveness in improving health behaviors and short-term health outcomes in the target population" (Tomisek et al., 2017). Specifically, the authors make this conclusion based upon a "marked step increase" (Tomisek et al., 2017) for participants in the lowest tertile-defined category of baseline step count. However, the analysis does not support this conclusion. This is because regression to the mean (RTM), rather than treatment effectiveness, explains, in part, the arrived-at conclusion.

RTM is a statistical phenomenon that describes the tendency for extreme values observed on initial assessment to be less extreme and closer to the population mean with repeated measurement when the correlation coefficient is less than 1.0 (Bland & Altman, 1994). First described in regards to height of children in comparison to their parents and the population by Francis Galton as "regression to mediocrity" (Galton, 1886), RTM is a concept that has often been ignored and misunderstood in health and obesity-related research (Allison, Loebel, Lombardo, Romano, & Siu, 2009; Cockrell Skinner, Goldsby, & Allison, 2016; George et al., 2016; Linden, 2013; Skinner, Heymsfield, Pietrobelli, Faith, & Allison, 2015). Failure to account for RTM often leads to errors in interpretation of results and unjustified conclusions. In pre-/poststudy designs that lack a comparator control group, neglecting RTM can lead to the inaccurate conclusion that an intervention was effective in improving a health outcome in a group of participants (George et al., 2016; Linden, 2013).

In the results section of Tomisek et al. (2017), the authors state, "The SHE program was most effective for participants with low levels of physical activity and steps." As shown in Table 8, subjects whose baseline values were below the bottom tertile averaged ~3,900 steps/day at baseline and ~5,540 steps at the end of the SHE program. The expected analytical approach of evaluating change in step count for the entire sample was not reported (beyond the authors stating that the goal of an increase of 2,000 steps/day on average was not reached). Interestingly, in regards to

waist circumference and body weight, Tomisek et al. first present results of the change from pre- to postintervention in the full sample. In the case of body weight, no significant difference was detected between baseline and postprogram measurement (p = .22). The authors go on to show that participants with higher baseline body weights lost more weight than those in the bottom or middle tertile. They comment that this result was "unsurprising"—which it should be, given that RTM occurs when selecting a subgroup of participants with higher baseline value of body weight from the full sample. Therefore, given the acknowledgement that a decrease in body weight in the group with highest initial body weights was expected, the same logic should have been applied to the outcome of change in step counts. Thus, the conclusion that there was evidence for effectiveness is not justified given that the results are likely due to RTM and not specific intervention effects attributable to the SHE program. This does not mean that the SHE program is not effective, only that it was not convincingly shown to be effective by ordinary scientific standards in this study.

Interventions that are evaluated without the use of a control group are susceptible to the reliance on results that may be a consequence of RTM. Greater vigilance regarding RTM is necessary throughout the research and publication process.

Funding

References

Allison, D. B., Loebel, A. D., Lombardo, I., Romano, S. J., & Siu, C. O. (2009). Understanding the relationship between baseline BMI and subsequent weight change in antipsychotic trials: Effect modification or regression to the mean? *Psychiatry Research*, *170*(2), 172–176. doi:10.1016/j.psychres.2008.10.007

Bland, J. M., & Altman, D. G. (1994). Regression towards the mean. *BMJ*, *308*(6942), 1499. doi:10.1136/bmj.308.6942.1499

Cockrell Skinner, A., Goldsby, T. U., & Allison, D. B. (2016). Regression to the mean: A commonly overlooked and misunderstood factor leading to unjustified conclusions in pediatric obesity research. *Childhood Obesity*, *12*(2), 155–158. doi:10.1089/chi.2015.0222

Galton, F. (1886). Regression towards mediocrity in hereditary stature. *The Journal of the Anthropological Institute of Great Britain and Ireland*, *15*, 246–263. doi:10.2307/2841583

George, B. J., Beasley, T. M., Brown, A. W., Dawson, J., Dimova, R., Divers, J., … Allison, D. B. (2016). Common scientific and statistical errors in obesity research. *Obesity*, *24*(4), 781–790. doi:10.1002/oby.21449

Linden, A. (2013). Assessing regression to the mean effects in health care initiatives. *BMC Medical Research Methodology*, *13*(1), 119. doi:10.1186/1471-2288-13-119

Skinner, A. C., Heymsfield, S. B., Pietrobelli, A., Faith, M. S., & Allison, D. B. (2015). Ignoring regression to the mean leads to unsupported conclusion about obesity. *The International Journal of Behavioral Nutrition and Physical Activity*, *12*, 56. doi:10.1186/s12966-015-0212-6

Tomisek, A., Flinn, B., Balsky, T., Gruman, C., & Rizer, A. M. (2017). Strong, healthy, energized: Striving for a healthy weight in an older lesbian population. *Journal of Women & Aging*, *29*(3), 230–242. doi:10.1080/08952841.2015.1137436

Tanya M. Halliday
Division of Endocrinology, Metabolism and Diabetes, Department of Medicine
University of Colorado - Denver | Anschutz Medical Campus, Aurora, CO, USA

Diana M. Thomas
Department of Mathematical Sciences
United States Military Academy, West Point, NY, USA

Cynthia O. Siu
COS & Associates Ltd., Central, Hong Kong

David B. Allison
Department of Epidemiology and Biostatistics, School of Public Health
Indiana University–Bloomington, Bloomington, IN, USA
✉ Allison@IU.edu
Indiana University School of Public Health-Bloomington, 1025 E 7th St, PH 111,
Bloomington, IN 47405.

Authors' Response (Tomisek, A., Flinn, B., Balsky, T., Gruman, C. & Rizer, A. M.)

To the editor:

Thank you for the opportunity to respond to Dr. Halliday et al.'s letter concerning our work "Strong, Healthy, Energized: Striving for a Healthy Weight in an Older Lesbian Population." This work was an important step in identifying opportunities for healthy weight interventions designed for older lesbian and bisexual women. Strong. Healthy. Energized. (SHE) was one of five healthy weight intervention pilots funded by the Office of Women's Health. Dr. Halliday and colleagues note that our assessment of the intervention data may have resulted in unjustified conclusions regarding the intervention. Specifically, that regression to the mean (RTM) could explain one of the study's findings rather than providing support for the intervention's effectiveness. We appreciate this insight and recommendation to consider RTM.

As noted by Dr. Halliday et al., the article notes that our analyses demonstrated the intervention's "effectiveness in improving health behaviors and short-term health outcomes in the target population." In the original article, our study team noted multiple reasons to support, or justify, the intervention's effectiveness in addition to the step increase for those with the lowest baseline step count. This includes:

(1) Waist circumference: Waist circumference decreased by 3.7% across the group ($p < .01$). This did not meet the program's set goal of a 5% decrease; however, the overall waist circumference decrease provides evidence that the intervention was impactful in improving short-term health outcomes.
(2) Impact of social support: Participants coming into the program with fewer close friends and family lost more weight, implying that SHE is more effective for people with less social support at baseline. As noted in the article, this may be because the SHE program provided social support for individuals who did not have as much of it at baseline.
(3) Goal achievement: Nineteen percent of participants met all of their goals set at the start of the program, and 46% met half of their goals or more, which includes important goals such as improved exercise knowledge, nutritional knowledge, and endurance.
(4) Nutrition impact: When controlling for serving size, 51% of SHE participants reported drinking fewer sugar-sweetened beverages at the end of the program in comparison to consumption at program start.

Additionally, through focus groups, participants noted that the pedometer was the most motivating factor for them. It is important not to discount the full body of evidence in assessing the effectiveness of a nutrition education, social support, and steps-based intervention for an older lesbian and bisexual population.