

certification activities), work toward reducing the overall costs of credentialing and recertifying physicians, and seek novel opportunities to support our profession's newest members. Doing so would reduce the overall trend of increasing bureaucracy and costs and allow young physicians to better focus on delivering patient care and becoming health care's future leaders.

Physician shortages are real, and we must minimize ill-constructed financial barriers to a career in medicine or limitations on specialty choice.⁵ Unless credentialing/recertification and other financial and nonfinancial burdens on physicians are remediated in the current period of increasing government-dictated equalization of scopes of practice and payments to physicians versus nonphysician providers, young trainees will increasingly ask, "Why sacrifice to become a physician?"

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A Discussion of the Refutation of Memory-Based Dietary Assessment Methods (M-BMs): The Rhetorical Defense of Pseudoscientific and Inadmissible Evidence

To the Editor: We read the well-written editorial of Davy and Estabrooks¹ with considerable interest, hoping that they would "provide empirical evidence rather than rhetoric"² to refute our conclusion that the data generated by memory-based dietary assessment methods (M-BMs) of nutrition epidemiology are pseudoscientific and inadmissible as scientific evidence.² Our hope was in vain as Davy and Estabrooks provided an exemplar of the rhetorical defense of M-BMs and the unacceptable "status quo."

THE REPEATED EMPIRICAL REFUTATION OF M-BMS

In 2013, my colleagues and I demonstrated via 2 independent methods that approximately 55% to 88% of the caloric intake estimates of the National Health and Nutrition Examination Survey (NHANES) M-BMs (1971-2010) were physiologically implausible³ and often "incompatible with life."^{4,p7} Davy and Estabrooks admit that our results are "...well recognized and acknowledged...",^{1,p845} but follow with the contradictory statement "we believe that [these data] reflect a reasonable representation of usual dietary intake."¹ These statements are logical contradictions and demonstrate the failure of nutrition

epidemiologists to acknowledge the obvious: population-level physiologically implausible data are not a mere limitation of M-BMs; they are direct empirical refutation of these methods.

Davy and Estabrooks cite Moshfegh et al⁵ as an example in which “the accuracy of dietary recalls can be substantially improved... [via the use of] well-trained research personnel.”^{1,p845} Yet in this study, even with the use of highly trained research personnel, the ratio of reported energy intake to resting energy expenditure for the entire sample was 1.43,^{5,p329} a physiologically implausible value well below the 1.51 needed to be credible (as per Goldberg et al^{6,p576}). The implausible results of Moshfegh et al are due to obese men and women systematically underreporting by 620 and 524 kcal/d (20% and 21%), respectively, and overweight men and women systematically underreporting by 419 and 334 kcal/d (14% and 15%), respectively.⁵ The physiologically implausible data of Moshfegh et al did not represent a limitation of M-BM, but rather represent a “fatal flaw” and direct refutation.

Unlike most research findings,⁷ the lack of credibility of M-BM data has been replicated consistently over the past 3 decades.^{3,8,9} We know of no other data collection tool (in any field of actual science) that demonstrates a significant decrement in performance each time it is used, yet that is precisely what was found in the Energetics study.¹⁰ Over the administration of eight 24-hour recalls, Arab et al¹⁰ reported a statistically significant decreasing trend for energy (−535 kcal/d; $P < .001$) that varied by macronutrient (protein: −22 g/d, −88 kcal/d; fat: −27 g/d, −243 kcal/d; carbohydrate: −54 g/d, −216 kcal/d). Given these results, we think that the Dietary Guidelines Advisory Committee’s (DGAC’s) statement, “repeated 24-hour recalls remain the backbone of dietary assessment and monitoring,”^{11,Appendix E-4,p3} demonstrates that nutrition epidemiologists refuse to acknowledge the

repeated, direct empirical refutation of M-BMs. As such, the DGAC’s request to “expand” the use of M-BM data collection^{11,Appendix E-1,p1} is illogical at best.

ALTERING DATA WHEN THE NUMBERS “DON’T ADD UP”

Nutrition epidemiology often uses statistical machinations and post hoc data exclusions to “correct” or simply delete implausible data and alter results.^{12–15} For example, Donin et al¹⁶ openly state before presenting their results that they removed “176 participants with implausible energy intakes” (ie, deleted ~9% of their data).^{16,p1126} Similarly, Mendez et al^{17,p9} stated that “Adjusting for implausible reporting may help to reduce bias in diet-health outcome association.” Poslusna et al^{18,p573} state that “energy adjustment seems to be a good tool for practice to decrease an influence of misreporting,” and Willet et al^{19,p61} suggested that “calorie-adjusted intakes are likely to be more appropriate with respect to public health policy...” These procedures are not merely correcting erroneous data entries or removing nonrepresentative data (ie, statistical outliers). The result of these machinations is to alter and/or delete the data of individuals *most representative of the population of interest*. For example, the US population is predominantly overweight and obese, and these individuals are the most likely to misreport. In other words, when the numbers did not add up, nutrition epidemiologists simply changed, ignored, or deleted the implausible data (regardless of the systematic biases they introduced) rather than acknowledge the invalidity of M-BMs. We are not aware of any research domain in which this type of data doctoring and consequent message distortion would be tolerated. We think that DGAC’s use of these manipulated data and consequent distorted messages to inform public health policy constitutes dubious scientific practices.

VIOLATIONS OF STATISTICAL ASSUMPTIONS

Since M-BMs were first refuted decades ago, numerous statistical data manipulation protocols have been developed^{20,21} and widely used despite the fact that the foundational assumptions of these methods are not met. For example, the National Cancer Institute’s method “...assumes that the 24-hour recall is an unbiased instrument for measuring usual food intake... and... provides an unbiased measure of the amount of food consumed on a consumption day.”²² Given the fallibility of human memory^{2,23,24} and the fact that M-BM data are not unbiased estimates of consumption,² this assumption is violated and provides an exemplar of the GIGO (Garbage-In = Garbage-Out) principle. Therefore, DGAC’s statement, “usual intake distributions can be estimated based on statistical techniques...”^{11,Appendix E-4,p2} is misleading, and the use of various energy adjustment²⁵ and calibration equations²⁶ should be a nonstarter, not government-funded standard practice.

The American Statistical Association’s “Ethical Guidelines for Statistical Practice”²⁷ clearly states that it is the statistician’s responsibility to “Report statistical and substantive assumptions... [and]... Clearly and fully report the steps taken to guard validity. Address the suitability of the analytic methods and their inherent assumptions...”²⁷ If Davy and Estabrooks’ assertion that the biased and wholly implausible nature of M-BM data “are [is] well recognized and acknowledged by those utilizing these methods,”^{1,p845} the continued use of statistical machinations despite the false assumptions and threats to validity constitute willfully specious statistical practices.

TO PRESENT MERE CORRELATIONS AS EVIDENCE OF CAUSATION IS NOT SOUND SCIENCE

In the 2015 DGAC report, the distinction between correlation and

causation is either ignored or dismissed. For example, the words *association*, *associated*, and *relationship* are used more than 900 times in the 571-page DGAC text, whereas the words *causal* and *causality* are used fewer than 30 times and not once to describe an actual causal diet-health relationship.¹¹ Individuals practicing rigorous science understand that associations are not sufficient to demonstrate causation. Yet the DGAC generates national public health policy recommendations via mere statistical associations from physiologically implausible data while ignoring established causal factors for the development of chronic noncommunicable diseases.²⁸ The DGAC's leap from questionable, confounded, and often clinically irrelevant correlations to dietary recommendations explains recent policy reversals¹¹ and demonstrates a lack of epistemic humility that has significant public health consequences.

MISREPRESENTATION OF THE EVIDENCE

Davy and Estabrooks^{1,p845} state that the implausible and biased nature of M-BMs is “well recognized and acknowledged by those utilizing these methods.” If true, why are the terms *misreporting*, *underreporting*, and *implausible* not evident in the DGAC report with respect to dietary intake? The DGAC does use the term *overreporting* once, but only in reference to physical activity.^{11,Part D,Chapter 7,p3} Nevertheless, if nutrition epidemiologists are well aware of the lack of credibility of M-BM data, then the 2015 DGAC's declaration without caveat that the NHANES M-BM data “provide national and group level estimates of dietary intakes of the U.S. population, on a given day...”^{11,Part C,Methodology,p13} is misleading to both the public and policymakers. It should be obvious that physiologically implausible estimates³ cannot be representative of national

and group-level consumption. As such, DGAC's statement is patently false and in direct violation of the US Department of Agriculture's information quality guidelines that “ensure that the information they disseminate is substantively accurate, reliable, and unbiased and presented in an accurate, clear, complete, and unbiased manner.”²⁹

Furthermore, the DGAC falsely suggests that our data from the article of 2013^{3,Appendix E-4,p2} merely “discussed” the “strengths and shortcomings of [NHANES M-BMs].” Our article was an empirical falsification and refutation of the NHANES M-BMs and presented data on “28,993 men and 34,369 women, aged 20 to 74 years” to arrive at the conclusion that the dietary reports of “the majority of respondents (67.3% of women and 58.7% of men) were not physiologically plausible.”^{3,p1} At no time does the DGAC acknowledge, address, or attempt to refute our findings. As with other empirical refutations of M-BMs,^{8,9,30} the nutrition epidemiologic community and the DGAC simply ignored our results and conclusions.

CONCLUSION

The hypothesis that M-BMs can provide estimates of dietary intakes on the national and group level has been strongly refuted,³ and on the individual-level, M-BM—derived data cannot be falsified (ie, recalled memories are nonempirical and therefore are not subject to independent observation, measurement, and quantification).² As such, these data are pseudoscientific and inadmissible in scientific research and the formulation of national dietary guidelines. Although the status quo is unacceptable, we do not fault Davy and Estabrooks for defending their discipline, which in our opinion promotes a failed research paradigm that lacks scientific rigor and skepticism. Nevertheless, it is time for the US Department of Agriculture,

Centers for Disease Control and Prevention, and the National Institutes of Health to recognize and acknowledge the empirical refutation of M-BMs and reexamine the extensive utilization and funding of these data collection protocols.

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Potential Competing Interests: Dr Archer has received honoraria from the International Life Sciences Institute and the Coca Cola Company. Dr Lavie reports receiving consulting fees and speaking fees from the Coca Cola Company and writing a book on the obesity paradox with potential royalties. Dr Pavela reports no competing interests.

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In Reply—A Discussion of the Refutation of Memory-Based Dietary Assessment Methods (M-BMs): The Rhetorical Defense of Pseudoscientific and Inadmissible Evidence

We appreciate the opportunity to respond to the letter submitted by Archer et al,¹ that was written in response to our editorial² accompanying their article published in the July issue of this Journal.³

We would like to first correct several statements made by these authors, which were either misquoted from our article² or misrepresented in their letter. Our position was not, as stated by Archer et al, to “admit” that *their* previously published results⁴ were “well-recognized and acknowledged,” but rather to acknowledge that there are limitations of self-reported dietary intake methodologies in general, which are

acknowledged by researchers who use these methods. The article by Arab et al⁵ was misrepresented in the letter by Archer et al, as this investigation⁵ studied the feasibility of Internet-based dietary assessment, and was not a study of the accuracy of self-reported dietary intake using the Automated Multiple Pass Method, although it is presented by Archer et al in that way. The final misrepresentation is the statement regarding the Dietary Guidelines Advisory Report (DGAC) calling to “expand” the use of memory-based dietary assessment methods data collection, which Archer et al state is “illogical.” Rather, on the page cited, the DGAC⁶ calls for *expanded participation* in the “What We Eat in America” survey by *underrepresented or at-risk groups*, including racial and ethnic minorities, older adults, and pregnant women.

The article published by Archer et al⁴ that was cited in this letter as evidence supporting their position has been very thoroughly critiqued in a previously published research article,⁷ and debated in a series of letters to the editor.^{8,9} Limitations of the approach used by Archer et al were thoroughly presented by Hébert et al.^{7,9} A reiteration of the points already well presented in these articles would not add new discussion points to this dialogue.

The letter by Archer et al refers to the DGAC report as “not scientifically sound” and “poor scientific advising,” which is notable, in light of recent media reports describing efforts by the food industry to fight proposed dietary guidelines (eg, see Reference 10). This media article,¹⁰ which is just one example of several, specially mentions the Coca Cola Company as a major funder of efforts that criticize the DGAC report. Given the stated financial relationship of 2 of the 3 Archer et al authors to the Coca Cola Company, this financial relationship should be taken into consideration when reviewing their stated position. The sections that criticize the DGAC report are *narrowly*