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LETTERS TO THE EDITOR

Testing Causal Assumptions in Obesity Research

The May edition of the *American Journal of Preventive Medicine* (*AJPM*) provided an interesting analysis by Barlow et al.[1] showing a free trade agreement (FTA) between Canada and the U.S. was temporally associated with approximately 170 additional daily per capita calories available. The authors estimate the causal effect of this association, claiming higher availability of American food caused an average between 1.8 kg and 12.2 kg of weight gain throughout the Canadian population.[1]

Several obesity scholars (including myself) have identified "globalization" occurred along with the obesity pandemic.[2,3] Quantifying this factor is difficult, so Barlow et al. deserve credit for the way they correlated food availability with a specific aspect of globalization (i.e., FTA). Unfortunately, after beginning with an empiric basis, the paper goes on to report some unwarranted speculation.

Specifically, the authors assume 50%−100% "pass-through" of higher food availability to higher intake. Prior investigation has shown the association between food availability and obesity (or raised fasting glucose) prevalence is concave. At low levels of availability there is a direct association, but beyond a hyper-abundant level of 2,926 calories available, the association begins to reverse direction.[2,3] Supporting this finding at the national level, other research indicates that county-level and individual food supply shows a similar pattern.[2] Historically, 2,926 daily per capita calories was the food availability the U.S. had in 1965.[2] By 2008, this level matched the highest obesity prevalence worldwide[2] and Canada had this type of worst-case supply before the FTA began.[1]

Quasi-experimental findings also support the idea that food supply does not necessarily pass through at hyper-abundant levels of food availability. A natural experiment in the U.S. where food availability was purposely reduced by about 100 daily per capita calories was associated with worsening population waist circumference.[2] Likewise, when overweight Air Force members were quasi-randomly relocated to overseas bases, there were more obesity diagnoses among those assigned to Japan (as compared with South Korea, the United Kingdom, or Germany) even though Japan had the lowest amount of national food available per person per day.[2]

Just as pass-through was not tested, the authors also claim experimental testing of free trade is "unfeasible,"[1] which seems unimaginative. Randomized implementation and sunset of FTA provisions could occur among national subdivisions, particularly for nations who wish to reassess whether effects are reciprocal. Investigation of net outcomes is important because of off-target effects. For instance, legislation protecting fast-food companies was unexpectedly associated with healthier reported behavior and more fast-food employment.[4] Although absent from the abstract, the text reports an average $1.82 billion in additional annual U.S. investment in Canadian food companies[1] or about $44 billion over 24 years (when higher employment is associated with less obesity).

Finally, *AJPM* has been courageous about self-assessment in the past, even publishing an investigation showing obesity correlation studies were three times as likely to use causal language when appearing in *AJPM* as compared with other journals.[5] A paper titled "The impact of U.S. [FTA] on. . .obesity" is an opportunity to disclose any changes from the editor's perspective about causal language (e.g., "impact")[6] advocated at that time.[7]

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Author Response to "Testing Causal Assumptions in Obesity Research"

We appreciate the interest generated by our paper evaluating the population impact of the 1989 Canada–U.S. Free Trade Agreement (CUSFTA) on Canadian diets.[1] In an accompanying letter, Dr. Voss, MD, questions (1) whether macro changes in food supply actually correspond to changes in food consumption; (2) whether experimental testing of FTAs is unfeasible; and (3) the use of causal language. Below we respond to each of Voss's claims in turn.

First, in our paper we estimated the potential weight gain that might have occurred if 50%–100% of the approximately 170 kcal/capita/day rise in calorie availability following CUSFTA translated into caloric intake. Voss cites a cross-national analysis showing that the relation between population food availability and obesity prevalence was concave in 2008. This is further supported by reference to two additional observational analyses of the relationship between changes to food availability and weight circumference and obesity.[2]

However, none of this relates to the relationship between food availability and caloric intake. If there is a non-linear association between calorie availability and obesity, this need not imply the link between availability and caloric intake is also non-linear. Alternatively, a non-linear relation between food availability and weight gain can arise from multiple factors, including a lag time in weight gain, differences in physical activity, and other unmeasured factors.

Second, Voss suggests that it is "unimaginative" to deem experimental testing of FTAs unfeasible. Indeed, we would be delighted to collaborate with governments to sequentially implement future FTAs along, for example, "national subdivisions." Yet, as recent difficulties in negotiating new trade deals such as the Transatlantic Trade and Investment Partnership have amply shown, FTA negotiations are complex, highly politicized, and require agreement and compromise among multiple parties.[3] We concede that, in an ideal world, everyone concerned might cooperate in an experiment, but we cannot see how this is realistic. Moreover, it is completely impossible to do so for an historic agreement, such as CUSFTA.

In light of these limitations, the United Kingdom Medical Research Council recommends using quasi-natural experimental designs, as we have done, as a means of fulfilling Bradford Hill's criteria for causality.[4,5] The key difference from a randomized trial is that, here, the intervention, CUSFTA, is outside researchers' control. We followed best-practice methods, including the synthetic control method, and advocated for analyzing the population-level impact of FTAs.[6–11]

Finally, Voss states that we assert causality, claiming that we write "higher availability of American food caused an average between 1.8 kg and 12.2 kg of weight gain throughout the Canadian population." In fact, a careful read of the manuscript reveals we never use the term "cause" or any variant thereof, in relation to CUSFTA's impact on weight gain. In reporting our findings we cautiously use the language of association, refer to CUSFTA's "impact" using suggestive phrasing, and report transparently the potential constraints on causal interpretations in this specific case.

What is clear is that our paper demonstrates the potential for massive, and potentially unintended, consequences for health of FTAs.

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