The Conceptual Framework for the International Food Policy Study: Evaluating the Population-Level Impact of Food Policy

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ABSTRACT

An unhealthy diet is among the leading global causes of death and disability. Globally, a range of policies are being implemented to support healthy food choices at a population level, including novel policies in the areas of food marketing, nutrition labeling, and taxation of less healthy foods. There is a need to evaluate and inform the implementation of these policies, including their impacts on marginalized population subgroups. The International Food Policy Study (IFPS) consists of repeated cross-sectional surveys conducted in 5 high- and upper-middle-income countries: Australia, Canada, Mexico, the United Kingdom, and the United States. In each country, approximately 4000 adults and 1200 children and youth (aged 10–17) were recruited from a global commercial panel to complete an online survey using consistent measures and methodologies across countries. The first annual IFPS surveys were conducted in 2017 with adults; annual surveys for young people aged 10–17 were launched in 2019 in the same countries, as well as in Chile. The design of the IFPS surveys creates a framework for evaluating “natural experiments” in food policies, including comparisons over time within countries implementing the policy and comparisons with countries in which the policy was not implemented. IFPS surveys have 3 primary areas of focus: 1) knowledge, attitudes, and beliefs associated with specific policies; 2) diet-related behaviors; and 3) dietary intake, including 24-hour dietary recalls for adults in 4 of the 5 countries. Surveys also assess food insecurity, income adequacy, sex and gender, race/ethnicity, and a range of other measures to assess trends among priority subgroups. Overall, the IFPS project has the potential to address important gaps in national monitoring surveys for dietary patterns, and to evaluate the impacts of novel food policies implemented in any of the 5 countries over the study period. J Nutr 2022;152:1S–12S.

Keywords: food policy, nutrition policy, policy evaluation, quasi-experimental study, dietary intake, between-country comparisons

Introduction

An unhealthy diet is a primary risk factor for noncommunicable diseases (NCDs), including cardiovascular diseases, type 2 diabetes, and several cancers, and plays a major role in the development of obesity (1, 2). The importance of dietary intake to global NCDs is reflected in major initiatives promoting healthy food policies, including the Global Action Plan for the Prevention and Control of NCDs 2013–2020 (3) and the WHO’s Ending Childhood Obesity Report (4).

Dietary intake is strongly influenced by food environments. Food environments comprise the social, economic, and policy factors that determine food availability, access, and quality, including the food supply, nutrition information, food marketing, cost of food, retail environments, and other environmental influences on dietary intake (5–7). Countries are implementing an increasing number of policies to improve food environments and support healthy eating, including in the areas of food labeling; restrictions on marketing to children; fiscal policies, such as taxes on sugar-sweetened beverages; and enhanced dietary guidelines (5, 8–12).

The need to evaluate these precedent-setting policies has been highlighted by the WHO and others (13). However, national-level policies present several methodological challenges for evaluation. First, population-level dietary patterns evolve over time in response to industry changes and consumer trends, making it difficult to detect the impacts of policies against this backdrop of “secular” change. Second, the impacts of many policies, such as marketing restrictions,
are not immediate, but build over time, necessitating a longer time period for evaluation. Third, national-level policies are frequently implemented with little advance notice, leaving insufficient time to establish evaluation studies and collect baseline measures. Fourth, it is not possible to conduct randomized trials of national-level nutrition policies: countries cannot be randomized to different policies, as would be required to establish control groups. Preimplementation experimental studies—in which research participants are assigned to hypothetical policy condition—can provide data on the potential efficacy of policies. However, these experimental designs have limited ecological validity: they do not account for either the educational efforts that often accompany policy implementation (14–16) or industry actions, which can both enhance policy impact, through actions such as product reformulation (11, 17), and undermine policy impact, including through low uptake of voluntary policies [e.g., the relatively low implementation of voluntary front-of-package (FOP) food labeling in Australia] (18).

“Natural experiment” research designs are ideally suited to evaluating complex interventions, such as national-level policies (19, 20). Natural experiments consist of comparisons between groups in the absence of randomization (21). In the case of national-level policies, countries serve as the comparison groups and differences in dietary trends between countries with and without nutrition policies are the analytical focus. Dietary trends can be assessed using several data sources, including sales data and various market-based indicators; however, population-level surveys are the most common methodology for assessing national-level changes in dietary behavior, particularly when surveys are incorporated into national dietary surveillance frameworks. The frequency with which population-level dietary surveys are conducted is an important factor in their ability to evaluate nutrition policies in a natural-experiment design (22, 23). Population-level surveys that are conducted at frequent intervals—such as in annual waves—can account for potentially different secular trends between countries and can help disentangle policy effects from the “background noise” of these secular changes. Population-level surveys are also enhanced when they include key mediators and moderators of dietary intake, such as nutrition knowledge, food security, and social norms, which are often the primary target of national-level policies. These measures are critical not only for measuring policy impacts, but also as part of routine surveillance to identify policy gaps and needs. Finally, unlike many studies of sales data or market-based data, population surveys typically collect dietary intake data that are linked with detailed measures of socioeconomic status to assess changes among priority at-risk groups (24, 25).

To date, few countries have implemented comprehensive nutrition surveillance frameworks capable of assessing the impacts of novel nutrition policies (26). In many cases, national dietary surveys are conducted on an ad hoc or infrequent basis, and few surveys provide sufficient detail on both dietary intake and key mediators and moderators to understand how and why dietary trends may be changing (27). Furthermore, population surveys across countries are often not comparable due to methodological differences in survey measures, samples, and data collection periods. These limitations are a considerable barrier to the type of between-country comparisons that are required to conduct robust natural experiments of nutrition policies.

The purpose of the current paper is to describe the conceptual approach and methods of an international study that seeks to provide comparative dietary data across countries using population-level surveys. The International Food Policy Study (IFPS) consists of repeated cross-sectional surveys conducted annually in 5 high- and upper-middle-income countries: Australia, Canada, Mexico, the United Kingdom, and the United States. The project provides comparisons within and between countries over time to assess changes in dietary patterns, including natural experiments for policy measures implemented in IFPS countries over the period of study.

Conceptual framework

The theoretical framework of the IFPS is based on the model of dietary behavior developed by Glanz and colleagues (28), which highlights the range of interrelated factors that affect food choices (see Figure 1). While much research to date has focused on individual-level factors, food choices are heavily influenced by broader environmental factors, including the commercial food system, government policies, and population-level nutrition interventions that shape the food environment and the food supply (29). Individual-level variables—including socioeconomic status (SES), food security, and health and nutrition literacy—can moderate or moderate the effects of the food environment on behavior and diet quality. SES and other individual-level variables are particularly important to understanding the impacts of health policies on health equity and current health disparities, as well as the unintended consequences of population-level policies on population subgroups, which are often overlooked in evaluation research.

The conceptual approach of the IFPS project is also based on the principle of natural experiment designs and comparisons across countries, as described above (21, 30). The selection of IFPS countries—Australia, Canada, Mexico, the United Kingdom, and the United States—was based on broad similarities in the food environments, languages, and cultures. In the case of Mexico, geographic proximity and sociocultural similarities to key US subpopulations was also a consideration. IFPS countries also differ in the national-level nutrition policies that have been implemented, which forms the basis for the natural experimental framework. For example, Table 1 illustrates differences between countries in FOP nutrition labeling policies. In 2018, the first year in which IFPS surveys were conducted, Canada and the United States had
not implemented FOP labeling systems. The United Kingdom and Australia had implemented voluntary policies, but for different types of FOP labels (the traffic light and Health Stars FOP labeling systems, respectively). In contrast, Mexico had implemented mandatory FOP labels based on the Guideline Daily Amounts (GDA) system. Thus, countries differed both in the existence of any FOP labeling policy and the type of FOP policy that had been implemented. In addition, FOP policies have changed over the course of the IFPS study: in 2020, Mexico revised its mandatory policy to replace the GDA FOP system with “High In” FOP warnings on foods, similar to the FOP system previously mandated in Chile (31). An additional policy change appears imminent, as Canada has released regulatory proposals to implement a similar High In FOP system (32, 33). The repeated cross-sectional design of the IFPS, in which surveys are conducted annually in each of the 5 countries, is critically important to capturing these policy changes and establishing the natural experiment design: countries with different policies can be compared over time, including “pre-post” differences in countries with and without the policy intervention. The same conceptual approach can be applied to other policy domains on which countries differ, including food marketing restrictions, nutrition labeling requirements in restaurants, retail policies, and national dietary guidelines, among others (34, 35).

The IFPS also draws on conceptual frameworks from tobacco control research, which aim to evaluate population-level policies in tobacco control by measuring upstream, proximal, policy-specific measures to understand the impacts on downstream, distal behavior changes and health outcomes (36, 37). IFPS surveys include measures of proximal and policy-specific variables (e.g., food label comprehension, exposure to food marketing, awareness of sugar taxes) that are conceptually close to the policies that are being evaluated, and are thus less likely to be affected by other confounding factors, compared to more downstream outcomes (see Figure 1). The use of proximal measures, such as self-reported exposure to marketing and awareness of product warnings/labels, are well established in domains such as tobacco control (37–39). For example, self-reported exposure to marketing is associated with objective data on advertising expenditures and audience viewership numbers, as well as behavioral outcomes (40–43). IFPS surveys incorporate policy-specific variables from multiple food environment policy domains (see Figure 1), which have the potential for synergistic and/or antagonistic effects.

**Methods**

IFPS data are collected in November/December annually. The first survey wave was conducted in 2018 following an extensive pilot study in the 5 IFPS countries in 2017 (44). All data collection for the IFPS occurs online. The use of online surveys is expanding, given their convenience and reach, and online surveys are now the most common form of data collection (45–50). Recent findings from major research centers suggest that response rates for telephone surveys in the United States are around 9% (51). Internet penetration now exceeds that for landline subscriptions, and is approximately 90% or more in Australia, Canada, the United Kingdom, and the United States (52–55) and 77% in urban areas of Mexico (56). In addition, internet usage is known to be similarly high among those with lower levels of education in IFPS countries (52, 57, 58), including Mexico (59), albeit somewhat lower among those with lower income levels (60). Online surveys also provide several administrative advantages, including the ability to use automated skip logic and questionnaire routing to address complicated patterns of dietary behaviors (61, 62) and the ability to include images that can both improve self-reporting and simplify the provision of complex, experimental designs related to viewing food products and food marketing (63). Research suggests that social desirability bias may be lower in online compared with interviewer-administered surveys for sensitive topics such as food security (64), with little or no difference in dietary intake reporting when data collection is conducted online or in person (65–67). IFPS surveys have been adapted to optimize the survey layout on smaller screens, including greater vertical (compared with horizontal) scrolling, to ensure the legibility of wording and any
TABLE 1: International Food Policy Study quasi-experimental study design for FOP labeling

<table>
<thead>
<tr>
<th>FOP labeling policy</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico: Guideline Daily Amount and &quot;High In&quot; FOP labels</td>
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<tr>
<td>Australia: Health Star FOP labels</td>
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<td>United Kingdom: Traffic light FOP labels</td>
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<tr>
<td>Canada: no FOP label (control)</td>
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<td></td>
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<tr>
<td>United States: no FOP label (control)</td>
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</tbody>
</table>

1 FOP, front-of-package.
2 Mandatory FOP labels.
3 Voluntary policy.

Survey content

The IFPS study incorporates best practices for online surveys to enhance data quality, including exclusions for speeders, (those completing the survey in less than one-third the median completion time), and respondents with high rates of inattention, including respondents with sticky answers or those responding without a pause of at least 10 seconds between responses (29). The survey includes primary modules, summarized below.

Sociodemographic measures and food security.

Whenever possible, sociodemographic measures were used or adapted from government-led national surveys in each country to ensure comparability to national, census-based surveys and across countries. The survey assesses age at birth, gender identity (74), ethnicity (75–79), and household and family composition. Socioeconomic measures include education (75, 76, 78–80), perceived income adequacy (81), subjective social status (82), and zip/postal code data to calculate the area-level deprivation index as an objective proxy measure of socioeconomic status (83, 84). Household food security is assessed using the US Household Food Security Survey Module (85).

Health literacy and nutrition knowledge.

Health literacy is examined using a self-administered adaptation of the Newest Vital Sign, which assesses comprehension of the information displayed in Nutrition Facts tables, which are a partial measure of the US Household Food Security Survey Module (85).

Health policy information.

Health policy information includes the results of pilot surveys and other research that inform the development of the survey instruments and questionnaires. This information is used to identify and address potential issues with the survey design, including the layout and presentation of questions, the choice of response options, and the overall effectiveness of the survey.

Health action plans.

Health action plans are developed based on the results of the survey and the relevant stakeholders. The plans are designed to provide guidance on the implementation of policies and practices that can improve health outcomes. The plans are reviewed and updated regularly to ensure that they remain relevant and effective.

Survey evaluation.

Survey evaluation includes the assessment of survey reliability, validity, and responsiveness. Reliability refers to the consistency of survey results across different samples or administrations. Validity refers to the extent to which the survey measures what it is intended to measure. Responsiveness refers to the ability of the survey to detect changes in the population over time.

Survey dissemination.

Survey dissemination includes the distribution of the survey results to relevant stakeholders, such as policymakers, public health officials, and researchers. The dissemination of survey results is designed to ensure that the findings are communicated effectively and that they are used to inform decision-making.

Survey implementation.

Survey implementation includes the planning and coordination of the survey activities, such as the recruitment of participants, the administration of the survey, and the analysis of the data. The implementation of the survey is designed to ensure that it is conducted efficiently and effectively.
tables displayed in each country) (86, 87). In addition, IFPS surveys include the FoodProK score, which assesses respondents’ ability to identify healthiness as a function of the overall level of food processing (88). A total of 12–15 food products are rated—3 products in each of 4 food groups (fruit and vegetables, grains, dairy, and meat)—with an additional category added for fish products in 2020 (89, 90). Participants are separately asked to self-report their perceived level of nutrition knowledge (91).

**Policy-specific variables.**

Policy-specific measures are included for 6 major policy domains (food labeling, food marketing, food price/taxation, food retail environments, public education campaigns, and dietary guidelines). For food labeling, respondents in each country view images of the relevant Nutrition Facts and FOP labels implemented in their country and are asked a series of survey measures regarding noticing, use of, ease of understanding, and perceived influence of food labels while the images are displayed on the screen (92–94). The incorporation of labeling images in the survey measures is important to ensure respondents do not confuse the labels of interest with voluntary claims and other labeling images frequently used by food manufacturers. Measures also incorporate noticing and use of nutrition information on menus (e.g., menu labeling) in restaurant settings. For food marketing, measures examine self-reported exposure to marketing via different channels (e.g., TV, digital, packaging), as well as marketing content (e.g., traditional ads, sponsorships, product tie-ins), with a focus on marketing of sugary drinks and fast food. Additional measures examine marketing exposure and outcomes among parents with children (95, 96). For food price/taxation, the measures examine purchasing patterns, awareness of sugar taxes, and social norms and attitudes regarding sugary products. For food retail environments, the measures query supermarket policies and retail environments within and surrounding homes, school, and work. For public education campaigns and dietary guidelines, open-ended questions probe awareness of and recall of key messages within campaigns or guidelines (97).

**Diet-related behaviors.**

Three frequency-based measures assess aspects of dietary intake. A Food Source Dietary Recall was adapted and validated to establish the proportion of meals that are purchased outside of the home and to understand the types of food outlets those meals were purchased at, as well as the manner of purchasing (take out, dine in, online ordering via a food app) (101–103). The Beverage Frequency Questionnaire (BFQ) assesses the prior 7-day beverage intake, focusing on sugary drinks (104). The BFQ captures drinks consumed infrequently or episodically, such as energy drinks and alcoholic beverages that may not be captured in 24-hour recalls, and has been shown to be highly correlated with 7-day food records among young adults in Canada (104). Compared to the 24-hour dietary recalls (described below), the 7-day period of the BFQ provides a better assessment of individual-level sugar drink intake, particularly for beverages that are consumed less frequently. An adaptation of the Behavioral Risk Factor Surveillance System fruit and vegetable screener was included to assess fruit and vegetable intakes (105). The survey also assessed efforts to modify intakes of specific food categories and nutrients (e.g., sugars or sodium) (106, 107) and efforts and modes for weight loss (108).

**Dietary outcomes (24-hour dietary recalls).**

Beginning in 2020, IFPS respondents in all countries except Mexico were asked to complete an online 24-hour dietary recall following completion of the main IFPS survey. The 24-hour dietary recalls provide the opportunity to examine population-level intakes for specific nutrients (e.g., sugar), as well as commonly used indices of diet quality, such as the Healthy Eating Index (109). The Automated Self-Administered 24-Hour Dietary Assessment Tool (ASA24) was used in the United States, Canada, and Australia. The ASA24 was developed by the US National Cancer Institute to make it feasible to collect recalls in large studies (110). The ASA24 is modeled on the automated multiple-pass method, developed by the USDA to enhance the accuracy of interviewer-administered recalls (111, 112), and is used in NHANES and the Canadian Community Health Survey (CCHS) (113). In the United States, the ASA24 is available in Spanish and includes foods consumed by Mexican people living in the United States, as well as Mexican-Americans. Respondents reported foods and drinks consumed the prior day (by browsing or searching user-friendly terms), entered details of food preparation and portion size, and were prompted to think about frequently forgotten items. The intake frame for the ASA24 was from midnight to midnight of the previous day, and respondents were required to complete reporting in a single session. ASA24 modules for location, “ate with,” and supplements were turned on. UK respondents completed a similar online dietary recall using the Intake24 system (114). An equivalent online 24-hour dietary recall is not available in Mexico.

**Distal health measures and weight-related measures.**

Self-reported height (without shoes) and weight (without clothes or shoes) were used to calculate BMI (115), using appropriate measurement units in each country (e.g., pounds, kilograms, or stones in the United Kingdom and Australia; pounds or kilograms in all other countries). The survey incorporates brief measures of weight perceptions, weight-related stigma, and disordered eating (116, 117). Self-reported measures of general health, stress, and mental health are incorporated (118).

**Analysis**

Poststratification sample weights were constructed for each country separately based on known population totals by age, sex at birth, region, ethnicity (except in Canada), and education (except in Mexico). Respondents were classified into sex-by-age-by-region groups, ethnicity-by-region groups (except in Canada) and education groups (except in Mexico). Corresponding census data from each country were obtained. Separately by country, a raking algorithm was applied to compute weights that are calibrated to these groupings. Raking is an iterative technique to align weighted sample proportions with known population proportions (119). A SAS macro (SAS Institute) (120) was used with trimming to control extreme weights and large CVs (121), if necessary. Trimming, if necessary, was applied for weights greater than 5 times the mean weight or less than 0.2 times the mean weight. Respondents missing a value for any of the weighting variables were assigned the mean weight for their other variables. Small sample sizes (cells generally of less than 15 respondents) lead to collapsing of some weighting variable categories. Finally, the weights were rescaled to equal the sample size in each country. Additional information on the age, sex at birth, region, ethnicity, and education categories used for weighting and the range of survey weights in each country are available in Supplemental Table 1.

Typically, analyses are conducted using survey-adjusted logistic and linear regressions, including indicator variables for country and year where applicable, and multiplicative interaction terms to examine differences between countries over time. The IPS data also support interrupted time series analyses to assess policies for which trends are expected to be linear and interventions are introduced at 1 time point, given the multiple waves of data collection prior to policy implementation in many circumstances (122, 123).

**Results**

**Survey response rates**

For commercial panels that include nonprobability-based samples, the American Association for Public Opinion Research downloaded from https://academic.oup.com/jn/article/152/Supplement_1/1S/6547004 by University of Waterloo user on 20 September 2022
(AAPOR) recommends reporting the participation rate, also referred to as the completion rate. The participation rate is defined as “the number of respondents who have provided a usable response divided by the total number of initial personal invitations requesting participation” (124). Participation rates are largely a product of sample management and the amount of sample that is “released” prior to reaching target quotas. The total participation rates were 6.5%, 4.0%, and 3.9% in 2018, 2019, and 2020, respectively. Because the IFPS surveys are conducted over predetermined, limited time periods, email invitations are sent to a greater number of respondents than are required to achieve the survey quotas before the survey end date. Accordingly, the number of nonresponders is higher than would otherwise be the case if the survey did not have quotas or the sample was released more slowly to allow for additional reminder invitations. Given this, the cooperation rate can provide a more informative indication of potential self-selection bias. The cooperation rate represents “the proportion of all cases interviewed of all eligible units ever contacted.” Based on AAPOR Cooperation Rate #2, the cooperation rates across all countries were 69.2% in 2018, 60.1% in 2019, and 62.1% in 2020. Additional information on sample dispositions is available in the online technical reports (125–127).

Disputation rates are also calculated for completion of the 24-hour dietary recalls among the IFPS samples. Prior to 2020, 24-hour dietary recalls were only conducted in Canada. In Canada, totals of 3303 respondents (75.1%) in 2018, 2606 respondents (63.5%) in 2019, and 3028 respondents (70.3%) in 2020 completed the 24-hour dietary recall and had usable data. In 2020, 72.1% of Australian respondents, 71.2% of UK respondents, and 61.3% of US respondents completed the 24-hour dietary recall.

Sample profile

Table 2 shows the unweighted and weighted sociodemographic characteristics for the 2020 sample in each of the 5 countries [tables for the 2018 and 2019 samples are publicly available (125, 126)]. Overall, the unweighted IFPS sample had a higher education level than the general population in all countries, and particularly in Mexico (see Supplemental Figures 1 and 2 for comparisons of national and weighted IFPS estimates for the percentages of participants that were of the majority ethnicity or had low education). The proportions of the weighted sample that identified as the ethnic majority in each country were similar to or slightly higher than national estimates, but were very similar (within 3%) when weighted, with the exception of the United States, which had a higher proportion of White-only participants than the general population. The application of survey weights made the proportion of the sample with low education similar to national estimates in all countries except Mexico, for which the small number of participants with low education made weighting by this variable unfeasible.

Figure 2 compares self-reported IFPS estimates of the percentage of the sample that have a BMI $\geq$ 25.0 kg/m$^2$ (indicating overweight or obesity) to national estimates of directly measured BMI among approximately the same age group using a similar data source across countries [Organization for Economic Cooperation and Development (OECD)] (128), indicating that self-reported IFPS estimates are systematically lower than directly measured estimates. When compared to the self-reported BMI (as opposed to the directly measured BMI) from nationally representative surveys (when available), IFPS estimates were more closely aligned (see Supplemental Figure 1). For example, the prevalence of overweight and obesity was 63.1% in the self-reported 2018 CCHS (129), compared with 59.0% in the 2018 IFPS Canadian sample, 59.9% in the 2019 IFPS sample, and 56.2% in the 2020 IFPS sample (excluding missing data to allow for comparable estimates) (129). Similarly, in the United States, the prevalence of overweight and obesity was 66.2% according to 2018 OECD self-reported obesity estimates of those aged 15 years or more, compared with 61.6% in those aged 18 years or more in the 2018 IFPS US sample and 60.6% in the 2019 IFPS US sample (128).

IFPS youth surveys

Although the IFPS surveys were originally limited to respondents 18 years and older, many policy measures are targeted at improving diets among children and youth. Beginning in 2019, IFPS surveys were expanded to include respondents aged 10–17 in each of the 5 countries, as well as in Chile, which has implemented a range of novel policy measures (130, 131). The methodology is similar to the adult IFPS surveys, with sample recruitment through parents/guardians in the Nielsen Consumer Insights Global Panel in each country. Annual surveys are conducted with approximately 1500 respondents in each country, with an oversample of approximately 3500 respondents in Canada due to greater funding availability. The wording and content of the IFPS child and youth surveys have been adapted to be age appropriate, and to have a greater focus on the school nutrition setting and food marketing. In 2019, the cooperation rate across all countries was 76.8%, calculated as the percentage of respondents who completed the survey (11,108) of those eligible who accessed the survey link (14,457) (124). As is the case for adults, the youth surveys are conducted in English, French, and Spanish, and the median survey time in 2019 was 24 minutes across countries. Note that 24-hour dietary recalls are not conducted among the youth sample. Additional details on the IFPS child and youth surveys and the sample profile are available (71).

Discussion

A new era in nutrition policy is emerging, in which an increasing number of countries are implementing policy measures to address the public health burden from deteriorating diet quality. There is an immediate need for evidence to inform and evaluate these policy decisions. The use of natural experiments—with comparisons within and across countries over time—provides a robust framework for examining the impacts of national-level policies. The consistent methodology and annual surveys of the IFPS study provide an infrastructure that can provide pre- and postmeasures for policies implemented in the participating countries, as well as direct comparisons with countries in which policies have not been implemented. Even in the absence of policy changes, the IFPS study can make contributions to dietary surveillance at the country level (132). In Canada, for example, nationally representative assessments of dietary intake are conducted sporadically, with the 2 most recent data collections occurring in 2004 and 2015. Similarly, household food security data are collected on an infrequent basis in Mexico and Australia, and regular data collection has only recently been announced in the United Kingdom (133, 134). The lack of routine dietary surveillance was laid bare by the coronavirus disease 2019 pandemic: few countries had the necessary survey measures in place to understand how the pandemic affected levels of food insecurity and dietary behaviors. In the absence of gold-standard, probability-based surveys conducted by national...
### TABLE 2  International Food Policy Study 2020 unweighted and weighted sample characteristics by country (N = 21,753)

<table>
<thead>
<tr>
<th></th>
<th>Australia, n = 4289</th>
<th>Canada, n = 4309</th>
<th>Mexico, n = 4284</th>
<th>United Kingdom, n = 4249</th>
<th>United States, n = 4622</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unweighted</td>
<td>Weighted</td>
<td>Unweighted</td>
<td>Weighted</td>
<td>Unweighted</td>
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<tr>
<td><strong>Sex at birth</strong></td>
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</tr>
<tr>
<td>Male</td>
<td>49.6% (2126)</td>
<td>49.1% (2104)</td>
<td>49.1% (2117)</td>
<td>49.4% (2127)</td>
<td>50.6% (2166)</td>
</tr>
<tr>
<td>Female</td>
<td>50.4% (2163)</td>
<td>50.9% (2185)</td>
<td>50.9% (2192)</td>
<td>50.6% (2182)</td>
<td>49.4% (2118)</td>
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<tr>
<td><strong>Age, years, mean (SD)</strong></td>
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<tr>
<td></td>
<td>48.3 (17.31)</td>
<td>46.6 (17.07)</td>
<td>48.2 (17.17)</td>
<td>47.9 (17.44)</td>
<td>38.1 (13.00)</td>
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<tr>
<td><strong>Education</strong></td>
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<tr>
<td>Low</td>
<td>43.6% (1870)</td>
<td>41.9% (1798)</td>
<td>28.0% (1207)</td>
<td>42.3% (1821)</td>
<td>22.7% (972)</td>
</tr>
<tr>
<td>Medium</td>
<td>30.9% (1326)</td>
<td>32.0% (1374)</td>
<td>40.9% (1764)</td>
<td>33.1% (1425)</td>
<td>13.6% (582)</td>
</tr>
<tr>
<td>High</td>
<td>25.0% (1071)</td>
<td>25.5% (1094)</td>
<td>30.5% (1314)</td>
<td>24.1% (1040)</td>
<td>63.6% (2723)</td>
</tr>
<tr>
<td>Not stated</td>
<td>0.5% (22)</td>
<td>0.5% (23)</td>
<td>0.6% (24)</td>
<td>0.6% (24)</td>
<td>0.2% (7)</td>
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<tr>
<td><strong>Ethnicity</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Majority</td>
<td>83.1% (3563)</td>
<td>73.3% (3144)</td>
<td>78.0% (3362)</td>
<td>77.3% (3300)</td>
<td>81.2% (3479)</td>
</tr>
<tr>
<td>Minority</td>
<td>16.6% (710)</td>
<td>26.3% (1,129)</td>
<td>20.6% (888)</td>
<td>21.4% (921)</td>
<td>16.3% (700)</td>
</tr>
<tr>
<td>Not stated</td>
<td>0.4% (16)</td>
<td>0.4% (16)</td>
<td>1.4% (59)</td>
<td>1.3% (58)</td>
<td>2.5% (105)</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>3.3% (140)</td>
<td>3.5% (151)</td>
<td>2.9% (123)</td>
<td>3.0% (128)</td>
<td>1.7% (72)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>30.8% (1321)</td>
<td>32.3% (1384)</td>
<td>34.4% (1483)</td>
<td>34.3% (1477)</td>
<td>37.3% (1600)</td>
</tr>
<tr>
<td>Overweight</td>
<td>27.4% (1176)</td>
<td>26.9% (1152)</td>
<td>27.4% (1181)</td>
<td>26.2% (1128)</td>
<td>30.3% (1298)</td>
</tr>
<tr>
<td>Obesity</td>
<td>23.2% (987)</td>
<td>21.9% (939)</td>
<td>21.2% (913)</td>
<td>21.7% (935)</td>
<td>14.2% (607)</td>
</tr>
<tr>
<td>Missing</td>
<td>15.3% (659)</td>
<td>15.5% (663)</td>
<td>14.1% (609)</td>
<td>14.3% (641)</td>
<td>16.5% (707)</td>
</tr>
</tbody>
</table>

1 The education level was categorized as low (i.e., completed secondary school or less), medium (i.e., some postsecondary qualifications), or high (i.e., university degree or higher) according to country-specific criteria related to the highest level of formal education attained.
2 Ethnic categories in each country, as per the census questions asked in each country: 1) in Australia, majority indicates the participant only speaks English at home and minority indicates they speak a language besides English at home; 2) in Canada, the United Kingdom, and the United States, majority indicates the participant is White and minority indicates they are of other ethnicity; and 3) in Mexico, majority indicates the participant is nonindigenous and minority indicates they are indigenous.
3 The BMI classifications are underweight (< 18.5 kg/m²), normal weight (18.5 to 24.9 kg/m²), overweight (25.0 to 29.9 kg/m²), and obese (≥ 30 kg/m²).
FIGURE 2 Comparison of self-reported BMI estimates from the IFPS weighted sample of the percentage of the population that has overweight and obesity in 2018 and 2019 compared to most recent ‘directly’ measured rates according to the OECD


authorities, IFPS data can serve as benchmarks to track changes over time in national samples with similar sociodemographic profiles to the broader population.

Limitations and data collection challenges
Response rates in population-based surveys are declining (68). Traditional random-digit-dialed phone surveys suffer from response rates below 10% (or <5% for sampling frames that include unlisted cell phone numbers) and are likely no longer suitable for surveying young people, who have diminishing access to landlines (135–137). Accordingly, methods for conducting population-based surveys are rapidly shifting from random-digit-dial telephone-based surveys to online data collection, often using commercial panels recruited through nonprobability recruitment methods. The extent to which these samples are representative of the broader population is an important consideration for population-based surveys such as the IFPS. The weighted IFPS estimates closely resemble population sociodemographics in most countries, including for variables that are incorporated in the poststratification weights. For example, the self-reported BMI was lower in the IFPS than in surveys where height and weight were objectively measured, while comparisons with self-reported data suggest that the IFPS estimates are similar to or perhaps slightly lower than nationally representative surveys. Overall, estimates from nonprobability-based samples should be interpreted with caution, and should be compared with key indicators from nationally representative surveys where possible.

A primary recruitment challenge is that of low-SES and older participants in Mexico, which are underrepresented in both unweighted and weighted IFPS data. Mexico is the only upper-middle-income IFPS country and has very different population demographics compared to other IFPS countries, including for the average age of the population, income, and life expectancy, which may systematically influence access to and participation in survey panels and online surveys. Preliminary data suggest that targeting these groups with specific online survey panels, and increasing accessibility of the survey among those with smartphones, may lessen some of these challenges. The inclusion of other middle- and lower-income countries, including those with markedly different food environments, would be an asset.

The use of self-reported measures for dietary indicators is subject to limitations. For example, self-reports of BMI are known to produce lower estimates than directly measured BMIs. Tests of changes over time in self-reported BMI values may help to mitigate some of the bias associated with single point estimates, on the basis that self-report biases at the population level should be generally constant over time. As the IFPS is limited to a single 24-hour dietary recall, the surveys estimate the mean usual intakes for groups, but are not considered representative of usual intakes for individuals, and cannot be used to estimate distributions of usual intakes for comparison to Dietary Reference Intakes, for example (138). All of the online 24-hour dietary recalls (the ASA24 in the United States, Canada, and Australia and the Intake24 system) use an online interface and adapted automated multiple-pass methods, but differences in responses and response biases have not been tested. Although an online 24-hour dietary recall is under development in Mexico, the lack of a comparable online tool for evaluation of dietary practices in Mexico limits the ability to conduct similar comparisons. Other dietary indicators, such as beverage intake, fruit and vegetable intake, and others, have been adapted from the national measures used in the United States and would be subject to similar levels of mis- or underreporting. Many measures have been tailored to capture unique aspects of dietary intake. For example, the BFQ assesses intake over 7 days to capture episodically consumed beverages that may be missed when only reporting intake for the previous 24 hours, and uses images to support accurate recall of the container size. A comparison of a version of the BFQ relative to 7-day food records among young adults 16–30 years in Canada found moderate to high correlations and agreement between
estimates of the frequency of consumption and total volume of each of the beverage categories consumed for 14 of 17 beverage categories (between 0.46 and 0.91 for the number of drinks and 0.48 and 0.95 for the volume) and lower correlations for 3 of 17 categories (coffee with cream or sugar, specialty coffee, and hard alcohol with no mix) (104).

Although the IFPS is designed primarily to examine national-level differences, several important nutrition policies are implemented at the subnational level, particularly in Canada, Australia, and the United States, in which many policies are implemented at the state/provincial level. The ability to evaluate subnational policies with IFPS data is largely determined by issues of sample size and statistical power. Analyses of subnational policies that apply to small segments of the population will have limited power for within-country differences over time; however, sample sizes of 4000 in each country may be sufficient to detect policies that cover substantial proportions of the overall population within a country.

In conclusion, the importance of diet-related NCDs and their contributions to global morbidity and mortality require fundamental shifts in nutrition policy and sociocultural norms surrounding food and nutrition. Innovative policy measures implemented in different countries provide an opportunity to advance the evidence on nutrition policies and to inform regulators in other jurisdictions. The IFPS project seeks to collect this evidence and to document broader trends in dietary patterns across countries.

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International food policy study conceptual framework


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