

Validity of a Single Item Food Security Questionnaire in Arctic Canada



WHAT'S KNOWN ON THIS SUBJECT: Food insecurity is best measured by comprehensive assessments. However, rapid assessments can be useful in certain circumstances, but their validity is not characterized.



WHAT THIS STUDY ADDS: Rapid assessment of food insecurity is feasible among Inuit adults and children.

abstract

OBJECTIVES: Assess sensitivity and specificity of each of the 18 US Department of Agriculture (USDA) Household Food Security Scale Module (HFSSM) questionnaire items to determine whether a rapid assessment of child and adult food insecurity is feasible in an Inuit population.

METHODS: Food insecurity prevalence was assessed by the 18-item USDA HFSSM in a randomized sample of Inuit households participating in the Inuit Health Survey and the Nunavut Inuit Child Health Survey. Questions were evaluated for sensitivity, specificity, predictive value (+/−), and total percent accuracy for adult and child food insecurity (yes/no). Child food security items were evaluated for both surveys.

RESULTS: For children, the question “In the last 12 months, were there times when it was not possible to feed the children a healthy meal because there was not enough money?” had the best performance in both samples with a sensitivity and specificity of 92.3% and 97.3%, respectively, for the Inuit Health Survey, and 88.5% and 95.4% for the Nunavut Inuit Child Health Survey. For adults, the question “In the last 12 months, were there times when the food for you and your family just did not last and there was no money to buy more?” demonstrated a sensitivity of 93.0% and a specificity of 93.4%.

CONCLUSIONS: Rapid assessment of child and adult food insecurity is feasible and may be a useful tool for health care and social service providers. However, as prevalence and severity of food insecurity change over time, rapid assessment techniques should not replace periodic screening by using the full USDA HFSSM questionnaire. *Pediatrics* 2014;133:e1616–e1623

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KEY WORDS

food insecurity, community medicine, survey

ABBREVIATIONS

HFSSM—Household Food Security Scale Module

IPY—International Polar Year

PV—predictive value

USDA—US Department of Agriculture

Ms Urke interpreted results and drafted and revised the initial manuscript; Ms Cao conducted data analyses, interpreted data, and reviewed and revised the manuscript; Dr Egeland conceptualized and designed the study, coordinated and supervised data collection and data analyses, interpreted the data, and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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Food insecurity, a state of “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways,”¹ is a global challenge. In the period 2010–2012, an estimated 870 million people were undernourished, a major manifestation of food insecurity.² In 2012, 14% of the US population were food insecure at some point during the year,³ and in 2004, 9% of Canadian households were food insecure.⁴ Although already a chief concern in developing countries, with economic instability in Europe and North America, it is reasonable to expect food insecurity is a growing challenge in developed countries as well. Household and individual food insecurity are related to poor cognitive development, and suboptimal learning and health in children,^{5–9} and to poorer nutrient intake and diet-sensitive chronic diseases in adults.^{8,10–18} The degree of food insecurity varies between and within groups and is highly prevalent among Indigenous Peoples.^{4,19,20} High food insecurity prevalence has been observed among Inuit in the Arctic^{21–23}; 62% of Inuit households were food insecure in 2007–2008,²¹ far above the Canadian national estimate.⁴ Further, a study from 2007 to 2008 of child food insecurity in 16 Nunavut Inuit communities revealed that 56% of children under 5 years were food insecure, with 25% being severely food insecure.²² Vulnerabilities in these communities include geographic location, which influence food prices, unemployment rates, and numerous factors associated with local traditional food availability and access.^{24,25}

Food insecurity assessment often relies on the US Department of Agriculture’s (USDA) 18-item Household Food Security Scale Module (HFSSM),¹ an experience-based measure of household food insecurity. Research has demonstrated

the ability of the USDA HFSSM to validly and reliably identify food insecure households²⁶ and to distinguish between different degrees of food insecurity.¹ Previous research has demonstrated the construct validity of the USDA HFSSM in assessing food insecurity in Inuit communities through significant associations with poor dietary quality,^{10,21,27} slightly lower mean BMI and body fat in adults,²¹ lower nutrient intakes and biomarkers of nutrient status,¹⁰ and lower socioeconomic status.²¹

Given growing economic instability and the importance of food insecurity as a determinant of health, there is an interest in identifying whether the use of 1 or 2 questions can adequately identify food insecurity in a population. Rapid assessment techniques could be useful for health care and social service providers in identifying households in need of assistance and could easily be incorporated into population-based surveys without increasing research burden for participants. We therefore evaluated the performance of individual USDA food insecurity questions for their ability to predict food insecurity assessed by the full USDA HFSSM.

METHODS

Study Design

The study was undertaken among Inuit households participating in the Canadian International Polar Year (IPY) Inuit Health Survey. For child food insecurity, the repeatability of the performance of the questions was evaluated in a second survey, the Nunavut Inuit Child Health Survey of preschoolers.

IPY Inuit Health Survey

A cross-sectional Inuit Health Survey was conducted as part of the Canadian IPY research activities in the late summer and fall of 2007 and 2008 in 36 communities (33 coastal and 3 land-based communities) in the 3 jurisdictions of Inuvialuit Settlement

Region, Nunavut, and Nunatsiavut.^{10,21} The communities represent the high-Arctic located from a latitude of 54°10’N to 76°25’N. Stratified random sampling was carried out where communities were strata and homes were randomized by using either a computer random generation of numbers or a random digit table. The overall sample comprised 2796 eligible households of which 1901 agreed to participate (response rate of 68%).²¹ The survey was developed in a participatory process²⁸ with steering committees representing each of the 3 jurisdictions. Details of steering committee membership are provided elsewhere.²⁹ Scientific research licenses were obtained from the Nunavut Research Institute and from the Aurora Research Institute–Aurora College (Inuvik, Northwest Territories). A certificate of ethical acceptability was awarded by the McGill Faculty of Medicine Institutional Review Board. Consent forms, questionnaires, and the DVD were translated into different Inuit dialects appropriate for the regions surveyed, and all participants signed a written consent form.

Nunavut Inuit Child Health Survey

The Nunavut Inuit Child Health Survey was also conducted in 2007–2008 and consisted of 388 randomly selected preschool children aged 3 to 5 years residing in 16 of the 25 communities in Nunavut (response rate of 72.3%), details of which have been published elsewhere.^{22,27} The USDA HFSSM was also used in the Child Health Survey. For the purpose of this study, households that were also included in the IPY Inuit Health Survey were excluded leaving a sample of 249 children for the repeated analysis.

Measures

Trained bilingual (English and Inuit dialects) assistants and research nurses interviewed the primary respondent of each participating household to collect information on household composition

and food security. Food security was assessed by using the 18-item USDA food security module¹ slightly modified by Indian and Northern Affairs Canada to improve acceptability among Inuit.³⁰ Ten questions were related to the status of adults and 8 questions pertained to children in the household. Answers to the 18 questions were considered affirmative when responses included “yes,” “often,” “sometimes,” and “almost every month,” or “some months” and “1–2 months” for questions asking about the frequency. Negative responses included “no,” “never,” and “not applicable.” The 18-item scale was then used to classify food insecurity on the basis of the Health Canada’s classification system.⁴ For children, the classification is the same for the USDA and Health Canada approaches (ie, ≥ 2 affirmative responses),³¹ but for adults, Health Canada and USDA approaches yield slightly different assessments with Health Canada using 2 affirmative responses in contrast to 3 used by the USDA for determining food insecurity. Those reporting anxiety that food will run out with no other indication of food insecurity are classified as food secure. Food insecurity ranges from moderate (ie, reduced quality, variety, or desirability of diets) to severe (ie, disruption of normal eating patterns, such as skipping meals, reducing the size of meals, going hungry, and not eating for a whole day). The equivalent terms used for the USDA food security assessment are *high/marginal food security*, *low food security*, and *very low food security*.³²

Statistical Analyses

For each individual item, sensitivity, specificity, positive and negative predictive value (PV), and total percent accuracy were calculated for household adult and child food insecurity (moderate and severe categories combined) as assessed by the full USDA HFSSM items applied to the IPY Inuit Health Survey.¹⁰ The Health Canada food security cutoffs

were used. For comparison purposes, these analyses were repeated by using USDA food security cutoffs. In line with epidemiologic theory, we hypothesized that as we moved the food security cutoff from ≥ 2 to ≥ 3 affirmative responses, sensitivity would increase, and specificity would decrease. In addition, for child food insecurity, we assessed the repeatability of the performance of the child questions in a second survey, the Nunavut Inuit Child Survey²² with the sample restricted to households that were not in the IPY Inuit Health Survey to provide an independent survey population ($n = 249$). As PVs positive and negative are dependent upon the prevalence of a condition in the population, we used different prevalence scenarios, holding sensitivity and specificity constant, to illustrate the changes we would expect in the PVs positive and negative performance of 1 question item.

RESULTS

For children, the question “In the last 12 months, were there times when it was not possible to feed the children a healthy meal because there was not enough money?” yielded high sensitivity (92.3%), specificity (97.3%), PV positive (97.3%), and PV negative (92.1%) for overall food insecurity with an overall accuracy of 94.7% in the IPY Inuit Health Survey (Table 1). All other questions performed more poorly in predicting child food insecurity (moderate and severe combined; Table 1). When analyses were repeated by using the subsample of the Nunavut Inuit Child Health Survey not represented in the IPY Inuit Health Survey, the same question as noted above yielded high sensitivity (88.5%), specificity (95.4%), PV positive (95.8%), and PV negative (87.3%) with an overall accuracy of 91.6% (Table 2). Another high performing question in both the IPY Inuit Health Survey and the Nunavut Inuit Child Health Survey was “In the last 12 months, were there times when you could only feed your children

less expensive foods because you were running out of money to buy food?” (Tables 1 and 2).

For adults, the question “In the last 12 months, were there times when the food for you and your family just did not last and there was no money to buy more?” had the best performance of all items with high sensitivity (93.0%), specificity (93.4%), PV positive (95.9%), PV negative (88.9%), and overall accuracy (93.2%; Table 3). The question “In the last 12 months, did you every worry whether the food for you and your family would run out before you had enough money to buy more?” also had good performance (Table 3).

Findings from the analyses applying the USDA food security cutoff supported our hypothesis that sensitivity would increase and specificity would decrease. For question item 1 “Did you ever worry whether the food for you and your family would run out before you have enough money to buy more?”, sensitivity increased to 94.4% and specificity decreased to 72.2%. For question item 2 “Were there times when the food for you and your family just did not last and there was no money to buy more?”, sensitivity increased to 95.8% and specificity decreased to 75.6%.

Figure 1 illustrates the effect of different food insecurity prevalence on PVs by using the Canadian cutoff and holding sensitivity and specificity constant. This underscores the role of prevalence of the condition in a population on PVs positive and negative of a screening tool.

DISCUSSION

This study tested the validity of single food insecurity assessment items as measured against the full 18-item HFSSM in Inuit households. Two items (1 adult and 1 child item) had high values for all measures (sensitivity, specificity, positive and negative PVs, and overall accuracy). A repeated analysis for the child items on a different sample

TABLE 1 Sensitivity, Specificity and PVs Positive and Negative for Child Food Insecurity. IPY Inuit Health Survey, 2007–2008

Questions	Sensitivity (%)	Specificity (%)	PV Positive (%)	PV Negative (%)	Accuracy (%)
"In the last 12 months...." ^a					
1. Were there times when you could only feed your children less expensive foods because you were running out of money to buy food?	94.8	81.9	85.0	93.6	88.6
2. Were there times when it was not possible to feed the children a healthy meal because there was not enough money?	92.3	97.3	97.3	92.1	94.7
3. Were there times when the children in the house were not eating enough because there was no money to buy enough food?	78.7	99.2	99.1	81.1	88.5
4. Did you ever cut the size of the children's meal because there wasn't enough money for food?	43.0	100.0	100.0	61.8	70.4
5. Did any of the children ever skip meals because there wasn't enough money for food?	38.3	99.8	99.6	59.9	67.8
5b. How often did this happen? ^b	32.4	100.0	100.0	57.7	64.8
6. Were the children ever hungry but you just couldn't afford more food?	45.9	99.8	99.7	63.0	71.8
7. Did your children ever not eat for a whole day because there wasn't enough money for food?	26.2	100.0	100.0	55.5	61.6

^a "Yes," "often," and "sometimes" were considered affirmative responses.

^b "Almost every month," "some months," and "1–2 months" were considered affirmative responses.

TABLE 2 Sensitivity, Specificity, and PVs Positive and Negative for Child Food Insecurity: Nunavut Inuit Child Health Survey ($n = 249$), 2007–2008

Questions ^a	Sensitivity (%)	Specificity (%)	PV Positive (%)	PV Negative (%)	Accuracy (%)
"In the last 12 months...." ^b					
1. Were there times when you could only feed your children less expensive foods because you were running out of money to buy food?	96.9	80.6	85.7	95.6	89.5
2. Were there times when it was not possible to feed the children a healthy meal because there was not enough money?	88.5	95.4	95.8	87.3	91.6
3. Were there times when the children in the house were not eating enough because there was no money to buy enough food?	82.3	97.2	97.3	82.0	89.1
4. Did you ever cut the size of the children's meal because there wasn't enough money for food?	37.7	99.1	98.0	56.9	65.5
5. Did any of the children ever skip meals because there wasn't enough money for food?	35.4	100.0	100.0	56.3	64.7
5b. How often did this happen? ^c	31.5	100.0	100.0	54.8	62.6
6. Were the children ever hungry but you just couldn't afford more food?	43.1	100.0	100.0	59.3	68.9
7. Did your children ever not eat for a whole day because there wasn't enough money for food?	25.4	100.0	100.0	52.7	59.2

^a Excluding households represented in the IPY Inuit Health Survey.

^b "Yes," "often," and "sometimes" were considered affirmative responses.

^c "Almost every month," "some months," and "1–2 months" were considered affirmative responses.

confirmed the high validity of the same question item. These results indicate that a 1-to-2 question item tool can be used for rapid assessment of adult and child household food insecurity in the Arctic. As expected, a comparison analysis of the adult items using the USDA food insecurity cutoff (≥ 3 affirmative responses) gave slightly higher sensitivity and lower specificity than using the Canadian food insecurity cutoff (≥ 3 affirmative responses).

The Study Results in Light of Previous Research

A few studies have evaluated the validity of single- or 2-item questionnaires for food insecurity assessment, but findings are mixed.^{33–36} Further, cultural context is likely an important factor that makes cultural adaptation and context specific validation studies necessary. Hence, there is a need for greater knowledge concerning the validity and reliability of short screen-

ing tools. Hager et al³³ recommend a 2-item food security screen on the basis of a combination of the following questions of the 18-item HFSSM: "In the past 12 months, did you ever worry whether the food for you and your family would run out before you have enough money to buy more?" and "In the past 12 months, were there times when the food for you and your family just did not last and there was no money to buy more?" This combination

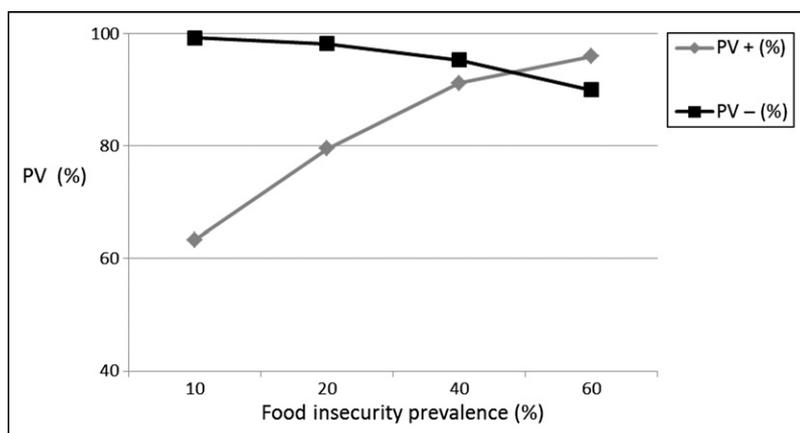
TABLE 3 Sensitivity, Specificity, and PVs Positive and Negative for Adult Food Insecurity. IPY Inuit Health Survey, 2007–2008

Questions	Sensitivity (%)	Specificity (%)	PV Positive (%)	PV Negative (%)	Accuracy (%)
"In the last 12 months...." ^a					
1. Did you ever worry whether the food for you and your family would run out before you have enough money to buy more?	91.9	89.1	93.4	86.9	90.9
2. Were there times when the food for you and your family just did not last and there was no money to buy more?	93.0	93.4	95.9	88.9	93.2
3. Were there times when you and your family could not afford to eat healthy food?	78.8	94.6	96.1	72.8	84.7
4. Did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?	50.5	100.0	100.0	54.8	69.1
4b. How often did this happen? ^b	42.3	100.0	100.0	51.0	64.0
5. Did you ever eat less than you felt you should because there wasn't enough money for food?	52.1	99.9	99.8	55.6	70.0
6. Were you ever hungry but didn't have enough money for food?	39.9	100.0	100.0	50.0	62.5
7. Did you lose weight because you didn't have enough money for the food?	28.7	100.0	100.0	45.7	55.5
8. Did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?	29.0	100.0	100.0	45.8	55.7
8b. How often did this happen?	28.0	100.0	100.0	45.5	55.0

Health Canada food insecurity definition (≥ 2 affirmative responses).

^a "Yes," "often," and "sometimes" were considered affirmative responses.

^b "Almost every month," "some months," and "1–2 months" were considered affirmative responses.

**FIGURE 1**

Food insecurity prevalence and predictive values (PV) positive and negative for the question, "were there times when the food for you and your family just did not last and there was no money to buy more?" in which sensitivity and specificity (based upon 2 or more affirmative responses) were held constant.

gave high sensitivity (97%) and specificity (83%), as well as construct validity when tested against the full 18-item HFSSM among low-income families with young children in the United States (Table 4).³³ Young et al³⁴ tested a 2-item food security tool comprising 1 question from the USDA 18-item HFSSM: "In the past 12 months, were there times when the food for you and your family just did not last and there was no money to buy more?", and a question about how often money could not buy balanced meals.

The tool was tested among patients infected with HIV-1 in an HIV ambulatory care center in Australia against a 6-item short form of the HFSSM and found it to have a sensitivity of 100% and a specificity of 78% with a negative PV of 100%,³⁴ suggesting its suitability for food insecurity screening in that particular setting (Table 4).

The inadequacy of single-item tools in assessing food insecurity has also been demonstrated (Table 4),^{35,36} and the mixed results in the literature hence

underscore the relevance of this study in testing the validity of a short screening tool for assessing food insecurity. The literature reveals some consistency concerning the validity of the item, "In the past 12 months, were there times when the food for you and your family just did not last and there was no money to buy more?", which was our highest performing adult question using both the Canadian and the USDA cutoff. Previous research has focused on specific segments of a population (patients, low-income groups), and our study complements this by addressing the issue among a representative sample in Inuit communities in Canada. Our findings indicate that 1 question from each of the adult and child modules in the 18-item HFSSM can assess food insecurity. Basing a rapid food insecurity assessment on both adult and child items gives a more accurate picture of the food security situation in a family, as only relying on items in the adult module as done in the study by Hager et al³³ might not apply to children. Although there is a tendency that food insecurity conditions are similar among household members, this cannot be assumed

TABLE 4 Validation Studies of Rapid Food Security Assessment Tools (Sensitivity and Specificity)

Study	Study Population	Question	Sensitivity, %	Specificity, %
Hager et al 2010 ³³	Low-income families with young children in the United States using hospital services (<i>n</i> = 34 049 caregivers)	In the past 12 months, did you ever worry whether the food for you and your family would run out before you have enough money to buy more? ^{a,b} In the past 12 months, were there times when the food for you and your family just did not last and there was no money to buy more? ^{a,c}	97	83
Young et al 2009 ³⁴	Patients infected with HIV-1 in an ambulatory care center in Australia (<i>n</i> = 49)	In the past 12 months, were there times when the food for you and your family just did not last and there was no money to buy more? ^{a,c} In the past 12 months, I/we couldn't afford to eat balanced meals. ^{a,d}	100	78
Kleinmann et al 2007 ³⁵	Users of a primary care pediatric clinic in a low-income, predominantly Hispanic population in the United States (<i>n</i> = 1750 families)	In the past month, was there any day when you or anyone in your family went hungry because you did not have enough money for food?	83	80
Nolan et al 2006 ³⁶	Households in areas with low socioeconomic status in Sydney, Australia (<i>n</i> = 1719 households)	In the past 12 months, were there times when the food for you and your family just did not last and there was no money to buy more? ^c	96	57
Our study	Representative sample from Inuit communities in the high-Arctic of Canada: IPY Inuit Health Survey, 2007–2008 (<i>n</i> = 1901 households)	In the past 12 months, were there times when the food for you and your family just did not last and there was no money to buy more? ^c	93.0	93.4
		In the past 12 months, were there times when it was not possible to feed the children a healthy meal because there was not enough money? ^e	92.3	97.3
	Representative sample from Inuit communities in the high-Arctic of Canada: Nunavut Inuit Child Health Survey, 2007–2008 (<i>n</i> = 249 children)	In the past 12 months, were there times when it was not possible to feed the children a healthy meal because there was not enough money? ^e	88.4	95.6

^a The 2 questions in the study were combined into a short screen and then tested for sensitivity and specificity.

^b Question 1 from adult USDA 18-item HFSSM.

^c Question 2 from adult USDA 18-item HFSSM.

^d Question from 6-item, Food Security Questionnaire.

^e Question 2 from child USDA 18-item HFSSM.

as adults tend to become food insecure before children in the same household, and as younger children are more protected against food insecurity than older children in the same household.³¹ Basing the food insecurity assessment on items from both adults and children creates a stronger basis for conclusions about the household food security situation. The fact that analyses of two different study populations confirmed the validity of the child item further strengthens the claim of the usefulness of this particular question item in a rapid assessment tool.

Strengths and Limitations

Strengths of the current study include the population-based sample, the previously demonstrated construct validity

of the full USDA HFSSM in Inuit communities, and the high sensitivity and specificity and percent accuracy noted for specific items. Further, the response rates of 68% and 72.3% for the IPY Inuit Health Survey and the Nunavut Inuit Child Health Survey, respectively, are adequate and comparable with other similar large population-based surveys such as NHANES 2011–2012 (72.6%).³⁷ An important limitation is that PVs and total percent accuracy are dependent on the prevalence of a condition in the population, in our case, the prevalence in Inuit communities. Therefore, it is reasonable to anticipate that the performance of screening tools would be higher in a low socioeconomic status population than in an economically diverse population. This underscores the importance of evaluating the perfor-

mance of short screening tools in diverse populations.

CONCLUSIONS

The findings of this study suggest that a rapid assessment of child and adult food security is possible through a 2-item questionnaire on the basis of the USDA 18-item HFSSM. Of particular value is the use of items from both adult and child food security modules. A rapid assessment tool is of particular relevance in clinical settings where time is limited and the need for a rapid assessment of a range of health and social conditions are important. In addition, in large community surveys attempting to assess numerous health indicators, rapid approaches can reduce participant burden and survey costs.

Further validation studies are needed for evaluating rapid assessment techniques in diverse settings and populations.

However, it is important to note that as prevalence and severity of food insecurity change over time, rapid as-

essment techniques should not replace periodic screening using the full USDA HFSSM questionnaire.

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