



Stability of food insecurity status in paediatric primary care

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Abstract

Objective: The American Academy of Pediatrics recommends screening for food insecurity (FI) at all well-child visits due to well-documented negative effects of experiencing FI in childhood. Before age 3, children have twelve recommended primary care visits at which screening could occur. Little is known regarding the stability of FI status at this frequency of screening.

Design: Data derived from electronic health records were used to retrospectively examine the stability of household FI status. Age-stratified (infant *v.* toddler) analyses accounted for age-based differences in visit frequency. Regression models with time since last screening as the predictor of FI transitions were estimated via generalised estimating equations adjusting for age and race/ethnicity.

Setting: A paediatric primary care practice in Philadelphia.

Participants: 3451 distinct patients were identified whose health record documented two or more household FI screens between April 1, 2012 and July 31, 2018 and were aged 0–3 years at first screen.

Results: Overall, 9.5% of patients had a transition in household FI status, with a similar frequency of transitioning from food insecure to secure (5.0%) and from food secure to insecure (4.5%). Families of toddlers whose last screen was more than a year ago were more likely to experience a transition to FI compared with those screened 0–6 months prior (OR 1.91 (95% CI 1.05, 3.47)).

Conclusions: Screening more than annually may not contribute substantially to the identification of transitions to FI.

Keywords
Food insecurity
Paediatric
Screening
Social determinants

As mounting evidence continues to reveal the impact of social factors on health outcomes, there is a growing recognition among healthcare leaders and policymakers of the critical role health systems can play in addressing these factors⁽¹⁾. The mandate from the Affordable Care Act for health systems receiving federal funds to assess community needs and health system redesign initiatives driven by the Center for Medicare and Medicaid Innovation have created an environment ripe for health system intervention for social determinants of health, broadly described as the conditions in which people are born, grow, live, work and age^(2,3). Food insecurity (FI) is one such determinant, defined as 'the limited or uncertain availability of nutritionally adequate and safe foods'⁽⁴⁾. Households with children, especially those headed by minority, single parents are at greater risk for FI than the general population⁽⁵⁾.

Children living in food-insecure households are generally in poorer health than their food-secure peers⁽⁶⁾. They get sick more often, recover more slowly and are

hospitalised more frequently⁽⁷⁾. FI has been specifically associated with anaemia, asthma and poor oral health as well as with depression and suicidal ideation during childhood and later in life^(8–13). Further, elementary-age children have been shown to receive lower test scores while experiencing FI and over a subsequent 4-year period^(14,15). In light of the myriad negative impacts of FI documented for children, the American Academy of Pediatrics issued a recommendation in 2015 for universal FI screening at all well-child care visits⁽¹⁶⁾.

Annual well-child care visits are recommended starting at age 3 but are more frequent in the first years of life⁽¹⁷⁾. Infants are recommended to be seen within the first week of life and at 1, 2, 4, 6 and 9 months of age, and there are six recommended visits between the ages of 1 and 3 years. Essentially, following the American Academy of Pediatrics, FI screening recommendation would result in a child's household being screened twelve times by age 3. Well-child care visits are expected to cover numerous

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topics and assessments as recommended by the Bright Futures Recommendations for Preventive Pediatric Health Care, but are often scheduled in increments as short as 5 min^(18,19). Given the vast array of topics to be covered in a short time, it is critical to better understand the stability of household FI status in paediatric settings and therefore what frequency of screening is warranted^(19,20).

We conducted a retrospective cohort study to identify the frequency of transitions in household FI status for patients aged 3 years or younger whose caregivers were screened multiple times in a primary care setting and to examine whether time since last screening predicts such transitions. Specifically, we extracted visit-level electronic health record data in order to (1) identify the proportion of patients with a positive household FI screen as well as the stability of household FI status, and (2) determine if time since last screen predicts transitions to FI.

Methods

Study design and population

We queried the electronic health record of the primary care practice associated with St. Christopher's Hospital for Children in Philadelphia, which serves a predominantly Medicaid population (>90%). St. Christopher's follows the American Academy of Pediatrics recommendation of universal screening at all well-child care visits. Providers receive instruction on explaining rationale for social screening. Caregivers self-assess fourteen social factors, including FI, via a paper form provided at rooming. Forms are available in either English or Spanish and are subsequently reviewed by the provider and discussed with the caregiver.

We identified patients whose caregivers were screened for FI at two or more visits from April 1, 2012 to July 31, 2018 and were aged 3 years or younger at the time of the first screen. A flow chart depicting the process of study sample selection is shown in Fig. 1.

Key variables

FI served as the outcome variable and was assessed using a modified version (with binary response options)

of the validated two-item Hunger Vital Sign screener⁽²¹⁾: (1) 'Within the past 12 months we worried whether our food would run out before we got money to buy more' (yes/no); (2) 'Within the past 12 months the food we bought just didn't last and we didn't have money to get more' (yes/no). The Hunger Vital Sign specifically measures uncertainty of food access (as opposed to dimensions of quality and quantity, e.g., that are assessed by the full eighteen-item USDA tool used in the census)⁽²²⁾. Endorsement of either question was classified as being positive for FI. FI transitions were defined as having a subsequent screen result that differed from that of the previous screen – that is, a patient in a food-secure household whose household became food insecure, or vice versa. We also calculated the elapsed time (in days) between each consecutive pair of screens to determine the time since last (immediately prior) screen. All screen pairs were then grouped into categories based on their time since last screen: 0–6 months (0–180 d), 6–12 months (181–360 d) or more than a year (greater than 360 d). Time since last screen was investigated as a predictor of FI stability.

Statistical analysis

To address potential confounding by age and to control for the effect of age-based differences in visit frequency (i.e. more frequent well-child care visits are scheduled in infancy), analyses were stratified into two categories by age at first screen: infants (<1 year) and toddlers (1–3 years). Descriptive statistics for infant and toddler groups were calculated and compared using Wilcoxon rank sum tests for continuous and χ^2 tests for categorical variables. Each patient contributed $n - 1$ screen pairs to analysis, with n being the total number of times that they were screened. Frequency of transitions in household FI status was calculated for each age. An assessment of collinearity between child age at screen and time since last screen showed sufficient heterogeneity in time since last screen for pairs within the same age cohort to support estimation of the association between time since last screen adjusted for age. To assess whether time since last screen was predictive of transition to FI a regression model estimated via generalised estimating equations was used,

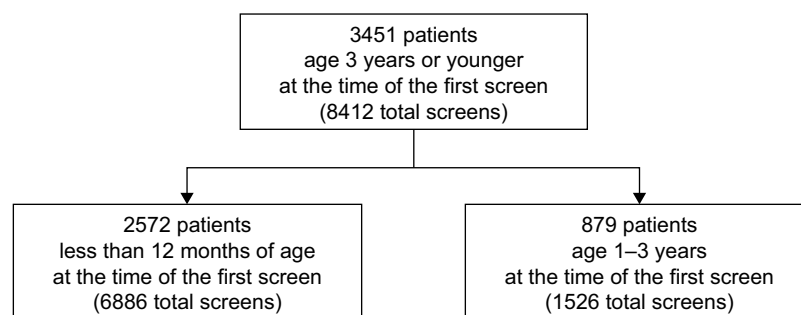


Fig. 1 Flow chart depicting study sample selection



specifying an exchangeable working correlation structure to account for the within-patient correlation introduced by a single patient contributing multiple screen pairs. Unadjusted and age- and race/ethnicity-adjusted odds of transitioning to FI by elapsed time between screens were calculated using generalised estimating equations. All analyses were conducted using the R programming language, including the 'geepack' package^(23,24).

Results

During the time frame specified, caregivers of 14 059 distinct patients were screened for household FI at 21 820 visits. Of those, 4924 distinct patients with 12 685 visits had more than one screen documented. Restricting to patients aged 3 or younger at the time of first screen resulted in a final sample of 3451 distinct patients with 8412 visits at which a screen was conducted. A majority (56%) of these patients had two documented screens (maximum number of screens for any one patient was nine). Patients had a median of two screens (interquartile range: 2, 3) and a median time from first to last screen of 8.2 months (interquartile range: 4, 15). Overall, 9.8% of

patients in the study were in food-insecure households at their first screen. The median age of the caregiver who responded to the screen at the first visit was 25 years (interquartile range: 22, 29). Nearly half of the sample (46.2%) identified as Hispanic and 9.5% endorsed Spanish as their preferred language at their first screen. The toddler cohort had a greater percentage of males and a higher proportion of patients who were in food-insecure households at first screen (Table 1).

The proportion of screen pairs that contained a transition in household FI status (in either direction) was low and the same across age stratifications (9.5% for both infants and toddlers) (Table 2). There was a similar prevalence of transitioning from food insecure to secure (5.0%) and from food secure to insecure (4.5%). Across cohorts, the households of 4.7% of infants and 4.0% of toddlers transitioned to FI.

Time since last screen predicted transition to FI in adjusted and unadjusted models. Screen pairs with elapsed time of more than a year since last screen had nearly twice the odds of experiencing a transition to FI for toddler screen pairs as did those with an elapsed time of 0–6 months since last screen, a statistically significant finding (adjusted OR: 1.91 (95% CI 1.05, 3.47)) (Table 3). Infant screen pairs

Table 1 Patient characteristics

	Total (n 3451)		Age at first screen		P-value
	n	%	Infant (<1 year) (n 2572)	Toddler (1–3 years) (n 879)	
Age at first screen (months)					
Median	4		2	18	
IQR	2, 12		1, 5	14, 25	
Age at last screen (months)					
Median	15		12	24	
IQR	9, 24		7, 19	19, 30	
Male sex	1814	52.6	1327	51.6	0.056
Total screens					<0.001
Median	2		3	2	
IQR	2, 3		2, 3	2, 3	
Total visits					<0.001
Median	6		6	8	
IQR	4, 9		3, 8	5, 10	
Proportion that are FI+ at first screen	337	9.8	234	9.1	0.024
Caregiver age at first screen (years)					<0.001
Median	25		25	26	
IQR	22, 29		21, 29	23, 31	
Race/ethnicity					0.869
Hispanic or Latino	1595	46.2	1187	46.2	
Non-Hispanic Black	1262	36.6	948	36.9	
Non-Hispanic White	69	2.0	49	1.9	
Non-Hispanic Asian	32	0.9	24	0.9	
Non-Hispanic multiracial	25	0.7	21	0.8	
Other	139	4.0	104	4.0	
Unknown	329	9.5	239	9.3	
Preferred language					0.077
English	3104	90.1	2331	90.8	
Spanish	326	9.5	227	8.8	

FI, food insecurity; IQR: interquartile range.

Table 2 Proportion of sequential screen pairs with a food insecurity (FI) status transition

Stability of FI status	Age at first screen					
	Total (N 5818)		Infant (<1 year) (n 3933)		Toddler (1–3 years) (n 1885)	
	n	%	n	%	n	%
No transition	5266	90.5	3561	90.5	1705	90.5
Secure	5022	86.3	3406	86.6	1616	85.7
FI	244	4.2	155	3.2	89	4.7
Any transition	552	9.5	372	9.5	180	9.5
FI to secure	293	5.0	189	4.8	104	5.5
Secure to FI	259	4.5	183	4.7	76	4.0

Table 3 OR for transitioning into food insecurity (FI) as a function of time since last screen

Time since last screen	Infant (<1 year*) (n 3589)				Toddler (1–3 years*) (n 1692)			
	OR	95 % CI	aOR	95 % CI†	OR	95 % CI	aOR	95 % CI†
0–6 months		Ref		Ref		Ref		Ref
6–12 months	0.93	0.61,1.42	0.94	0.61,1.45	1.68	0.87,3.25	1.73	0.88,3.41
More than year	1.46	1.03,2.07‡	1.46	1.02,2.07‡	1.96	1.12,3.43§	1.91	1.05,3.47‡

aOR, adjusted OR.

*Age at first screen in pair.

†Adjusted for age at first screen in pair and race/ethnicity.

‡ $P = 0.03$.§ $P = 0.02$.

with more than a year since last screen had 46 % higher odds of transitioning to FI compared with those with 0–6 months since last screen ($P = 0.03$). There was no difference in odds of transitioning to FI for screen pairs with 6–12 months since last screen *v.* those with 0–6 months since last screen for either infant or toddler screen pairs ($P = 0.77$ and $P = 0.11$, respectively).

Discussion

Most caregivers in this sample of paediatric patients under 3 years of age were rescreened for household FI within less than a year. We found food security status to be stable over that interval, with the vast majority of patient households retaining the same status they endorsed at their first screen at subsequent screens. For those that experienced a transition from secure to FI status (4.5 %), time since last screen of more than a year was predictive of that transition.

To our knowledge, this is the first study to examine longitudinal FI patterns in a paediatric cohort using a two-item measure in a clinical setting. Few studies have assessed FI results longitudinally, and those that have most often assessed annual trends utilising the eighteen-item measure of FI that has been used to measure national FI levels via the census since 1995^(25–27). It is important to note, however, that while the full eighteen-item tool evaluates multiple dimensions of FI, the two-item Hunger

Vital Sign tool focuses on assessing the uncertainty of access to food only.

Further, prior studies were conducted in non-clinical settings, such as schools and agencies providing government benefits (WIC, TANF). However, our findings mirror those previous studies regarding the frequency of transitions in household FI status. For example, Kimbro *et al.*, using the eighteen-item survey for a kindergarten cohort with follow-up in the first grade, found 80 % secure at both assessments, 7 % insecure at both assessments, and a relatively equal percentage transitioning in each direction (7 % FI to secure, 6 % secure to FI)⁽²⁷⁾. Their study was conducted amid the Great Recession which may account for the slightly higher levels of insecurity and transitions.

Our results support the recommendation by Garg *et al.* (2015) for comprehensive social determinants of health screening, including but not limited to FI, at the patient's first visit to the practice, no matter the age, given the likelihood that initial screen results will remain stable at future visits⁽²⁸⁾. Previous research has identified various social factors associated with an increased likelihood of transitioning to FI. These tend to be economic – such as a level of financial resources insufficient to tolerate an economic shock, including a change in employment status – as well as the presence of one or more mental health problems^(26,29,30). Screening for and addressing these factors may prevent a transition to FI for those that do not endorse FI at the time of initial screening.



Our finding that screening within 6–12 months of last screen was no more likely to detect a transition to FI than rescreening within 0–6 months aligns with a recent finding by a team at Kaiser Permanente⁽³¹⁾. Their study, conducted in an adult healthcare setting, found that basic resource needs were stable at a 3-month screening interval. It is worth noting that caregivers for all patients in our study should have been screened at intervals more frequent than annually, or at least no less than annually, if well-child care visit recommendations were being followed. Indeed, patients included in our study do appear to have been seen at an appropriate frequency (median six total visits for infants, eight for toddlers). Screening presumably occurred at all well-child care visits, as per the American Academy of Pediatrics guideline and practice protocol, but was not documented in the discrete fields of the record.

Our results contribute to the nascent evidence base regarding how best to balance the desire to identify changing needs without conducting potentially unnecessary screening. Research on other paediatric screening topics has found that repeated administration of a screen can be associated with decreased endorsement of a problem⁽³²⁾. Additionally, while a tool may be validated with high levels of both specificity and sensitivity, the positive predictive value of the screen is influenced by the prevalence in the population, such that as the prevalence drops, so does the positive predictive value⁽³³⁾. For some practices, this may indicate that a risk-based, rather than universal, screening approach may be appropriate. Finally, no measure has perfect reliability, and so some amount of the observed transitions may have been in fact be the result of measure unreliability, which would strengthen our conclusion of FI stability over time.

This study had several limitations. First, the electronic health record from which data were abstracted allows no easy way to aggregate patients into families, so our sample may include multiple patients with the same caregiver. While our analyses controlled for within-patient clustering, it did not account for the possibility that patients could be clustered by family. Secondly, while this practice has an algorithm prescribing interventions for addressing positive screens, interventions provided for FI have not been systematically documented. This leaves us unable (without more in-depth study, perhaps utilising free text note fields) to speak definitively as to what actions were taken, and therefore could have impacted, those patients that experienced a transition. A final limitation is the fact that the questions of the Hunger Vital Sign FI measurement tool used in this practice are framed to assess household FI over the past year in a population that is seen much more frequently than that. It may be that caregivers answered using a truly 12-month retrospective frame or rather with changes since their last visit in mind. However, that does not change the empirical fact that few transitions were seen at shorter intervals, suggesting the limited value of using this screen more often than annually.

Conclusion

While the importance of addressing FI is clear, longitudinal assessment of FI status stability in paediatric settings is lacking, especially for the population under 3 years of age whose recommended well-child care visits are more frequent than annually. Our study contributes to the knowledge base for FI screening in paediatric clinical settings by showing (1) that household FI status for patients under 3 years was relatively stable and (2) that time since last screen predicted odds of experiencing a transition to FI for this population. Future research should build upon these results by more rigorously assessing FI stability in the context of screening and addressing co-existing social factors.

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