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# Food Insecurity Was Associated With Greater Family Health Care Expenditures In The US, 2016–17

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**ABSTRACT** Food insecurity has been associated with the health care expenditures of individuals, but it can affect the entire family. Evaluating the relationship between food insecurity and family expenditures provides a better understanding of the financial implications of food insecurity interventions. Our primary objective was to evaluate the association between food insecurity in one year (2016) and family health care expenditures—for all members, for children only, and for adults only—in the next year (2017). We also evaluated whether this association varied across types of insurance coverage within families: all private, all public, or mixed (including uninsured). Using nationally representative data, we found that food-insecure families had 20 percent greater total health care expenditures than food-secure families, for an annual difference of $2,456. Food insecurity was associated with greater expenditures across all family insurance patterns, including the 19.1 percent of families with mixed coverage. Our findings suggest that in families with mixed coverage, positive impacts of food insecurity interventions on health care use may accrue to family members other than the targeted beneficiaries and those who have different insurance, benefiting the entire family but potentially discouraging investments on the part of any one payer.

ood insecurity is the limited or uncertain availability of nutritionally adequate and safe food or the limited or uncertain ability to acquire acceptable food items in socially acceptable ways.[1] In 2020, 10.5 percent of US households experienced food insecurity. Households with children are at highest risk for food insecurity, and in 2020, 14.8 percent of US households with children were food insecure.[1] Food insecurity affects many areas of people's lives, such as their diet and ability to adhere to prescribed medications.[2–4] It has also been associated with negative health outcomes in children and adults.[2,3,5]

Food insecurity is a household-level construct and has detrimental effects on all family members in the home. Prior studies have shown that food insecurity is associated with increased health care expenditures in adults[6–8] and may be associated with increased expenditures in children.[9–11] What is needed, however, is to quantify the association across the entire family. Evaluating the relationship between food insecurity and total family health care spending could provide a better understanding of the financial implications of food insecurity for families overall. This nuanced information is important for understanding the potential impact of food insecurity interventions, which can have spillover effects throughout the family even when targeted to an individual. Therefore, given the growing interest and investment among health systems

and health insurers, both public and private, to assist patients with food insecurity,[12–14] not understanding the relationship between food insecurity and family health care spending represents an important knowledge gap.

To fill this gap in the literature, the primary objective of this longitudinal study was to determine the association between food insecurity across the family in one year and the health care expenditures of the entire family in the following year. Our measure of interest was the family unit, which we refer to here as "family," following the Medical Expenditure Panel Survey (MEPS) definition as two or more people living in the same household who were related by blood, marriage, or adoption (which is the definition used in the Census Bureau's Current Population Survey).[15] Further, we sought to contextualize these findings by evaluating different insurance coverage within families (for example, all privately insured) and whether the relationship between food insecurity and health care expenditures may vary across coverage patterns. As a secondary analysis, we evaluated whether continuation of or change in families' food security status during the year in which health care expenditures were measured affected the association between prior food security and subsequent health care expenditures.

## Study Data And Methods

**STUDY DESIGN AND POPULATION** We conducted a retrospective longitudinal cohort study using data from Panel 21 of MEPS.[16] MEPS is a longitudinal study conducted annually by the Agency for Healthcare Research and Quality, and the results are representative of the noninstitutionalized US population. MEPS follows the same cohort of households for two years, and households are interviewed multiple times during the study period. All data are reported by a single respondent. MEPS contains data on a variety of characteristics including sociodemographics, health insurance, and health care expenditures. Panel 21 completed its interviews in 2016 and 2017 and is the only MEPS panel to have completed food insecurity screening at two time periods.[16]

We included all adult and child participants in Panel 21 ($N = 16,074$). We excluded participants who were missing data on food insecurity in 2016 ($n = 1,297$) or on health care expenditures in either year ($n = 111$), for a total unweighted sample of 14,666 participants (91.2 percent of the panel). The Wake Forest University School of Medicine Institutional Review Board deemed this study of publicly available, deidentified data exempt from the requirements for human subjects research.

**FOOD INSECURITY** Our primary predictor was food insecurity in 2016. Food insecurity is measured in MEPS using the Department of Agriculture's validated ten-item U.S. Adult Food Security Survey Module with a thirty-day reference period.[17] We used the established scoring system to categorize families as food secure (0–2 affirmative responses) or food insecure (3 or more affirmative responses).[17]

**HEALTH CARE EXPENDITURES** Our primary outcome was health care expenditures in 2017, expressed as a continuous variable in 2017 US dollars. We evaluated total health care expenditures and expenditures broken down by type: inpatient, emergency department, outpatient, prescription drug, and out of pocket. Primary respondents identify all family members and report on their prior health care use, and information on health care use for each family member is supplemented with information collected from health care providers. Expenditures are then determined by the direct payments for care provided during the year and include out-of-pocket payments and payments by private insurance, Medicaid, Medicare, and other sources.[16] MEPS uses weighted hot deck statistical imputation methods, incorporating sample weights and sociodemographic characteristics, to impute missing or unavailable expenditure data.[18]

**COVARIATES** Because sociodemographic and socioeconomic characteristics may confound the relationship between food insecurity and expenditures, we extracted data from MEPS on several covariates. The covariates, based on 2016 data, were age, sex, self-reported race and ethnicity (Hispanic, non-Hispanic White, non-Hispanic Black, and multiple race or other), region of residence (Northeast, Midwest, South, and West), and household income (expressed as a percentage of the federal poverty level and accounting for household size). We also included participants' health insurance (private; Medicaid, Children's Health Insurance Program [CHIP], or other public insurance; Medicare; or uninsured) as of December 31, 2016. For participants ages eighteen and older, our adult-specific models also included highest education level achieved (less than high school, high school graduate, or more than high school) and whether an adult reported having any one of the following chronic medical conditions (yes or no): hypertension, diabetes, chronic obstructive pulmonary disease (including chronic bronchitis and emphysema), or cardiovascular disease (including coronary heart disease, angina, myocardial infarction, and stroke). For our child-specific models, we included whether a child had special health care needs (yes or no), defined as being at increased risk for chronic health con-

ditions or requiring greater than usual use of health care services based on the validated children with special health care needs screening instrument included in MEPS.[19] All children ages 2–17 were screened for whether they were children with special health care needs.

STATISTICAL ANALYSIS We performed univariate analysis and bivariate analysis, using chi-square test or $t$-test. To determine the association between food insecurity and total family health care expenditures for our main analysis, first we evaluated the association between food insecurity in 2016 and individual adult and child health care expenditures in 2017, using a two-part model.[20] We used a two-part model because of known challenges with modeling health care expenditures (for example, extreme observations and point mass at zero). Sensitivity analyses using a one-part generalized linear model with log link function and gamma distribution and zero-inflated negative binomial regression found similar results (data not shown). The first part of the model used multivariable logistic regression to evaluate the association between food insecurity in 2016 and having any health care expenditures in 2017. Among those with any health care expenditures, the second part of the model used a generalized linear model with log link and gamma distribution to evaluate the association between food insecurity in 2016 and total health care expenditures in 2017. We constructed one two-part model for adults (age 18 or older) and one two-part model for children (younger than age 18). Both models adjusted for age, sex, race and ethnicity, region, household income, insurance, and 2016 health care expenditures. For the adult model, we also adjusted for education level and chronic medical conditions. For the child model, we adjusted for children with special health care needs. We used predictive margins to determine adjusted mean total health care expenditures, using the "margins" command in Stata. Second, we then summed the adult and child estimates per family and evaluated the difference in total family expenditures by food security. We used the family identifier provided in MEPS, which is based on the Current Population Survey definition.[15] Single people are also given a family identifier in MEPS, which was included in our analysis.

As is commonly recommended,[6] we used a winsorizing cutoff at the 97.5th percentile of total expenditures ($38,263 in this sample) because health care expenditures can be highly skewed and outliers can distort the estimated means. We conducted sensitivity analyses at different winsorizing thresholds (ninety-fifth percentile, ninety-ninth percentile, and no winsorizing) and found similar results (data not shown). We

## Observing the full financial benefit of food insecurity interventions may be more challenging for families with mixed coverage.

used the same approach to evaluate the association between food insecurity in 2016 and health care expenditures broken down by type (inpatient, emergency department, outpatient, prescription drugs, and out of pocket) per family in 2017. For analyses evaluating the association between food insecurity and expenditure type, we adjusted for the specific expenditure type in 2016 (for example, 2016 inpatient expenditures for analyses where 2017 inpatient expenditures were the outcome).

Because many insurers are implementing initiatives to address food insecurity,[21] we then evaluated how family insurance coverage modified the relationship between food insecurity and health care expenditures. We created three mutually exclusive insurance categories based on the collective insurance status of all family members. These were as follows: All family members reported having private insurance, all family members reported being publicly insured (including Medicaid, CHIP, other public insurance, and Medicare), and mixed (any combination of privately insured, publicly insured, and uninsured). We evaluated the interaction between food insecurity and family insurance category in 2016 to determine whether differences in total family health care expenditures in 2017 varied by insurance coverage pattern. We also evaluated for differences in family health care expenditures by family demographics (race and ethnicity of primary respondent, income, and region) by evaluating the interaction between food insecurity and sociodemographic characteristics. In addition, we evaluated the association between food security status in both 2016 and 2017 on total family health care expenditures in 2017. We categorized families as food secure in both 2016 and 2017, food secure in 2016 and food insecure in 2017, food insecure in 2016 and food secure in 2017, or food insecure in both

**Improving families' access to food at a pediatric visit could have important health benefits for other children and adults in the home.**

2016 and 2017 (see the online appendix technical brief for further details).[22]

All analyses accounted for the complex survey design of MEPS by applying sample weights, clustering, and the primary sampling unit. For all multivariable analyses, we used bias-corrected bootstrapping with 500 iterations. Because missingness was low (<5 percent) we did not conduct any imputations for missing data. We used a two-sided hypothesis test and considered a $p$ value <0.05 to be statistically significant. All analyses were conducted using Stata 15.1.

**LIMITATIONS** There were several limitations to this study that should be acknowledged. First, in this observational study, unmeasured confounding was an important concern. We attempted to account for this by adjusting for 2016 health care expenditures, which can help control for unmeasured time-invariant confounders, but we recognize that there may have been residual confounding, including confounding as a result of unmeasured time-varying factors.

Second, because of small sample sizes and being unable to identify the specific carrier, we had to broadly categorize families as all having private insurance, all having public insurance, or mixed, and we could not assess uniform coverage with the same carrier. Further, sample-size limitations also precluded us from separately considering families whose members were all uninsured (which we grouped with mixed coverage) and families with nongroup or exchange coverage (which we counted as private coverage).

Third, we were limited to identifying a family based on the definition included in MEPS.[15] People living in the same home but who were not related by blood, marriage, or adoption were defined as separate families.

Fourth, we adjusted for individual covariates (such as diabetes), not family covariates, as we thought these likely to be more influential for an individual's health care expenditures. We were concerned that using family covariates implicitly assumes that everyone in the family is affected by the variable to the same extent, which could lead to misclassification that may bias results to the null. Characteristics of other family members (for example, if anyone in the family had a chronic condition), however, could influence other individuals' receipt of health care and should be considered for future studies.

## Study Results

**STUDY SAMPLE** The study population contained 14,666 children and adults (weighted $N = 308,082,576$) from 6,621 distinct families. Most of the study sample was female, was non-Hispanic White, and had private health insurance (exhibit 1). Within the study sample, in 2016, 90.0 percent ($n = 12,616$) of individual participants were food secure, and 10.1 percent ($n = 2,050$) were food insecure. In bivariate analysis, participants who reported food insecurity were more likely than their food-secure counterparts to be younger, non-Hispanic Black, or Hispanic; have a lower income; and either have public insurance or be uninsured. We found similar differences when stratifying by adult and child participants (appendix exhibits A and B).[22]

Among families, the mean age of the primary respondent was 49.2 years, and 26.4 percent of families had at least one child (appendix exhibit C).[22] Within the study sample, in 2016, 89.7 percent ($n = 5,719$) of families were food secure, and 10.3 percent ($n = 902$) of families were food insecure. Of the families included, 50.6 percent reported that all family members had private insurance, 30.3 percent reported that all family members had public insurance, and 19.1 percent reported having a mix of insurance types.

Within families that reported all receiving private insurance, 54.5 percent of adults reported receiving employer-sponsored insurance, and 13.7 percent reported having more than one policy holder (appendix exhibit D).[22] Among those reporting all public insurance, 53.2 percent had Medicare, and 46.8 percent had Medicaid, CHIP, or other public insurance. Of families reporting mixed insurance coverage, 31.5 percent had private insurance; 28.6 percent had Medicaid, CHIP, or other public insurance; 10.2 percent had Medicare; and 29.7 percent were uninsured.

**FOOD INSECURITY AND HEALTH CARE EXPENDITURES**

▶ **INDIVIDUAL EXPENDITURES:** In multivariable models adjusting for sociodemographics, clinical covariates, and 2016 health care expenditures, we found that food insecurity in 2016, compared with food security, was associated

**EXHIBIT 1**

**Sample individual characteristics, study of food insecurity and health care expenditures in US families, 2016**

| Characteristics | Total individuals (N = 14,666, weighted N = 308,082,576) | Food-secure individuals (n = 12,616) | Food-insecure individuals (n = 2,050) |
|---|---|---|---|
| Age (mean), years**** | 38.6 | 39.1 | 33.5 |
| Female, %* | 51.0 | 50.8 | 53.4 |
| Race and ethnicity, %**** | | | |
| Hispanic | 18.1 | 17.2 | 26.2 |
| Non-Hispanic White | 60.0 | 61.7 | 45.5 |
| Non-Hispanic Black | 12.3 | 11.5 | 19.3 |
| Multiple race or other | 9.6 | 9.7 | 9.0 |
| Region of residence, % | | | |
| Northeast | 17.5 | 17.9 | 14.6 |
| Midwest | 21.0 | 20.7 | 23.5 |
| South | 37.7 | 37.4 | 40.9 |
| West | 23.8 | 24.1 | 21.0 |
| Household income, %**** | | | |
| <100% FPL | 12.9 | 10.7 | 33.0 |
| 100% to <125% FPL | 4.0 | 3.2 | 11.4 |
| 125% to <200% FPL | 14.1 | 13.0 | 24.4 |
| 200% to <400% FPL | 29.9 | 30.5 | 24.2 |
| ≥400% FPL | 39.1 | 42.6 | 7.1 |
| Insurance type, %**** | | | |
| Private | 58.6 | 61.2 | 34.7 |
| Medicaid, CHIP, or other public | 19.0 | 16.1 | 45.3 |
| Medicare | 15.1 | 15.9 | 7.7 |
| Uninsured | 7.4 | 6.8 | 12.2 |
| Age group, %*** | | | |
| Adult (age 18 or older) | 71.6 | 72.1 | 67.0 |
| Child (younger than age 18) | 28.4 | 27.9 | 33.0 |
| Education level (adults only), %**** | | | |
| Less than high school | 13.3 | 12.0 | 25.8 |
| High school graduate | 45.6 | 44.6 | 54.9 |
| More than high school | 41.2 | 43.5 | 19.3 |
| Chronic medical conditions, % | | | |
| Hypertension (adults only) | 32.7 | 32.6 | 33.9 |
| Diabetes (adults only)**** | 10.4 | 10.0 | 14.3 |
| COPD (adults only)**** | 3.5 | 3.0 | 8.4 |
| CVD (adults only)** | 15.7 | 15.4 | 18.1 |
| CSHCN (children only)*** | 14.5 | 13.7 | 20.3 |

**SOURCE** Medical Expenditure Panel Survey, Panel 21, 2016. **NOTES** "Family" was defined as 2 or more people living in the same household who were related by blood, marriage, or adoption, based on the Current Population Survey definition of a family. The study population included 14,666 children and adults from 6,621 distinct families. FPL is federal poverty level. CHIP is Children's Health Insurance Program. COPD is chronic obstructive pulmonary disease. CVD is cardiovascular disease. CSHCN is children with special health care needs. *$p < 0.10$ **$p < 0.05$ ***$p < 0.01$ ****$p < 0.001$

with greater total health care expenditures in 2017 ($6,693 [95% confidence interval: 5,694, 7,693] versus $5,387 [95% CI: 5,148, 5,625]), with an estimated difference of $1,307 (95% CI: 279, 2,335) among adults (exhibit 2). We did not find a significant association between food insecurity and child health care expenditures in adjusted multivariable models (see appendix exhibits E and F for full two-part model results).[22]

▶ FAMILY EXPENDITURES: Families that were food insecure had 20 percent greater subsequent adjusted total health care expenditures than their food-secure counterparts ($14,625 [95% CI: 13,909, 15,341] versus $12,169 [95% CI: 11,983, 12,355]), with an estimated difference of $2,456 (95% CI: 1,736, 3,176) (exhibit 2). Food insecurity was not associated with greater subsequent out-of-pocket expenditures (exhibit 3) but was associated with greater subsequent expenditures across all other health expenditure categories (inpatient, emergency department, outpatient, and prescription drugs).

▶ BY FAMILY INSURANCE COVERAGE: We found that food insecurity in 2016 was associated

with greater adjusted total health care expenditures in 2017 among families across all insurance coverage types (exhibit 4). It was associated with $2,017 (95% CI: 271, 3,764) greater total expenditures among families whose members all received private insurance, $1,855 (95% CI: 979, 2,731) greater expenditures among families whose members all received public insurance, and $3,531 (95% CI: 2,189, 4,873) greater expenditures among families with mixed insurance coverage. The between-group differences (all private versus all public versus mixed) in health care expenditures were not significant.

▶ OTHER ANALYSES: We also found that food insecurity was associated with greater health care expenditures when stratifying by the race and ethnicity of the primary respondent, family income, and region of residence (appendix exhibits G–I).[22]

In multivariable models, we found that families that were food insecure in both 2016 and 2017 had greater total health care expenditures in 2017 than families that were food secure in both years ($14,096 [95% CI: 13,061, 15,131] versus $12,247 [95% CI: 12,046, 12,448]), for a difference of $1,849 (95% CI: 778, 2,920) (appendix exhibit J).[22] Families that were food insecure in 2016 and food secure in 2017 had greater total expenditures in 2017 than families that were food secure in both years ($13,622 [95% CI: 12,775, 14,468] versus $12,247 [95% CI: 12,046, 12,448]), for a difference of $1,375 (95% CI: 538, 2,211). We did not find a significant difference in health care expenditures between families that were food secure in 2016 and food insecure in 2017 compared with families that were food secure in both years.

## Discussion

In this nationally representative cohort of US families, we found that food insecurity in 2016 was associated with greater total family health care expenditures in 2017. Also, families that were food insecure in 2016—whether they were food insecure or food secure in 2017—had greater total health care expenditures than families that were food secure in both years. Food insecurity was associated with greater total health care expenditures for families that were privately insured, were publicly insured, or had mixed insurance coverage. One in five families, however, had multiple forms of insurance coverage, which would complicate any efforts to see returns on social investments in ameliorating food insecurity by any one payer.

These results help provide a clearer understanding of the relationship between food insecurity and health care spending for families

**EXHIBIT 2**

**Association between food security status in 2016 and total health care expenditures in 2017 at the individual and family levels, by family characteristics**

| Family characteristics | Estimated mean annual total health care expenditures | |
| --- | --- | --- |
| | Expenditure amount in 2017 | Difference, food insecure versus food secure |
| **INDIVIDUAL LEVEL** | | |
| Adults | | |
|   Food insecure in 2016 | $ 6,693 | $1,307*** |
|   Food secure in 2016 | 5,387 | —[a] |
| Children | | |
|   Food insecure in 2016 | 1,893 | 28 |
|   Food secure in 2016 | 1,921 | —[a] |
| **FAMILY LEVEL** | | |
| All families (includes 1-person families) | | |
|   Food insecure in 2016 | 14,625 | 2,456**** |
|   Food secure in 2016 | 12,169 | —[a] |
| Families with 2 or more individuals | | |
|   Food insecure in 2016 | 16,884 | 3,104**** |
|   Food secure in 2016 | 13,780 | —[a] |
| Families with at least 1 child | | |
|   Food insecure in 2016 | 17,618 | 2,811**** |
|   Food secure in 2016 | 14,807 | —[a] |

**SOURCE** Medical Expenditure Panel Survey, Panel 21, 2016 and 2017. **NOTES** Results represent adjusted mean total health care expenditures. Individual adult and child results were determined using a multivariable 2-part model evaluating the association between food insecurity in 2016 and individual health care expenditures in 2017. The first part of the model used multivariable logistic regression to evaluate the association between food insecurity in 2016 and having any health care expenditures in 2017. Among those with any health care expenditures, the second part of the model used multivariable generalized linear model with log link and gamma distribution to evaluate the association between food insecurity in 2016 and total health care expenditures in 2017. To determine family-level results, we summed the adult and child estimates per family and evaluated the difference in total family expenditures by food security. Our definition of "family" is in the exhibit 1 notes. [a]Not applicable. ***$p < 0.01$ ****$p < 0.001$

and of how potential investments to address food insecurity could lead to cost savings for insurers and capitated health care systems. Our results, when considering individual family members, are consistent with those of prior studies that examined this association among individual adults and children. In adults, our results are consistent with the growing evidence showing that food insecurity is associated with greater health care expenditures.[6–8] In children, several studies,[9–11] including this one, have not found associations between food insecurity and health care expenditures. The difference between adults and children may be because, on average, children use fewer health services. It may also be that the negative impacts of food insecurity on health can take many years to manifest.[23,24] A major component of health care expenditures in our study, as in others, was prescription drugs.[6,8] The greater health care expenditures we found in adults could be due to the worsening of underlying chronic conditions requiring medications,

EXHIBIT 3

**Association between food security status in 2016 and family health care expenditures in 2017, by health care expenditure category**

| Expenditure categories | Estimated mean annual health care expenditures | |
| --- | --- | --- |
| | Expenditure amount in 2017 | Difference, food insecure versus food secure |
| Inpatient | | |
| Food insecure in 2016 | $1,751 | $281**** |
| Food secure in 2016 | 1,471 | —[a] |
| Emergency department | | |
| Food insecure in 2016 | 428 | 108**** |
| Food secure in 2016 | 320 | —[a] |
| Outpatient | | |
| Food insecure in 2016 | 2,997 | 213*** |
| Food secure in 2016 | 2,783 | —[a] |
| Prescription drugs | | |
| Food insecure in 2016 | 2,710 | 500**** |
| Food secure in 2016 | 2,210 | —[a] |
| Out of pocket | | |
| Food insecure in 2016 | 1,407 | 16 |
| Food secure in 2016 | 1,391 | —[a] |

**SOURCE** Medical Expenditure Panel Survey, Panel 21, 2016 and 2017. **NOTES** Results represent adjusted mean health care expenditures per family. Individual adult and child results were determined using a multivariable 2-part model evaluating the association between food insecurity in 2016 and health care expenditures in 2017 by expenditure category, controlling for sociodemographics, clinical covariates, and health care expenditures in 2016. To determine family-level results, we summed the adult and child estimates per family and evaluated the difference in family expenditures by food security. Our definition of "family" is in the exhibit 1 notes. [a]Not applicable. ***$p < 0.01$ ****$p < 0.001$

EXHIBIT 4

**Association between food security status in 2016 and total health care expenditures in 2017, by family members' health insurance type**

| Health insurance types | Estimated mean annual health care expenditures | |
| --- | --- | --- |
| | Expenditure amount in 2017 | Difference, food insecure versus food secure |
| All privately insured | | |
| Food insecure in 2016 | $14,024 | $2,017** |
| Food secure in 2016 | 12,006 | —[a] |
| All publicly insured (Medicaid, CHIP, other public, Medicare) | | |
| Food insecure in 2016 | 11,471 | 1,855**** |
| Food secure in 2016 | 9,616 | —[a] |
| Mixed insurance (any combination of private, public, uninsured) | | |
| Food insecure in 2016 | 18,455 | 3,531**** |
| Food secure in 2016 | 14,924 | —[a] |

**SOURCE** Medical Expenditure Panel Survey, Panel 21, 2016 and 2017. **NOTES** Results represent adjusted mean total family health care expenditures by family members' health insurance type. An explanation of the methods is in the exhibit 3 notes. Our definition of "family" is in the exhibit 1 notes. CHIP is Children's Health Insurance Program. [a]Not applicable. **$p < 0.05$ ****$p < 0.001$

which would be less likely to occur in children. Further studies that evaluate the impact of food insecurity on health and health care expenditures over many years are needed.

## Implications

**POLICY IMPLICATIONS** Our results have important implications for policy and clinical practice. From a policy standpoint, there have been growing investments by Medicare, Medicaid, and commercial health insurers in addressing food insecurity as a way to improve health, mitigate avoidable utilization, and reduce health care expenditures. Examples include more robust screening for food insecurity, referrals to community-based organizations, and the provision of medically tailored meals.[12,21] Our findings are consistent with the promise of that approach, as we found greater health care spending in families that experienced food insecurity. As families generally share food and other resources, an intervention that addresses food insecurity in one or more specific family members may provide benefits to other family members, even if only a single individual qualifies for the benefit. Thus, for families covered by the same carrier, initiatives at the insurer level could increase every family member's access to food, improve the health of both children and adults, and reduce family health care expenditures in a way that unlocks both financial and health benefits.

However, we found that one in five families had more than one insurance plan. Observing the full financial benefit of food insecurity interventions may be more challenging for families with mixed coverage, potentially creating conditions that discourage investment. The number of low- and middle-income parents and guardians who enroll their children in Medicaid or CHIP, rather than their employer-sponsored health insurance, is increasing because of the rising out-of-pocket expenses of private insurance, and these families are often at high risk of having unmet social needs.[25] It is also likely that the true percentage of families with mixed coverage is higher than 20 percent, given our inability to identify the exact carrier or plan of each individual.[26] Among families categorized as all having public insurance, 50 percent reported being insured by Medicare and 50 percent by Medicaid, CHIP, or other public insurance. Even for families all receiving Medicaid, many families might not have been on the same health plan, as nearly two-thirds of Medicaid recipients are enrolled in a health maintenance organization and auto-assignment algorithms may enroll members of the same family in different managed care plans.[27] Similarly, for family members who re-

ported private insurance, 13 percent of families had more than one policy holder, suggesting that even within these households, different employers or benefit structures may exist. Also of note, food insecurity may be associated with greater differences in health expenditures among families with mixed coverage than among families with all private or all public insurance. Although we found those differences to be not statistically significant, on average, they were large and may warrant further examination.

This complexity of households with mixed insurance coverage means that a single carrier financing an intervention might not see the full benefits of that intervention reflected in the improved health or reduced health care costs of the targeted family members. Such a situation could be understood as an externality in the sense that there are third-party benefits (that is, benefits to parties other than the insurer and its members) that may result from a food insecurity intervention. Economic theory would suggest that such externalities could lead to less investment in initiatives than might be socially desirable.[28] One way to address such externalities would be public subsidies for food insecurity interventions undertaken by insurers or using social impact bonds.[29] Alternatively, addressing food insecurity at the public health or social policy level, where stakeholders have responsibility for the entire population, may be needed. Such approaches include expansion of nutrition subsidies (such as the Supplemental Nutrition Assistance Program [SNAP]) or income support (such as the Child Tax Credit). For example, multiple studies have shown that SNAP leads to reductions in food insecurity.[30] The recent recalibration of the Department of Agriculture's Thrifty Food Plan has led to significant increases in the benefit amounts that families receive and will potentially have a profound impact on improving food security in the US.[31] Expansion of SNAP eligibility could also reduce, or potentially eliminate, food insecurity.[32] Other policy options could include encouraging insurers' participation across numerous lines of business (that is, Medicaid managed care and private coverage) in a state to promote more uniformity in coverage or developing quality metrics at the family level.[26]

CLINICAL CARE IMPLICATIONS Although this study identified variation in health insurers within families, there may be an analogous challenge for clinical care providers, where a growing number of food insecurity interventions are being conducted.[33,34] These interventions primarily focus on individual-level outcomes and thus might not assess how addressing social needs could have positive benefits for other family members—members who may be seen in different clinics or even different health systems. This may be particularly relevant for pediatric providers. There has been a strong endorsement among national pediatric societies for pediatricians to screen for and address food insecurity as a routine part of clinical care.[35] Although addressing food insecurity at pediatric visits could have important long-term benefits for children, we found, as have other researchers, that short-term return on investment in the form of reduced health care expenditures might not occur. Improving families' access to food at a pediatric visit, however, could have important health benefits for other children and adults in the home, and short-term reductions in health care expenditures may occur for adult family members. Similar to health insurance level initiatives, there could be an important externality with food insecurity interventions in clinics or health systems, and less investment in these initiatives may occur than socially desirable. Future studies are needed to evaluate the effect of addressing food insecurity at an individual patient visit on the health outcomes and health care use of other family members. ∎

## NOTES

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22 To access the appendix, click on the Details tab of the article online.

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