Food Insecurity and Nonstandard Work among Low-income Rural Households, A Longitudinal Analysis*

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ABSTRACT

Food insecurity refers to a household's inability to provide adequate food for all adults and children. This study focuses on how work characteristics — number of hours worked, schedule of employment, and travel distance from home to work — relate to food insecurity. Much food insecurity research has been cross-sectional; this study is unique in analyzing panel data and utilizing discrete time event history analysis to model the transition to food insecurity. Data from the Family Life Project consists of approximately 1200 low-income, rural families with young children that are followed over three years of data collection. Controlling for income and other characteristics, mothers that work full-time without a partner are more likely to transition to food insecurity than mothers not employed with a partner working full-time during the day shift. In addition, role overload, or greater demands on mothers' time is significantly related to transitioning into food insecurity. The inability to invest adequate time in home food preparation and complexity in household scheduling are discussed as potential mechanisms whereby work hours and schedules relate to food insecurity net of income. Potential policy implications are discussed.

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Household food insecurity refers to an inability to provide adequate food for all household members. In 2007, 11.1 percent of U.S. households were considered food insecure (Nord, Andrews, and Carlson 2008). Given economic conditions since 2007, food insecurity is likely to have become more problematic in the U.S. It is clear that food insecurity is related to income, lower income households face a much higher likelihood of food insecurity than higher income households (Hamilton et al. 1997a; Nord et al. 2008). But, "measured food insecurity contains a great deal of variation that is not associated with income: measures of fit are moderately high at best, even with controls for race/ethnicity and household structure" (Nord 2000:123). Much about the factors that predict food insecurity remains undocumented. Work characteristics may relate to food insecurity in ways beyond income related to employment.

In particular, how might characteristics of employment such as hours worked and work schedule relate to food insecurity? This is the primary research question addressed in the following analysis of a panel data set of low-income rural families with young children. Hours worked and timing of those hours worked may affect food insecurity due to time available for home food preparation. Market work may reduce the time available for home food production, thus resulting in higher prices paid for food (Rose 2007). Nonstandard hours, those outside the typical 8 am to 4 pm work day, may be particularly problematic for meal preparation because these nonstandard hours may interfere with family evening meals (Presser 2003). Being "time-poor" (Vickery 1977) may be an important dimension that affects household food insecurity as time is a valuable resource needed to reduce household food costs.

Literature Review

Food Insecurity is defined by USDA as households that "were, at times, uncertain of having, or unable to acquire, enough food for all household members because they had insufficient money and other resources for food" (Nord, Andrews, and Carlson 2004:3).[1] Nonstandard work can be defined as work that is part-time, temporary, contract work, or has varied hours (Kalleberg, Reskin, and Hudson 2000; McLaughlin and Coleman-Jensen 2008). Nonstandard schedules refer to employment during night or evening shifts or rotating and irregular schedules (Presser 2003). In this paper, work that is part-time (less than 35 hours) regardless of shift and work that is full-time other than a day shift is considered nonstandard.

Prior research using U.S. Current Population Survey data indicates that a household head engaged in nonstandard work, that is part-time or varied hour work (employment where the minimum hours work varies unsystematically from week to week) or multiple job holding is related to higher odds of household food insecurity, each compared to full-time employment (Coleman-Jensen Under Review). Meanwhile, having a household head out of the labor force relates to lower odds of food insecurity compared to full-time work, controlling for income and other social demographic characteristics. These different work arrangements may relate to food insecurity due to the time available for at home food preparation and the complexity of planning meals around the time demands of work. Those not in the labor force may have a lower likelihood of food insecurity because they are able to invest more time in at home food preparation and are able to reduce their food budget. Meanwhile, those working part-time jobs may very well be working nonstandard schedules which may interfere with typical family meal times such as dinner. Heads working during dinner hours may be more likely to purchase fast food, thereby spending more on food and expending a possibly limited food budget more quickly

[1] Unfortunately, the full food insecurity measured used for national food security statistics by USDA is not available in the current data set. An alternative food insecurity measure is used. This may result in discrepancies between the current analyses and prior research using the USDA measure.

than they would have given a different work schedule. Workers with multiple jobs and varied hour employment may face a frenetic schedule managing work and family needs and also may resort to more expensive convenience food items. Spending money on convenience foods, dining out or fast food may place families that have limited budgets at an even greater risk for food insecurity. These potential mechanisms whereby work hours and scheduling may relate to food insecurity are discussed in more detail below.

Families must often plan household activities around the time demands of work (Roy, Tubbs, and Burton 2004). Yet, planning and budgeting for household food preparation and consumption takes significant time and organization (DeVault 1991), especially if resources are limited. To alleviate the burden of food provisioning, convenience foods, such as take out, fast food, or prepared meals, can be substituted for meals made at home from scratch, but these options are more expensive. Yet, there is a time-cost for at home meal preparation and preparing low-cost nutritionally adequate meals. Low-cost recipes that follow the USDA Thrifty Food Plan require more time than American households typically spend in home meal preparation (Davis and You Forthcoming). Many families with limited time resources may be unable to limit their household food spending by investing time instead of money.

Mothers' do appear to feel a tension between work demands and time for home food preparation. Inflexible work schedules or working nights or evenings in particular conflict with family needs and are related to mothers' feelings of time scarcity for food provisioning (Jabs et al. 2007). In qualitative interviews, mothers working long hours, overtime, shift work or with inflexible schedules more often purchased take out, fast food, or ate out than mothers working fewer hours or with more flexible schedules (Devine et al. 2003). Erratic work schedules are also problematic for mothers' cooking time and result in a higher incidence of purchasing fast

food (Jabs et al. 2007). Mothers working jobs with night or evening or rotating shifts may find themselves purchasing higher priced food to feed their families because they are unable to utilize lower cost but more time intensive meal options. As a result, household food expenditures may be higher than they would be given different work characteristics, and the increase in food spending may quickly deplete a food budget, leaving a family at higher risk for food insecurity.

U.S. food assistance policy assumes that low-income households will be able to make the tradeoff between cost and time, by preparing meals from scratch. The Thrifty Food Plan, the meal plan on which federal Food Stamp allotments are based, assumes that most meals are prepared at home from basic ingredients, yet federal welfare policy (PRWORA) assumes that low-income mothers are working in the labor force (Rose 2007). As Rose notes, the assumption of these policies are at odds. The question here is how do these contradictory assumptions affect household food insecurity? Among low-income households, controlling for income and other characteristics, does time at home or time at work relate to higher likelihood of food insecurity?

Low-income women that are not in the labor force spend more time in food preparation than all other women, yet they still spend less time per day that the average needed to prepare meals from the Thrifty Food Plan recipe book (Mancino and Newman 2007). As number of hours worked increase, the time in household food preparation decreases. However, low-income full-time working women spend more time in food preparation than do other women, likely out of economic necessity. It is worth noting that men, regardless of number of hours worked or income, spend much less time in food preparation than do women. Women with a partner spend more time in meal preparation than single women. This may be due to the added work created by a partner, or because the partner frees the woman from other tasks and allows her to invest more time in meals. In models estimating time spent in food provisioning, time resources, such

as number of hours worked and presence of a partner had a greater effect than financial resources (Mancino and Newman 2007). Therefore, it may be that time for food provisioning is an important factor in protecting low-income households from transitioning into food insecurity.

The sample used for the analysis is rural. Considering rural households is important, although they have lower food insecurity rates than central city households, they have higher food insecurity rates than suburban households (Nord et al. 2008). In addition, rurality is important because caregivers living in rural areas may have to travel longer distances to work and to childcare, thereby exacerbating the effect of time at work. Also, many nonmetropolitan or rural communities lack large food retailers and so cannot benefit from economies of scale in their local communities. As a result, low-income households face higher prices in local stores or higher travel costs for reduced prices elsewhere (Blanchard and Lyson 2002; Kaufman 1999). Lack of a vehicle may exacerbate any problems resulting from travel distances. A potential advantage of living in a rural community is space to garden and cultivate food; however, such activities would clearly require time that may be limited. The analysis considers these many factors of rurality that may relate to household food insecurity.

Several other factors related to food insecurity should be controlled when considering the relationship between work characteristics and household food insecurity. As mentioned earlier, income is significantly related to household food insecurity and closely related to work characteristics. Uninsured households are more likely to be food insecure than households with health insurance (Alaimo et al. 1998). Minority headed households are more likely to be food insecure than whites (Nord et al. 2008). Household characteristics are also important predictors of food insecurity. Single mother households are more likely to report food insecurity than other households (Alaimo et al. 1998). Employed single mothers, suggest that lacking a partner to

help with household needs is an added barrier to investing time in at home food preparation (Jabs et al. 2007). The support of others, such as non-resident fathers and friends and neighbors, is important for reducing food insecurity, even if they do not reside in the household (Garasky and Stewart 2007; Martin et al. 2004). Households with children, and young children in particular have higher rates of food insecurity than households without children (Nord et al. 2008). Those with low education also face higher food insecurity rates (Olson et al. 2004). Adult depression has been linked to household food insecurity (Heflin, Siefert, and Williams 2005; Vozoris and Tarasuk 2003) and recent research has documented the important of controlling for indicators of mental health, especially depression, when considering the link between employment and food insecurity because depression is related to both employment outcomes and food insecurity (Heflin, Corcoran, and Siefert 2007).

This analysis contributes to prior research on food insecurity in several ways. First, the transition to food insecurity is estimated whereas most other food insecurity research documents significant factors related to a cross-section of households that are currently food insecure. Second, more detailed indicators of work characteristics are examined. Third, mothers' feelings of time pressure or role overload are considered as a factor related to food insecurity.

Hypotheses

Four main hypotheses are considered in the analysis. First, controlling for income and other family characteristics, mothers not employed will be less likely to be food insecure than those employed, because they can invest more time in low-cost meal preparation. Second, mothers working other than day shifts will be more likely to experience food insecurity than those working day shifts because they will have less time for dinner at home. Third, longer commuting distances will increase the likelihood of food insecurity because of the time required

for commuting. Finally, increased time demands will relate to an increased likelihood of transitioning to food insecurity.

Data and Methods

Data

The data used in this study is the Family Life Project.[2] The Family Life Project is principally designed to investigate child development within low-income rural families. This is a panel data set that follows families from the birth of a target child. Therefore, it is a cohort study, following a group of children from birth. Three years of data are used in the current analysis. The data collection time points reference the age of the target child. Data for the current analysis were collected when the target children were aged 6, 15, 24, and 35 months. These are all time points that are currently available (except for data from 2 months, but data collection at this time point was limited and several key measures used here were not collected at 2 months).

Sampling of Counties

The six counties for the study were selected on several factors. One was that they had to be representative of locations with rural poverty, the Pennsylvania counties are part of Appalachia and the North Carolina counties reflect southern black poverty. Beale codes were also used in selecting counties, Beale codes are used to define metropolitan and nonmetropolitan counties in the U.S. Counties are categorized into one of ten Beale codes, three of these county types are included in this study. The study includes small metropolitan areas, counties adjacent to a metropolitan county containing an urban population of 20,000 people or more, and counties adjacent to a metropolitan county with at least one urban place having at least 2,500 urban

[2] The Family Life Project is supported by a grant from the National Institute of Child Health and Human Development (PO1-HD-39667), Lynne Vernon-Feagans and Martha Cox, PIs, with co-funding from the National Institute on Drug Abuse.

residents. Therefore, the study includes residents of mid-size and small towns and surrounding areas within a county. It is worth noting that the "most rural" counties, those without an urban place and those that are not adjacent to a metropolitan county, are excluded.

Based on the demographic restrictions of likelihood of having enough low-income births to sample, poverty restrictions based on having half of the children in a county eligible for free and/or reduced school lunch (180% of poverty), and size of place restrictions, three contiguous counties were selected within each state. Because of greater racial/ethnic diversity in North Carolina, more families were sampled there than in Pennsylvania.

Sampling of Families

Participants were recruited from hospitals in the six study counties. If there was more than one hospital in a county, one hospital was randomly chosen. Mothers were asked to participate while still in the hospital after the birth of the target child. Sampling was purposive, with oversampling of low-income families (those below 200% of poverty or eligible for needs based public assistance program) in both states and oversampling of black families in North Carolina. Households that did not speak English and households intending to move away from the area within three years were excluded. Of the families that were eligible, 68% were willing to participate and of those 58% were invited to join the study. Of those invited, 82% completed their first home visit (when the target child was 2 months old). The original sample size was 1,292 families. Sample recruitment occurred from September 2003 to September 2004. Three-quarters of the sample was below 200% of poverty at the time of recruitment.

Sample Restrictions, Attrition and Missing Data

Two restrictions are placed on the sample for this study. Households that left the study after the 2 month interview and were not interviewed at subsequent waves are excluded,

removing 42 families from the analysis. In addition, if the mother's response to the household food insecurity question is missing at all observations (6, 15, 24 and 35 months) the family is excluded, removing an additional 57 families. Finally, if the mother changes over the course of the study (meaning the target child begins living in a new household), the family is excluded, deleting an additional 49 families from the analysis. The resulting sample size at 6 months is 1144 families. The study has very low attrition, retaining 1075 families at 35 months. A family is included in the analysis for all time points at which they were interviewed. For instance, if a family missed the 15 month interview but participated again at 24 months, they are included in the event history for each month in which they have non-missing data. Missing data is not imputed. For some variables, described in the measures section, a separate category is included indicating missing data. Data are not weighted.

Primary and Secondary Caregivers Defined

The terminologies used for the heads of household in the Family Life Project are primary and secondary caregiver. Primary caregiver refers to the target child's caregiver. Generally the primary caregiver is the target child's biological mother. In a few cases the primary caregiver is the target child's grandmother. All primary caregivers are women. Throughout the paper, primary caregiver and mother are used interchangeably, although primary caregiver is technically correct. The secondary caregiver refers to someone living in residence with the mother and child who the mother identifies as the secondary caregiver. Usually this is the mother's spouse or cohabiting partner. In some cases, this is the mother's mother or target child's grandmother. In relatively few cases the secondary caregiver is another family member such as the mother's sister. The secondary caregiver may change over the course of the three years of data collection.

Measures

Dependent Variable, Food Insecurity: Food insecurity is measured in this study by the primary caregiver's response to a question about their ability to afford the food they need for their family. The question reads: "My family has enough money to afford the kind of food we need. Do you… Strongly Disagree, Disagree, Agree, Strongly Agree." Mothers responding that they strongly disagree or disagree are coded as food insecure. This is not the standard measure of food insecurity used by the USDA in national surveys, but it is significantly correlated with households in the sample participating in Food Stamp and WIC programs (data not shown). Households that are coded as food insecure are more often in need of and use food assistance programs than those that do not indicate food insecurity, indicating that they are less food secure. The food insecurity measure was collected at 6, 15, 24, and 35 months.

Independent Variable of Interest, Employment:

Family Work Characteristics. Family work characteristics refer to the combination of work arrangements between the primary and secondary caregiver. Because work choices and arrangements are likely to be made in combination between caregivers and because time for food preparation and other household activities may depend on the availability of other adults in the household, work characteristics of the primary and secondary caregiver were combined into one variable. In the creation of this variable, detail on mother's work took precedence over secondary caregivers work because as discussed earlier women more often engage in food preparation activities than men, especially in low-income households (Mancino and Newman 2007). Therefore, mothers work was divided into five categories based on number of hours work and work schedule. The primary caregiver work categories are: not employed, full-time (35 hours or more) day shift (most hours between 8am and 4pm), full-time other shift (most hours

between 4pm and 8am, or rotating or irregular shift), part-time (employed, but less than 35 hours) day shift, and part-time other shift. Relatively less attention was paid to secondary caregivers hours of employment and work shift. Primary caregiver's employment is thought to affect time for food preparation more than secondary caregiver's work because men (most secondary caregivers) are less likely to engage in food preparation activities than women (Harnack et al. 1998; Mancino and Newman 2007; Zick, McCullough, and Smith 1996). The secondary caregiver work categories are divided as follows: not employed, full-time day, nonstandard (part-time or full-time other shift), no secondary caregiver, no data on secondary caregiver employment[3]. In combining these multiple categories from both the primary and secondary caregiver, some categories had small sample sizes. Therefore, by necessity some categories were collapsed. For example, the smaller number of mothers working full-time other shifts did not enable division of secondary caregivers' hours or shifts, resulting in an overall, secondary employed category. The resulting categories for the dummy variables are:

- Primary Not Employed - Secondary Full-time Day (Reference)
- Primary Not Employed - Secondary Not Employed
- Primary Not Employed - Secondary Nonstandard
- Primary Not Employed - No Secondary
- Primary Not Employed - Secondary Missing
- Primary Full-time Day - Secondary Full-time Day
- Primary Full-time Day - Secondary Nonstandard
- Primary Full-time - No Secondary
- Primary Full-time - Secondary Missing
- Primary Full-time Other - Secondary Employed
- Primary Employed - Secondary Not Employed
- Primary Part-time Day - Secondary Employed
- Primary Part-time - No Secondary
- Primary Part-time - Secondary Missing
- Primary Part-time Other - Secondary Employed

[3] If the secondary caregiver was not available for an interview, no data was collected regarding their employment arrangements. Due to the relatively small sample size removing these cases was undesirable. Therefore, missing data on secondary caregiver's employment is included as a category. In future analyses, these data will be imputed, using information on secondary caregiver's work from prior and subsequent waves.

Employment characteristics were collected at 6, 15, 24, and 35 months. Primary Not Employed - Secondary Full-time Day is the reference category because this group may invest the most time in food preparation and therefore be the most able to minimize their food budget by preparing home cooked meals. According to an analysis of the American Time Use Survey, women that are low-income, not working and who have a partner invest the most time in food preparation compared to women with other income, work and partner combinations (Mancino and Newman 2007).

Commuting Distance. Mother's ability to spend time in food preparation depends not only on the number of hours worked and schedule of employment, but also on the time she must spend commuting from home to work and childcare. Therefore, variables indicating distance from home to work and childcare are included in the models. To create these variables, the family's home address was geocoded, along with work address and childcare address. Distances between these points were calculated using Environmental Science Research Institute (ESRI) Street Map Pro Data. This is the most complete street network dataset available, with information on all types of roads including interstates and neighborhood streets. Therefore, these distances are not the shortest distance between two points, but the distance given a specific travel route generated using the street networks.

Distances from home to primary caregiver work, distance from home to childcare, and distance from home to secondary caregiver work were estimated. For this analysis distance from home to mothers work and distance from home to childcare were added together. Both of these distances were measured in miles. Because many mothers are not employed, using distance as a continuous variable was highly skewed due to zero miles for many of the households. Therefore distance is included in the analysis as a set of dummy variables. Of mothers with distance data,

seventy-five percent had a total travel distance of less than 20 miles, therefore 20 or more miles was deemed as high on the distance variable. Greater than zero but less than 20 was deemed low on the distance variable. Categories are also included for no distance for those that work from home or are not working, and a category indicating missing distance data. About ten percent of households have missing data on distance to work because either the mother did not provide a work address, or the address was insufficient to allow for geocoding. The distance variables are available for all waves.

Control Variables, Income Related:

Family Income. Family income is measured using the income relative to poverty ratio. Income from all sources is combined and the income is compared to the federal poverty thresholds for the households' size and composition in the given year that the family was interviewed for each wave. A poverty ratio of one indicates that the family's income is at the federal poverty threshold, above one indicates their income is above poverty and below one indicates their income is below poverty. The income relative to poverty ratio was calculated for each data collection (6, 15, 24, and 35 months), using the poverty thresholds for the year of the interview.

Money in Bank Accounts. At the 6 month interview families were asked about assets. The money in bank accounts variable includes money in all bank accounts (checking and savings) held by the family. The variable is continuous and is measured in thousands of dollars. The variable is top-coded at 40,000. The mean is somewhat skewed by a few households with large savings. This information was only collected at 6 months and is included but is not time-varying.

Access to Health Insurance. Families are differentiated in the analysis by whether or not members have access to health insurance. If the primary and secondary caregiver and target

child all have insurance the family is coded one on the health insurance variable. If one or more family members do not have health insurance they are coded zero. Health insurance information is included from 6, 15, 24, and 35 months.

Control Variables, Family Characteristics:

State of Residence. The sample consists of families from North Carolina and Pennsylvania. Families that moved out of these states were removed from the study. In the analyses, North Carolina is the reference category. State of residence is important to control because it is likely to affect the household through differences in state policies, cost of living and local economic conditions.

Race/Ethnicity. The sample primarily consists of families that are white or black. Less than two percent of the sample is from some other race or ethnic group. In the analysis white (non-Hispanic) is the modeled category, and black/other is the reference group. This variable is not time varying and is set at the race/ethnicity to which the primary caregiver identified herself at initial recruitment into the study.

Family Composition. Several variables are used to identify family composition. A family structure variable is included for descriptive purposes, but because the work variable includes whether or not a secondary caregiver is present, the full set of family structure dummy variables cannot be included in the model with the work characteristics dummies. The family structure variable is based on the secondary caregiver's relationship to the primary caregiver. There are four family structure categories, married couple, cohabiting, single mother (no secondary caregiver) and three generation or other family. The three generation or other family category consists mostly of primary caregivers living with their mothers. Some primary caregivers live with other family members as well.

Because family structure is closely related to gender of the secondary caregiver, a dummy variables is included indicating whether the secondary caregiver female or if there is no secondary caregiver or a male secondary caregiver. Given differences in time spent in food preparation by, female secondary caregivers may reduce the likelihood of food insecurity by spending time preparing low-cost food. Secondary caregivers in the three generation or other family category are all women.

Also, a dummy variable is included in the analysis indicating whether the family is headed by a married couple or not. Two additional indicators of family composition are number of adults and number of children in the family. These are both continuous variables. All the measures for family composition are time varying and are measured at 6, 15, 24, and 35 months.

Control Variables, Primary Caregiver Characteristics:

Education. Education is included as a single dummy variable. The variable is assigned a value of one if *either* the primary or secondary caregiver has a college degree (associates, bachelors or higher)[4]. Education is time-varying and measured at each wave.

Primary Caregiver Age. Primary caregiver's age is a continuous measure that is time-varying[5].

Maternal Depression. An indicator of maternal depression is included. The measure changed over the course of the study. At 6 and 15 months, the BSI-18 (Brief Symptom Inventory 18) was used (Derogatis 2000). The BSI-18 includes three subscales, somatization, anxiety and depression but only the six items referring to depression are used in this study. The CES-D (Center for Epidemiologic Studies Depression Scale), a more detailed depression indicator was used at the 24 and 35 month assessments (Radloff 1977). This scale consists of twenty items all related to depression. Because the BSI-18 and CES-D range of scores are different due to the

[4] A more detailed education variable for the primary caregiver was included in earlier analyses, but none of the categories was significant, so the single dummy variable was included for parsimony.

[5] Age squared was included in some analyses but was not significant. The relationship is not curvilinear with age.

different number of items, standardized scores are used in the analysis where the mean is set to zero with a standard deviation of one.

Control Variables, Food Access:

Distance to Nearest Grocery Store. Distance to the nearest grocery store is measured in kilometers and is measured at 6, 15, 24 and 35 months.

Gardening. At 6 months primary caregivers were given the statement: "Growing food and gardening are very important in my family." If respondents indicated "very true of me" or "somewhat true of me" they are defined as gardening being important to their family. This variable is not time varying.

Access to Vehicle. At 6 months primary caregivers are asked if they or another member of their family owns a car, truck or van that the primary caregiver can use. Respondents indicating that she or a family member owns a vehicle are coded as one on the access to vehicle variable. This variable is not time varying.

Geographic Isolation. A geographic isolation variable is constructed using distance data from home to residence to important community and business locations such as schools, hospitals, the county seat, nearest gas station, etc. The geographic isolation variable is the mean of the distances from home to each location. The log of the variable is used. The variable is measured at 6, 15, 24 and 35 months.

Role Overload (demands on time). The role overload scale is used as an indicator of demands on time and feeling that there are too many demands. Feelings of role overload may relate to time for food preparation. The role overload scale was originally used to understand the relationship between wives employment and convenience consumption (Reilly 1982), a modified, shorter version of the scale is used in the current study. It consists of 6 items (provided in the

Appendix). The sum of the items is used the analysis. A higher score indicates greater role overload or more demands on time. The sum score is time varying and the measure is collected at 6, 15, 24, and 35 months.

Methods

Event History

Discrete time event history analysis is used to model the first transition to food insecurity following the birth of the target child. Discrete time event history models are used when time is not continuous but rather is measured at distinct intervals. Intervals can be of unequal duration, as is the case with these data. These models utilize basic logistic regression but also include an indicator of duration to measure time at risk of experiencing the event, in this case food insecurity (Allison 1995).

To perform the discrete time event history models, a person-observation file was created. In this data file there is one line of data for each family for each month that they were interviewed. A family that has data for all interviews will have four lines of data from observations at 6, 15, 24, and 35 months. Most of the predictors included in the analysis are time-varying as described in the measures section. Households are included in the analysis at each observation that they participated in the study. Missing data was not imputed. Households that left the study completely were considered right censored. The useable sample size for each of the models is displayed in Table 4.

For the analysis, the risk period for experiencing food insecurity will begin at the birth of the study's target child. Therefore, the event history analysis focuses on transitions to food insecurity after the birth of a child until that child is aged three years. While this risk period is

somewhat arbitrary and defined by the data, it is a meaningful risk period because food insecurity is more common among households with young children (Nord et al. 2004).

Event history models the first transition to food insecurity. Households that are food insecure at 6 months cannot be included in the analysis because it is unknown when they transitioned to food insecurity. Almost one-half of the households that are food insecure at any point during the observation period were food insecure at the first interval (148 out of 308 households that were food insecure; see Table 2). These households are removed from the analysis. This may bias the results if households that enter food insecurity earlier in the study, or prior to the start of data collection are experiencing more severe food insufficiency. However, because the analysis models the transition to food insecurity, including these households does not add to the analysis because their transition is not modeled. A logistic regression model predicting food insecurity at six months is included to account for the fact that these households are not part of the event history models.

Analytic Strategy

The analysis has three parts, a description of the sample, estimation of logistic regression models predicting food insecurity at six months and estimation of event history models predicting the first observed transition to food insecurity. The description of results proceeds as follows. First, Table 1 shows the sample characteristics and the percentage of households that are food insecure across the variables included in the study. This table includes descriptions of the sample at the 6 month observation. Panel A displays the sample description and percent of households that are food insecure across categorical variables. Panel B shows the sample mean and mean for food insecure households for the continuous variables included in the study. Second, Table 2 shows the percent of households that are food insecure at each observation. One

column shows the percent of households at each observation that are first time food insecure households and another column shows the total percent of households that are food insecure at each observation whether or not they were food insecure at earlier observations. Third, Table 3 includes logistic regression models predicting food insecurity at 6 months. Logistic regression models are used to identify relevant predictors of food insecurity at 6 months because households that are food insecure at 6 months are not included in the event history model. Finally, Table 4 shows event history models modeling the first observed transition to food insecurity over the course of the study. There is an important distinction between the logistic regression models and discrete time event history models. The logistic regression models are based on prevalence of food insecurity, or which families are food insecure and which are not, while the event history models are based on transitioning from food security to food insecurity, or which families become food insecure. All analyses were performed using SAS 9.1.

Results

Descriptive Statistics

The sample distribution across each of the categorical variables is shown in Table 1 Panel A. First considering the sample distribution, the modal work category is having a primary caregiver that is not employed and a secondary caregiver working a full-time day shift with 13.91 percent of families at 6 months. The fewest families (3.41%) have a primary caregiver working a full-time day shift with a secondary caregiver in a nonstandard job (full-time other shift, or part-time). Most mothers work relatively close to their home, 44 percent of mothers have a combined distance from home to work and home to childcare of less than 20 miles. The distribution of the categorical control variables is not described in the text, but the reader is referred to the first column of Table 1 to observe the sample characteristics.

The second column of Table 1 shows the percentage of households that are food insecure for each of the given characteristics. There is wide variation in the percentage of households that are food insecure across the work combination categories. The highest percentage food insecure is for households with a primary caregiver employed and a secondary not employed, followed by primary caregivers working full-time without a secondary caregiver. The lowest percentage of households that are food insecure is for households with primary caregivers working part-time day shift and an employed secondary caregiver and for households with a primary caregiver working full-time other shift and an employed secondary caregiver.

Somewhat surprisingly, families with primary caregivers commuting less than 20 miles have a higher percentage of food insecurity than families with primary caregivers commuting 20 miles or more. Perhaps this is related to commuting longer distances to find "better" jobs.

Turning to the control variables, a higher percentage of households without health insurance are food insecure than those with health insurance. Food insecurity is more prevalent in the North Carolina sample than in the Pennsylvania sample. Black and other race/ethnicity primary caregivers have a higher prevalence of food insecurity than white primary caregivers. Across family structure, the highest percent food insecure is among single mothers, while the lowest percent is among married couples. Food insecurity is relatively more prevalent among households with a female secondary caregiver than those with a male secondary caregiver. Families without a college degree holder have a higher prevalence of food insecurity. A slightly higher percentage of households identifying gardening as important are food insecure. Food insecurity is slightly more prevalent among households without a vehicle.

Table 1 Panel B shows the mean for the sample and the mean for food insecure households for the continuous variables included in the study. Food insecure households have a

lower mean income to poverty ratio than does the overall sample. Food insecure households, on average, also have less money in bank accounts than does the overall sample. The average number of adults in food insecure households is slightly lower than the sample, while the average number of children is somewhat higher. The average age of the primary caregiver is about 27 for both food insecure households and the entire sample. Distance to the nearest grocery store is slightly lower for food insecure households than the sample. Food insecure households, on average, score higher on the role overload scale than does the overall sample, indicating that food insecure households perceive or have more demands on their time. The log of geographic isolation is similar between the sample and food insecure households.

Table 2 shows the percentage of households that are food insecure over waves of the Family Life Project. The first column shows the percentage of households that are food insecure for the first time for each observation month. About 12.5 percent of families were food insecure at six months. At 15 months, 6.8 percent were food insecure for the first time. At 24 months 4.3 percent were food insecure for the first time and 2.4 percent were food insecure for the first time at 35 months. About half of all households that are ever food insecure (25.9 % of all households) are food insecure at the first observation (12.5 % of all households).

The second column in Table 2 shows the percentage of households that are food insecure at each observation month regardless of whether they were food insecure at earlier observations. Here the percentages of households that are food insecure are higher than in the first column because many households are food insecure at more than one observation. However, the percentage of households that are food insecure does decline somewhat as the study continued.

Logistic Regression

Logistic regression models predicting household food insecurity at 6 months are shown in Table 3. Three models are displayed, the first model includes only work and income. This model is included to show the effect of work without other controls, however because the effect of work is so related to the effect of income associated with employment, income variables are also included in the model. The full model with all controls is displayed next, followed by a reduced model with only statistically significant controls.

In the first model, including work and income, only one work category is marginally significant, a primary working a full-time other shift with an employed secondary caregiver is less likely to be food insecure than a primary not employed with a secondary working a full-time day shift. Money in savings is also marginally significant, more money in savings relates to a lower likelihood of food insecurity. Commuting distance is not significantly related to food insecurity.

In the full model, the work category primary full-time other shift and secondary employed remains less likely to be food insecure than the category primary not working and secondary full-time day shift. Also, having a primary caregiver not employed with secondary working nonstandard hours (part-time) or other shift is also less likely to be food insecure. In addition, more money in savings is significantly related to a lower likelihood of food insecure. Consistent with prior literature, primary caregivers with higher depression scores are more likely to be food insecure. Time does appear to be significantly associated with food insecurity, higher scores on the role overload scale relate to higher likelihood of food insecurity. Each one point higher on the summed scale is associated with being 5 percent more likely to be food insecure.

In the reduced model, nonsignificant variables were removed one by one with the least significant variables being removed first. The differences in the reduced model work categories

are the same as in the work and income model. As other variables were removed, the primary caregiver's age became significantly associated with food insecurity, so it is retained in the reduced model.

Event History

The event history models are displayed in Table 4. These models predict a household's first observed transition to food insecurity. As mentioned earlier, households that are food insecure at six months are removed because it is unknown when their transition to food insecurity occurred. The models displayed in Table 4 mirror those displayed in Table 3, with a work and income model, full model and reduced model.

In the work and income discrete time event history model, duration at risk is significantly associated with food insecurity. Among work categories, having a primary not working, but with missing data on the secondary caregiver's work is related to a higher likelihood of transitioning to food insecurity compared to primary caregivers not working with secondary caregivers working full-time day shifts. Primary caregivers working full-time without a secondary caregiver are more than three times more likely to be food insecure than primary caregivers not working with secondary caregiver's in a full-time day shift job. Having a primary in a full-time other shift job and an employed secondary is marginally significant and associated with greater odds of food insecurity. The significant work combinations fit with theories regarding time for food preparation related to primary caregiver's employment hours and schedule. The income to poverty ratio is also significantly associated with food insecurity, as income increases, the likelihood of food insecurity decreases. Surprisingly, those with health insurance are more likely to be food insecure, however health insurance could be government sponsored health insurance for low-income families, it is not necessarily from employment.

Contrary to hypotheses regarding long distances to work, commuting distance is not significantly associated with food insecurity.

In the full model in Table 4, the significant work categories remain so, but the marginally significant primary full-time secondary employed category is no longer marginally significant. The income to poverty ratio is significant in the full-model as well. Number of children is significantly associated with food insecurity; each additional child increases the odds of transitioning to food insecurity by 19 percent. Marital status and gender of the secondary caregiver is each marginally significant. As a mother's score on the depression scale increases, the odds of food insecurity increase. Role overload is also significantly related to food insecurity, mother's that perceive or have greater time demands are more likely to be food insecure.

In the reduced model, nonsignificant variables were eliminated one by one. When state was removed from the model, race became significant. Whites are less likely to be food insecure than blacks or other race/ethnic groups. Also marital status is significantly associated with transitioning to food insecurity. Unexpectedly, married couple households are more likely to be food insecure. The effect of marital status may be different from prior literature due to the greater amount of detail with which household work combinations are measured in the current study.

Discussion

Summary of Findings

In summary, employment is significantly related to the first transition to food insecurity in the discrete time event history models. In particular, a household with a mother employed full-time with no secondary caregiver is more likely to transition into food insecurity than a

household with a mother not working and a secondary caregiver in a full-time day shift. This is consistent with the first hypothesis, that mothers working will be more likely to be food insecurity than mother not employed. From this finding, it appears that both presence of another caregiver and hours worked by the primary caregiver relate to transitioning into food insecurity. The second hypothesis was not supported; working an other shift does not significantly increase the likelihood of food insecurity. The third hypothesis was also not supported; long commuting distances were not associated with significantly higher odds of food insecurity. However, the fourth hypothesis was supported; an increase in demands on mothers' time is associated with significantly higher odds of transitioning to food insecurity. This is an important finding from the study and a contribution to the food security literature that role overload, or time demands, is significantly associated with household food insecurity. Time as a resource appears to be an important factor relating to low-income households' transitions to food insecurity.

Limitations

In the current analysis many factors that are significantly related to food insecurity in earlier literature are not significant here. This may be due to several factors. One limitation of the analysis is that the standard USDA food security questions are not available in the data. Instead, a more limited single item is used to assess food insecurity. This difference in measurement may cause some difference in the predictors of food insecurity. In addition, the event history analysis is estimating a transition to food insecurity rather than a current state of food insecurity, factors related to the transition to food insecurity may be somewhat different from factors related to the general state of food insecurity, although the 6 month logistic regression models also show few factors significantly related to food insecurity. Also, much food insecurity research is based on national samples. This sample is restricted in several ways,

by being rural and small-town, by consisting of families with young children and by being predominantly low-income. It may be that the factors related to food insecurity in the general population do not relate in the same way to food insecurity in a more selective sample of low-income, rural households with young children. Another limitation is that the sample size may be too small for the analyses at hand. With a larger sample, the work combinations categories may have greater significance. Many of the coefficients are in the hypothesized direction and are relatively large in magnitude but do not reach significance. In addition, distance to work and childcare may be an important factor, but there may be too little variation on the variable, most mothers worked close to home. Although the sample is nonmetropolitan, the most rural county types are excluded, where the biggest effect of commuting may be evident.

Potential Implications

There are potential implications of the study. The work category that was significantly different from the reference was having a mother working full-time without a secondary caregiver (having a primary not employed but with missing data on the secondary caregiver's employment was also significant, but it is not clear what this means). It appears that for this group of women time is an important factor affecting food insecurity. The fact that role overload was an important predictor of food insecurity across the logistic regression and event history models is an important finding as well. Time as a resource is important in helping families to avert food insecurity. Food assistance resources that address the time concerns of parents seem important. One option would be to provide more convenience foods at food banks and food pantries and allow households to purchase convenience foods with Food Stamps. In addition, food assistance programs and offices should provide families with easy and fast low-cost recipes

and tips for easy meals on a budget. Such steps would help to alleviate the tension between competing demands of work and time to minimize food spending in low-income households.

Future Research

In future work with this data, I plan to impute the missing data by using information from earlier and/or subsequent waves to inform the imputation. In addition, I will continue to explore meaningful combinations of household work. With these data, considering primary caregivers' or secondary caregivers' employment in isolation was not significantly related to food insecurity. It is clear that work decisions and time allocation for food provisioning will occur at the household level, taking into consideration other workers and caregivers. But it is not clear from prior research how family work characteristics will combine to affect food insecurity.

Conclusions

Time does appear to be an important factor in the transition to food insecurity. Employment and other caregivers are important to understanding how time resources relate to food insecurity. Food insecurity researchers and policy makers must consider the time required by current food assistance programs. The assumption of unlimited time for at home low-cost food preparation may require revision if low-income working households do not have the time to trade for lower cost food.

Tables

Table 1. Sample Characteristics and Descriptive Statistics on Food Insecure Households Family Life Project Data at 6 months

Panel A. Sample Distribution and Percent of Households Food Insecure by Given Characteristic Across Categorical Variables at 6 month observation

	Sample Distribution	Percent Food Insecure	N
Food Insecure	-	12.86	
Family Employment Characteristics			1143
Primary Not Employed - Secondary Full-time Day	13.91	15.09	
Primary Not Employed - Secondary Not Employed	5.16	16.95	
Primary Not Employed - Secondary Nonstandard	8.92	10.78	
Primary Not Employed - No Secondary	9.10	16.35	
Primary Not Employed - Secondary Missing	10.15	13.79	
Primary Full-time Day - Secondary Full-time Day	9.89	7.08	
Primary Full-time Day - Secondary Nonstandard	3.41	7.69	
Primary Full-time - No Secondary	4.72	24.07	
Primary Full-time - Secondary Missing	6.04	8.70	
Primary Full-time Other - Secondary Employed	4.11	4.26	
Primary Employed - Secondary Not Employed	4.64	24.53	
Primary Part-time Day - Secondary Employed	6.04	5.80	
Primary Part-time - No Secondary	3.59	17.07	
Primary Part-time - Secondary Missing	3.76	11.63	
Primary Part-time Other - Secondary Employed	6.56	10.67	
Distance - Primary Work and Childcare Combined			1151
20 plus miles	7.3	9.52	
Less than 20 Miles	44.48	13.10	
Zero (not employed)	37.2	14.25	
No Distance Data	11.03	9.45	
Health Insurance			1151
Primary, Secondary and Child have Health Insurance	69.33	11.78	
One or more do NOT have Health Insurance	30.67	15.30	
State of Residence			1151
Pennsylvania	41.18	9.70	
North Carolina	58.82	15.07	
Race/Ethnicity			1151
Black	40.05	14.97	
White	58.21	11.34	
Other	1.74	15.00	
Family Structure			1151
Cohabiting	18.25	12.38	
Three Generation or Other Family	15.29	15.91	
Married	49	9.93	
Single Mother	17.46	18.91	
Secondary Caregiver Gender			1151
Male	66.9	10.65	
Female	15.64	15.56	
No Secondary Caregiver	17.46	18.91	

Education			1151
Neither Primary nor Secondary has College Degree	71.68	14.79	
Primary or Secondary has College Degree	28.32	7.98	
Gardening			1141
Gardening is Important to Family	26.47	12.91	
Gardening is Not Important to Family	73.53	12.75	
Access to Vehicle			1150
Member of Household Owns Vehicle	85.39	12.73	
No Member of Household Owns Vehicle	14.61	13.10	

Panel B. Sample Mean and Mean of Food Insecure Households on Continuous Variables at 6 month Observation

	Sample Mean (Standard deviation)	Food Insecure Mean (Standard Deviation)	Range	N
Poverty Ratio	1.83 (1.69)	1.36 (1.14)	0 - 16.48	1156
Money in Bank at 6 months (in thousands of dollars)	2.02 (5.29)	0.80 (3.69)	0 - 40	1119
Number of Adults in Household	2.12 (0.81)	2.09 (0.76)	1 - 7	1156
Number of Children in Household	2.21 (1.13)	2.45 (1.38)	1 - 8	1156
Primary Age	26.49 (6.01)	26.71 (6.32)	14.7 - 58.2	1156
Distance to Nearest Grocery Store	2.27 (2.80)	2.04 (2.32)	0.02 - 20.0	1107
Role Overload (time)	20.80 (6.48)	22.64 (6.30)	6 - 30	1150
Log of Geographic Isolation	1.50 (0.73)	1.51 (0.70)	-0.21 - 3.27	1107

Table 2. Percent of Families Food Insecure with Family Life Project Data

	% First Time Food Insecure (Sample N = 1188[A])	% Food Insecure at Each Observation (Sample N)
6 Months	12.46%	12.86% (1151)
15 Months	6.82%	10.75% (1126)
24 Months	4.30%	10.32% (1085)
35 Months	2.36%	8.09% (1075)
Ever Food Insecure	25.93%	

[A] Sample N=1188 indicates number of families that had at least one valid observation across all four waves.

Table 3. Logistic Regression Models Predicting Food Insecurity at 6 Months with Family Life Project Data

	Work and Income Model		Full Model		Reduced Model	
	Parameter Estimate	Odds Ratio	Parameter Estimate	Odds Ratio	Parameter Estimate	Odds Ratio
Intercept	-1.28***		-3.53***		-3.39***	
Employment (Reference: primary not working, secondary full-time day)						
Primary Not Employed - Secondary Not Employed	-0.10	0.90	0.05	1.05	0.1794	1.20
Primary Not Employed - Secondary Nonstandard	-0.49	0.61	-0.77+	0.47	-0.6138	0.54
Primary Not Employed - No Secondary	-0.17	0.85	-0.13	0.88	-0.2044	0.82
Primary Not Employed - Secondary Missing	-0.46	0.63	-0.58	0.56	-0.5353	0.59
Primary Full-time Day - Secondary Full-time Day	-0.45	0.64	-0.58	0.56	-0.6559	0.52
Primary Full-time Day - Secondary Nonstandard	-0.40	0.67	-0.41	0.66	-0.6327	0.53
Primary Full-time - No Secondary	0.38	1.46	0.22	1.25	0.1441	1.16
Primary Full-time - Secondary Missing	-0.54	0.58	-0.59	0.55	-0.4924	0.61
Primary Full-time Other - Secondary Employed	-1.30+	0.27	-1.30+	0.27	-1.40+	0.25
Primary Employed - Secondary Not Employed	0.54	1.71	0.41	1.51	0.339	1.40
Primary Part-time Day - Secondary Employed	-0.92	0.40	-0.88	0.41	-0.9347	0.39
Primary Part-time - No Secondary	-0.01	1.00	0.16	1.18	0.0104	1.01
Primary Part-time - Secondary Missing	-0.61	0.54	-0.53	0.59	-0.5307	0.59
Primary Part-time Other - Secondary Employed	-0.30	0.74	-0.42	0.66	-0.4926	0.61
Distance to Primary Work and Childcare (Reference: Less than 20 miles)						
20 plus miles	-0.24	0.79	-0.13	0.88		
No Distance Data	-0.18	0.83	-0.24	0.79		
Income to Poverty Ratio	-0.09	0.91	-0.05	0.95		
Money in Bank Accounts at 6 months	-0.07+	0.93	-0.16*	0.85	-0.22*	0.80
Primary, Secondary and Child have Health Insurance	-0.20	0.82	-0.30	0.74		
Pennsylvania			-0.41	0.66		
White			0.23	1.26		
Number of Adults			-0.04	0.96		
Number of Children			0.12	1.13		
Primary Caregiver Married			-0.01	0.99		
Secondary Caregiver Female			0.26	1.29		
Primary or Secondary has College Degree			-0.14	0.87		
Primary Caregiver Age			0.03	1.03	0.03*	1.03
Primary Caregiver Depression Scale			0.27**	1.30	0.25**	1.28
Distance to Grocery Store			-0.06	0.94		
Gardening is Important to Family at 6 months			-0.12	0.89		
Member of Household owns Vehicle at 6 months			0.33	1.39		
Log of Geographic Isolation			0.14	1.15		
Role Overload			0.05**	1.05	0.05**	1.05
Effective Sample Size	1111		1052		1101	
-2LL	812.279		710.288		764.423	
Likelihood Ratio (df)	36.9863 (19) **		84.3805 (33) ***		74.4210 (18) ***	

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4. Event History Models Predicting First Transition to Food Insecurity with Family Life Project Data

	Work and Income Model		Full Model		Reduced Model	
	Parameter Estimate	Odds Ratio	Parameter Estimate	Odds Ratio	Parameter Estimate	Odds Ratio
Intercept	-3.86***		-5.96***		-5.76***	
Duration at Risk	0.03**	1.03	0.02**	1.03	0.02**	1.02
Employment (Reference: Primary not working - Secondary Full-time Day)						
Primary Not Employed - Secondary Not Employed	-0.04	0.96	-0.26	0.78	-0.03	0.97
Primary Not Employed - Secondary Nonstandard	0.39	1.48	0.18	1.20	0.34	1.41
Primary Not Employed - No Secondary	0.37	1.45	0.29	1.34	0.47	1.61
Primary Not Employed - Secondary Missing	0.89*	2.44	0.83*	2.30	0.90*	2.46
Primary Full-time Day - Secondary Full-time Day	0.66	1.93	0.62	1.86	0.58	1.79
Primary Full-time Day - Secondary Nonstandard	0.42	1.53	0.46	1.59	0.44	1.55
Primary Full-time - No Secondary	1.16**	3.21	1.01*	2.76	1.44***	4.22
Primary Full-time - Secondary Missing	0.55	1.74	0.44	1.56	0.46	1.59
Primary Full-time Other - Secondary Employed	0.95+	2.58	0.72	2.06	0.74	2.09
Primary Employed - Secondary Not Employed	0.15	1.16	-0.30	0.74	-0.03	0.97
Primary Part-time Day - Secondary Employed	-0.44	0.64	-0.41	0.67	-0.36	0.70
Primary Part-time - No Secondary	0.42	1.52	0.59	1.80	0.68	1.98
Primary Part-time - Secondary Missing	0.46	1.59	0.42	1.52	0.49	1.63
Primary Part-time Other - Secondary Employed	0.04	1.04	-0.06	0.94	0.05	1.05
Distance to Primary Work and Childcare (Reference: Less than 20 miles)						
20 plus miles	-0.45	0.64	-0.47	0.62		
No Distance Data	-0.17	0.84	-0.06	0.94		
Income to Poverty Ratio	-0.36***	0.70	-0.35**	0.70	-0.28**	0.76
Money in Bank Accounts at 6 months	-0.01	0.99	-0.01	0.99		
Primary, Secondary and Child have Health Insurance	0.37+	1.45	0.26	1.30		
Pennsylvania			-0.26	0.77		
White			-0.20	0.82	-0.44*	0.64
Number of Adults			-0.19	0.83		
Number of Children			0.17*	1.19	0.16*	1.18
Primary Caregiver Married			0.49+	1.64	0.41*	1.51
Secondary Caregiver Female			0.57+	1.77		
Primary or Secondary has College Degree			0.16	1.17		
Primary Caregiver Age			0.02	1.02		
Primary Caregiver Depression Scale			0.34***	1.41	0.34***	1.41
Distance to Grocery Store			-0.03	0.97		
Gardening is Important to Family at 6 months			-0.19	0.83		
Member of Household owns Vehicle at 6 months			0.30	1.35		
Log of Geographic Isolation			0.00	1.00		
Role Overload			0.06***	1.06	0.07***	1.07
Effective Sample Size	3503		3209		3617	
-2LL	1178.13		1014.345		1168.155	
Likelihood Ratio (df)	66.7822 (20)		124.0563 (34)		142.4926 (21)	

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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Appendix

ROLE OVERLOAD SCALE

NOTE: All items are reverse coded. A higher sum score indicates greater role overload, or more demands on time.

	Strongly Agree	Mildly Agree	Neither Agree or Disagree	Mildly Disagree	Strongly Disagree
ROv1 There are too many demands on my time.	1	2	3	4	5
ROv2 I need more hours in the day to do all the things which are expected of me.	1	2	3	4	5
ROv3 I can't ever seem to get caught up.	1	2	3	4	5
ROv4 I don't ever seem to have any time for myself.	1	2	3	4	5
ROv5 Sometimes I feel as if there are not enough hours in the day.	1	2	3	4	5
ROv6 I seem to have to over-extend myself in order to be able to finish everything I have to do.	1	2	3	4	5