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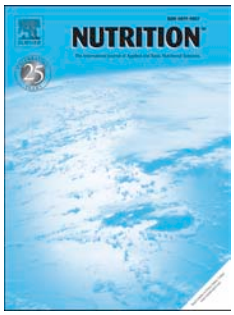


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# The influence of family functioning on the consumption of unhealthy foods and beverages among 1-12 year old children in Victoria, Australia

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Running head: Family functioning and unhealthy eating

## Abstract

### Objective

Family functioning, which reflects how well family members communicate and interact with each other, is associated with childhood overweight and obesity, but its association with children's eating behaviours remains unclear. The aim of this study was to examine the association between family functioning and unhealthy food and beverage consumption among children 1 to 12 years old.

### Research methods and procedures

4,602 caregivers of children completed an interview as part of the Victorian Child Health and Wellbeing study, a random sample of caregivers who participated in a single telephone interview in 2006. Caregivers reported on their child's consumption of three types of unhealthy foods and beverages, and responses were recoded into: weekly consumption of potato crisps and chips, monthly consumption of takeaway foods, and daily consumption of sweet beverages. Family functioning included general functioning ($\alpha$=0.89) and parental psychological distress ($\alpha$=0.78).

### Results

Consumption of potato crisps and chips occurred, on average, twice a week, while takeaway foods were consumed an average of three times per month. Consistently and controlling for other covariates, male caregiver respondents had children who consumed takeaway foods more frequently and who drank more daily cups of sweet beverages. Caregiver education and living in a single parent household were consistently associated with poorer eating habits. In all models, general family functioning and parental psychological distress were associated with poorer eating habits.

### Conclusions

In addition to traditional methods for improving diet, family-based interventions need to target more general aspects of the family's and caregiver's functioning to improve dietary intake.

**Key words:** unhealthy foods and beverages, family functioning, children, obesity, Australia

## Introduction

The consumption of unhealthy foods and beverages, especially takeaway foods, is becoming more prevalent worldwide [1, 2]. The term 'unhealthy foods' usually refers to energy-dense nutrient-poor foods and beverages which are often high in fat, sugar and salt including sweet beverages, pre-packaged snacks such as candy/lollies and chips, and takeaway or fast foods such as French fries, potato wedges, burgers and pizza [3, 4]. Increased consumption of unhealthy foods and beverages represents a public health concern affecting all levels of society [4, 5]. Deleterious health effects associated with increased consumption of unhealthy foods and beverages among children include obesity and its consequences[6-8] as well as asthma[9] .

Many societal and family factors could explain the rise in consumption of unhealthy foods and beverages. Societal factors include increased reliance on takeaway foods,[3] increased availability of high-calorie and nutrient-poor foods particularly in poorer neighbourhoods, and the availability of large portion sizes in restaurants.[10-12] Family functioning, as an element of the family environment, is an important factor in the regulation of children's eating behaviours. It refers to activities essential to the survival of the family including interactions between family members that involve emotional, physical, and psychological activities. It also involves other aspects of family life including: acceptance of the individual, parental psychological wellbeing, problems in raising children, consumption of time by household tasks, time spent with children, communication, consensus on decision making and the ability to solve day to day problems [13, 14]. It is well documented that children from poorly functioning families experience deleterious health effects [15, 16] and consume fewer servings of fruits and vegetables [17] than children from healthily functioning households.[18, 19]

However, the influence of family functioning on the consumption of unhealthy foods and beverages remains poorly understood. The aim of this study was to assess whether family functioning was associated with the consumption of unhealthy foods and beverages among children aged 1-to-12 years. Family functioning was measured in two ways: 1) by assessing parental psychological distress and 2) the overall family functioning. Given that socio-demographic factors are associated with the consumption of unhealthy foods and beverages among children, [20-22] we sought to first confirm these findings in our study and then examine whether family functioning was independently associated with consumption. We hypothesized that weekly consumption of potato crisps and potato chips, monthly consumption of takeaway foods and daily consumption of sweet beverages would be significantly higher among children from socio-economically disadvantaged households than those from high socio-economic households. We further hypothesised that, after controlling for the socio-economic factors, weekly consumption of potato crisps and potato chips, monthly consumption of takeaway foods, and daily consumption of sweet beverages would be significantly higher among children in poorly functioning families than those from well-functioning families.

## Methods

### *Study design, recruitment, and interview procedures*

The study used data from the 2006 Victorian Child's Health and Wellbeing (VCHW) dataset [23], which involved 5,000 randomly selected primary caregivers of 0-to-12-year old children, of whom 4,602 were 1-to 12- year old children. Funded by the Victorian Department of Education and Early Childhood Development, the 2006 VCHW study was a state-wide cross-sectional telephone survey carried out between October 2005 and March 2006. Data pertaining to the consumption of energy-dense and nutrient poor foods and family

characteristics including the level of family functioning as reported by the child's caregiver formed the focus of this paper. The study was approved by the Deakin University Human Ethics Committee.

The survey procedures have been described elsewhere. [23] Briefly, participants were selected using computer-based random digit dialling of a sample of telephone numbers generated at the regional level, stratified by area of residence. Only households with at least one child aged less than 13 years were automatically included in the database of potential participants to be contacted by telephone. Where a household had more than one eligible child, the computer program randomly selected one child to be included in the study. A maximum of six telephone call attempts were made throughout the day and evenings on both weekdays and weekend, in order to establish initial contact with a household. Once contact was established, up to nine calls were made to secure participant involvement and to confirm a suitable interview time. Before the interview could commence, each selected respondent was required to provide verbal consent.[23] Data were collected by 28 trained interviewers and each interview lasted approximately 23 minutes. Interviewers were trained prior to data collection and included acquainting them with the study background, the questionnaire, and departmental requirements (including issues such as maintaining confidentiality). The training was complemented with practice interviews to ensure adherence to interview protocols and to help interviewers refine their interviewing technique.

**Study variables**

***Dependent variables***

This study included three dependent variables: weekly consumption of potato crisps and potato chips, monthly consumption of takeaway foods, and daily consumption of sweet

beverages. For the purpose of this study, potato crisps and potato chips included potato chips, French fries, wedges, fried potatoes or crisps. Takeaway foods were conceptualised as "foods or meals that are prepared and purchased outside of the home, and ready for immediate consumption either at the place of purchase or elsewhere" p.69.[24-27] The definition of sweet beverages followed the Better Health Channel's definition, that is, "Sweet drinks include all fruit juices, soft drinks, cordials, energy drinks, sports drinks and flavoured mineral waters; either bought or homemade. Fruit juice contains sugars that are found naturally in fresh fruits, but become very concentrated when made into juice. Other sweet drinks have large amounts of sugars added"p.1[27]

The children's caregivers answered the following questions:

1. How often does your child eat potato chips, French fries, wedges, fried potatoes or crisps?

2. How often does your child have meals or snacks such as burgers, pizza, chicken, or chips from places like McDonalds, Hungry Jacks, Pizza Hut, KFC, Red Rooster or local takeaway food places?

3. How many cups of soft drink, fruit juice, cordials, or sports drink, does your child usually drink in a day? (1 cup=250ml. One can of soft drink = 1 and a half cups. One 500ml bottle = 2 cups)

In order to minimise errors due to varying levels of health literacy, for questions 1 and 2, caregivers were allowed to provide the frequency using the following options: times per day (record number), times per week (record number), times per month (record number), rarely (less than once a month) or never (coded one). This is consistent with national approaches to dietary data collection in the U.S.[28] Responses were recoded into times per week

consumption of potato crisps and potato chips and times per month consumption of takeaway foods. For question 3, responses were recoded into cups per day, with consumption of less than one cup per day or none coded as zero.

***Independent variables***

Family functioning

Family functioning was measured two ways: overall family functioning and parental psychological distress. Overall family functioning was measured using the McMaster Family Assessment Device –General Functioning Scale[29]. The scale includes 12 items (e.g. In times of crisis we can turn to each other for support), scored on a 4 point scale (1=strongly agree; 2=agree; 3=disagree; 4=strongly disagree), with a Cronbach alpha of 0.89 in this study. Higher scores indicated poorer family functioning.[29] In order to compute the prevalence of poorly functioning households, the family functioning scores were dichotomized into well-functioning (scores ≤2) and poorly functioning families (> 2). [29]

Parental psychological distress was measured with the Kessler-6 (K-6)[30], which consists of 6 items (Cronbach alpha = 0.78 in this study). The questions asked caregivers about negative emotional states experienced in the 4 weeks prior to interview (e.g. In the last 4 weeks, about how often did you feel nervous?) and scored on 5 point scale (1=none of the time through to 5=all of the time). Higher scores indicated greater parental psychological distress. [31] In order to compute the prevalence of parental psychological distress, scores were dichotomized as healthy (< 19) and distressed (≥ 19). [31]

**Demographic and socio-economic variables**

Demographic and socio-economic factors included the child's age in years and gender (1=boy; 0=girl), responding caregiver's age in years and gender (1=male; 0=female),

household income level (0=less than $20,000; 1=$20,000 – $39,000; 2=$40,000 –$59,000; 3>=$60,000); caregiver educational level (0=high school or less; 1=tertiary or further education), family structure (0= couple, 1= single parent household), caregivers' language use at home (0=English only, 1=a language other than English), and home ownership (0=owned or being purchased, 1=renting: public housing trust, and 2=renting privately)

**Data analysis**

All analyses were conducted using Stata Version 10 (Stata Corporation, TX, USA). Univariate and bivariate analyses were used to examine the basic features of the study variables and how they were related to the dependent variables. Relationships between demographic and socio-economic variables as well as family functioning and weekly consumption of potato crisps and potato chips, monthly consumption of takeaway foods, and daily consumption of sweet beverages were assessed using Poisson regression. We use the vce (robust) option in Stata to obtain robust standard errors to control for mild violations of underlying assumptions.[32]. The regression results are summarised as incident rate ratios (IRRs). All regressions were adjusted for population weights and the significance was set at $P<0.05$

**RESULTS**

The demographic characteristics are summarised in Table 1. The analytic sample included 4,602 caregivers of children between 1 and 12 years of age. Approximately one seventh (13.3%) spoke a language other than English at home while 16.7% of the responding caregivers were single parents. The caregiver-reported child consumption of unhealthy foods and beverages averaged [mean (SD)] 1.93±2.34 times per week for potato crisps and potato chips, 2.81±3.63 times per month for takeaway foods, and 1.24±1.57 cups of sweet beverages

per day. Figures 1a and 1b summarise the consumption of potato crisps and potato chips, takeaway foods, and sweet beverages by child's age and gender.

**Potato crisps and potato chips consumption**

In the unadjusted model, weekly consumption of potato crisps and potato chips was significantly higher among 4-to-7 (IRR=1.31; 95% CI: 1.16, 1.47; P<0.001) and 8-to-12 (IRR=1.60; 95% CI: 1.41, 1.81; P<0.001) year old children than their 1-to-3 year old counterparts. Higher weekly consumption of potato crisps and potato chips among children was associated with coming from a single parent-headed household (IRR=1.32, 95% CI: 1.10, 1.59; P<0.001), living in a house rented from a public housing trust (IRR=1.54, 95% CI: 1.05, 1.27; P<0.05), speaking a language other than English at home (IRR=1.19, 95% CI: 1.04, 1.36; P<0.01), and being a male caregiver respondent (IRR=1.03, 95% CI: 0.94, 1.13; P<0.05). However, lower weekly consumption of potato crisps and potato chips among children was associated with having a tertiary educated caregiver (IRR=0.76, 95% CI: 0.69, 0.84; P<0.001) and coming from a household earning ≥ $60,000 per year (IRR=0.73, 95% CI: 0.56, 0.95; P<0.05). Results remained significant for child's age, responding caregiver's gender, caregiver educational attainment and family structure after controlling for all other demographic and socio-economic factors in the table (Table 2). The effects of household income, language spoken at home and house ownership became non-significant.

There was a positive relationship between weekly consumption of potato crisps and potato chips among children and family functioning (IRR=1.24, 95% CI: 1.10, 1.40; P<0.001) and parental psychological distress (IRR=1.03, 95% CI: 1.01, 1.04; P<0.001). These results remained significant after controlling for potential confounding factors (Table 3).

**Takeaway food consumption**

In the unadjusted model, monthly consumption of takeaway foods was significantly higher among 4-to-7 (IRR=1.34, 95% CI: 1.21, 1.49; P<0.001) and 8-to-12 (IRR=1.35, 95% CI: 1.20, 1.52; P<0.001) year old children when compared to their 1-to-3 year old counterparts. Higher monthly consumption of takeaway foods among children was associated with male caregiver respondent (IRR=1.22, 95% CI: 1.10, 1.35; P<0.001), speaking a language other than English at home (IRR=1.19, 95% CI: 1.00. 1.40; P<0.05), and coming from a single parent household (IRR=1.27, 95% CI: 1.08, 1.50; P<0.01). However, lower monthly consumption of takeaway foods among children was associated with having a tertiary educated caregiver (IRR=0.99, 95% CI: 0.80, 0.96; P<0.01) and an older caregiver (i.e. ≥ 50 years: IRR=0.71; 95% CI: 0.56, 0.89; P<0.01). The findings remained significant after adjusting for demographic and socio-economic factors in the model. Interestingly though, in the adjusted model, household income was positively associated with monthly consumption of takeaway foods consumption among children (Table 2).

There was positive relationship between monthly consumption of takeaway foods among children and family functioning (IRR=1.34, 95% CI: 1.15, 1.56; P<0.001) and parental psychological distress (IRR=1.02, 95% CI: 1.01, 1.03; P<0.01). These results remained significant after controlling for potential confounding factors (Table 3)

**Sweet beverages**

In the unadjusted model, the number of cups of sweet beverages consumed per day among children was significantly higher among 4-to-7 (IRR=1.42, 95% CI: 1.24, 1.62; P<0.001) and 8-to-12 (IRR=1.55, 95% CI: 1.38, 1.75; P<0.001) year old children when compared to their 1-to-3 year old counterparts. The number of cups of sweet beverages consumed per day among children was positively associated with being a boy (IRR=1.13, 95% CI 1.04, 1.23; P<0.01), being a male caregiver respondent (IRR=1.17, 95% CI: 1.06, 1.29; P<0.01), coming

from a single parent household (IRR:1.49, 95% CI: 1.34, 1.67; P<0.001), and living in a house rented from a public housing trust (IRR= 1.69, 95% CI: 1.40, 2.03; P<0.001) or a private land lord (IRR=1.26, 95% CI: 1.12, 1.41; P<0.001). However, the number of cups of sweet beverages consumed per day among children was inversely associated with caregiver educational attainment, household annual income and responding caregiver's age (Table 2). Some of the findings remained significant after adjusting for demographic and socio-economic factors in the model; single parent household and renting from a private landlord were no longer significant in the adjusted model.

There was a positive relationship between the number of cups of sweet beverages consumed per day among children and family functioning (IRR=1.28, 95% CI: 1.16, 1.42; P<0.001) and parental psychological distress (IRR=1.03, 95% CI: 1.02, 1.04; P<0.01). These results remained significant after controlling for potential confounding factors (Table 3)

**Discussion**

To our knowledge, this is one of the few studies to examine the relationship between family functioning and consumption of unhealthy foods and beverages among children aged 1-to-12 years. We first tested the hypothesis that weekly consumption of potato crisps and potato chips, monthly consumption of takeaway foods, and daily consumption of sweet beverages would be significantly higher among children living in socio-economically disadvantaged households compared with those living in high socio-economic households. This hypothesis was confirmed with certain variables; we found that compared to children living in high socio-economic households, as measured by caregiver educational attainment and family structure (single parent vs. nuclear family), children from socio-economically disadvantaged households were more likely to consume potato crisps and potato chips on a weekly basis, consume takeaway foods on a monthly basis, and consume sweet beverages daily. Our

findings are consistent with the literature, which suggests that caregiver education is among the strongest determinants of children's eating habits. [17, 33-36] However, the effects of household income were mixed; unhealthy eating behaviours decreased with higher annual household income levels for potato crisps and potato chips and sweet beverages, but increased with higher annual household income levels for takeaway foods. Although a positive relationship between household income and the consumption of takeaway foods may be surprising, it is consistent with other research [37, 38] and may be related to greater work commitments among parents with higher income. For example, French and colleagues found that parental commitments may promote greater reliance on takeaway foods [39]

We then tested the hypothesis that weekly consumption of potato crisps and potato chips, monthly consumption of takeaway foods, and daily consumption of sweet beverages would be significantly higher among children in poorly functioning families than those from well-functioning families. Across all analyses and considering both overall functioning and parental psychological distress, this hypothesis was supported. Poorly functioning families had children who consumed unhealthy foods and beverages with greater frequency (and quantity) than among children from well-functioning families. Most studies on unhealthy food and beverage consumption have focused on the consequences of consuming unhealthy foods and beverages such as weight gain [40-42]; on the role of family meals and television watching [43]; and on the influence of the family environment, including household socio-economic status and mothers' child-feeding practices and perceptions of their daughters' risk of overweight.[44-47]

The focus on the family environment, and parenting specifically, is based on the premise that such an environment mediates children's eating behaviours in three ways: (1) parents make the food available and accessible to children; (2) parents dictate how food is offered and

shared in terms of meal structure; and (3) parents transmit eating habits including food attitudes, food preferences, brand preferences, and values.[18] For example, Yannakoulia and colleagues found that unfavourable family situations such as divorce are associated with children's overweight and eating patterns.[48] However, the influence of general family functioning, a concept that considers the physical, emotional, and psychological interactions among family members, on children's eating habits is not well understood and in some cases, the evidence is contradictory. For instance, in a recent study involving 408 first-time mothers at 24–34 weeks of pregnancy, the researchers found that family functioning was not associated with the consumption of chips, fast foods, soft drinks, and processed meats[18]. Although our hypotheses were confirmed, they are difficult to interpret in the absence of other studies in this area. More research is needed to confirm or reject our findings. Nevertheless, our findings support emerging evidence suggesting that there is a positive relationship between family functioning and a family's diet quality.[14, 17, 49]

The strengths of this study are the large sample size and comprehensive assessment of family functioning, both psychometrically sound and conceptually diverse. However, this is a cross-sectional study in which only 13% of the sample was from a non-English speaking background. As such, the extent to which these findings generalize to a non-English speaking population is not yet known. Nevertheless, the reported Poisson regressions were adjusted for population weights computed to reflect the probability of household selection, the child within the household, and the age, sex and geographic distribution of Victoria's child population aged 0 to 12 years. [23] Since information on the child's consumption of unhealthy foods and beverages was provided by responding caregivers there is possibility of bias, such as recall bias or social desirability bias which could affect the internal validity of

the results. A final limitation relates to the fact that the data collection procedures did not include anthropometric data as it relied on a computer-assisted telephone interview.

Notwithstanding these limitations, the reported findings make an important contribution to the field. Our findings suggest that targeting aspect of the family and the parent to reduce consumption of unhealthy foods and beverages could be an avenue to address childhood obesity and its consequences. Our findings further suggest that family-based obesity prevention interventions need to consider the physical, emotional, and psychological aspects of the family that affect family life, namely their ability to problem solve, achieve consensus in decision making, communicate effective, and accept individuals within the family. Such interventions should address family dysfunction and ensure support for parents with psychological distress.

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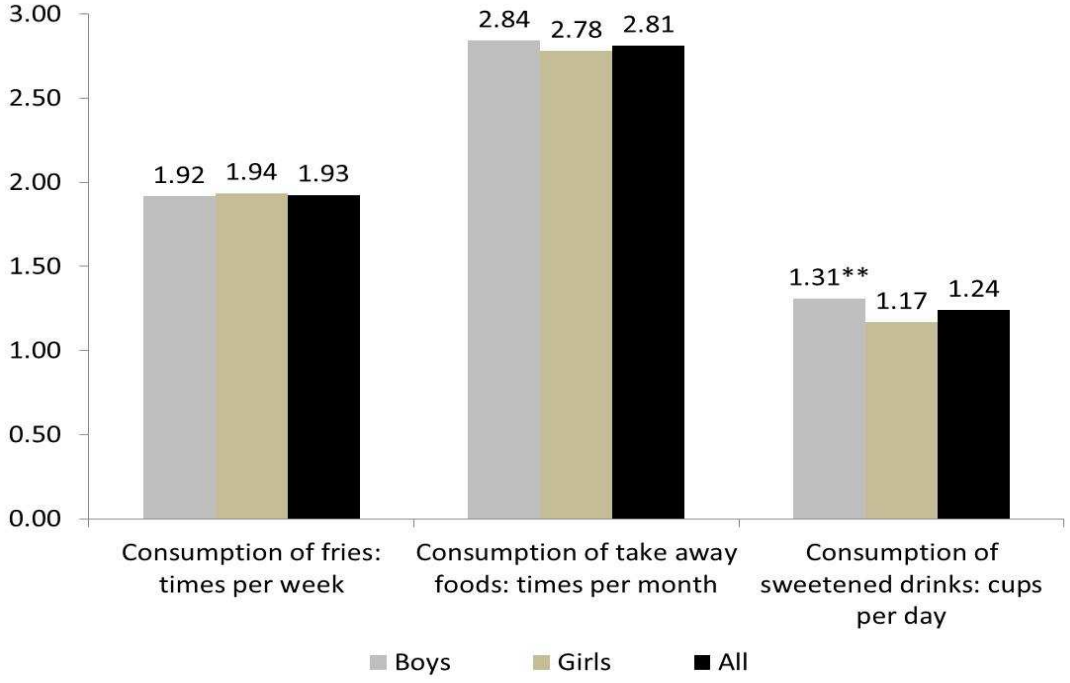
Figure 1: Consumption of potato crisps and potato chips, takeaway foods, and sweet beverages by child's gender




*<0.05, **<0.01; and ***<0.001

**Table 1: The demographic and socio-economic characteristics of the study sample**

| **Demographic characteristics** | N (%) |
|---|---|
| **All** | **4602 (100)** |
| **Child's age** | |
| 1-3 years | 1,232 (26.8) |
| 4-7 years | 1,298 (28.2) |
| 8-12 years | 2,072 (45.0) |
| Mean (SD) | 6.6 (3.6) |
| **Responding caregiver's age** | |
| =<29 years | 431 (9.4) |
| 30-39 years | 2254 (49.1) |
| 40-49 years | 1676 (36.5) |
| >=50 years | 227 (5.0) |
| Mean (SD) | 38.2 (7.0) |
| **Responding caregiver's gender** | |
| Female | 3847 (83.6) |
| Male | 755 (16.4) |
| **Child's gender** | |
| Girl | 2226 (48.4) |
| Boy | 2376 (51.6) |
| **Household income** | |
| <$20,000 | 484 (11.4) |
| $20,000-39,000 | 779 (18.3) |
| $40,000-59,000 | 918 (21.6) |
| >=$60,000 | 2070 (48.7) |
| **Caregiver Education level** | |
| ≤High school | 2084 (45.3) |
| Tertiary or more | 2514 (54.7) |
| **Family structure** | |
| Couple | 3827 (83.3) |
| Single parent | 769 (16.7) |
| **Language spoken at home** | |
| English only | 3996 (86.7) |
| Language other than English | 598 (13.3) |
| **Home ownership** | |
| Owned or being purchased | 3580 (78) |
| Renting: public housing trust | 254 (5.6) |
| Renting privately | 750 (16.4) |
| **Consumption of potato chips and crisps: Times per week** | |
| 0 | 393 (8.4) |
| <1 | 857 (18.6) |
| 1-≤2 | 1545 (33.6) |
| >2 | 1807 (39.3) |
| Mean (SD) | 1.93 (2.34) |

| | |
|---|---|
| **Consumption of take away foods: Times per month** | |
| 0 | 924 (20.1) |
| 1-3 | 1831 (39.8) |
| 4-5 | 1504 (32.7) |
| ≥6 | 341 (7.41) |
| Mean (SD) | 2.81 (3.63) |
| **Consumption of sweet beverages (cups/day)** | |
| <1 | 1881 (40.9) |
| 1-2 | 2,029 (44.1) |
| ≥3 | 692 (15.0) |
| Mean (SD) | 1.24 (1.57) |
| **Family functioning scores** | |
| <2 | 4103 (91.6) |
| ≥2[a] | 376 (8.4) |
| Mean (SD) | 1.48 (0.41) |
| **Parental psychological distress** | |
| <19 | 4429 (96.7) |
| ≥19[b] | 139 (3.04 |
| Mean (SD) | 9.60 (3.56) |

[a] A score ≥2.0 is considered unhealthy; [b]A score ≥19 is to define parental psychological distress.

**Table 2: Incident rate ratios (95% confidential interval) of unhealthy food and beverage consumption by demographic and socio-economic factors**

| | Consumption of potato crisps and chips: Times per week | | Consumption of takeaway foods: Times per month | | Consumption of sweet beverages: Number of Cups per day | |
|---|---|---|---|---|---|---|
| | UIRR (95%CI) | AIRR (95%CI) | UIRR (95%CI) | AIRR (95%CI) | UIRR (95%CI) | AIRR (95%CI) |
| **Child's age** | | | | | | |
| 1-3 years | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| 4-7 years | 1.31*** (1.16, 1.47) | 1.32*** (1.17, 1.50) | 1.34*** (1.21, 1.49) | 1.36*** (1.22, 1.51) | 1.42*** (1.24, 1.62) | 1.43*** (1.25, 1.63) |
| 8-12 years | 1.60*** (1.41, 1.81) | 1.61*** (1.40, 1.85) | 1.35*** (1.20, 1.52) | 1.44*** (1.27, 1.64) | 1.55*** (1.38, 1.75) | 1.57*** (1.38, 1.79) |
| **Child gender** | | | | | | |
| Girls | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Boys | 1.03 (0.94, 1.13) | 1.04 (0.94, 1,14) | 1.00 (0.91, 1.09) | 0.99 (0.90, 1.10) | 1.13** (1.04, 1.23) | 1.14** (1.04, 1.25) |
| **Responding caregiver's age** | | | | | | |
| <29 years | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| 30-39 years | 0.98 (0.83, 1.16) | 1.03 (0.85, 1.24) | 0.81* (0.68, 0.96) | 0.75** (0.62, 0.91) | 0.83* (0.72, 0.96) | 0.84* (0.72, 0.98) |
| 40-49 years | 1.08 (0.92, 1.28) | 0.98 (0.81, 1.17) | 0.84 (0.70, 1.01) | 0.68*** (0.55, 0.83) | 0.84* (0.72, 0.97) | 0.74 (0.62, 0.87) |
| >=50 years | 1.04 (0.84, 1.29) | 0.87 (0.70, 1.10) | 0.71** (0.56, 0.89) | 0.50*** (0.38, 0.65) | 0.96 (0.97, 1.19) | 0.76* (0.59, 0.98) |
| **Responding caregiver's gender** | | | | | | |
| Female | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Male | 1.03 (0.94, 1.13) | 1.10* (1.00, 1.21) | 1.22*** (1.10, 1.35) | 1.32*** (1.19, 1.47) | 1.17** (1.06, 1.29) | 1.27*** (1.14, 1.42) |
| **Household income** | | | | | | |
| <$20,000 | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| $20,000-39,000 | 0.90 (0.68, 1.20) | 1.01 (0.80, 1.27) | 1.13 (0.91, 1.40) | 1.29* (1.01, 1.64) | 0.87 (0.74, 1.03) | 0.98 (0.83, 1.15) |
| $40,000-59,000 | 0.80 (0.61, 1.06) | 0.98 (0.80, 1.20) | 1.03 (0.91, 1.18) | 1.32** (1.08, 1.62) | 0.68*** (0.58, 0.80) | 0.84 (0.71, 1.00) |
| >=$60,000 | 0.73* (0.56, 0.95) | 0.93 (0.77, 1.12) | 0.97 (0.87, 1.09) | 1.31** (1.07, 1.60) | 0.57*** (0.49, 0.66) | 0.75*** (0.63, 0.89) |
| **Caregiver's education level** | | | | | | |
| High school or less | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Tertiary/TAFE | 0.76*** (0.69, 0.84) | 0.81*** (0.75, 0.89) | 0.99** (0.80, 0.96) | 0.89* (0.80, 1.00) | 0.71*** (0.65, 0.77) | 0.77*** (0.71, 0.85) |
| **Language spoken at home** | | | | | | |
| English only | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Lang other than English | 1.19** (1.04 1.36) | 1.12 (0.98, 1.27) | 1.19* (1.00, 1.40) | 1.20 (0.98, 1.45) | 0.97 (0.85, 1.09) | 0.96 (0.84, 1.09) |
| **Family structure** | | | | | | |
| Couple | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Single parent | 1.32*** (1.10, 1.59) | 1.16* (1.01, 1.35) | 1.27** (1.08, 1.50) | 1.43*** (1.10, 1.86) | 1.49*** (1.34, 1.67) | 1.09 (0.96, 1.25) |
| **Home ownership** | | | | | | |
| Owned or being purchased | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Renting: public housing trust | 1.54 * (1.05, 1.27) | 1.27 (0.88, 1.85) | 1.03 (0.89, 1.21) | 0.85 (0.70, 1.03) | 1.69*** (1.40, 2,03) | 1.27* (1.04, 1.55) |
| Renting privately | 1.07 (0.95, 1.21) | 0.92 (0.82, 1.04) | 1.05 (0.91, 1.22) | 0.96 (0.80, 1.15) | 1.26*** (1.12, 1.41) | 1.05 (0.93, 1.18) |

UIRR= Unadjusted Incident Rate ration and AIRR= Adjusted Incident Rate ration; *<0.05, **<0.01; and ***<0.001; adjusted for factors in the table.
TAFE= Technical And Further Education

**Table 3: Incident rate ratios (95% confidential interval) of unhealthy food and beverage consumption by family functioning**

| | Consumption of potato crisps and chips: times per week | | Consumption of take away foods: times per month | | Consumption of sweet beverages: cups per day | |
|---|---|---|---|---|---|---|
| | UIRR (95%CI) | AIRR [a] (95%CI) | UIRR (95%CI) | AIRR [b] (95%CI) | UIRR (95%CI) | AIRR [c] (95%CI) |
| Family functioning score | 1.24*** (1.10, 1.40) | 1.14* (1.02, 1.27) | 1.34*** (1.15, 1.56) | 1.02** (1.01, 1.03) | 1.28*** (1.16, 1.42) | 1.03 *** (1.02, 1.04) |
| Parental psychological distress | 1.03*** (1.01, 1.04) | 1.02** (1.01, 1.03 | 1.02** (1.01, 1.03) | 1.02** (1.00, 1.03) | 1.03** (1.02, 1.04) | 1.01* (1.00, 1.02) |

[a] Adjusted for child age, responding caregiver gender, responding caregiver's educational attainment, language spoken at home, family structure and home ownership;

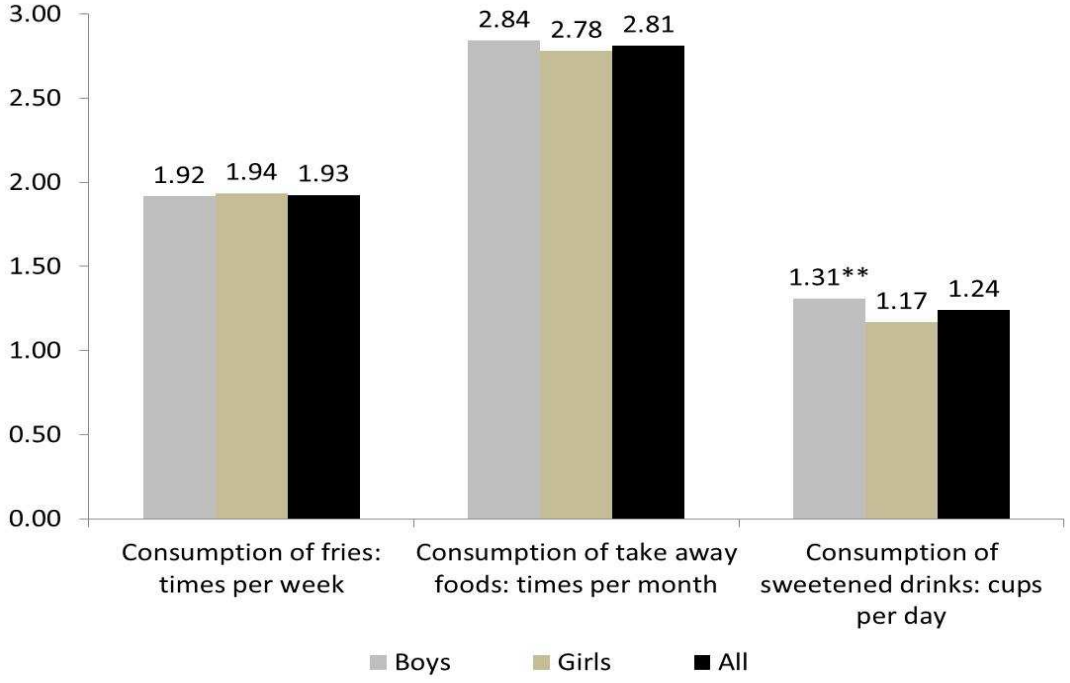
[b] Adjusted for child age, responding caregiver's age and gender, household annual income, language spoken at home and family structure;

[c] Adjusted for child age and gender, responding caregiver's age and gender, household income, responding caregiver's educational attainment, family structure, and home ownership.

UIRR= Unadjusted Incident Rate ratio and AIRR= Adjusted Incident Rate ratio;

*<0.05, **<0.01; and ***<0.001

Figure 1: Consumption of potato crisps and potato chips, takeaway foods, and sweet beverages by child's gender




*<0.05, **<0.01; and ***<0.001

**Table 1: The demographic and socio-economic characteristics of the study sample**

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| 4-7 years | 1,298 (28.2) |
| 8-12 years | 2,072 (45.0) |
| Mean (SD) | 6.6 (3.6) |
| **Responding caregiver's age** | |
| =<29 years | 431 (9.4) |
| 30-39 years | 2254 (49.1) |
| 40-49 years | 1676 (36.5) |
| >=50 years | 227 (5.0) |
| Mean (SD) | 38.2 (7.0) |
| **Responding caregiver's gender** | |
| Female | 3847 (83.6) |
| Male | 755 (16.4) |
| **Child's gender** | |
| Girl | 2226 (48.4) |
| Boy | 2376 (51.6) |
| **Household income** | |
| <$20,000 | 484 (11.4) |
| $20,000-39,000 | 779 (18.3) |
| $40,000-59,000 | 918 (21.6) |
| >=$60,000 | 2070 (48.7) |
| **Caregiver Education level** | |
| ≤High school | 2084 (45.3) |
| Tertiary or more | 2514 (54.7) |
| **Family structure** | |
| Couple | 3827 (83.3) |
| Single parent | 769 (16.7) |
| **Language spoken at home** | |
| English only | 3996 (86.7) |
| Language other than English | 598 (13.3) |
| **Home ownership** | |
| Owned or being purchased | 3580 (78) |
| Renting: public housing trust | 254 (5.6) |
| Renting privately | 750 (16.4) |
| **Consumption of potato chips and crisps: Times per week** | |
| 0 | 393 (8.4) |
| <1 | 857 (18.6) |
| 1-≤2 | 1545 (33.6) |
| >2 | 1807 (39.3) |
| Mean (SD) | 1.93 (2.34) |

| | |
|---|---|
| **Consumption of take away foods: Times per month** | |
| 0 | 924 (20.1) |
| 1-3 | 1831 (39.8) |
| 4-5 | 1504 (32.7) |
| ≥6 | 341 (7.41) |
| Mean (SD) | 2.81 (3.63) |
| **Consumption of sweet beverages (cups/day)** | |
| <1 | 1881 (40.9) |
| 1-2 | 2,029 (44.1) |
| ≥3 | 692 (15.0) |
| Mean (SD) | 1.24 (1.57) |
| **Family functioning scores** | |
| <2 | 4103 (91.6) |
| ≥2[a] | 376 (8.4) |
| Mean (SD) | 1.48 (0.41) |
| **Parental psychological distress** | |
| <19 | 4429 (96.7) |
| ≥19[b] | 139 (3.04 |
| Mean (SD) | 9.60 (3.56) |

[a] A score ≥2.0 is considered unhealthy; [b]A score ≥19 is to define parental psychological distress.

**Table 2: Incident rate ratios (95% confidential interval) of unhealthy food and beverage consumption by demographic and socio-economic factors**

| | Consumption of potato crisps and chips: Times per week | | Consumption of takeaway foods: Times per month | | Consumption of sweet beverages: Number of Cups per day | |
|---|---|---|---|---|---|---|
| | UIRR (95%CI) | AIRR (95%CI) | UIRR (95%CI) | AIRR (95%CI) | UIRR (95%CI) | AIRR (95%CI) |
| **Child's age** | | | | | | |
| 1-3 years | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| 4-7 years | 1.31*** (1.16, 1.47) | 1.32*** (1.17, 1.50) | 1.34*** (1.21, 1.49) | 1.36*** (1.22, 1.51) | 1.42*** (1.24, 1.62) | 1.43*** (1.25, 1.63) |
| 8-12 years | 1.60*** (1.41, 1.81) | 1.61*** (1.40, 1.85) | 1.35*** (1.20, 1.52) | 1.44*** (1.27, 1.64) | 1.55*** (1.38, 1.75) | 1.57*** (1.38, 1.79) |
| **Child gender** | | | | | | |
| Girls | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Boys | 1.03 (0.94, 1.13) | 1.04 (0.94, 1,14) | 1.00 (0.91, 1.09) | 0.99 (0.90, 1.10) | 1.13** (1.04, 1.23) | 1.14** (1.04, 1.25) |
| **Responding caregiver's age** | | | | | | |
| <29 years | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| 30-39 years | 0.98 (0.83, 1.16) | 1.03 (0.85, 1.24) | 0.81* (0.68, 0.96) | 0.75** (0.62, 0.91) | 0.83* (0.72, 0.96) | 0.84* (0.72, 0.98) |
| 40-49 years | 1.08 (0.92, 1.28) | 0.98 (0.81, 1.17) | 0.84 (0.70, 1.01) | 0.68*** (0.55, 0.83) | 0.84* (0.72, 0.97) | 0.74 (0.62, 0.87) |
| >=50 years | 1.04 (0.84, 1.29) | 0.87 (0.70, 1.10) | 0.71** (0.56, 0.89) | 0.50*** (0.38, 0.65) | 0.96 (0.97, 1.19) | 0.76* (0.59, 0.98) |
| **Responding caregiver's gender** | | | | | | |
| Female | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Male | 1.03 (0.94, 1.13) | 1.10* (1.00, 1.21) | 1.22*** (1.10, 1.35) | 1.32*** (1.19, 1.47) | 1.17** (1.06, 1.29) | 1.27*** (1.14, 1.42) |
| **Household income** | | | | | | |
| <$20,000 | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| $20,000-39,000 | 0.90 (0.68, 1.20) | 1.01 (0.80, 1.27) | 1.13 (0.91, 1.40) | 1.29* (1.01, 1.64) | 0.87 (0.74, 1.03) | 0.98 (0.83, 1.15) |
| $40,000-59,000 | 0.80 (0.61, 1.06) | 0.98 (0.80, 1.20) | 1.03 (0.91, 1.18) | 1.32** (1.08, 1.62) | 0.68*** (0.58, 0.80) | 0.84 (0.71, 1.00) |
| >=$60,000 | 0.73* (0.56, 0.95) | 0.93 (0.77, 1.12) | 0.97 (0.87, 1.09) | 1.31** (1.07, 1.60) | 0.57*** (0.49, 0.66) | 0.75*** (0.63, 0.89) |
| **Caregiver's education level** | | | | | | |
| High school or less | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Tertiary/TAFE | 0.76*** (0.69, 0.84) | 0.81*** (0.75, 0.89) | 0.99** (0.80, 0.96) | 0.89* (0.80, 1.00) | 0.71*** (0.65, 0.77) | 0.77*** (0.71, 0.85) |
| **Language spoken at home** | | | | | | |
| English only | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Lang other than English | 1.19** (1.04 1.36) | 1.12 (0.98, 1.27) | 1.19* (1.00, 1.40) | 1.20 (0.98, 1.45) | 0.97 (0.85, 1.09) | 0.96 (0.84, 1.09) |
| **Family structure** | | | | | | |
| Couple | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Single parent | 1.32*** (1.10, 1.59) | 1.16* (1.01, 1.35) | 1.27** (1.08, 1.50) | 1.43*** (1.10, 1.86) | 1.49*** (1.34, 1.67) | 1.09 (0.96, 1.25) |
| **Home ownership** | | | | | | |
| Owned or being purchased | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** | **Ref** |
| Renting: public housing trust | 1.54 * (1.05, 1.27) | 1.27 (0.88, 1.85) | 1.03 (0.89, 1.21) | 0.85 (0.70, 1.03) | 1.69*** (1.40, 2,03) | 1.27* (1.04, 1.55) |
| Renting privately | 1.07 (0.95, 1.21) | 0.92 (0.82, 1.04) | 1.05 (0.91, 1.22) | 0.96 (0.80, 1.15) | 1.26*** (1.12, 1.41) | 1.05 (0.93, 1.18) |

UIRR= Unadjusted Incident Rate ration and AIRR= Adjusted Incident Rate ration; *<0.05, **<0.01; and ***<0.001; adjusted for factors in the table.
TAFE= Technical And Further Education

**Table 3: Incident rate ratios (95% confidential interval) of unhealthy food and beverage consumption by family functioning**

| | Consumption of potato crisps and chips: times per week | | Consumption of take away foods: times per month | | Consumption of sweet beverages: cups per day | |
|---|---|---|---|---|---|---|
| | UIRR (95%CI) | AIRR [a] (95%CI) | UIRR (95%CI) | AIRR [b] (95%CI) | UIRR (95%CI) | AIRR [c] (95%CI) |
| Family functioning score | 1.24*** (1.10, 1.40) | 1.14* (1.02, 1.27) | 1.34*** (1.15, 1.56) | 1.02** (1.01, 1.03) | 1.28*** (1.16, 1.42) | 1.03 *** (1.02, 1.04) |
| Parental psychological distress | 1.03*** (1.01, 1.04) | 1.02** (1.01, 1.03 | 1.02** (1.01, 1.03) | 1.02** (1.00, 1.03) | 1.03** (1.02, 1.04) | 1.01* (1.00, 1.02) |

[a] Adjusted for child age, responding caregiver gender, responding caregiver's educational attainment, language spoken at home, family structure and home ownership;

[b] Adjusted for child age, responding caregiver's age and gender, household annual income, language spoken at home and family structure;

[c] Adjusted for child age and gender, responding caregiver's age and gender, household income, responding caregiver's educational attainment, family structure, and home ownership.

UIRR= Unadjusted Incident Rate ratio and AIRR= Adjusted Incident Rate ratio;

*<0.05, **<0.01; and ***<0.001