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Misclassification of Fourth-Grade Children's Participation in School-Provided Meals Based on Parental Responses Relative to Administrative Daily Records

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Abstract

Although many studies have relied on parental responses concerning children's school-meal participation, few studies have evaluated parental response accuracy. This article's analyses investigated misclassification of fourth-grade children's participation in school-meal programs based on parental responses relative to administrative daily records using cross-sectional study data collected for three school years (2004–05, 2005–06, 2006–07) for 1,100 fourth-grade children (87% Black; 52% girls) from 18 schools total in one district. Parents reported children's usual school-meal participation on paper consent forms. The district provided administrative daily records of individual children's school-meal participation. Researchers measured children's weight and height. "Usual participation" in breakfast/lunch was defined as 50% of days. Parental responses misclassified 16.3%, 12.8%, 19.8%, and 4.7% of children for participation in breakfast, classroom breakfast, cafeteria breakfast, and lunch, respectively. Parental responses misclassified more children for participation in cafeteria than classroom breakfast ($P=0.0008$); usual-participant misclassification probabilities were less than non-usual-participant misclassification probabilities for classroom breakfast, cafeteria breakfast, and lunch ($P<0.0001$ for each) [two-proportion z-tests]. Parental responses concerning children's participation were more accurate for lunch than breakfast; parents overstated breakfast participation (both classroom and cafeteria) and lunch participation. Breakfast participation misclassification was not related to body mass index ($P=0.41$), sex ($P=0.40$), age ($P=0.63$), or socioeconomic status ($P=0.21$) [multi-category logistic

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CONFLICTS OF INTEREST

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regression controlling for school year, breakfast location, and school]. Relying on parental responses concerning children's school-meal participation may hamper researchers' abilities to detect relationships that have policy implications for the child nutrition community. The use of administrative daily records of children's school-meal participation is recommended.

Keywords

Children; School meals; Parental responses; Misclassification; Socioeconomic status

Parental responses can efficiently measure children's participation in the School Breakfast Program (SBP) and National School Lunch Program (NSLP). National surveys and other studies have relied on parental responses to investigate various relationships with school-meal participation including children's body mass index (BMI) and food insecurity.¹⁻⁹

Although research has relied on parental responses concerning children's school-meal participation, few studies have evaluated parental response accuracy. Results from those studies raise questions about parents' accuracy. In one study, 24% of parents gave incorrect responses of children's SBP participation compared to study records.¹⁰ In another study, parental responses concerning children's school-meal participation were more accurate for one day or one week's participation than for annual participation, and more accurate for NSLP than SBP participation relative to school-district administrative records.¹¹ Parental response accuracy was 74% for SBP participation and 92% for NSLP participation compared to study records in one study.¹² In another study, when asked to report the number of days per week that children usually ate school lunch, parents reported higher levels of NSLP participation than administrative data.¹³

Because parents may inaccurately report children's school-meal participation, studies relying on parental responses may provide erroneous or conflicting results. For example, there is concern that childhood obesity may be related to school-meal participation.¹⁴⁻¹⁹ Several studies investigating this relationship in elementary school children have used parental responses for school-meal participation^{3,4,6,12} and have provided conflicting results. Specifically, they found a positive association between NSLP participation and BMI,³ no association between NSLP participation and overweight status,⁴ an inverse association between SBP participation and BMI but no association between NSLP participation and BMI,⁶ and a positive association between SBP participation and BMI but an inverse association between NSLP participation and BMI.¹² In contrast, two studies^{20,21} that based participation on more objective measures (administrative records and study records, respectively) found no association between fourth-grade children's BMI and participation in SBP and/or NSLP.

This article used data from a dietary-reporting validation study²² to investigate misclassification of children's participation in school-meal programs based on parental responses relative to administrative daily records. A basic premise is that administrative data on children's school-meal participation are accurate. This is reasonable, although schools and districts do make errors as found in published studies.^{5,23}

METHODS

The University of South Carolina's institutional review board approved this project. Written parental consent and child assent were obtained. Because data collection methods for the dietary-reporting validation study are described in detail elsewhere,²² this article provides only a summary.

Cross-sectional data were collected over three consecutive school years (2004–05, 2005–06, 2006–07) with fourth-grade children from 18 public elementary schools total in one district in Columbia, South Carolina. The district provided school meals using a nutrient-based menu planning approach that complied with national standards.²⁴ Menus followed four-week cycles and included choices (e.g., entrée, milk flavor); á la carte items were sold. The district had implemented the offer-versus-serve provision, so children could refuse some meal items.²⁴ Data were collected during school year 2004–05 in 17 schools, school year 2005–06 in 16 of the same schools plus an additional school, and school year 2006–07 in eight schools involved during the previous two school years. (School year 2006–07 had fewer schools because data collection needs were less.) Researchers identified schools based on high average daily participation in SBP and NSLP; each school principal provided permission for data collection, renewing it each subsequent school year. For the three respective school years, 74%, 76%, and 72% of children invited to be in the study agreed.

Each school year, each school's principal determined the SBP breakfast location as classroom or cafeteria. The location was unchanged for a school year. For school years 2004–05 and 2005–06, the location was classroom for six schools and cafeteria for 11 schools. For school year 2006–07, the location was classroom for seven schools and cafeteria for one school. One school changed its breakfast location from cafeteria for the first two school years to classroom for the third. Breakfast was scheduled before the school day began irrespective of location.

Parents answered questions on paper consent forms about children's usual participation in school-provided meals. Table 1 provides questions and response options. Instead of contacting parents directly, researchers distributed consent and assent forms in classes, read the assent form aloud, and asked children to take forms home for parents to complete and return signed forms to class several days later.

Parents granted permission on consent forms for the district to release information to researchers about children's daily participation in school-provided meals. Administrative records from the district provided information about individual children's daily participation (i.e., receipt of a reimbursable school meal) in breakfast and lunch on 180 possible school days during children's fourth-grade school year.

On a morning in the spring of children's fourth-grade school year, researchers measured children's weight and height using standardized procedures^{25,26} with digital scales (LifeSource Precision Health Scale UC-321, A&D Medical) and portable stadiometers (PE-AIM-102 Portable Adult/Infant Measuring Unit with Knitting Needle Technology, Perspective Enterprises, Inc). Inter-measurer reliability was assessed daily for pairs of researchers on a random sample of 10% of children; intraclass correlation reliability was

>0.99 for weight and height each school year.²⁰ Children's age was calculated by subtracting birth date (from school records) from measurement date. After calculating BMI, for descriptive purposes, BMI percentile was determined using age/sex BMI charts,²⁷ and children were categorized as defined in Table 2's footnotes.²⁸

Data were analyzed using SAS/STAT® software (version 9.2, © 2002–2008, SAS Institute Inc, Cary, NC). Parental responses concerning children's participation in school-provided breakfast and lunch were categorical and coded "1" for "usual participant" or "0" for "non-usual participant" (see Table 1's footnotes). For breakfast, parents had to select "at school" for responses to be coded "usual participant". For lunch, parents had to select "from the cafeteria" for school year 2004–05 or 2005–06, or "from school" for school year 2006–07, for responses to be coded "usual participant". One breakfast response option ("at home and school") for each school year, and one lunch response option ("from school and home") for school year 2006–07, were excluded from analyses (440 children) because the meaning of these options was unclear. Administrative records were categorized for each child to parallel these two categories. Specifically, using administrative records of daily participation, each child's breakfast participation was coded "1" for "usual participant" if the child participated in breakfast on 50% of days; otherwise, breakfast participation was coded "0" for "non-usual participant". Each child's lunch participation from administrative records was categorized and coded analogously. When analyzing breakfast participation misclassification, location (classroom, cafeteria) was also considered. Parental responses could misclassify children by indicating non-usual participant when administrative records indicated usual participant, or vice versa. To measure misclassification, percentages (across schools and school years) of children who were misclassified by parental responses were calculated separately for breakfast and lunch (and by breakfast location), keeping track of misclassification direction.

To measure sensitivity against the "usual participant" definition, misclassification percentages using alternative cut-offs of 55%, 60%, and 65% of days were investigated.

Usual participants and non-usual participants (as defined using administrative records) were treated as independent samples. Two-proportion z-tests compared probabilities of usual participant misclassification to non-usual-participant misclassification for breakfast, classroom breakfast, cafeteria breakfast, and lunch.

In cases of substantial parental response misclassification, a multi-category logistic regression was conducted: Using breakfast as an example, the model was fit with the dependent variable, breakfast participation, having three categories (correct; non-usual participant misclassified as usual participant; usual participant misclassified as non-usual participant) and with independent variables socioeconomic status (SES; as measured by paid, reduced-price, or free-meal status), BMI, sex, and age. The model controlled for school year, breakfast location, and school. A generalized estimating equation model with an independent working correlation structure accounted for correlation between children in the same school. The state's Division of Research and Statistics staff requested information from the state's Department of Education about individual children's eligibility for school-provided meals as an SES proxy, and provided aggregate results to researchers.

RESULTS AND DISCUSSION

Table 2 provides demographics for the sample of 1,100 children. The 10-year-old children were predominantly Black with approximately equal numbers by sex; almost half were categorized as overweight to severely obese, and most were free-meal status. Breakfast location was classroom and cafeteria for approximately equal percentages of children.

Table 3's top panel provides information comparing parental responses to administrative records using the 50% cut-off for "usual participation". Concerning *breakfast* participation, parental responses misclassified 16.3% of children overall ($(75+104)/(747+353)$). Examining conditional distributions by column, parental responses misclassified 10.0% of usual participants ($75/747$) and 29.5% of non-usual participants ($104/353$). Regarding *breakfast location*, parental responses misclassified, in total, 12.8% and 19.8% of children whose schools had classroom ($(50+21)/(505+50)$) and cafeteria ($(25+83)/(242+303)$) breakfast, respectively. For classroom breakfast, parental responses misclassified 10.0% of usual participants ($50/505$) and 42.0% of non-usual participants ($21/50$). For cafeteria breakfast, parental responses misclassified 10.3% of usual participants ($25/242$) and 27.4% of non-usual participants ($83/303$). For both classroom and cafeteria breakfast, the usual-participant misclassification probability was significantly less than the non-usual-participant misclassification probability ($P<0.0001$ for each). Parental responses misclassified more children for participation in cafeteria than classroom breakfast ($P=0.0008$).

Concerning *lunch* participation, using the 50% cut-off for "usual participation" (Table 3's top panel), parental responses misclassified 4.7% of children ($(43+9)/(1,057+43)$). Examining conditional distributions by column, parental responses misclassified 4.1% of usual participants ($43/1,057$) and 20.9% of non-usual participants ($9/43$). For lunch, the usual-participant misclassification probability was less than the non-usual-participant misclassification probability ($P<0.0001$).

In summary, parental responses were more accurate for lunch than breakfast participation, confirming results from previous studies.^{11,12} The participation misclassification direction was consistent across meal type—parents overstated breakfast participation (both classroom and cafeteria) and lunch participation, being more likely to label a non-usual participant as a usual participant than vice versa. Parental responses misclassified significantly more children for participation in cafeteria than classroom breakfast, likely because the classroom breakfast sample was predominantly usual participants. Classroom breakfast is increasingly common; studies have found SBP participation is greater for classroom than cafeteria breakfast.^{29,30}

For sensitivity analyses, using alternative cut-offs of 55%, 60%, and 65% of days, participation misclassification ranged from 16% to 23% of children for breakfast, 13% to 21% for classroom breakfast, 20% to 24% for cafeteria breakfast, and 4% to 5% for lunch. Table 3's bottom panel uses the more stringent cut-off of 65%. Concerning participation misclassification direction, using the 65% cut-off, for each of classroom breakfast, cafeteria breakfast, and lunch, parents were again less likely to misclassify usual participants than

non-usual participants ($P < 0.0001$ for each). Thus, the cut-off choice did not influence conclusions about participation misclassification direction for breakfast or lunch.

Parental response misclassification was substantial for breakfast participation, and a multi-category logistic regression showed that breakfast participation misclassification was not related to children's BMI ($P = 0.41$), sex ($P = 0.40$), age ($P = 0.63$), or SES ($P = 0.21$). (No multi-category logistic regression was conducted for lunch participation misclassification because the lunch model had cell counts smaller than recommended.³¹) Although not a significant result from the current analyses, one might expect children with paid-meal status to be classified more correctly by parents than children in the other two SES categories. This is logical as parents of paid-meal-status children are billed regularly to cover meal costs, and thus have knowledge concerning their children's participation extent. Parents of reduced-price-status children are billed regularly to cover a small part of meal costs. Parents of free-meal-status children are not billed.

Results concerning the participation misclassification direction agree with three previous studies that found parental responses overestimated children's school-meal participation.^{10–12} However, samples for the three previous studies and current investigation differ in race and locality. The current investigation's sample was predominantly Black from one district in South Carolina. Samples for previous studies included approximately equal numbers of Black and White children from one district in Georgia,^{10,12} or was 70% Black from across the US.¹¹

Schools that allowed data collection for the current investigation had high school-meal participation rates. According to administrative records, 68%, 46%, 22%, and 96% of 1,100 sample children usually participated in breakfast, classroom breakfast, cafeteria breakfast, and lunch, respectively (Table 3). However, nationwide, on a typical day in school year 2004–05, about 18% and 62% of children participated in the SBP and NSLP, respectively.⁵

Past nationwide research has shown that 26% of children who had SBP available to them self-reported that they usually ate school breakfast at least three days a week, and 72% of children self-reported that they usually ate school lunch at least three days a week.^{5,32} The current investigation's administrative data showed that 63%, 43%, 20%, and 95% of 1,100 sample children participated in breakfast, classroom breakfast, cafeteria breakfast, and lunch, respectively, on at least 60% of days (Table 2).

Parental responses were more accurate for children's lunch than breakfast participation, possibly due to greater participation in lunch than breakfast. Parents especially misjudged or did not know their children's extent of breakfast participation. This could have consequences for children's daily intake. If parents provided children with breakfast at home thinking children were not eating breakfast at school, and these children ate breakfast at school, then these children would have eaten two breakfasts. Or, if parents did not provide children with breakfast at home thinking children were eating breakfast at school, and these children did not eat breakfast at school, then these children did not eat breakfast at all. Unfortunately, the study that provided these data did not capture the number of children nor days that children ate two breakfasts, or zero breakfasts. The frequency, or lack, of eating

daily breakfast at home and school could affect children's BMI; future studies could investigate this.

Questions concerning school-meal participation could be interpreted differently by different parents. The authors are not aware of research examining the relationship between wording of participation questions and parental response accuracy. Regardless of how questions are worded, parental responses are prone to inaccuracy because most parents lack first-hand knowledge of children's participation in school-provided meals.

There are limitations to consider. The study that provided data for these analyses was not designed to investigate accuracy of parental responses of children's school-meal participation. Analyses excluded two response options (one per meal) that were vague. Due to study design, schools that allowed data collection had high school-meal participation rates, which produced a sample unlike national tendencies in this characteristic. Other limitations include the sample of children being primarily Black and from one district. Parental responses concerning fourth-grade children's school-meal participation were obtained on consent forms at the school year's beginning while administrative records were compiled throughout the school year. However, this time lapse is similar to that between parental responses concerning children's school-meal participation and other studies' objective measure.^{1,3,5,10–12}

A strength is that these analyses are the first to investigate parental response accuracy concerning children's participation in school breakfast based on location (classroom, cafeteria).

CONCLUSIONS

Parental responses more closely reflected administrative records for children's lunch than breakfast participation. Although results imply that research may rely on parental responses to assess children's participation in lunch but not breakfast, the use of administrative daily records is recommended. Districts are encouraged to share administrative records of individual children's daily participation in school-provided meals for research. Relying on parental responses of children's school-meal participation may hamper researchers' abilities to detect relationships that have policy implications for the child nutrition community.

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Table 1

Questions concerning children's usual participation in school-provided meals that were asked of parents on paper consent forms for a cross-sectional study conducted during three school years with 1,100 fourth-grade children.^a

School year	Children (n)	Question (response options [percentage of children whose parents replied using the response option]) concerning breakfast ^{b,c,d}	Question (response options [percentage of children whose parents replied using the response option]) concerning lunch ^{c,d,e}
2004–05	435	On school days, where does this child usually eat breakfast? (at home [26.7%], at school [67.6%], child usually does not eat breakfast/unanswered [5.7%])	When at school, does this child usually eat lunch? (from the cafeteria [89.9%], brought from home [8.0%], this child usually does not eat lunch/unanswered [2.1%])
2005–06	451	On school days, where does this child usually eat breakfast? (at home [25.3%], at school [67.8%], child usually does not eat breakfast/unanswered [6.9%])	When at school, does this child usually eat lunch? (from the cafeteria [93.6%], brought from home [4.6%], this child usually does not eat lunch/unanswered [1.8%])
2006–07	214	On school days, where does this child usually eat breakfast? (at home [15.9%], at school [82.2%], child usually does not eat breakfast/unanswered [1.9%])	When at school, does this child usually eat lunch? (from school [98.1%], from home [1.4%], child usually does not eat lunch/unanswered [.5%])

^aParents who provided permission on consent forms for their children to participate in the study were asked to answer the breakfast and lunch questions.

^bFor breakfast, parents had to select “at school” for responses to be coded “usual participant”.

^c“Unanswered” was coded when a parent did not answer a question. The “unanswered” response was combined with “child usually does not eat” response in this table due to low frequency of both responses.

^dThe breakfast question included a response option of “at home and school” for each school year, and the lunch question included a response option of “from school and home” for school year 2006–07. This article's analyses excluded 440 children whose parents used the “at home and school” response for breakfast and/or the “from school and home” response for lunch because the meaning of these response options was unclear. The final sample analyzed was 1,100 children.

^eFor lunch, parents had to select “from the cafeteria” for either school year 2004–05 or 2005–06, or “from school” for school year 2006–07, for responses to be coded “usual participant”.

Table 2

Demographics of the sample of 1,100 fourth-grade children in misclassification analyses concerning their participation in school meals based on parental responses relative to administrative daily records.

Race	960 Black (87.3%)
Sex	577 girls (52.5%)
Mean age	10.25 years
Body mass index (BMI) percentile category ^a	
<i>Underweight</i>	11 (1.0%)
<i>Healthy weight</i>	546 (49.6%)
<i>Overweight</i>	213 (19.4%)
<i>Obese</i>	229 (20.8%)
<i>Severely obese</i>	101 (9.2%)
Average BMI	21.12 kg/m ²
Average BMI percentile	74.1
Socioeconomic status ^b	
<i>Free meals</i>	853 (77.5%)
<i>Reduced-price meals</i>	62 (5.6%)
<i>Paid meals</i>	169 (15.4%)
<i>Missing information</i>	16 (1.5%)
School breakfast location	
<i>Classroom</i>	555 (50.5%)
<i>Cafeteria</i>	545 (49.5%)

Number (percentage) of children with school-meal participation on ^c	Breakfast [1,100 children]	Classroom breakfast [555 children]	Cafeteria breakfast [545 children]	Lunch [1,100 children]
<i>90% of days</i>	151 (13.7%)	107 (19.3%)	44 (8.1%)	625 (56.8%)
<i>80% of days</i>	391 (35.5%)	279 (50.3%)	112 (20.6%)	954 (86.7%)
<i>65% of days</i>	627 (57.0%)	433 (78.0%)	194 (35.6%)	1,041 (94.6%)
<i>60% of days</i>	687 (62.5%)	471 (84.9%)	216 (39.6%)	1,049 (95.4%)
<i>50% of days</i>	747 (67.9%)	505 (91.0%)	242 (44.4%)	1,057 (96.1%)
<i>40% of days</i>	794 (72.2%)	524 (94.4%)	270 (49.5%)	1,062 (96.5%)
<i>20% of days</i>	862 (78.4%)	541 (97.5%)	321 (58.9%)	1,070 (97.3%)

^a Children were categorized as *underweight* (< 5th percentile), *healthy weight* (5th to < 85th percentiles), *overweight* (85th to < 95th percentiles), *obese* (95th to < 99th percentiles), and *severely obese* (99th percentile).²⁸

^b Socioeconomic status was measured by proxy as eligibility for paid, reduced-price, or free school-provided meals.

^c Numbers and percentages of children with participation in school meals on 180 possible school days was based on administrative records. The breakfast location at each school was classroom or cafeteria, and was unchanged for a school year. Thus, the Classroom breakfast and Cafeteria breakfast columns were subsets of the Breakfast column. Each column's percentages are based on that column's number of children.

Table 3

Descriptives for the sample of 1,100 fourth-grade children comparing parental responses to administrative records concerning participation in school meals.

Number (percentage) of children participating in school-provided meals [using 50% of days to define usual participation] comparing...			
...Parental responses... ^a	...to Administrative records ^a		Row totals
	Usual participant	Non-usual participant	
Breakfast^b			
Usual participant	672 (61%)	104 (9%)	776
Non-usual participant	75 (7%)	249 (23%)	324
Column totals	747	353	1,100
Classroom breakfast^b			
Usual participant	455 (82%)	21 (4%)	476
Non-usual participant	50 (9%)	29 (5%)	79
Column totals	505	50	555
Cafeteria breakfast^b			
Usual participant	217 (40%)	83 (15%)	300
Non-usual participant	25 (5%)	220 (40%)	245
Column totals	242	303	545
Lunch			
Usual participant	1,014 (92%)	9 (1%)	1,023
Non-usual participant	43 (4%)	34 (3%)	77
Column totals	1,057	43	1,100

Number (percentage) of children participating in school-provided meals [using 65% of days to define usual participation] comparing...			
...Parental responses... ^a	...to Administrative records ^a		Row totals
	Usual participant	Non-usual participant	
Breakfast^b			
Usual participant	577 (52%)	199 (18%)	776
Non-usual participant	50 (5%)	274 (25%)	324
Column totals	627	473	1,100
Classroom breakfast^b			
Usual participant	396 (71%)	80 (14%)	476
Non-usual participant	37 (7%)	42 (8%)	79
Column totals	433	122	555
Cafeteria breakfast^b			
Usual participant	181 (33%)	119 (22%)	300
Non-usual participant	13 (2%)	232 (43%)	245
Column totals	194	351	545
Lunch			
Usual participant	1,008 (92%)	15 (1%)	1,023

Number (percentage) of children participating in school-provided meals [using 65% of days to define usual participation] comparing...			
<i>...Parental responses...^a</i>	...to Administrative records^a		Row totals
	Usual participant	Non-usual participant	
<i>Non-usual participant</i>	33 (3%)	44 (4%)	77
Column totals	1,041	59	1,100

^aInformation is shown on rows for parental responses (in italics) and in columns for administrative records (in bold) to indicate correct classification and misclassification of children. Percentages (in parentheses) are based on the total number of children for each subsection; they sum to 100% for each of the four cells (parental response/administrative record: usual/usual, usual/non-usual, non-usual/usual, non-usual/non-usual) for each of Breakfast, Classroom breakfast, Cafeteria breakfast, and Lunch in each panel (50% cut-off; 65% cut-off).

^bThe breakfast location at each school was classroom or cafeteria, and was unchanged for a school year. Thus, the 555 and 545 children for Classroom breakfast and Cafeteria breakfast, respectively, were subsets of the 1,100 children for Breakfast.