

Convergent Validity of Preschool Children's Television Viewing Measures among Low-Income Latino Families: A Cross-Sectional Study

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Abstract

Background: Television viewing is an important modifiable risk factor for childhood obesity. However, valid methods for measuring children's TV viewing are sparse and few studies have included Latinos, a population disproportionately affected by obesity. The goal of this study was to test the reliability and convergent validity of four TV viewing measures among low-income Latino preschool children in the United States.

Methods: Latino children ($n=96$) ages 3–5 years old were recruited from four Head Start centers in Houston, Texas (January, 2009, to June, 2010). TV viewing was measured concurrently over 7 days by four methods: (1) TV diaries (parent reported), (2) sedentary time (accelerometry), (3) TV Allowance (an electronic TV power meter), and (4) Ecological Momentary Assessment (EMA) on personal digital assistants (parent reported). This 7-day procedure was repeated 3–4 weeks later. Test–retest reliability was determined by intraclass correlations (ICC). Spearman correlations (due to nonnormal distributions) were used to determine convergent validity compared to the TV diary.

Results: The TV diary had the highest test–retest reliability ($ICC=0.82$, $p<0.001$), followed by the TV Allowance ($ICC=0.69$, $p<0.001$), EMA ($ICC=0.46$, $p<0.001$), and accelerometry ($ICC=0.36–0.38$, $p<0.01$). The TV Allowance ($r=0.45–0.55$, $p<0.001$) and EMA ($r=0.47–0.51$, $p<0.001$) methods were significantly correlated with TV diaries. Accelerometer-determined sedentary minutes were not correlated with TV diaries. The TV Allowance and EMA methods were significantly correlated with each other ($r=0.48–0.53$, $p<0.001$).

Conclusions: The TV diary is feasible and is the most reliable method for measuring US Latino preschool children's TV viewing.

Introduction

Childhood obesity is a major public health problem in the United States¹ and worldwide.^{2,3} Television viewing is an important modifiable risk factor for childhood obesity.^{4,5} However, some studies have inconsistently reported relationships between TV viewing and obesity,⁴ in part possibly due to imprecise subjective recall methods to estimate TV viewing. Most measures of TV viewing have not been validated compared to direct observation (in-person or video recorded), which is considered the criterion standard.⁶ A meta-analysis on children and adolescents reported that TV viewing accounted for less than 1% of the variance in

body fatness.⁴ Almost 80% of studies from the meta-analysis used subjective recall methods (parent/child reports) for assessing TV viewing.⁴ A subsequent study that used direct observation for measuring TV viewing reported models that accounted for 65% of the variability in children's BMI.⁷ Because the relationship between TV viewing and adiposity has varied, likely due in part to the use of different methods with varying degrees of validity, valid and reliable TV viewing measures are necessary to assess this important behavior.⁵

TV diaries are one of the few instruments to be validated against direct observation and had acceptable validity correlations. For example among non-Latino families, TV diaries completed by parents on their children's TV

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viewing were highly correlated with concurrent direct observation ($r=0.84, p<0.001$).⁸ TV diaries also had the highest correlation with direct observation, as reviewed.⁶ In contrast, child- or parent-reported estimates of weekly television viewing had only low to medium correlations ($r=0.07$ – 0.39) with direct observation,⁶ which raises concerns regarding their validity.

Even though TV diaries were validated against direct observation, they may be burdensome due to their length. Moreover, TV diary methods have not been studied among ethnic minorities, which is recommended to ensure validity.^{6,9}

TV viewing validation studies with Latinos in particular are necessary for a number of reasons. First, there may be culture- and language-specific issues associated with Latino children's TV viewing and obesity risk.^{10–12} For example, language barriers, which may influence feasibility of recalls such as the TV diary, could affect the validity and reliability of this method. Second, Latinos are the fastest growing and largest ethnic minority in the United States.¹³ Finally, Latino children have the highest prevalence of obesity in the United States.¹ The latter two points underscore the growing need to accurately characterize TV viewing among this demographically important ethnic minority in the United States.

This study fills many of the identified gaps by testing the feasibility of the TV diary among low-income Latino families and comparing it to three, relatively low-burden, methods—accelerometry,^{14–16} the TV Allowance,¹⁷ and Ecological Momentary Assessment (EMA).^{18,19} We hypothesized that physical inactivity (PI) measured by accelerometry would have the highest correlation with TV viewing measured by TV diaries, because TV viewing is the most common form of PI among US children of all ages.^{20, 21}

Methods

Population and Sample

A convenience sample ($n=96$) of preschoolers and parents was enrolled (January, 2009, to June, 2010) from Head Start centers ($n=4$) in Houston, Texas. As the preschool children were enrolled in Head Start, they were considered low-income because enrollment in Texas Head Start programs requires proof of income at or below the federal poverty level guidelines. Inclusion criteria were: Self-identifying as Latino or Hispanic, 3- to 5-year-old child in family (parents chose the study child if there was more than 1 eligible), and parent able to complete instruments in English or Spanish (as determined by the parent). Research staff approached parents regarding the study, provided information/the study flyer, obtained informed consent, and disbursed a modest incentive for participating. This study was approved by the Institutional Review Board of Baylor College of Medicine.

The recruitment goal of 90 children was based on an expected 10% attrition and missing data rate for a final

sample size of approximately 80 children. A final sample size of 80 children provided 80% power to detect a moderate correlation of 0.32 between television viewing as estimated by the four instruments detailed below, assuming an $\alpha=0.05$.

Instruments

Initial measurements were obtained concurrently over 7 days (time 1) and repeated 3–4 weeks later (time 2), which provided families with at least a 1- to 2-week break between the 7-day intensive measurement periods. The weeks chosen for measurements were based on the school calendar and only included weeks without school breaks, special events, or early dismissals. Study staff visited participants' homes to set up equipment and explain the surveys. A TV diary was adapted, in English and Spanish, based on a previous TV measurement validation study.⁸ Briefly, the diary underwent forward translation from English to Spanish, then back translation from Spanish to English to check for conceptual, not literal, equivalence with the original version. The method of decentering,²² in which the source text itself could be modified to address problems in translation or conceptual clarity, was used to allow for flexibility and to maximize cultural sensitivity in the process. Parents were instructed to mark when their child was watching TV or videos in 15-minute increments from 6 a.m. to 12 midnight each day for 7 continuous days. Average TV and video viewing in minutes per day were calculated for analyses.

Children wore accelerometers, which provided a valid objective measure of children's physical activity^{15,23} and inactivity.²⁴ Children wore the GT1M accelerometer (Actigraph LLC, Ft. Walton Beach, FL), recording in 15-second epochs, over their hip. The cut point of <1100 counts/minute defined preschoolers' PI,²⁴ and the average was calculated in minutes per day. A valid day was defined as ≥ 8 hours of accelerometer wear time/day and participants with ≥ 1 valid day were included in analyses, since intraclass correlations (ICC) for PI did not change with increasing valid days (data not shown). Two definitions of PI were used: PI-1 excluded data from 12 a.m. to 6 a.m., similar to the TV diary. PI-2 excluded data from 10 p.m. to 7 a.m. all days and 9 a.m. to 1 p.m. on weekdays (to exclude time at preschool and asleep).

The TV Allowance (Mindmaster Inc, Miami, Florida) tracks each time a TV is powered on/off. Each study child was assigned a unique pin number, which when entered by a parent or adult, tracks the target child's TV viewing and thereby provides a proxy estimate of the child's TV viewing. A separate unique "family" pin number was provided to track TV viewing when others were watching TV but the child was not, *e.g.*, TV viewing by other family members or guests. In the cases where the child entered the room to watch TV when the family already had the TV on, the family was asked to additionally enter the child's unique PIN number. Study staff installed TV allowances on all TVs in the participants' homes, and average daily

minutes of TV and video viewing by the study child were calculated for analyses. One study found that TV Allowance estimates were significantly correlated with parental estimates of TV viewing,¹⁷ although no comparison was reported with TV diaries or direct observation.

EMA involves participants/proxies answering brief surveys throughout their day related to the behavior of interest.^{18,19} EMA produces an ecologically valid assessment close in time to the behavior. Although it is a self-report method, it minimizes subjective errors by obtaining an immediate report of the behavior of interest, within a specified brief time limit, rather than over the course of days, months, or even years.^{25–27} An 8-item survey assessed the child's current activities, including TV and video viewing. The survey was delivered to parents on handheld personal digital assistants 8 times/day on weekdays (3–9 p.m.) and 12 times/day on weekends (8 a.m. to 9 p.m.) at random intervals. Parents were instructed to answer surveys within 10 minutes if possible, because after 10 minutes they would be locked out and had to wait for the next random survey administration. After establishing that the child was with the parent, the survey assessed the child's TV viewing by asking, "What activity is your child doing now?" and had the following responses, "sleeping; awake and resting quietly; playing nonelectronic games; playing with toys; watching television; watching a video or DVD; playing video games; playing computer games; listening to music or stories; reading a book; coloring/drawing; eating/drinking; household chores; actively playing indoors; actively playing outdoors; and other." The parent chose the single best response. The average daily percent of survey responses with the child watching TV or videos was calculated for analyses.

Statistical Analyses

A number of methods were used to determine study feasibility. The overall participant retention rate was calculated based on the number of participants who were assessed at both times 1 and 2. Completion rates of the TV diary and TV Allowance were assessed by the percentage that completed each of the measurements at times 1 and 2. The completion rate for EMA was determined by two methods: (1) Calculating the percentage of surveys answered by parents, and (2) the percentage of parents who provided EMA data at times 1 and 2. Finally, the completion rate for accelerometers was calculated by the percentage of children who provided valid data on at least one day each at times 1 and 2.

ICC determined test–retest reliability (time 1 vs. time 2). Due to nonnormal distributions (not shown), Spearman correlations determined the convergent validity of each measure compared to the TV diary. The Cohen classification criteria described the strength of correlations.²⁸ Analyses and subanalyses, stratified by weekends versus weekdays, were conducted using SAS 9.2 (Cary, NC), with a significance level $p < 0.05$. Participants with missing data were excluded from applicable analyses.

Results

A total of 227 flyers were distributed by study staff to interested parents at Head Start centers during parent information sessions or before/after school. No data were collected from the parents during the flyer distribution, because this occurred prior to obtaining parent informed consent. We do not have information on how many recruited parents considered themselves and their children to be Latino or Hispanic and therefore eligible for the study. Of the 227 total flyers distributed to parents, 96 parent-child dyads enrolled in the study for a crude enrollment rate of 42.3%. This enrollment rate may underestimate the true enrollment rate of eligible participants because it includes parents who may not have identified themselves as Latino or Hispanic.

For the sample (Table 1, $n = 96$), average child's age was 4.7 ± 0.5 years, 42.7% of the children were female, and 100% of the children were Latino or Hispanic. The overall retention rate of participants from time 1 to time 2 was 85.4% (82 of 96 were assessed at both time 1 and time 2). The completion rate for the TV diary was 100% at time 1 and 83.3% at time 2, which was similar to the completion rate for the TV Allowance (100% at time 1 and 84.4% at time 2) and accelerometry (100% at time 1 and 82.3% at time 2). The completion rate for the EMA method per participant was 91.7% at time 1 and 85.4% at time 2. Parents answered the EMA survey 69.3% and 68.5% of the random sessions at times 1 and 2, respectively.

Comparing time 1 to time 2 data, the TV diary had the highest test–retest reliability (Table 2, ICC = 0.82, $p < 0.001$), followed by the TV Allowance (ICC = 0.69, $p < 0.001$), EMA (ICC = 0.46, $p < 0.001$), PI-2 (ICC = 0.38, $p < 0.001$), and PI-1 (ICC = 0.36, $p = 0.0013$).

TV diary data were not significantly correlated with accelerometry, but were highly and significantly correlated with both the TV Allowance (time 1, $r = 0.45$, $p < 0.001$, and time 2, $r = 0.55$, $p < 0.001$) and EMA (time 1, $r = 0.47$, $p < 0.001$, and time 2, $r = 0.51$, $p < 0.001$). The TV Allowance and EMA were significantly correlated with each other (time 1, $r = 0.48$, $p < 0.001$, and time 2, $r = 0.53$, $p < 0.001$). In contrast, accelerometers were not correlated with the TV Allowance or EMA at either assessment (all $p > 0.05$).

When stratified by weekend versus weekday TV viewing, weekday test–retest reliability and validity were largely the same as the nonstratified results (data not shown). In contrast, test–retest reliability results for weekends failed to reach significance for the following, likely due to fewer weekend data available or greater natural variability in weekend TV viewing: PI-1, PI-2, and EMA (data not shown). Stratification by weekend versus weekday was not possible for the TV Allowance data, because the unit recorded data over an entire week and did not distinguish among different days.

Discussion

This is the first study to report, among Latinos, reliability and convergent validity of several TV viewing measures,

Table 1. Participant Characteristics (n = 96) from Houston, Texas, January, 2009 to June, 2010

		<i>n</i>	%
Child gender	Boy	53	55.2
	Girl	41	42.7
	Missing	2	2.1
Parent education	8th grade or less	32	33.3
	Some high school	22	22.9
	High school graduate	12	12.5
	Some college or technical school	18	18.8
	Associate's degree or higher	7	7.3
	Missing	5	5.2
Family income	\$10,000 or less	21	21.9
	\$10,001 to \$20,000	21	21.9
	\$20,001 to \$30,000	15	15.6
	\$30,001 to \$40,000	8	8.3
	\$40,001 or more	5	5.1
	Missing	26	27.1

	<i>Time 1</i>		<i>Time 2</i>	
	<i>n</i>	<i>Mean ± SD</i>	<i>n</i>	<i>Mean ± SD</i>
TV Diary: TV & video viewing (minutes/day)	96	103.0 ± 91.2	80	106.7 ± 95.6
Accelerometry: PI-1 (minutes/day)	96	789.2 ± 122.6	79	824.1 ± 113.6
Accelerometry: PI-2 (minutes/day)	96	500.5 ± 96.8	79	523.1 ± 96.4
TV Allowance: TV and video (minutes/day)	96	199.4 ± 211.1	81	218.5 ± 254.1
EMA: % Time watching TV and videos	88	18.6 ± 13.2	82	17.5 ± 15.0

SD, Standard deviation; PI, physical inactivity; EMA, Ecological Momentary Assessment.

which extends previous results conducted mainly among non-Latinos.⁴ Parents' diary reports of their preschoolers' TV viewing appeared feasible among this low-income sample, given the high rate of TV diary completion at time 1 (100%) and time 2 (83.3%). The TV diary also had the

highest test-retest reliability (ICC = 0.82), which was similar to a previous study among non-Latinos ($r = 0.72$).⁸ The TV Allowance and EMA were correlated with the TV diary and each other, suggesting convergent validity. In contrast, both definitions of accelerometer-determined PI were not

Table 2. Test-Retest Reliability and Spearman Correlations of TV Viewing Measures^a

	<i>TV diary</i>	<i>Accelerometry: PI-1</i>	<i>Accelerometry: PI-2</i>	<i>TV Allowance</i>	<i>EMA</i>
TV diary	0.82 ($p < 0.001$)	-0.18 ($p = 0.08$)	-0.07 ($p = 0.494$)	0.45 ($p < 0.001$)	0.47 ($p < 0.001$)
Accelerometry: PI-1	0.04 ($p = 0.730$)	0.36 ($p = 0.0013$)	0.87 ($p < 0.001$)	-0.01 ($p = 0.953$)	-0.09 ($p = 0.416$)
Accelerometry: PI-2	0.07 ($p = 0.535$)	0.88 ($p < 0.001$)	0.38 ($p < 0.001$)	0.02 ($p = 0.844$)	-0.02 ($p = 0.881$)
TV Allowance	0.55 ($p < 0.001$)	-0.15 ($p = 0.197$)	-0.11 ($p = 0.326$)	0.69 ($p < 0.001$)	0.48 ($p < 0.001$)
EMA	0.51 ($p < 0.001$)	0.01 ($p = 0.910$)	-0.03 ($p = 0.798$)	0.53 ($p < 0.001$)	0.46 ($p < 0.001$)

^aThe shaded diagonal is test-retest reliability (intraclass correlations of time 1 and time 2) and the upper and lower triangles are the Spearman correlations of measures at time 1 and time 2, respectively. Participants with missing data were excluded.

PI, Physical inactivity; EMA, Ecological Momentary Assessment.

correlated with TV diary data, EMA, or the TV Allowance, likely due to misclassification of other sedentary activities as TV viewing. The null associations between accelerometers and the other three methods were consistent with previous studies among children and adolescents. TV viewing, measured by EMA, was not an acceptable marker of sedentary behaviors among adolescents in the United Kingdom.²⁹ Another study among Australian children compared self-reported TV viewing to accelerometer-determined sedentary time and reported no associations.³⁰ In that study, TV viewing was assessed by child recall for the past week,³⁰ which had only medium correlations ($r=0.39$) with direct observation⁶ and may have biased findings towards the null hypothesis. In the present study, while the TV Allowance had acceptable test-retest reliability (ICC=0.69), reliability of EMA (ICC=0.46) and accelerometry (ICC=0.36–0.38) was lower and not acceptable. Besides acceptable reliability, the TV Allowance had a similar completion rate at time 1 (100%) and time 2 (84.4%) compared to the TV diary. One feasibility issue for the TV Allowance that may arise is related to cost (each unit was \$99), and every TV in the household must have its own unit.

Strengths of this study include: (1) The low-income Latino sample, (2) data collection occurred in a naturalistic setting, e.g., a nonlaboratory or controlled setting, and reflected contemporary TV viewing and sedentary behaviors, (3) comparison was made with the TV diary method, which was the only method to have acceptable validity correlations with direct observation,^{6,8} and (4) the relatively high retention rate (85.4%) from times 1 and 2 assessments. The major limitations were: (1) Limited generalizability to members of other ethnicities or middle/high income groups, (2) being unable to determine if the TV Allowance measured the children's TV viewing time or simply when the TV was turned on, (3) because the EMA and TV Allowance measured TV viewing concurrently with the TV diary, this procedure may have affected the overall accuracy for each of the measurements compared to using each method individually, and (4) the sample may not be representative of low-income Latinos, given the enrollment rate.

Conclusion

This study extends to Latinos the high reliability of the TV diary for measuring TV and video viewing and suggests convergent validity with the TV Allowance and EMA. The TV diary appears to be a feasible, reliable, and valid method for assessing TV and video viewing among low-income Latino families and thus has our highest recommendation. The TV Allowance also appears to be a feasible and reliable alternative for measuring TV viewing and warrants further investigation.

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Author Disclosure Statement

No competing financial interests exist.

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