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Similarities and Differences between Actigraphy and Parent-Reported Sleep in a Hispanic and non-Hispanic White Sample

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Abstract

Objective: Despite concerns about the inaccuracy of parents' reports of children's sleep, it remains unclear whether the bias of parents' reports varies across racial/ethnic groups. To address this limitation, the current study systematically investigated the concordance among parent-reported sleep questionnaires, sleep diaries, and actigraphy-based sleep in a sample of Hispanic and non-Hispanic White children.

Methods: Parents of 51 Hispanic and 38 non-Hispanic White children ($N = 89$; $M_{\text{age}} = 6.46$, $SD = 0.62$; 50.6% male) reported their child's bedtime and wake time on school days using sleep diaries and questionnaires. Children's sleep also was assessed with actigraphy for five consecutive school days.

Results: Parents reported longer sleep duration, earlier bedtime, and later wake time using sleep diaries and questionnaires compared to actigraphy-based assessments. Larger discrepancies between diaries and actigraphy of sleep duration, and between questionnaires and actigraphy of wake time were found in non-Hispanic White children, compared to Hispanic children.

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Conclusions: Although parents tended to overestimate their child’s sleep as compared to actigraphy, parents of Hispanic children may be more accurate in some estimates of children’s sleep than parents of non-Hispanic White children. Researchers, clinicians, and parents should be aware of the potential biases in parents’ reports and estimates of their child’s sleep and that the degree of bias could vary across racial/ethnic groups.

Keywords

actigraphy; sleep questionnaire; sleep diary; parent report; Hispanic

1. Introduction

Sleep is critical for children’s development and health [1,2]. Children with insufficient sleep (e.g., less than 9 hours for children aged 6–12 years) are at risk for poor executive function [3], behavioral problems [4], obesity [5], cardiometabolic health conditions [6], and low levels of academic achievement [7]. Despite the negative consequences of insufficient sleep, parents reported that over one-third (36%) of children aged 6–9 years did not get enough sleep at least one night during the past week in the United States [8]. In a meta-analysis of actigraphy-based sleep parameters among children aged 3–18 years, Galland and colleagues [9] found that the average sleep duration declined with increasing age, from 9.68 hours in children aged 3–5 years to 7.40 hours for those aged 15–18 years. These average sleep durations reported in the meta-analysis were close to or below the minimum sleep hours for each age group recommended by the American Academy of Sleep Medicine [10]. Additionally, there is increasing evidence that insufficient sleep is not distributed equally among children in the United States, but rather it is distributed in a manner that reflects broader social inequality. Illustratively, children with fewer household socioeconomic resources or who are racial/ethnic minorities are at especially higher risk to experience insufficient sleep than their peers [3,11].

Hispanic children are considered to be at greater risk for worse sleep than non-Hispanic White (hereafter referred to as “White”) children [11,12]. Given that Hispanic children make up 25% of US children under the age of 18 [13], understanding their sleep and how to accurately measure their sleep is critical. This is especially important as studies that compared sleep in Hispanic and White children have yielded mixed findings. For example, some researchers found that parents reported shorter sleep duration and later bedtime on weekdays in Hispanic children as compared to White children, after controlling for children’s age, sex, and household income [14]. Further, a recent review indicated that compared to White youth, Hispanic youth were more likely to have insufficient sleep [11]. In contrast, a study involving children aged 6–17 years suggested that Hispanic children were *less* likely to have insufficient sleep than White children based on parents’ reports [8]. A survey utilizing a nationally representative sample of U.S. children indicated that the median value of sleep duration for Hispanic children was similar to that of White children before age 5, was lower between ages 5 and 8, and was higher after age 9 [15]. Moreover, one other study found that although parent-reported sleep duration was shorter in Hispanic than White children, there was no difference in sleep duration measured by polysomnography [16]. These divergent findings suggest that researchers should carefully

consider developmental age and also evaluate the impact of using different measurements when estimating racial/ethnic disparities in sleep. In this study, we investigated the consistency and agreement between parents' reports (i.e., questionnaire and sleep diary) and actigraphy of sleep in Hispanic and White children, aiming to advance the understanding of how utilizing different measures of sleep might elucidate discrepant estimations of Hispanic-White disparities in sleep.

Prior research has supported the use of both device-based measures (e.g., actigraphy) and subjective reports (e.g., parents' reports) of sleep [17]. Device-based measures include polysomnography and actigraphy, and the latter is more popular because it is less invasive, less expensive, and available to assess multiple nights in the home environment compared to polysomnography [18]. Subjective reports include self-reports and parents' reports via sleep diaries or questionnaires. Parents' reports are frequently used with young children and provide more accurate estimations of sleep than children's reports [19]. However, there is evidence that the reverse might be true in adolescents [20]. Compared to device-based measures of sleep, researchers likely employ subjective reports because they are nonintrusive, comparably cheap, and readily obtained with sleep diaries or questionnaires. Although subjective reports are inexpensive and easy to collect in large samples, these reports are subject to recall and reporter bias [21]. Indeed, studies have shown that parents tend to overestimate children's sleep by reporting longer sleep duration, earlier bedtime, and later wake time than assessments from actigraphy [22,23]. However, we are unaware of any research that has analyzed if the bias is consistent across racial/ethnic groups and the potential implications of such a bias for better understanding sleep disparities between Hispanic and White children.

The extent to which parents' reports deviate from actigraphy assessments also varies between sleep diaries and questionnaires. For example, research has shown that compared to parent-reported sleep questionnaires, parent-reported sleep diaries are more strongly correlated with actigraphy sleep [23]. In a study of children aged 4–7 years in Switzerland, Werner and colleagues [24] observed an acceptable agreement (i.e., differences were less than 30 minutes) between actigraphy and parent-reported sleep diaries for sleep start, sleep end, and assumed sleep duration, but an unsatisfactory agreement between actigraphy and parent-reported sleep questionnaires. Moreover, Werner and colleagues [24] found that the discrepancies between different sleep measures were not affected by children's sex, age, or socioeconomic status. We build on these findings by utilizing a more recently collected and racially/ethnically diverse sample. This is important because recent research has illustrated that sleep has declined substantially among children, potentially due to technology entering the bedroom in recent years [25–27]. Indeed, it is possible that shifts in sleep and bedtime use of technology in children affect the accuracy of parents' reports, and Hispanic and White parents may be disproportionately affected.

In this study, we systematically analyzed the consistency and agreement between parents' reports of their child's sleep with actigraphy assessments. We then documented if there were Hispanic-White differences in any observed bias. We are unaware of any research that has investigated whether Hispanic and White populations differ in the concordance (or accuracy) between parents' reports (via sleep diaries and questionnaires) and actigraphy of children's

sleep duration and timing. This is an important oversight that might be a potential reason for the discrepant findings of Hispanic-White differences in sleep among children [8,11,12].

2. Materials and Methods

2.1. Participants

This sample was focused on children in a Southwestern city of the United States who were part of a larger longitudinal study [28]. The sample consisted of 103 children in kindergarten ($n = 50$) and first grade ($n = 53$) and their parents. Six children were excluded because of missing data on race/ethnicity. Eight children were excluded because their race/ethnicity was not Hispanic or White (i.e., four were American Indian, two were non-Hispanic Black, one was Asian American, and one was non-Hispanic mixed race). The analytic sample ($N = 89$) included 51 Hispanic (43 were Hispanic White, six were Hispanic Black, and two were Hispanic mixed race) and 38 (non-Hispanic) White children. These children aged between 5.26 and 7.75 years ($M = 6.46$, $SD = 0.62$) and 45 (50.6%) of them were male. Almost half of fathers ($n = 42$, 47.2%) and mothers ($n = 43$, 48.3%) obtained a college degree or higher. Among 79 families that reported their annual household income, 67.1% of families had an annual income above \$50,000, with the average annual income being \$60,000–\$69,999 and the median being \$70,000–\$79,999.

2.2. Procedure

Children in the present study were involved in a larger longitudinal study [28]. After the initial study began, a subset of children was recruited through mailings and phone calls to participate in a study involving sleep. Of the 301 families in the larger study, 103 participated in and completed this study, 5 participated in but did not complete data collection, 36 declined to participate in this study, 133 did not respond to the invitation, and 24 were not contacted (either dropped out of the larger study or failed to contact in the larger study). Independent-samples t tests or Pearson χ^2 tests showed that participating ($n = 108$) and non-participating families ($n = 193$) were not significantly different in terms of children's age ($t = 0.32$, $df = 296$, $p = .751$), sex ($\chi^2 = 0.22$, $df = 1$, $p = .883$), Hispanic ethnicity ($\chi^2 = 0.28$, $df = 1$, $p = .600$), maternal educational attainment ($\chi^2 = 6.11$, $df = 3$, $p = .106$), and household income ($t = 1.88$, $df = 229$, $p = .062$), but were significantly different in paternal educational attainment ($\chi^2 = 10.53$, $df = 3$, $p = .015$). Fathers of participating families had higher educational attainment than those that did not participate (e.g., high percentages of college graduation and above).

Parental consent forms and children's verbal assent were obtained prior to data collection. In the spring school semester (January to May), research assistants brought actigraphy devices to participating families during home visits and instructed caregivers to have the participating child wear the actigraphy device for five consecutive school days. Parents also kept a sleep diary each night to record the child's bedtime and wake time when the child wore the actigraphy device. Sleep questionnaires were collected during the first home visit. All procedures were approved by the Arizona State University Institutional Review Board.

2.3. Measures

2.3.1. Sleep measured by actigraphy—Measures of actigraphy sleep included sleep onset time, wake time, and sleep duration assessed by the Actiwatch-2 (Philips Respironics Inc.). Participating children wore the Actiwatch on the non-dominant wrist for five consecutive school days from Sunday night to Friday morning. During the five school days of assessment, children were instructed to keep the Actiwatch on unless engaging in activities that could damage the Actiwatch (e.g., swimming). To increase compliance with wearing the Actiwatch, parents were instructed to give the child one sticker each day when the child successfully wore the Actiwatch.

The Actiwatch detected sleep-wake status using activity counts generated from a piezoelectric accelerometer. Data from the Actiwatch were collected in 1-min epochs and were scored using the Philips Actiware (version 5.7, Philips Respironics Inc.). Following previous research on school-age children [29], a medium-sensitivity threshold (i.e., activity counts of 40 per epoch) was used to determine if the child was asleep or awake, with activity counts no greater than 40 indicating inactivity. Actigraphy sleep onset time was defined as the time point at the start of the first 10 consecutive minutes of inactivity, which was after the sleep start time reported by parents [30,31]. Likewise, actigraphy wake time was defined as the time point at the last minute of the last 10 consecutive minutes of inactivity, which was before the sleep end time reported by parents. Actigraphy sleep duration was calculated as the interval between sleep onset time and wake time. Consistent with prior research, actigraphy data were validated with parents' reports of children's bedtime and wake time with sleep diaries [30,31]. The majority (88.8%) of children had actigraphy sleep data for five school days, nine children had missing data on sleep onset and wake time for one school day, and one child had missing data on wake time for five school days. Prior research suggested that aggregated values based on three days' actigraphy sleep data were comparable to values calculated from seven days' data [32]. Therefore, sleep onset time, wake time, and duration were averaged across five school days, or four school days when children had one day's missing data. The child who had missing data on wake time for five school days was coded as missing on wake time and sleep duration measured by actigraphy. Thus, this child was not included in analyses involving wake time and sleep duration assessed by actigraphy.

2.3.2. Parent-reported sleep diaries—Parents reported children's bedtime and wake time from Sunday night to Friday morning using sleep diaries when actigraphy sleep was recorded. Thirteen parents completed diaries in Spanish, and other parents completed diaries in English. Sleep duration was calculated as the interval between bedtime and wake time. Like the actigraphy sleep, most (88.8%) children had diary sleep data for five school days, nine had missing data on bedtime and wake time for one school day, and one had missing data on wake time for five school days. Thus, consistent with actigraphy sleep, parent-reported bedtime, wake time, and duration were averaged across four or five school days or coded as missing ($n=1$) when missing five days' data.

2.3.3. Parent-reported sleep questionnaires—Parents also reported children's typical weekday bedtime and wake time via questionnaires. Bedtime and wake time were

assessed using the question: “*What is your child’s typical weekday bedtime? And weekday wake time?*” Sleep duration was calculated as the interval between parent-reported bedtime and wake time.

2.3.4. Covariates—Covariates included children’s age, sex (0 = female, 1 = male), household socioeconomic status (SES), the season of data collection (0 = winter, 1 = spring), and sleep medication (0 = taking no medication that affects sleep, 1 = taking medication that may affect sleep). Household SES was created by averaging the means of standardized scores of paternal and maternal educational attainment with the standardized scores of household income ($r_s = .53-.66$, $p_s < .001$).

2.4. Data analytic plan

First, we calculated descriptive statistics, including means and standard deviations, of sleep measures in Hispanic and White children, respectively. Next, using Pearson’s correlations, we evaluated the rank order consistency between actigraphy and parent-reported sleep measures in Hispanic and White children, respectively. Then, to examine whether there were mean-level differences in bedtime, wake time, and sleep duration between actigraphy assessments and parents’ reports and whether these discrepancies were different between Hispanic and White children, we conducted a series of 2×2 mixed factorial ANOVAs [33]. Type of sleep measure (actigraphy vs. parent-reports) was examined as a within-subject factor, while Hispanic vs. White children was examined as a between-subject factor. Children’s age, sex, household SES, season, and sleep medication were included as covariates in the ANOVAs. Although children were from 31 classrooms, design effects for sleep measures varied between 1.01 and 1.74, indicating non-independence of data is not a concern [34]. Thus, we did not account for non-independence in analyses. Analyses were conducted using SPSS 27.0.

3. Results

3.1. Descriptive analyses

Descriptive statistics are presented in Table 1. Based on actigraphy assessments, children fell asleep at around 21:00, woke up at about 6:25, and had a sleep duration of 9 hours and 23 minutes (9.38 hours) on average. Using sleep diaries, parents reported children’s bedtime at about 20:37, wake time at around 6:43, and sleep duration of 10 hours and 5 minutes (10.09 hours) on average. When using questionnaires to report children’s sleep during weekdays, parents reported children’s bedtime at about 20:20, wake time at around 6:33, and sleep duration approximately 10 hours and 13 minutes (10.21 hours).

Independent samples *t* tests revealed that Hispanic children went to bed later than White children based on sleep diaries (16 minutes; $t = -2.39$, $df = 87$, $p = .019$). Additionally, Hispanic children had a shorter sleep duration than White children based on sleep questionnaires (18 minutes; $t = 2.68$, $df = 87$, $p = .009$).

3.2. Correlations among sleep measures in Hispanic and White children

We employed Pearson's correlations to examine the rank order consistency among sleep measures in Hispanic and White children, respectively. Results are presented in Table 2. With respect to bedtime, actigraphy and parents' reports were highly correlated in Hispanic children ($r = .92$ and $.68$ for sleep diaries and questionnaires, respectively, $ps < .001$) and White children ($r = .91$ and $.64$ for sleep diaries and questionnaires, respectively, $ps < .001$). Similarly, actigraphy and parents' reports of wake time also were highly correlated in Hispanic children ($r = .94$ and $.73$ for sleep diaries and questionnaires, respectively, $ps < .001$) and White children ($r = .88$ and $.66$ for sleep diaries and questionnaires, respectively, $ps < .001$). Regarding sleep duration, the correlation between actigraphy and parent-reported sleep diaries was high in Hispanic ($r = .85$, $p < .001$) and White children ($r = .74$, $p < .001$), but only moderate to large correlations were found between actigraphy and parent-reported sleep questionnaires in Hispanic ($r = .59$, $p < .001$) and White children ($r = .43$, $p < .01$).

We conducted Fisher's z tests to compare whether parent-reported sleep diaries or sleep questionnaires were more strongly correlated with actigraphy. Results revealed that for bedtime, wake time, and sleep duration, parent-reported sleep diaries, compared to sleep questionnaires, were more strongly correlated with actigraphy in both Hispanic ($z = 2.84$ – 4.05) and White children ($z = 2.10$ – 3.15).

3.3. Mean-level differences in sleep measures between actigraphy and parents' reports in Hispanic and White children

3.3.1. Actigraphy versus parent-reported sleep diaries—Next, we utilized a series 2×2 mixed factorial ANOVAs to compare actigraphy versus parent-reported sleep diaries in Hispanic and White children while accounting for covariates. Results are shown in Table 3. Type of sleep measure had significant main effects on bedtime, wake time, and sleep duration, suggesting that children had earlier bedtime, later wake time, and longer sleep duration assessed by parent-reported diaries than those measured by actigraphy. Notably, the interaction effect between type of sleep measure and Hispanic vs. White on sleep duration was significant. As shown in Panel A of Figure 1, the discrepancy between parent-reported diaries and actigraphy of sleep duration was significant in both White ($F(1, 32) = 51.67$, $p < .001$) and Hispanic children ($F(1, 44) = 38.13$, $p < .001$), but was smaller in Hispanic children compared to White children.

3.3.2. Actigraphy versus parent-reported sleep questionnaires—We then conducted similar ANOVAs for comparisons between actigraphy and parent-reported sleep questionnaires in Hispanic and White children. Results are shown in Table 4. Consistent with the results from Table 3, parents reported earlier bedtime and longer sleep duration than those measured by actigraphy. The interaction effect between type of sleep measure and Hispanic vs. White on wake time was significant, suggesting significant differences in the accuracy of parents' reports versus actigraphy between Hispanic and White children. As shown in Panel B of Figure 1, the discrepancy between parent-reported questionnaires and actigraphy of wake time was significant in White children ($F(1, 32) = 4.82$, $p = .036$), but not significant in Hispanic children ($F(1, 44) = 0.43$, $p = .515$).

The interaction effects between type of measure and age and between type of measure and season were significant on bedtime, indicating that the discrepancy between parent-reported questionnaires and actigraphy of bedtime was larger in older children as compared to younger children and in children whose data were collected in spring months as compared to those whose data were collected in winter months. The interaction effect between type of measure and household SES was significant on sleep duration, indicating that the discrepancy between parent-reported questionnaires and actigraphy of sleep duration was larger in children from higher SES families than those from lower SES families.

4. Discussion

As the importance of sleep for children's development and well-being is becoming increasingly clear, it has become paramount to better understand how to efficiently and accurately measure sleep across an increasingly diverse population. Unfortunately, understanding the accuracy and concordance between parents' reports and actigraphy in diverse samples is far from clear. Indeed, prior research analyzing inequality in sleep between Hispanic and White children has found discrepant results [8,11,14,15], calling into question if the discrepant results are partially due to different measures of sleep that are used. This study investigated the concordance between parents' reports and actigraphy of sleep and whether parents of Hispanic or White children were more accurate in reporting their child's sleep duration and timing using sleep diaries and questionnaires compared to actigraphy-based assessments.

Consistent with previous studies in the United Kingdom and Japan [18,23], our results from correlational analyses suggest that children who are rated to have longer sleep duration, earlier bedtime, or later wake time by their parents also generally exhibit longer duration, earlier bedtime, or later wake time, respectively, based on assessments of actigraphy. These results indicate that parents' reports using sleep diaries or questionnaires could serve as proxies for actigraphy-based assessments when mean levels of sleep measures are not involved in analyses. Additionally, compared to parent-reported sleep questionnaires, sleep diaries were more strongly correlated with actigraphy-based assessments and may serve as a better proxy for actigraphy sleep.

In contrast, when mean levels of sleep measures are of interest, it may be problematic to use parents' reports of children's sleep. In this study, we found that parents tended to overestimate children's sleep duration and to report earlier bedtimes and later wake times on school days either using sleep diaries *or* questionnaires. The illustrated discrepancies between parents' reports and actigraphy are consistent with previous studies [22–24] and suggest that children may obtain less optimal sleep than their parents believe. Given the negative consequences of insufficient sleep for children's development [1–7], it is important to educate parents about the importance and patterns of children's sleep and to be aware of their bias when estimating or reporting their children's sleep.

We found that for most estimates of children's sleep, parents of Hispanic and White children tended to be inaccurate to similar extents as compared to actigraphy. However, there were two important exceptions. Specifically, our results indicated that even though parents of

White and Hispanic children both overestimated children's sleep duration when using sleep diaries as compared to actigraphy, parents of Hispanic children were more accurate than parents of White children. Likewise, parents of Hispanic children more accurately reported their child's wake time using questionnaires than parents of White children. Cumulatively, these findings suggest that compared to parents of White children, parents of Hispanic children may be more accurate in estimating their children's sleep duration and wake time. Hispanic families may spend more time together and have higher occurrences of bedsharing than White families [35–37], such that Hispanic parents are more aware of their children's routines. Moreover, parent-child relationship quality may also be a potential mechanism underlying the observed discrepancies as a recent study found that better parent-child relationship quality was related to better sleep and this association was stronger among Hispanic adolescents than White adolescents [38]. It is also plausible that because White families had higher household SES than Hispanic families in our sample, White children might have more technology in the bedroom than Hispanic children. Parents may inaccurately perceive their children's sleep when they are unaware of bedtime use of technology in their children. While we controlled for household SES, unfortunately we lacked measures regarding technology use around sleep time. It is critically important for researchers to investigate whether technology use disproportionately affects children's sleep and parents' reports of their child's sleep across racial/ethnic groups [26,27]. Alternatively, parents of White and Hispanic children may be differentially affected by social desirability biases when reporting their child's sleep [39,40].

Overall, research employing parents' reports may overestimate racial/ethnic differences in sleep. Indeed, our results showed that Hispanic and White children were similar in bedtime, wake time, and sleep duration based on actigraphy assessments, whereas significant or marginally significant differences appeared between Hispanic and White children using parents' reports. Therefore, differences in children's sleep reported by parents across racial/ethnic groups should be interpreted with caution because these differences could be partially due to degrees of biases in parents' reports.

A major strength of this study was the use of multiple assessments of sleep in a diverse sample of children, including parent-reported sleep diaries and questionnaires and actigraphy-based assessments. To our knowledge, it is the only study to compare actigraphy to parents' reports in a diverse sample and to investigate whether parents of Hispanic and White children are biased to the same extent in reporting their child's sleep. There are, however, limitations that should be considered when interpreting the findings. First, the sample size of this study is relatively small, a limitation that is common in studies involving actigraphy assessments. Given the sample size, we can focus on only the comparison between Hispanic and White children. Future studies should use a larger sample size and include more racial/ethnic groups to increase generalizability. Second, this study examined only weekdays' sleep. There is some evidence that our findings may not generalize to weekends [14,23]. However, we have no *a priori* reasons to anticipate that the Hispanic-White documented findings would differ in weekend nights. Third, although we found that parents of Hispanic children might be more accurate in reporting some (but not all) aspects of their child's sleep than White parents, we can only speculate about possible reasons.

Future studies should further investigate the mechanisms underlying the disparities reported in this study.

5. Conclusion

Despite these limitations, this study contributes to our understanding of the consistency and agreement between parents' reports and actigraphy of sleep in Hispanic and White children. Our findings show strong rank-order consistency between parents' reports and actigraphy in assessing children's bedtime, wake time, and sleep duration, suggesting that parents' reports, particularly parent-reported sleep diary, can serve as proxies of actigraphy when mean levels of sleep measures are not of interest. However, parent-reported sleep did not fully align with actigraphy-based assessments: parents reported longer sleep duration, earlier bedtime, and later wake time than actigraphy. Importantly, compared to parents of Hispanic children, parents of White children are more likely to inaccurately report their child's sleep duration using diaries and wake time using questionnaires. These results indicate that when mean levels of sleep measures are of interest, parents' reports could be biased compared to actigraphy, and parents of Hispanic children may be more accurate in some estimates of sleep than parents of White children. Given that subjective reports of sleep (e.g., parents' reports) can be biased and biased to different extents across racial/ethnic groups (e.g., White-Hispanic), findings of studies comparing racial/ethnic differences in sleep using subjective reports should be interpreted with caution. These discrepancies could be partially due to different biases in subjective reports. It is not only essential for researchers, clinicians, and parents to consider the potential biases of parent-reported sleep but also important to be aware that the degree of biases may vary among parents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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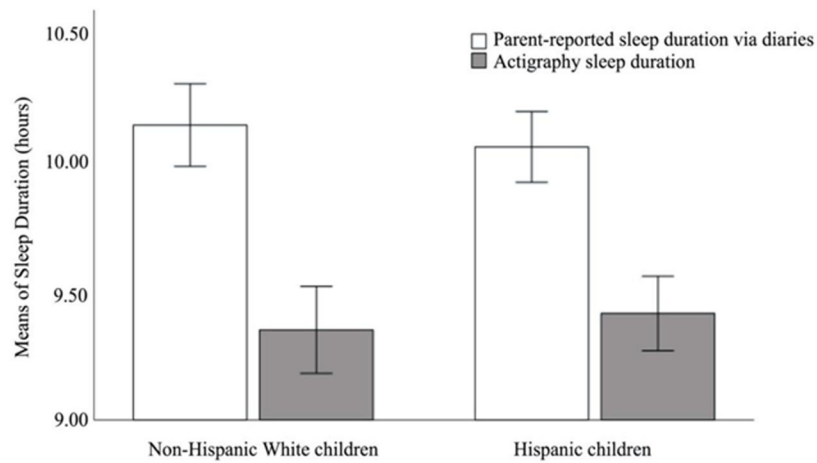
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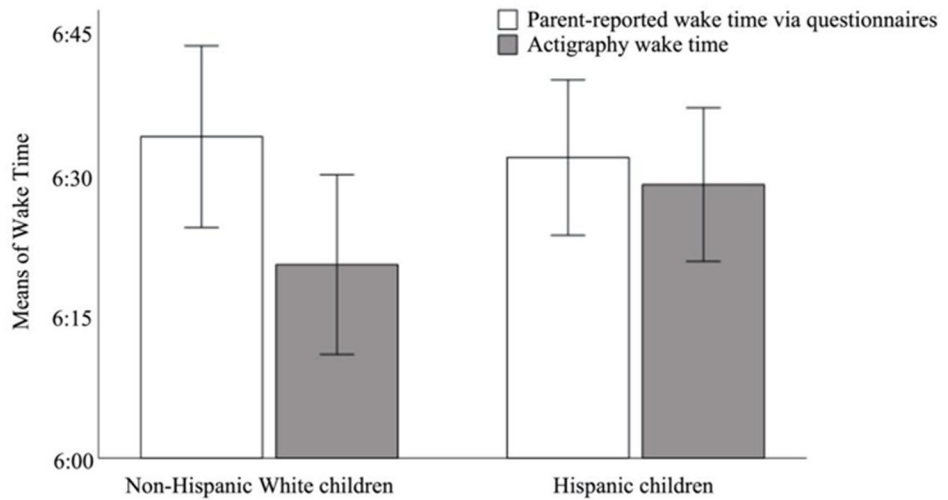
Highlights

- We found high rank-order consistency between parents' reports and actigraphy sleep
- Results showed mean-level discrepancies between parents' reports and actigraphy
- Hispanic parents might be more accurate reporters of sleep than White parents
- Research using parents' reports may overestimate racial/ethnic differences in sleep

Panel A



Panel B

**Figure 1.**

Sleep duration (Panel A) and wake time (Panel B) among Hispanic and White children across types of sleep measures

Note. Error bars represent 95% confidence intervals. Covariates, including children's age and sex, household socioeconomic status, season, and sleep medication, are evaluated at their mean values.

Table 1
Descriptive statistics of actigraphy and parent-reported sleep measures among Hispanic and White children

	Full Sample (N = 89)		White children (N = 38)		Hispanic children (N = 51)		$t(df = 87)/\chi^2(df = 1)$	P
	M	SD	M	SD	M	SD		
Bedtime								
Actigraphy bedtime	21:02	0.57	20:56	0.51	21:07	0.61	1.61	.112
Parent-reported bedtime via diaries	20:37	0.54	20:28	0.45	20:44	0.57	2.39	.019
Parent-reported bedtime via questionnaires	20:20	0.57	20:13	0.41	20:25	0.65	1.79	.078
Wake time								
Actigraphy wake time ^a	6:25	0.44	6:20	0.45	6:29	0.43	1.56	.123
Parent-reported wake time via diaries ^a	6:43	0.41	6:40	0.38	6:45	0.44	1.06	.292
Parent-reported wake time via questionnaires	6:33	0.45	6:36	0.37	6:30	0.50	1.02	.313
Sleep duration (hours)								
Actigraphy sleep duration ^a	9.38	0.50	9.41	0.45	9.36	0.53	0.47	.637
Parent-reported sleep duration via diaries ^a	10.09	0.46	10.19	0.41	10.01	0.49	1.77	.081
Parent-reported sleep duration via questionnaires	10.21	0.56	10.38	0.44	10.08	0.62	2.68	.009
Children's age	6.46	0.62	6.41	0.61	6.49	0.62	0.60	.548
Children's sex ^b	0.51	0.50	0.66	0.48	0.39	0.49	6.15	.013
Household SES	0.05	0.85	0.48	0.64	-0.27	0.85	4.78	<.001
Season ^b	0.61	0.49	0.50	0.51	0.69	0.47	3.17	.075
Sleep medication ^b	0.22	0.42	0.29	0.46	0.18	0.39	1.60	.206

Note. SES = socioeconomic status; household SES was calculated from parental education and family income. Children's sex: 0 = female, 1 = male; Season: 0 = winter, 1 = spring; Sleep medication: 0 = no relevant medication, 1 = medication which may affect sleep. The 24-hour clock time was shown for bedtime and wake time and was transformed into hours when calculating SD and independent samples *t* tests.

^aOne Hispanic child had missing data on this measure.

^bPearson's chi-square (χ^2) test was used.

Table 2
Correlations among actigraphy and parent-reported sleep measures among Hispanic ($N = 51$) and White ($N = 38$) children

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Actigraphy bedtime	-	.92***	.68***	.53***	.58***	.42***	-.73***	-.58***	-.37**	.13	.01	-.26	.23	-.17
2. Parent-reported bedtime via diaries	.91***	-	.74***	.52***	.56***	.43**	-.65***	-.68***	-.43**	.07	-.03	-.27	.16	-.19
3. Parent-reported bedtime via questionnaires	.64***	.74***	-	.38**	.45**	.44**	-.48***	-.47**	-.69***	-.11	.04	-.35*	-.12	.03
4. Actigraphy wake time ^a	.57***	.58***	.50**	-	.94***	.73***	.20	.23	.19	-.02	-.20	-.06	.02	.01
5. Parent-reported wake time via diaries ^a	.55***	.53**	.47**	.88***	-	.77***	.10	.23	.15	.06	-.15	-.12	.05	.08
6. Parent-reported wake time via questionnaires	.36*	.35*	.38*	.66***	.77***	-	.10	.18	.34*	-.18	-.09	.12	-.09	.06
7. Actigraphy sleep duration ^a	-.57***	-.46**	-.23	.35*	.25	.25	-	.85***	.59***	-.16	-.18	.26	-.25	.20
8. Parent-reported sleep duration via diaries ^a	-.49**	-.61***	-.38*	.18	.34*	.34*	.74***	-	.64***	-.03	-.10	.22	-.15	.30*
9. Parent-reported sleep duration via questionnaires	-.29	-.39*	-.61***	.09	.22	.50**	.43**	.64***	-	-.03	-.11	.46**	.06	.02
10. Children's age	.12	.05	-.25	-.04	-.05	.06	-.18	-.10	.28	-	-.07	-.26	.30*	-.08
11. Children's sex	.25	.27	.07	.22	.31	.32	-.06	-.01	.21	.08	-	.13	.02	.26
12. Household SES	-.08	-.10	-.21	.08	-.03	.05	.18	.08	.24	.30	-.01	-	-.13	.12
13. Season	.24	.23	.17	-.02	-.05	.03	-.29	-.30	-.13	.50**	.17	.001	-	-.24
14. Sleep medication	.02	-.03	-.31	-.17	-.25	-.29	-.20	-.21	.04	.01	.22	.22	-.06	-

Note. The area above the diagonal shows correlations in Hispanic children, and the area below the diagonal shows correlations in White children. SES = socioeconomic status; household SES was calculated from parental education and family income. Children's sex: 0 = female, 1 = male; Season: 0 = winter, 1 = spring; Sleep medication: 0 = no relevant medication, 1 = medication which may affect sleep.

^a One Hispanic child had missing data on this measure.

* $p < .05$

** $p < .01$

*** $p < .001$.

Table 3

Comparisons between actigraphy and parent-reported sleep diaries across Hispanic and White Children ($N=89$)

Variables	Bedtime		Wake time ^a		Sleep duration ^a	
	<i>F</i> (1, 82)	<i>p</i>	<i>F</i> (1, 81)	<i>p</i>	<i>F</i> (1, 81)	<i>p</i>
Main effect						
Measure	58.42	< .001	55.02	< .001	109.77	< .001
Hispanic	0.78	.381	1.00	.321	0.01	.924
Age	0.02	.893	0.004	.949	0.04	.853
Male	1.01	.317	0.07	.796	0.95	.334
SES	3.40	.069	0.13	.716	3.42	.068
Season	2.16	.146	0.01	.913	3.22	.076
Sleep medication	0.44	.509	0.42	.518	0.03	.857
Interaction effect						
Measure × Hispanic	1.98	.163	2.55	.114	4.19	.044
Measure × Age	1.33	.252	1.12	.293	2.25	1.37
Measure × Male	0.09	.770	1.36	.247	0.97	.327
Measure × SES	0.002	.968	3.25	.075	1.39	.242
Measure × Season	0.90	.346	0.30	.583	0.13	.722
Measure × Sleep medication	0.58	.449	0.11	.744	0.59	.446

Note. SES = socioeconomic status; household SES was calculated from parental education and family income. Measure (actigraphy vs. parent-reported sleep diaries) is a within-subject variable, whereas Hispanic vs. White is a between-subject variable. Children's age (mean-centered), sex (0 = female, 1 = male), household SES (mean-centered), season (0 = winter, 1 = spring), and sleep medication (0 = no relevant medication, 1 = medication which may affect sleep) are covariates.

^aThe sample size in this analysis was 88 because one Hispanic child had missing data on wake time measured by actigraphy and sleep diaries.

Table 4

Comparisons between actigraphy and parent-reported sleep questionnaires across Hispanic and White children ($N = 89$)

Variables	Bedtime		Wake time ^a		Sleep duration ^a	
	<i>F</i> (1, 82)	<i>p</i>	<i>F</i> (1, 81)	<i>p</i>	<i>F</i> (1, 81)	<i>p</i>
Main effect						
Measure	35.36	< .001	3.06	.084	44.06	< .001
Hispanic	0.27	.605	0.25	.617	0.02	.901
Age	0.39	.532	0.27	.603	0.05	.823
Male	0.97	.329	0.15	.704	0.57	.452
SES	6.77	.011	0.24	.628	11.76	.001
Season	0.76	.385	0.02	.884	1.27	.263
Sleep medication	0.36	.552	0.90	.345	0.05	.820
Interaction effect						
Measure × Hispanic	0.04	.847	4.19	.044	1.64	.204
Measure × Age	5.66	.020	0.30	.583	2.72	.103
Measure × Male	0.10	.754	0.75	.390	1.03	.314
Measure × SES	2.34	.130	1.30	.258	4.31	.041
Measure × Season	4.11	.046	0.13	.719	2.16	.145
Measure × Sleep medication	0.03	.864	0.27	.607	0.08	.780

Note. SES = socioeconomic status; household SES was calculated from parental education and family income. Measure (actigraphy vs. parent-reported sleep questionnaires) is a within-subject variable, whereas Hispanic vs. White is a between-subject variable. Children's age (mean-centered), sex (0 = female, 1 = male), household SES (mean-centered), season (0 = winter, 1 = spring), and sleep medication (0 = no relevant medication, 1 = medication which may affect sleep) are covariates.

^aThe sample size in this analysis was 88 because one Hispanic child had missing data on wake time measured by actigraphy.