Prospective study of mobile phone acquisition and ownership and well-being among low-income Latinx children

Xiaoran Sun,* K. Farish Haydel, Donna Matheson, Manisha Desai, Thomas N. Robinson

Stanford University School of Medicine; *Correspondence: xbs5014@stanford.edu

Background

At what age should children receive their first mobile phone? Is owning a mobile phone harmful to children? Growing evidence about potential benefits and harms of mobile phones (Orben & Przybylski, 2019; Twenge et al., 2018) have mainly examined *frequency* and *time* of use, without directly addressing these questions. Few studies have prospectively observed children as they acquire mobile phones. Further, we know little about mobile phone ownership effects among ethnic minority children, including Latinx youth who are the fastest-growing racial/ethnic group under age 18 in the U.S. (Lopez et al., 2018). Findings from predominantly White samples may not generalize to low-income Latinx youth (García Coll et al., 1996).

Study Aims

Aim 1: Describe the prevalence of Latinx children's mobile phone ownership by age, and the age when first acquired.

Aim 2: Examine longitudinal associations between mobile phone ownership and the age when first acquired with measures of well-being (i.e., depressive symptoms, sleep, and academic achievement).

Aim 2a: Examine the *within-person* longitudinal associations between mobile phone ownership status and levels and changes in well-being.
Aim 2b: Examine the *between-person* longitudinal associations between PHONE acquisition age and well-being.
Aim 2c: Examine the acquisition age as a moderator of the associations between ownership status and levels of changes in well-being.

Participants

- Data come from the baseline and 12-, 24-, 36-, and 48-month follow-up assessments (i.e., 5 yearly time points) of *Stanford GOALS*, a randomized controlled trial of a multi-level intervention on weight gain among low-income, 7-11 year old overweight and obese children and their families (Robinson et al., 2013).
- N = 263 Latinx children from 236 families:
  - 55% female
  - Baseline *M* age = 9.5 years, *SD* = 1.5
  - Family income mean = $15,000-$24,999
  - 86.5% families with married parents
  - 8.1% with parent(s) born in U.S.
- Retention rates after 1, 2, 3 and 4 years: 99.2%, 97.0%, 93.9% and 62.0%

Measures

Constructs	Descriptions
Mobile phone ownership	Parent reports; "Does this child personally have a mobile phone?" (0 = no; 1 = yes and all time points following the first report of yes)
Age when mobile phone first acquired (i.e., onset age)	Estimated as the midpoint between the age at the last time point when they did not own a mobile phone, and the age at the first time point when they owned a mobile phone
Depressive symptoms	Child reports; 3-point, 10-item Child Depression Inventory-Short Version
Sleep bedtimes and duration — accelerometry	Measured by triaxial accelerometers (Actigraph GT3X+) worn on the hip for up to 7 complete days; Sleep time and duration computed using the refined sleep algorithm (Barreira et al., 2015). Outcomes include: *average school night* (Sun-Thu) and *non-school night* (Fri, Sat) *sleep bedtime and duration*; irregularity of *school night sleep time and duration*.
Sleep bedtimes and duration and daytime sleepiness— survey	Parent reports; "In a typical week, what time does your child go to sleep [wake up] on a school/non-school night [day]?" 3-point, 8-item, *Daytime sleepiness* subscale of the Children's Sleep Habits Questionnaire (Owens, 2004).
Academic performance	Parent reports; "What were this child's most recent school grades?"
Covariates	Demographics, intervention status, sexual maturity (Marshall & Tanner, 1969;1970)

Statistical Considerations

Analysis plan is pre-registered on OSF.
Modeling:
- multilevel modeling (2-level models), for each outcome
  - main effects of onset age and ownership status (Model 1)
  - interaction effect of ownership status × time (Model 2)
  - interaction effects of ownership status × onset age, and ownership status × onset age × time (Model 3)
  - Controlling the False Discovery Rate (FDR) using Benjamini-Hochberg approach for the 5 associations tested of each well-being outcome
- multiple imputation (m=5) to address missing data issues

Power Calculation:
- power estimation: Monte Carlo simulation shows the detectable (80% power) effect sizes:
  - Level 1 (within-person) direct effect ≧ .10
  - Level 2 (between-person) direct effect ≧ .19 to .29 (varying by ICC = .10, .30, .50)
  - Cross-level interaction effect ≧ .33
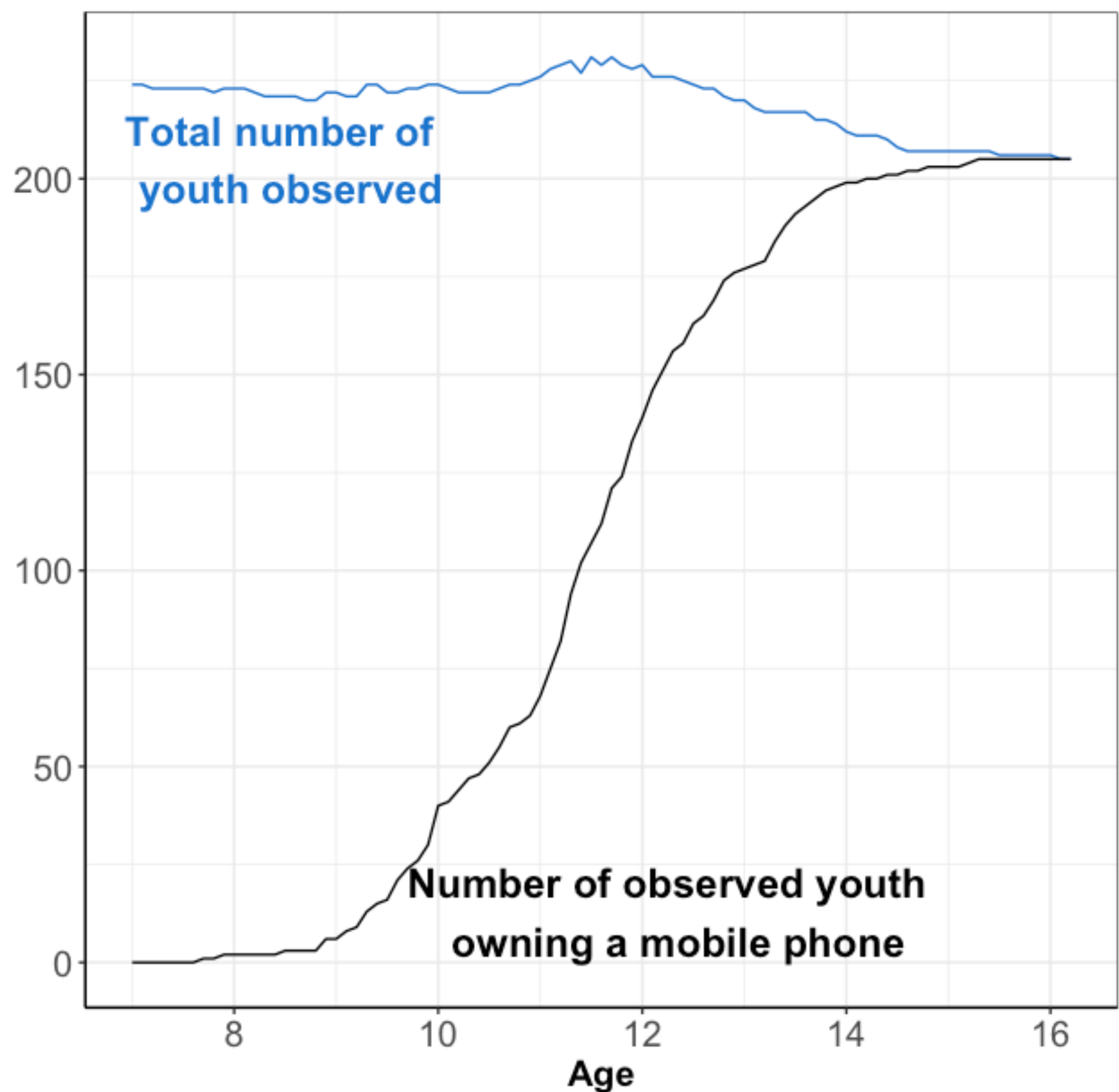
Results

FIGURE 1: Age when mobile phone acquired. Acquisition (i.e., ownership onset) age: *M* = 11.62, *SD* = 1.41, Range = 7.70-15.25, 1st Quartile = 10.70, Median = 11.60, 3rd Quartile = 12.55

	Child Report			Parent Reports																	
	Depressive symptoms			Academic Performance			School Night Bedtime			School Night Sleep Duration			Non-School Night Bedtime			Non-School Night Sleep Duration			Daytime Sleepiness		
	γ	SE	p	γ	SE	p	γ	SE	p	γ	SE	p	γ	SE	p	γ	SE	p	γ	SE	p
Intercept	1.12	.23	.001	70.00	4.70	.000	1.12	.15	.000	9.80	.18	.000	1.89	.29	.000	10.35	.28	.000	11.84	.70	.000
Time	-.10	.03	.001	-.05	.65	.939	.10	.02	.000	-.13	.03	.000	.07	.04	.099	.05	.05	.245	-.25	.11	.040
Onset age	-.03	.02	.284	.10	.93	.919	.02	.03	.378	-.02	.03	.435	.03	.04	.432	.01	.04	.919	.06	.11	.573
Mobile phone ownership	-.02	.06	.741	2.79	1.90	.158	.03	.08	.754	-.01	.07	.848	.14	.09	.150	.01	.13	.966	-.01	.25	.985
Mobile phone ownership × Time	.09	.04	.018	.05	.77	.951	.03	.03	.274	-.08	.03	.014	.05	.04	.187	.01	.06	.867	.12	.12	.315
Mobile phone ownership × Onset age	.03	.04	.471	.11	1.23	.928	.04	.05	.456	-.01	.04	.924	.03	.05	.536	.05	.08	.557	.02	.31	.952
Mobile phone ownership × Onset age × Time	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

	Accelerometry Sleep Measures																	
	School Night Bedtime			School Night Sleep Duration			School Night Bedtime Irregularity			School Night Sleep Duration Irregularity			Non-School Night Bedtime			Non-School Night Sleep Duration		
	γ	SE	p	γ	SE	p	γ	SE	p	γ	SE	p	γ	SE	p	γ	SE	p
Intercept	2.62	.29	.000	8.88	.47	.000	.83	.07	.000	1.09	.14	.000	3.04	.45	.000	8.58	.63	.000
Time	.15	.05	.014	-.15	.07	.065	.03	.01	.043	-.01	.01	.675	.08	.05	.078	.20	.08	.024
Onset age	-.02	.04	.691	.04	.06	.524	-.00	.01	.925	.01	.01	.683	.03	.05	.600	-.06	.06	.291
Mobile phone ownership	-.07	.13	.608	.26	.19	.209	-.01	.04	.778	.03	.04	.361	.08	.14	.584	-.25	.20	.229
Mobile phone ownership × Time	.01	.05	.927	-.06	.07	.357	.03	.02	.093	.02	.02	.260	-.03	.08	.675	.18	.09	.040
Mobile phone ownership × Onset age	-.01	.06	.877	.02	.07	.773	-.01	.02	.863	.02	.02	.381	.03	.09	.581	.22	.12	.090
Mobile phone ownership × Onset age × Time	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Note. **All tested effects are nonsignificant with FDR controlled.** Results for intercept, time, and onset age and mobile phone ownership main effects are from Model 1; for mobile phone ownership × Time is from Model 2; for Mobile phone ownership × Time and Mobile phone ownership × Onset age × Time are from Model 3. Nonsignificant three-way interactions are omitted. Covariates are not displayed for parsimony.

Discussion

In a **4-year prospective study of of mobile phone ownership among low-income 7-15 year old Latinx children**, the **mean age of first mobile phone acquisition was 11.62 years** (ranging from 7.70 to 15.25 years). We **did not find statistically significant associations between mobile phone ownership status and first age of acquisition and measures of children's well-being** (depressive symptoms, academic performance, and sleep parameters).

This result was based on a rigorously designed, pre-registered analysis plan, with multiple imputation for missing data and tests on a variety of well-being outcomes reported by **children and parents** as well as sleep objectively measured with **accelerometers**. The **ethnic homogeneous** sample allowed us to focus on a previously understudied racial-ethnic minority group.

Despite prior research revealing both positive and negative effects of mobile phone use on child well-being outcomes, and existing debate about when and whether children should have their own mobile phones, this pattern of null results is **consistent with prior findings based on predominantly White samples** that have identified little evidence for effects of digital technology use on child well-being (George et al., 2020; Jensen et al., 2019; Orben & Przybylski, 2019). An important future direction is to investigate the implications of children's specific digital activities and behaviors for their well-being.