

CAUSAL EVIDENCE · ENTROPY BALANCING

Playgrounds or Platforms?

The causal effect of device-use intensity on child sleep and active play, from an entropy-balanced analysis of 451 Kenyan children aged 0–8.

Authors A. Mbithi; L. Maina; C. Mbithi, and C. Sorkpor **Published** Kernel Institute Working Paper · 2026 **Publisher** Kernel Institute of Socio-Economic Research
Kernel Institute generates evidence for reducing societal-scale risks from transformative technologies. kernelinstitute.org

Do smartphones really steal children's sleep, or do wealthier, less-supervised households just look that way on paper? This snapshot uses entropy balancing to estimate the causal effect of high-intensity device use (≥ 3 hours/day) on sleep duration and active play among 451 Kenyan children aged 0–8. A naive comparison shows high-intensity users sleeping 1.33 fewer hours and playing 0.91 fewer hours daily than low-intensity peers. After balancing on income, education, supervision, and gender, the causal effect shrinks by roughly two-thirds but survives: about 28 fewer minutes of sleep per night ($p < 0.01$) and a similarly sized, more tentative loss of active play ($p < 0.10$). In Kenya, intensive device use is a marker of wealth and reduced supervision, not deprivation, inverting the pattern typically assumed in high-income countries.

FINDINGS

 **High-intensity use cuts sleep by 28 min/night:** -0.47 hrs, $p < 0.01$
This causal estimate survives full entropy balancing on income, education, supervision, and gender: the study's most robust finding.

 **Active play likely falls too:** -0.47 hrs, $p < 0.10$
A similarly sized loss in daily active play, though the evidence is more tentative and warrants replication with objective measures.

 **Naive estimates overstate harm 2.8x:** 1.33 hrs $\rightarrow$ 0.47 hrs
The unadjusted sleep gap between high- and low-intensity users shrinks by 64% once confounding is properly removed.

 **In Kenya, heavy use is a wealth marker:** inverted gradient
High-intensity users are wealthier, more educated, and more urban than low-intensity users, the opposite of the high-income-country pattern.

 **Supervision is protective:** $+0.46$ hrs sleep / unit
Each one-unit increase in adult supervision frequency adds 0.46 hours of sleep and 0.44 hours of active play, independent of device use.

 **The cumulative cost is real:** ≈ 170 hrs/year
28 minutes a night compounds to roughly seven full nights of lost sleep annually for the average high-intensity child.

IMPLICATIONS

 **Frame guidance around evening use, not blanket caps**
Blue-light and arousal mechanisms concentrate harm near bedtime; a screen-free wind-down window may capture most of the benefit.

 **Target high-income, low-supervision households**
Kenya's risk profile inverts typical assumptions; pediatric messaging aimed only at low-income families will miss the highest-risk group.

 **Strengthen supervision as a complementary lever**
Supervision independently protects sleep and play; pair screen-time guidance with practical, time-poor-friendly supervision strategies.

 **Anticipate harm migrating to lower incomes**
As devices cheapen, Kenya's risk profile may converge toward the high-income-country pattern; plan equity-focused guidance now.

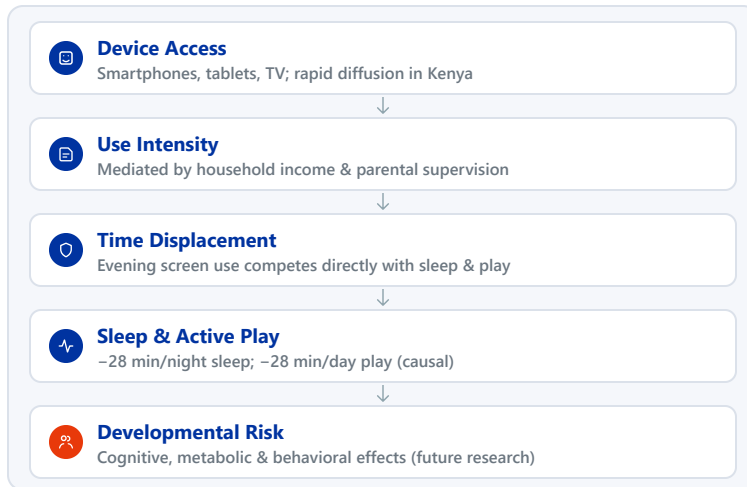
 **Always adjust for confounding before citing screen-time harms**
Unadjusted numbers substantially mislead; require entropy balancing or equivalent methods before quoting effect sizes to policymakers.

 **Prioritize sleep guidance first, replicate play findings**
The sleep effect is robust; the play effect is suggestive and needs replication with accelerometer-based, objective measures.

METHODOLOGY AT A GLANCE

SAMPLE	METHOD	THRESHOLD	ETHICS REVIEW	COVARIATES BALANCED
451 Kenyan children, aged 0–8	Entropy Balancing Doubly-robust regression	≥ 3 hrs/day 253 high- · 198 low-intensity	NACOSTI Permit P/25/4178956	Age Gender Income Education Supervision

1 CONTEXT: ISOLATING DEVICE EFFECTS FROM CONFOUNDING



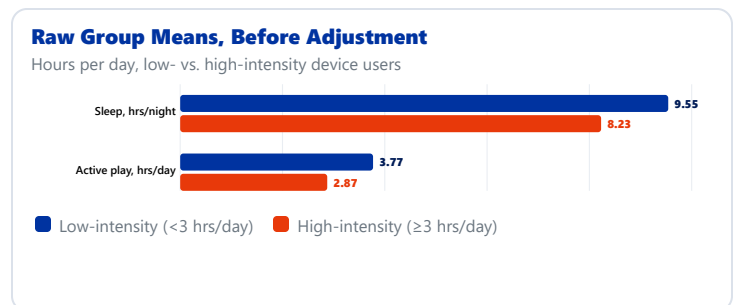
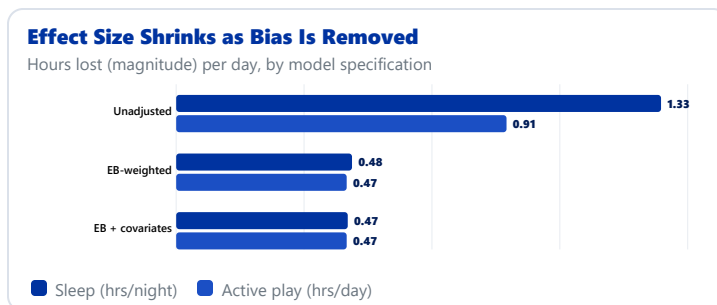
- Opportunity**
Not all screen time is equal; educational content and active video games may displace sedentary play, not outdoor play.
- Biological mechanism**
Blue light suppresses melatonin and delays sleep onset by 1–2 hours; evening use directly displaces sleep time.
- Inverted equity gradient**
Unlike high-income countries, Kenya's heaviest device users are wealthier and more urban, not poorer, than low-intensity peers.
- Supervision gap**
High-intensity households report nearly one full category less adult supervision during device use (1.92 vs. 2.66 on a 0–3 scale).

2 RESEARCH DESIGN: BALANCING A SKEWED COMPARISON

COVARIATE	LOW-INTENSITY (N=198)	HIGH-INTENSITY (N=253)	AFTER ENTROPY BALANCING
Parent education (1–6)	3.30	3.92	Exact match
Household income (1–7)	2.38	3.16	Exact match
Internet access (%)	61.1%	87.0%	Exact match
Supervision (0–3)	2.66	1.92	Exact match
Male child (%)	64.6%	43.9%	Exact match

Before balancing, standardized differences exceeded 0.10 on every covariate except age ($p < 0.001$ for all five shown). Entropy balancing (Hainmueller, 2012) reweights controls to match treated-group means and variances exactly, in finite samples, without discarding observations.

3 KEY QUANTITATIVE RESULTS



4 AN INVERTED RISK PROFILE

“ In Kenya, intensive device use is a marker of wealth and reduced supervision, not deprivation.

INCOME

2.38 vs 3.16

Household income score (1–7) for low- vs. high-intensity users: heavy users are the wealthier group, not the poorer one.

SUPERVISION

2.66 vs 1.92

Adult supervision frequency (0–3) is nearly a full category lower among high-intensity households.

CONNECTIVITY

61% vs 87%

Internet access among low- vs. high-intensity households: access itself, not restriction, enables heavy use.

5 BOTTOM LINE

TAKE-AWAY FOR PEDIATRICIANS, POLICYMAKERS & PARENTS

High-intensity device use costs children real sleep and likely some active play, but naive screen-time warnings overstate the harm nearly three-fold.