

# Parental Incarceration and Future Healthcare Use

*A Norwegian whole-population cohort study — preliminary*

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NORCE Norwegian Research Centre

ACE project — Research Council of Norway (project no. 324963)

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**Objective** ► To examine whether a child's first experience of parental incarceration is followed by changes in healthcare use over the next five years.

**Motivation** ► Parental incarceration is a major adverse childhood experience, but we know less about what happens to children's actual contact with the healthcare system afterward.

**Approach** ► We use Norwegian linked registry data for the 1999–2001 birth cohorts, combining parental incarceration records with primary-care and specialist-care use.

**Contribution** ► Preliminary findings suggest parental incarceration is followed by sustained increases in healthcare contact, with the largest increase in specialist care.

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*(Felitti et al., 1998; Murray & Farrington, 2008; Hughes et al., 2017)*

- ▶ **Evidence links parental incarceration to poorer child wellbeing and development**, but effects vary by outcome, family context, and welfare-state setting.

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- ▶ **The Inverse Care Law raises a key concern**: children with greater needs may not receive care in proportion to those needs.

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# Hypothesis: disengagement from care — or intensified contact?

## H1 · Disengagement — our starting hypothesis

Inverse Care Law: the family shock weakens the child's connection to ordinary care (stress, stigma, broken routines).

**Prediction: primary-care contact FALLS ↓**

## H2 · Intensified contact — the alternative

Need rises and becomes visible; GP gatekeeping refers it onward through the care pathway — not substitution.

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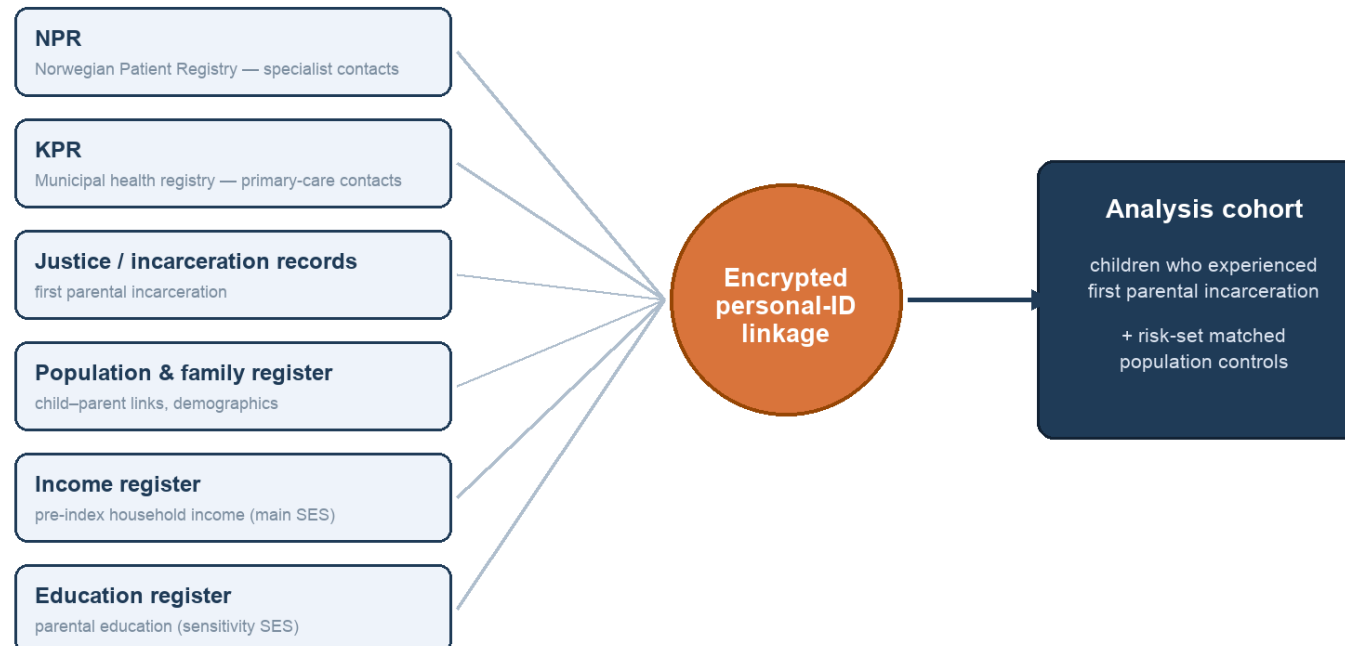
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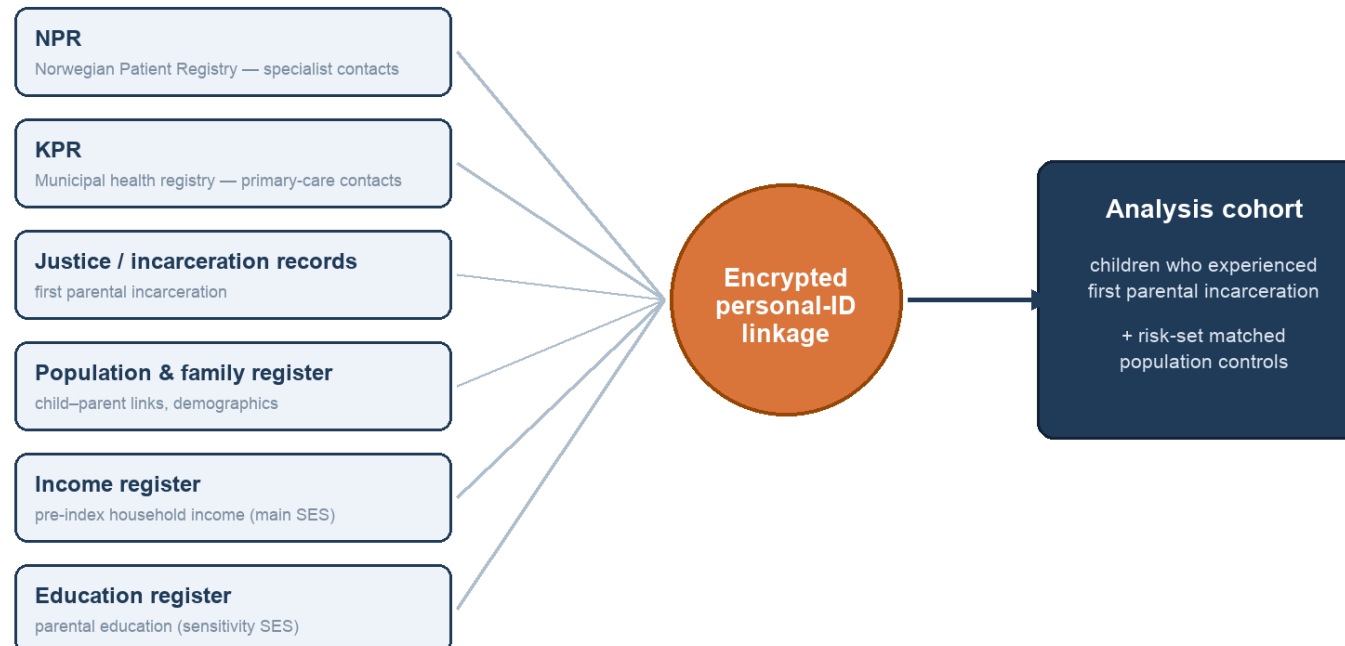
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- ▶ Birth cohorts 1999–2001, observed 2008–2023 in linked individual-level registries.
- ▶ Justice/incarceration records linked to primary-care (KPR) and specialist (NPR) registries.
- ▶ First parental incarceration 2011–2018 (full baseline & 5-year follow-up).
- ▶ Outcomes: cumulative 5-year counts of specialist, primary-care and total contacts.



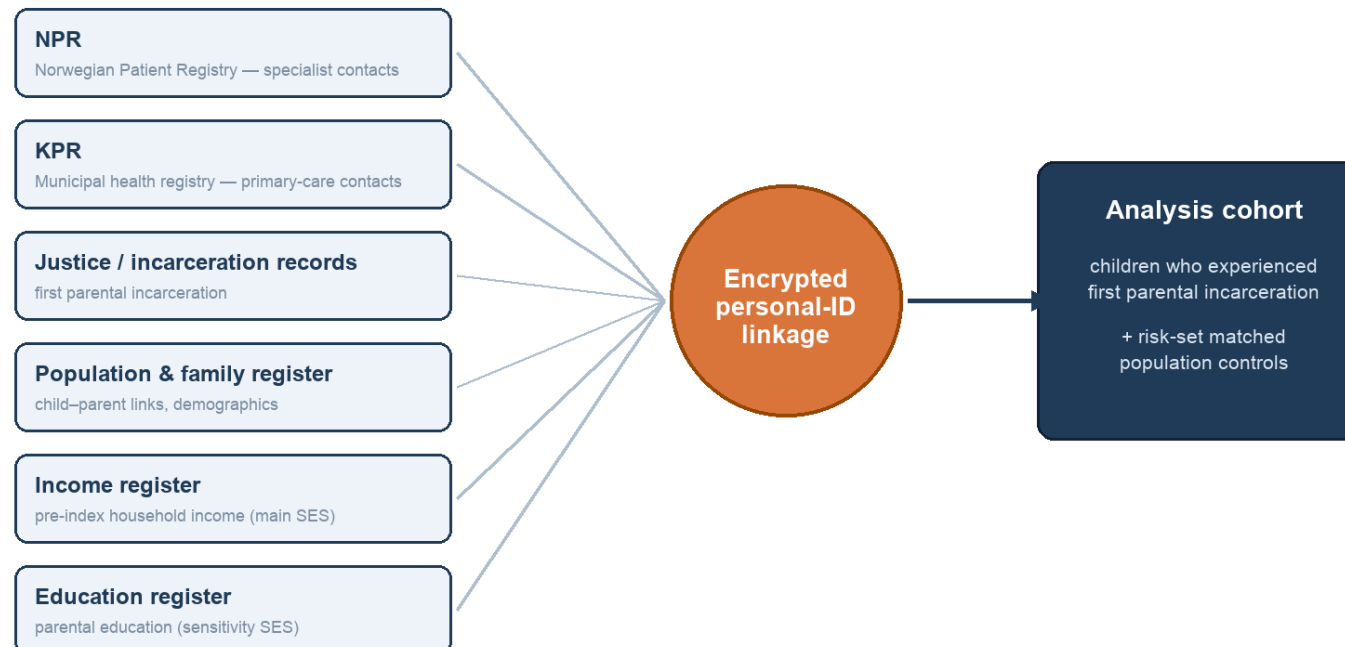
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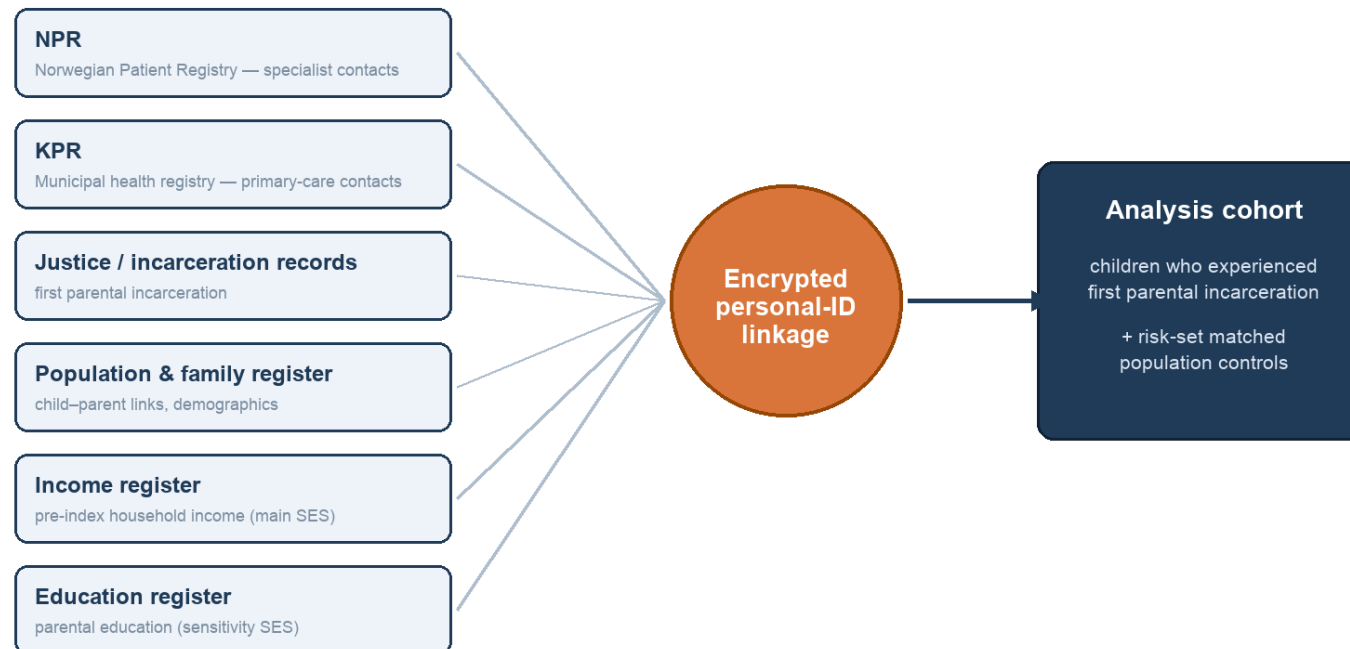
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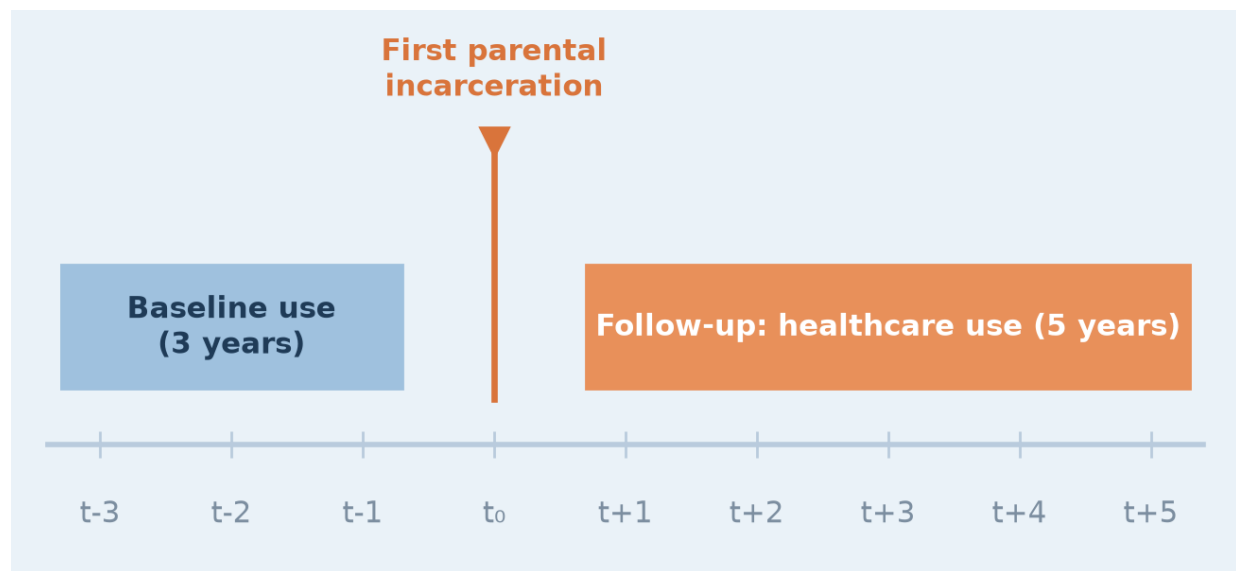
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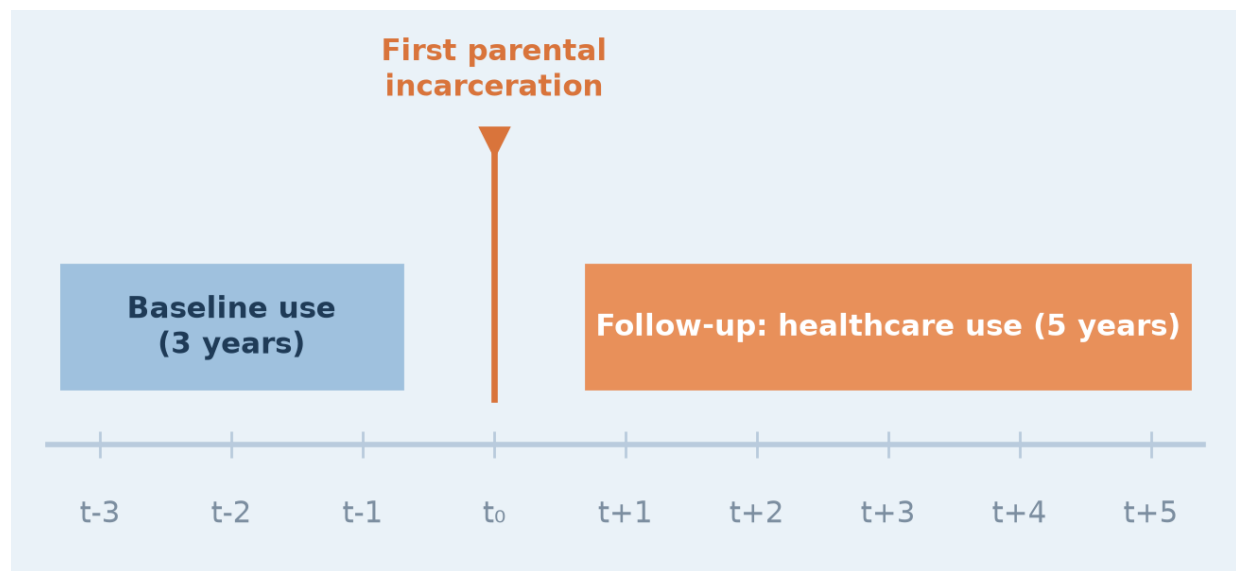
## Design: risk-set sampling around the first incarceration

- ▶ Index year = year of first parental incarceration.
- ▶ Each exposed child matched to up to 5 not-yet-exposed controls: same calendar year, sex, age  $\pm 1$ .
- ▶ Covariates measured pre-index (index - 1); baseline use over the 3 prior years.
- ▶ Estimation sample: 26,274 children (4,379 exposed; 21,895 controls).



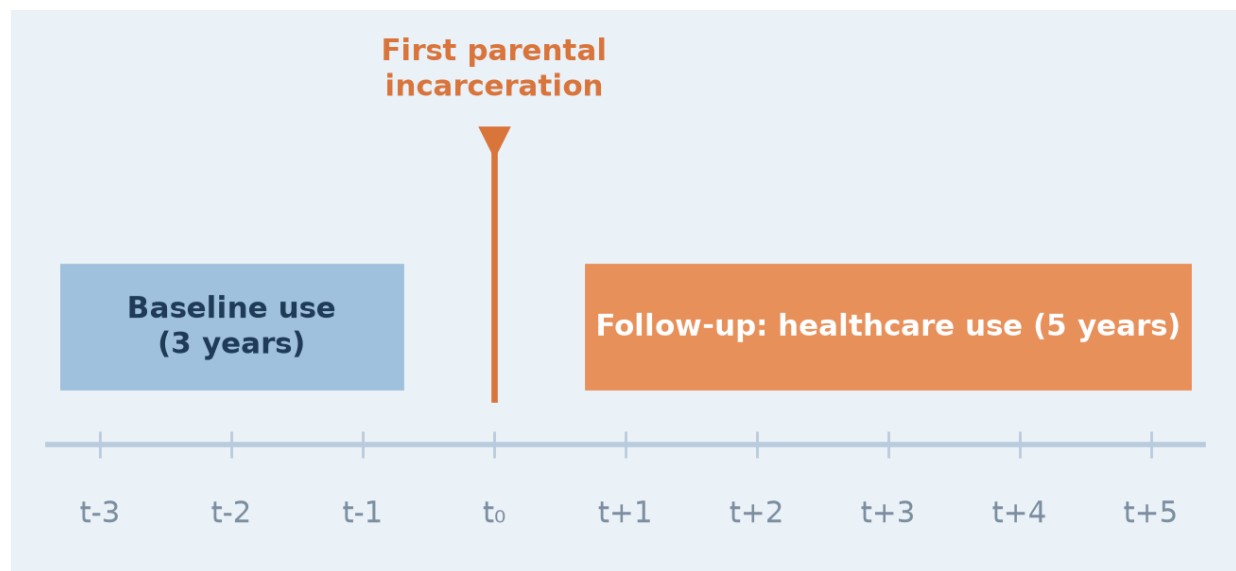
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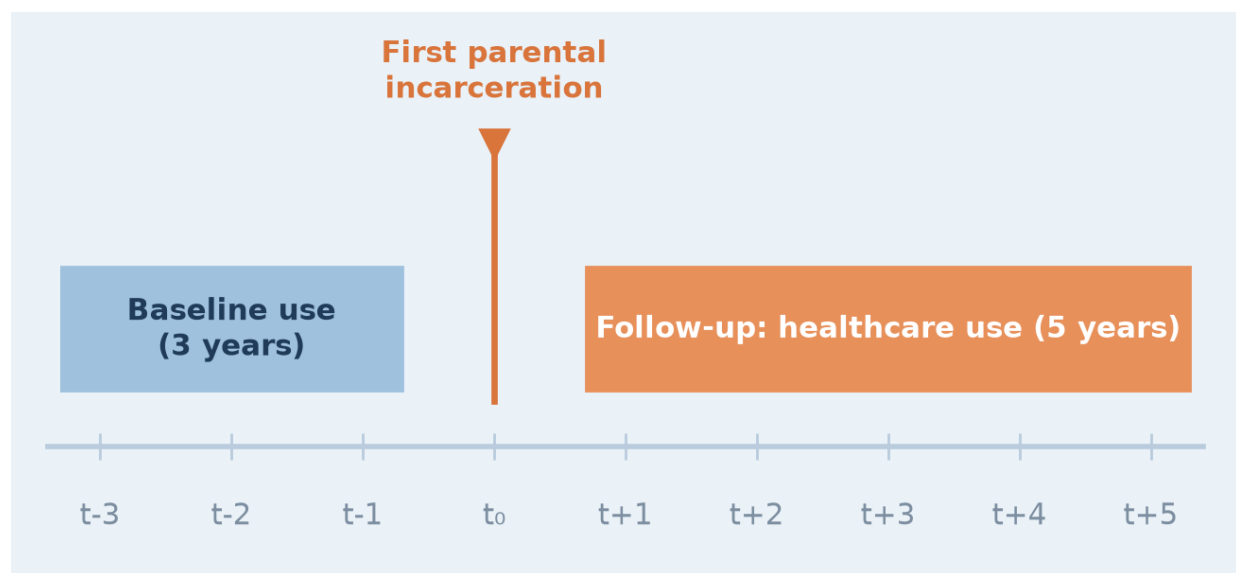
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## What we adjust for — all measured before the index year

- ▶ **Matched by design:** calendar year, sex, and age ( $\pm 1$ ).
- ▶ **Child health:** any chronic condition; baseline primary- and specialist-care contacts over the 3 pre-index years.
- ▶ **Family:** mother partnered; number of siblings.
- ▶ **Background:** immigrant background — none / first-generation / second-generation / other.
- ▶ **SES:** pre-index household income quintile — register-based, measured at index – 1, and the SES dimension most proximate to the economic shock of incarceration. *Missing income (14.4%) kept as an explicit category.* (Case et al. 2002; Galobardes et al. 2006; Kinge et al. 2019).

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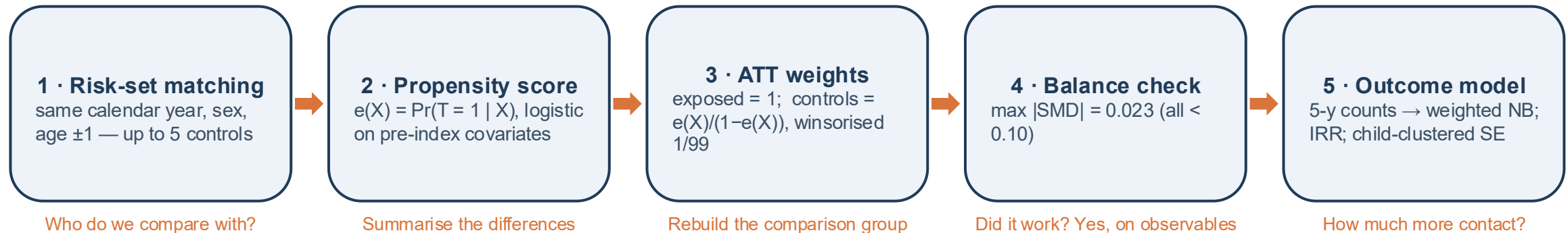
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**Estimand:** among children exposed to parental incarceration, we estimate how later healthcare use differs from similar not-yet-exposed children.

- Estimates are adjusted associations, reported as IRRs and five-year absolute differences.

**From raw registries to the estimate:**



**The outcome model (negative binomial):**

$$E(Y_i|T_i, X_i) = \exp(\alpha + \beta T_i + X_i' \gamma)$$

$$\text{IRR} = \exp(\beta)$$

$Y_i$  healthcare contacts of child  $i$  over the 5 post-index years.

$T_i$  first parental incarceration (1 = exposed, 0 = not-yet-exposed).

$X_i$  pre-index covariates: baseline use (3 y), chronic condition, immigrant background, mother partnered, siblings, income quintile.

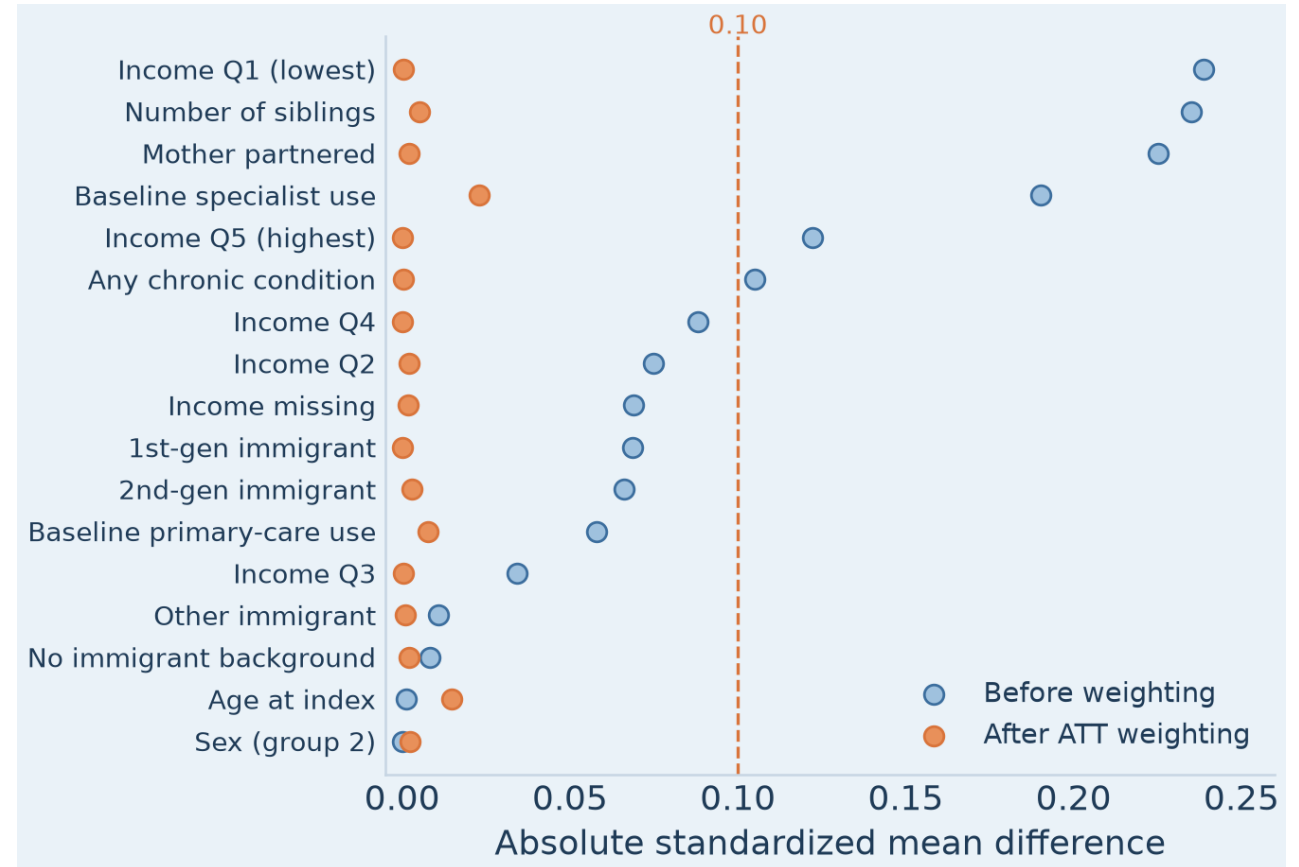
$\beta$   $\exp(\beta)$  = IRR — the rate ratio of contacts, exposed vs comparison; fitted separately per outcome.

**weights** ATT: exposed = 1; controls  $e(X)/(1-e(X))$ .

**SE** cluster-robust at the child level; age, sex, year matched by design.

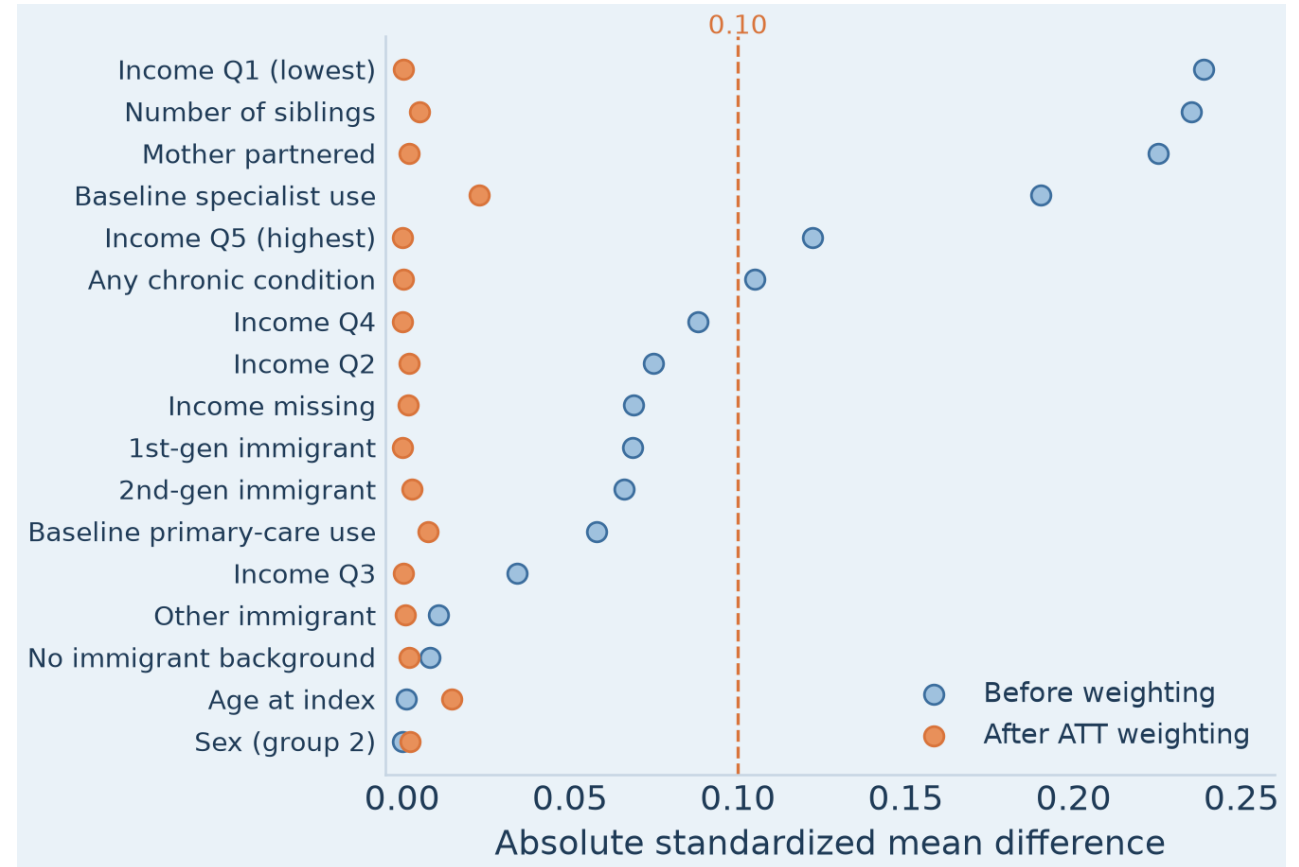
## Comparable groups after weighting

- ▶ Maximum |SMD| after weighting = 0.023; all observed covariates < 0.10.
- ▶ Baseline healthcare use, SES, family structure and demographics are well balanced after weighting.
- ▶ ATT weights keep exposed children at weight = 1; comparison children are reweighted toward the exposed group.



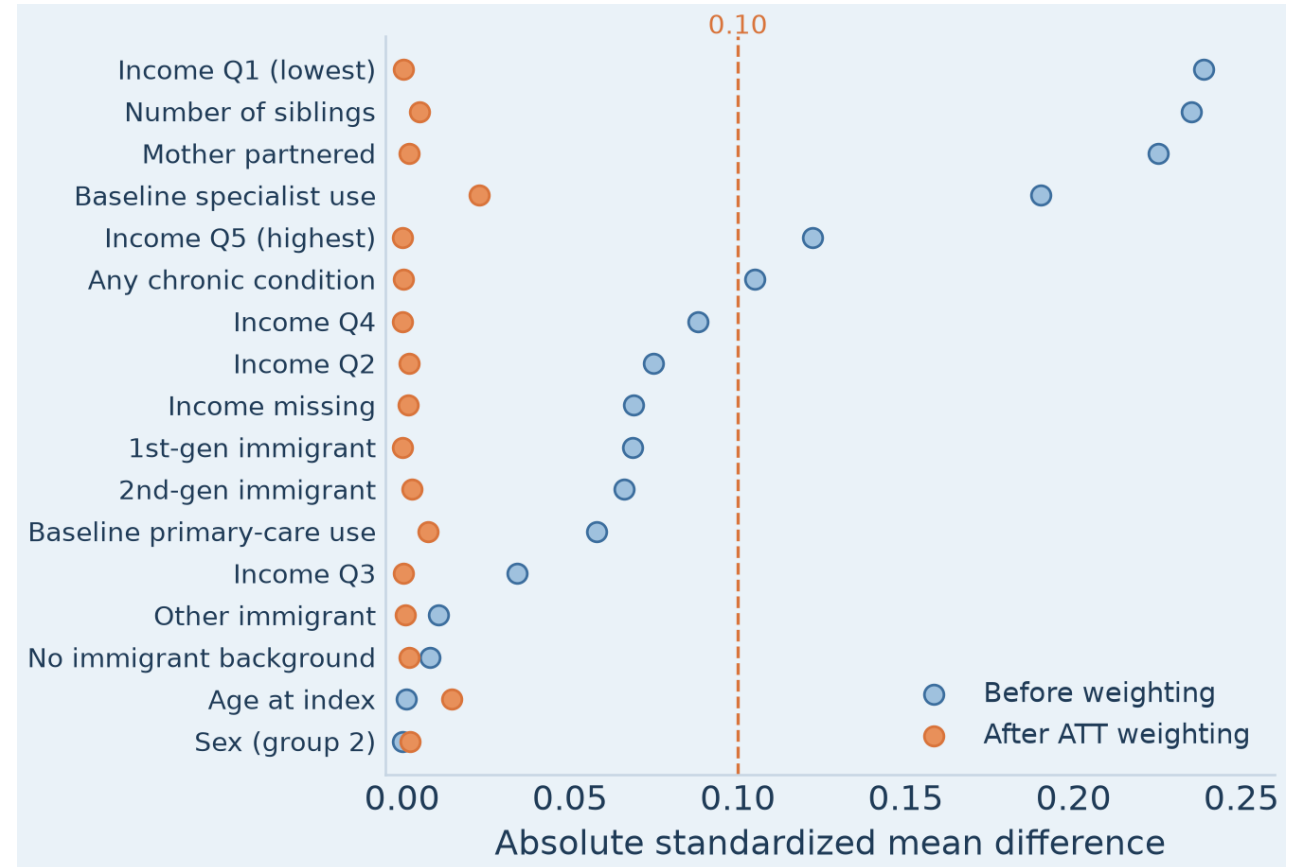
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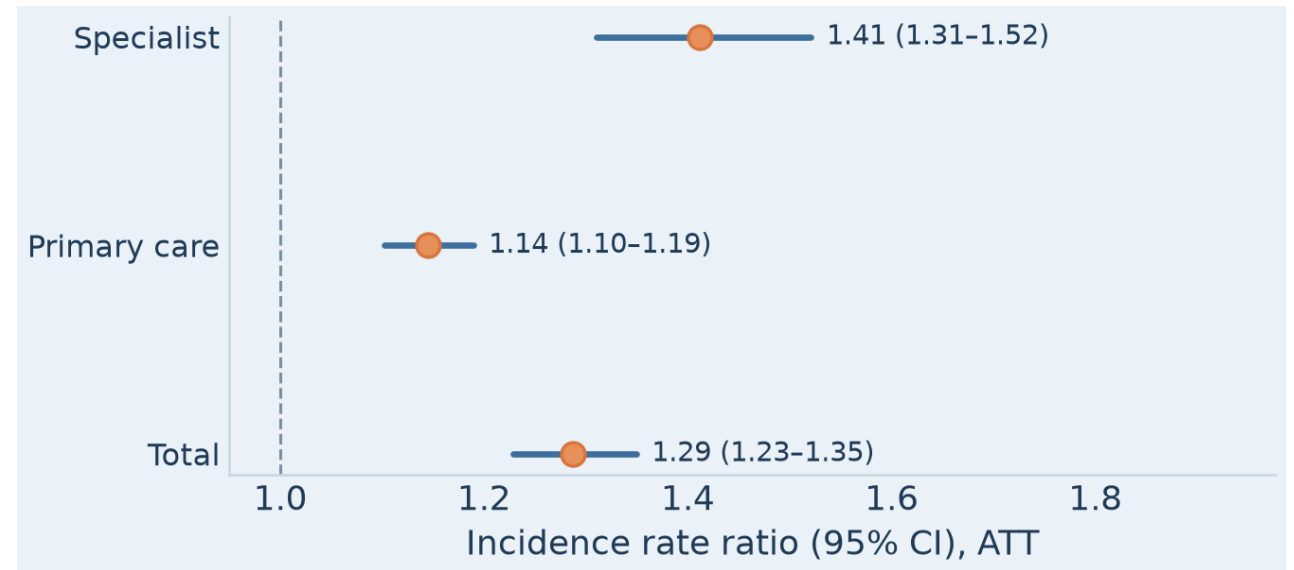
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## Both specialist and primary-care contacts increase

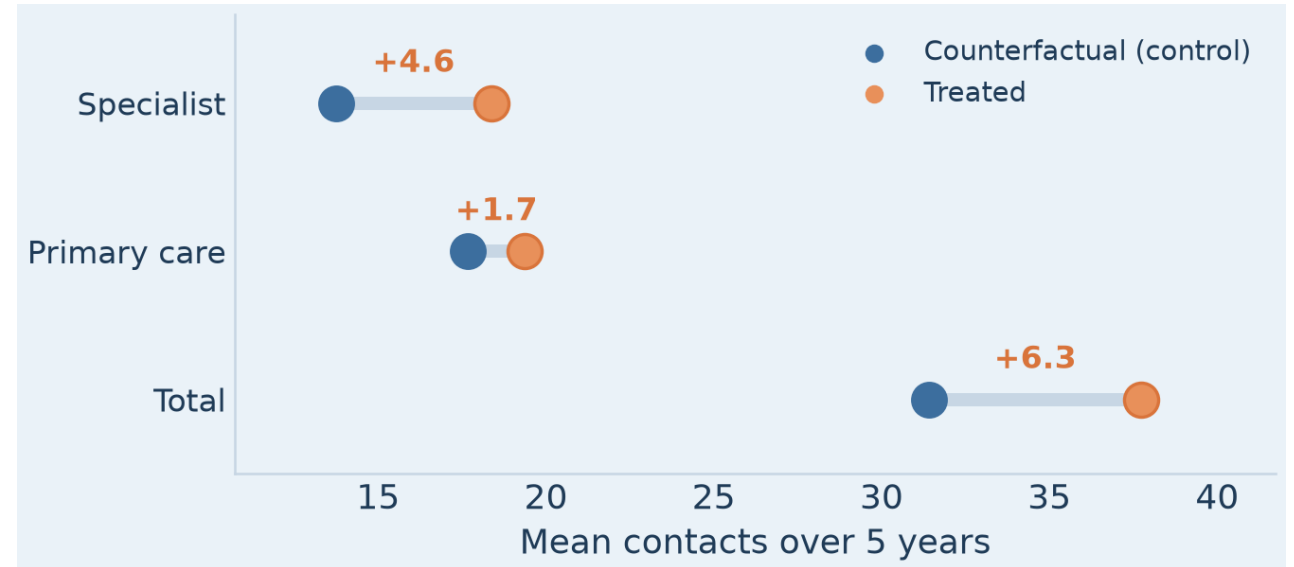
- ▶ Specialist: IRR 1.41 (1.31–1.52)
- ▶ Primary care: IRR 1.14 (1.10–1.19)
- ▶ Total: IRR 1.29 (1.23–1.35)



**Pattern points away from withdrawal** — primary-care contact increases rather than falls.

### How much more care? (5-year totals per exposed child)

- ▶ Specialist: 13.7 → 18.4 (+4.6 visits)
- ▶ Primary care: 17.7 → 19.4 (+1.7 visits)
- ▶ Total: 31.4 → 37.7 (+6.3 visits)



**Per exposed child over five years** — especially large additional specialist-care use.

# Findings do not support simple withdrawal from care

- ▶ We do not observe primary-care withdrawal, both increases.
- ▶ The pattern is consistent with greater need, detection, or referral after parental incarceration.
- ▶ Specialist care rises more strongly, suggesting movement into more intensive care pathways.
- ▶ The consequences of parental incarceration may extend beyond the justice system into children's healthcare trajectories.

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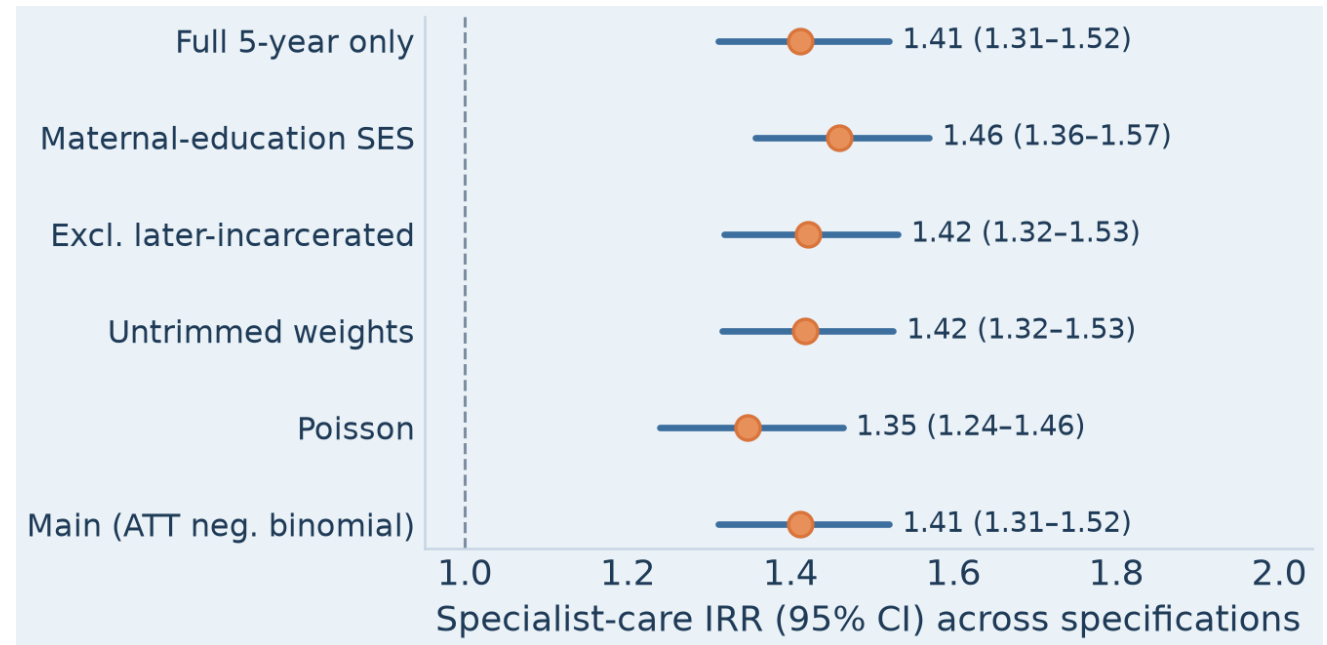
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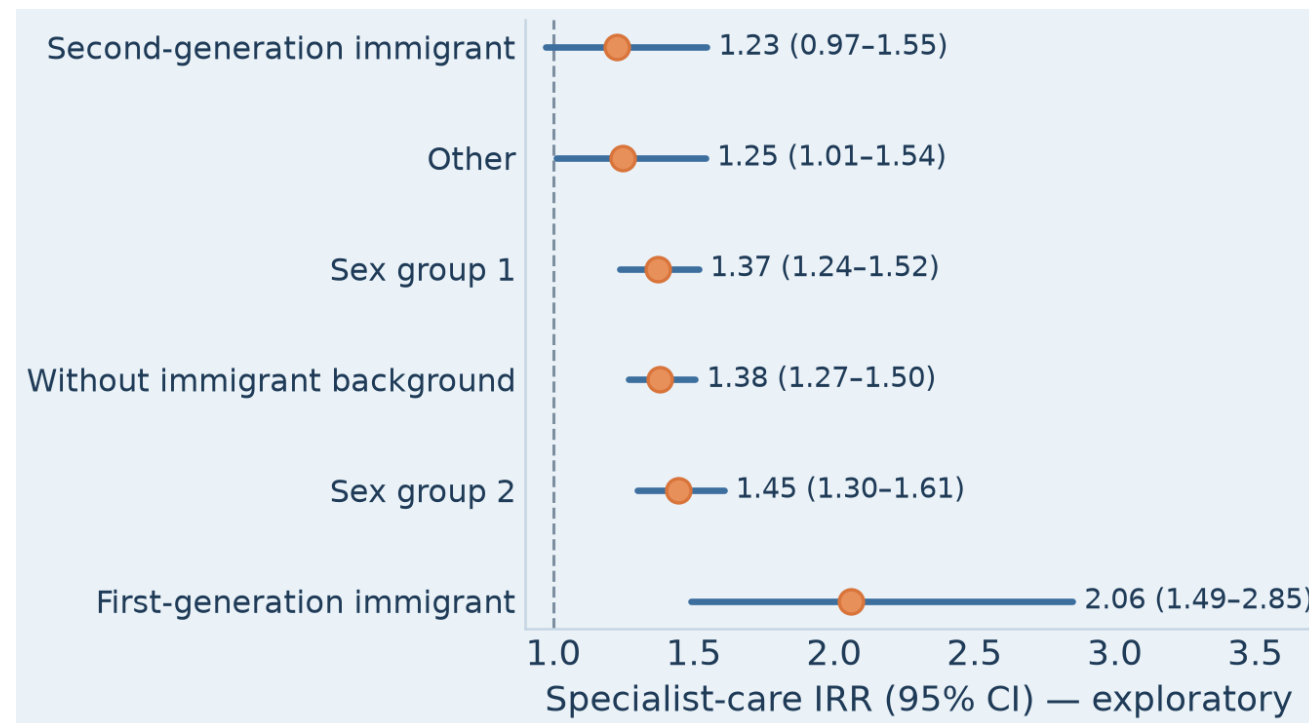
## Specialist-care result is stable across specifications

- ▶ Poisson instead of negative binomial.
- ▶ Untrimmed weights.
- ▶ Excluding controls later exposed to parental incarceration.
- ▶ Maternal-education SES specification.
- ▶ Specialist IRR remains 1.35–1.46; direction unchanged.



### Specialist-care increase across subgroups

- ▶ **Male:** specialist IRR 1.37 (1.24–1.52)
- ▶ **Female:** specialist IRR 1.45 (1.30–1.61)
- ▶ **First-generation immigrant children:** largest estimate, IRR 2.06 (1.49–2.85)



# What we cannot claim

- ▶ **Unmeasured confounding:** parental mental health, substance use, and family conflict are not observed.
- ▶ **Exposure timing:** the family disruption begins before imprisonment (arrest, prosecution), so part of it falls inside our baseline window.  
*This biases our estimates towards zero, not away from it.*
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# Takeaway

- ▶ **What we find:** after a first parental incarceration, children's healthcare contacts rise over five years, *specialist care most*.
- ▶ **What it means:** not withdrawal from care, as the disengagement hypothesis predicted, but a more intensive care trajectory for affected children.
- ▶ **What remains unclear:** whether higher use reflects greater need, earlier detection, or movement through the care pathway. Separating mental from somatic care with ICD-10 diagnoses is our next step.

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# Thank you — questions welcome

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*Preliminary results — please do not cite without contacting the authors.*

# Backup — Main results (full)

| Outcome      | IRR  | 95% CI    | p      | +visits/5y | Treated | ATT-weighted comparison |
|--------------|------|-----------|--------|------------|---------|-------------------------|
| Specialist   | 1.41 | 1.31–1.52 | <0.001 | +4.6       | 18.4    | 13.7                    |
| Primary care | 1.14 | 1.10–1.19 | <0.001 | +1.7       | 19.4    | 17.7                    |
| Total        | 1.29 | 1.23–1.35 | <0.001 | +6.3       | 37.7    | 31.4                    |

N = 26,274 child-index observations (4,379 exposed). ATT-weighted negative binomial; child-clustered robust SE. Max |SMD| = 0.023.

# Backup — Robustness checks by outcome

| Specification                | Specialist       | Primary care     | Total            |
|------------------------------|------------------|------------------|------------------|
| Poisson                      | 1.35 (1.24–1.46) | 1.12 (1.08–1.17) | 1.23 (1.17–1.29) |
| Untrimmed weights            | 1.42 (1.32–1.53) | 1.15 (1.10–1.19) | 1.29 (1.23–1.36) |
| Excl. later-exposed controls | 1.42 (1.32–1.53) | 1.15 (1.10–1.19) | 1.29 (1.23–1.36) |
| Maternal-education SES       | 1.46 (1.36–1.57) | 1.17 (1.13–1.21) | 1.33 (1.27–1.39) |
| Full 5-year only             | 1.41 (1.31–1.52) | 1.14 (1.10–1.19) | 1.29 (1.23–1.35) |

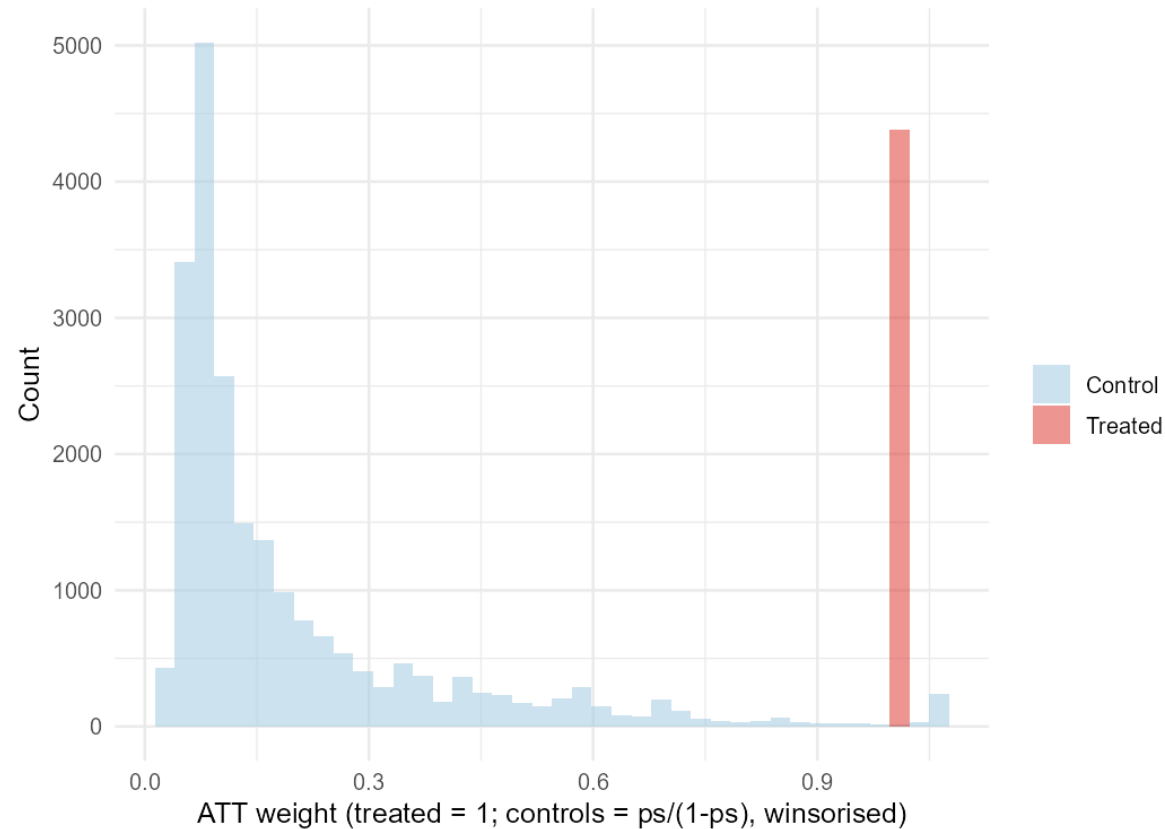
# Backup — Exploratory subgroup results

| Subgroup                     | Specialist       | Primary care     | Total            | N treated |
|------------------------------|------------------|------------------|------------------|-----------|
| Male                         | 1.37 (1.24–1.52) | 1.14 (1.07–1.20) | 1.29 (1.21–1.37) | 2,316     |
| Female                       | 1.45 (1.30–1.61) | 1.15 (1.10–1.21) | 1.29 (1.20–1.38) | 2,063     |
| First-generation immigrant   | 2.06 (1.49–2.85) | 1.29 (1.11–1.51) | 1.67 (1.36–2.05) | 480       |
| Other                        | 1.25 (1.01–1.54) | 1.03 (0.92–1.16) | 1.12 (0.98–1.29) | 488       |
| Second-generation immigrant  | 1.23 (0.97–1.55) | 0.98 (0.86–1.11) | 1.16 (1.00–1.34) | 523       |
| Without immigrant background | 1.38 (1.27–1.50) | 1.17 (1.12–1.22) | 1.28 (1.21–1.35) | 2,888     |

Exploratory; not multiplicity-adjusted. Sex and immigrant background are separate splits. Immigrant background (Statistics Norway categories): First-generation = born abroad to two foreign-born parents; Second-generation = born in Norway to two foreign-born parents; Without = no immigrant background; Other = remaining categories (one foreign-born parent, foreign-born with Norwegian-born parent(s), incl. children adopted from abroad).

# Backup — ATT weight distribution

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ATT weights: treated children have weight = 1; comparison children receive  $ps/(1-ps)$ , winsorised at the 1st/99th percentiles.

# Backup — Covariate balance (full table)

| Covariate                           | SMD before weighting | SMD after ATT weighting |
|-------------------------------------|----------------------|-------------------------|
| Age at index                        | -0.001               | -0.015                  |
| Sex: female (design-matched)        | 0.000                | -0.002                  |
| First-generation immigrant          | -0.069               | 0.000                   |
| Second-generation immigrant         | 0.066                | 0.003                   |
| Other immigrant background          | 0.011                | -0.001                  |
| Without immigrant background        | -0.008               | -0.002                  |
| Any chronic condition (child)       | 0.105                | -0.001                  |
| Baseline specialist contacts (3y)   | 0.190                | 0.023                   |
| Baseline primary-care contacts (3y) | 0.058                | -0.008                  |
| Mother partnered                    | -0.225               | -0.002                  |
| Number of siblings                  | 0.235                | 0.005                   |
| Income quintile 1 (lowest)          | 0.239                | 0.000                   |
| Income quintile 2                   | 0.075                | -0.002                  |
| Income quintile 3                   | -0.034               | 0.000                   |
| Income quintile 4                   | -0.088               | 0.000                   |
| Income quintile 5 (highest)         | -0.122               | 0.000                   |
| Income quintile missing             | -0.069               | 0.002                   |

SMD = standardized mean difference (exposed vs comparison). All  $|SMD| < 0.10$  after weighting; max = 0.023. Sex coding: 1 = male, 2 = female.

# Backup — Covariates: definitions, timing, missingness

| Variable                         | Definition / categories                               | Timing       | Missing              |
|----------------------------------|-------------------------------------------------------|--------------|----------------------|
| Age                              | Years at index (measured at index-1, +1)              | at index     | 0%                   |
| Sex                              | 1 = male, 2 = female (registry coding)                | fixed        | 0%                   |
| Immigrant background             | None / first-gen / second-gen / other                 | pre-index    | 0%                   |
| Chronic condition                | Any chronic condition, child (binary)                 | index-1      | 0%                   |
| Baseline primary care            | KPR contacts, sum of 3 pre-index years                | index-3...-1 | 0%                   |
| Baseline specialist care         | NPR contacts, sum of 3 pre-index years                | index-3...-1 | 0%                   |
| Mother partnered                 | Partnered status of mother (binary)                   | index-1      | 0%                   |
| Number of siblings               | Count, same mother                                    | index-1      | 0%                   |
| SES (main)                       | Household income quintile + explicit missing category | index-1      | 14.4% → own category |
| Maternal education (sensitivity) | Register education; sensitivity analysis only         | index-1      | 70.8%                |

All covariates measured before the index year to avoid adjusting for consequences of the event. Missing income handled as an explicit category, not dropped.

# Backup — Weight diagnostics & sample flow

| Group                | Min   | Median | Max   | ESS    | % winsorised |
|----------------------|-------|--------|-------|--------|--------------|
| Exposed (weight = 1) | 1.000 | 1.000  | 1.000 | 4,379  | —            |
| Comparison           | 0.037 | 0.116  | 1.073 | 10,812 | 1.66         |
| All                  | 0.037 | 0.151  | 1.073 | 12,421 | 1.66         |

| Sample flow                                           | N      |
|-------------------------------------------------------|--------|
| Children with first parental incarceration, 2011–2018 | 4,379  |
| Risk-set rows (exposed + matched controls)            | 26,274 |
| of which controls (up to 5 per exposed child)         | 21,895 |
| With complete 5-year outcome (no loss)                | 26,274 |

ESS = effective sample size. Control weights  $ps/(1-ps)$ , winsorised at the 1st/99th percentiles among controls; treated weights all exactly 1 (ATT). 247 controls (~1%) are later exposed during follow-up; excluding them leaves estimates essentially unchanged.

# Backup — Potential extensions

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## Care content

Mental vs somatic specialist care; emergency vs planned contacts; psychotropic prescriptions.

## Timing

Year-by-year event-study around the index year; referral sequences from primary into specialist care.

## Exposure detail

Maternal vs paternal incarceration; sentence length; repeat episodes (dose-response).

## Robustness

Family-level clustering; sibling comparisons.

# Backup — Methodological justification (cited)

| Decision                                   | Why                                                        | Citation                                      |
|--------------------------------------------|------------------------------------------------------------|-----------------------------------------------|
| Exposure = parental incarceration (an ACE) | Family-level adversity; possible health consequences       | Felitti 1998; Hughes 2017                     |
| Access vs use framing                      | Higher need does not necessarily imply higher use          | Hart 1971; Andersen 1995                      |
| Register design credibility                | Whole-population linkage                                   | Bhuller et al. 2020; Andersen & Wildeman 2014 |
| Confounder selection (pre-index)           | Adjust common causes                                       | VanderWeele 2019; Hernán & Robins 2020        |
| PS + IPTW (ATT)                            | Balance measured confounders                               | Rosenbaum & Rubin 1983; Austin & Stuart 2015  |
| ATT estimand                               | Effect among the exposed                                   | Imbens 2004                                   |
| Negative binomial + cluster SE             | Over-dispersed counts; reused controls                     | Cameron & Trivedi 2013; Cameron & Miller 2015 |
| Income quintile as main SES                | Education has high missingness; income has better coverage | Galobardes 2006                               |

# Backup — References

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