SUPPLEMENTAL MATERIAL.

A small segment of the population with large economic burden: Childhood forecasting

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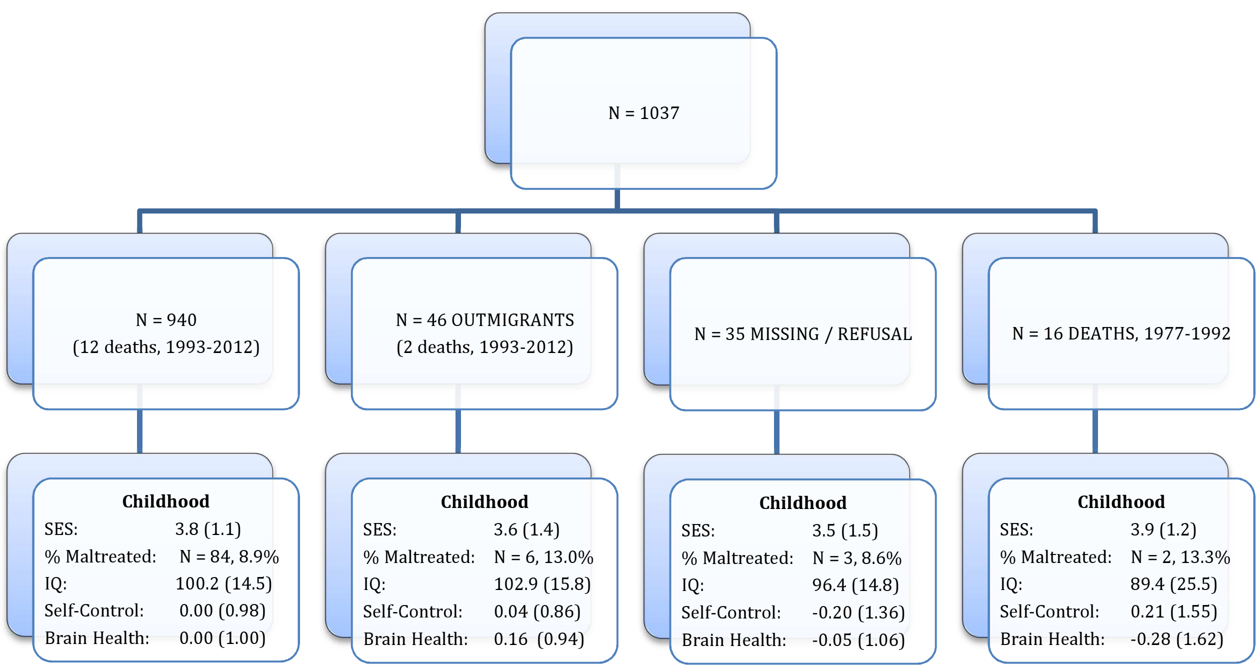
Birth cohort.

Participants are members of the Dunedin Multidisciplinary Health and Development Study, a longitudinal investigation of the health and behavior of a representative birth cohort of consecutive births between April 1972 and March 1973 in Dunedin, New Zealand (Poulton, Moffitt, Silva, 2015). The cohort of 1,037 children (52% boys) was constituted at age 3 as 91% of eligible births resident in the province. The cohort represents the full range of socioeconomic status on NZ's South Island and matches the NZ National Health and Nutrition Survey on adult health indicators (e.g., BMI, smoking, GP visits). Cohort members are primarily white; approximately 7% self-identify as having any non-white ancestry, matching the South Island. Follow-up assessments were conducted at ages 5, 7, 9, 11, 13, 15, 18, 21, 26, 32, and most recently 38, when 95% of the 1,007 living study members underwent assessment in 2010-2012.

This report contains information about 940 of the 1037 cohort members, as shown in the **flowchart**. Informed consent from living Study members was obtained at the age-38 assessment for administrative record searches. 12 Study members died as adults, between ages 21 and 38 years. Following specific Ethics Committee review, deceased Study members were searched if they had consented to the Study gathering data at the assessment phase immediately prior to their death. In addition, their values for smoking, fatherless parenting, and excess weight were used from the last assessment phase in



Socio-economic status (SES) is coded on a 6-point scale; IQ is standardized to M = 100, SD = 15; self-control and brain health are standardized to M = 0, SD = 1 which they took part before their death.

Outmigrants. N = 46 Study members were excluded from this article because they did not reside in New Zealand as adults, from January 1993 through 2012 (i.e., after they turned 21 years old), although these Study members continue to be involved in the Study and participate in all of our assessments. They were excluded from this report because, in theory, they were not eligible for New Zealand government support during this exposure period (although, in practice, some did receive support; for example, there were exceptions such as compensation for an accident sustained while visiting family in New Zealand). These individuals are noted as 'outmigrants' on the flowchart. They did not differ significantly from Study members included in this report on childhood socio-economic background (t = 0.80, p = 0.43), exposure to childhood maltreatment (t = -0.93, p = 0.35), childhood IQ (t = -1.18, p = 0.24), childhood self-control (t = -0.25, p = 0.80), or age-3 brain health (t = -1.06, p = 0.29).

Missing/refusal. N = 35 Study members were excluded because they were long-term missing to the Study or because they did not provide consent for administrative record searches at the age-38 assessment. Although they had slightly lower childhood IQ and self-control scores, they did not differ significantly from Study members included in this report on childhood socio-economic background (t = 0.85, p = 0.40), exposure to childhood maltreatment (t = 1.22, p = 0.22), childhood IQ (t = 1.19, p = 0.24), childhood self-control (t = 0.85, p = 0.40), or age-3 brain health (t = 0.27, p = 0.79).

Deceased. N = 16 Study members were excluded from this report because they died before January 1993 (before reaching adulthood). These Study members had non-significantly lower childhood IQ scores (t = 1.52, p = 0.15) and did not differ significantly from included Study members on childhood socio-economic background (t = -0.59, p = 0.55), exposure to childhood maltreatment (t = 0.30, p = 0.76), childhood self-control (t = -0.54, p = 0.60), or age-3 brain health (t = 0.70, p = 0.50).

Measuring economic-burden outcomes.

We drew on personal interviews and on New Zealand's multiple nationwide administrative data bases to ascertain the cumulative distributions of economically burdensome outcomes in eight social and health sectors.

Matching to administrative data bases was completed following the end of the age-38 assessment, with an end date of March 31, 2012. Matching was completed by a senior Unit staff member working onsite at each agency, alongside dedicated agency staff who guided us through agency-specific processes. Because the Dunedin Study has archived so much information about Study participants, it was possible to carefully evaluate and resolve any uncertain matches. And because the sample size is under 1000, we were able to give individual attention to every match. All match processes stipulated that no identifying information was retained by the matching agency and all Study member data were deleted at the end of the match process (that is, agencies did not retain Study data).

Social welfare benefit months. We obtained information about social welfare from the New Zealand Ministry of Social Development (MSD). Matching was done on full names, date of birth, gender, and residential location history. The match was supervised by Unit staff and a senior analyst at MSD. A range of tools was available to the Unit staff to resolve any partial or uncertain matches, including a full history of all previous addresses for Study members, a history of any name changes, and detailed month-by-month information about household composition (marital status, cohabitation, children) from Life History Calendars collected at each data-collection phase of the Dunedin Study. As part of the search process, several persons were identified with multiple Social Welfare Numbers (SWN) and the analyst linked these cases to ensure that all relevant information was captured. Together this process resulted in a SWN list which connected Study members to MSD benefit data. Data on welfare benefit receipt were available from January 1993, with this date marking the beginning of reliable electronic data capture of welfare benefits. We obtained information about incident spells and duration of the following New Zealand government benefits: Unemployment Benefit, Invalids Benefit, Sickness and Emergency Benefits, Domestic Purposes Benefit-Sole Parent and Emergency Maintenance Allowance, Training Benefit, Emergency Benefit (for those who do not usually meet entitlement conditions). Only one benefit can be received at any given time. The cohort accumulated 24,997 months of welfare payments between January 1993 and March 2012. The cumulative distribution of benefit months revealed that 20% of the cohort accounted for 80% of the months of social welfare benefits received in the cohort. Males (48%) and females (52%) were equally represented in the high-cost social welfare sector, χ^2 (940, 1) = 1.58, p = 0.21. These individuals constituted a high-cost group in the social-welfare sector.

Fatherless child-years (defined by the absence of the biological father from the households in which a cohort member's offspring live). Using Life History Calendars (Caspi et al. 1996), we recorded information about childbirths and living arrangements of all cohort members' offspring (until each reached age 18 years). In the cohort, 669 parents produced 1,418 live births. These offspring lived a total of 10,946 child-years of which 25% (2,755 child-years) were spent in households without their biological fathers. 20% of the cohort accounted for 82% of their offsprings' fatherless years. Males (63%) were over-represented in the high-cost fatherless-children sector, χ^2 (940, 1) = 7.55, p = 0.006. These individuals constituted a high-cost group in the fatherless-children sector.

Tobacco smoking pack-years. In repeated personal interviews, we gathered details about tobacco smoking and calculated the number of pack-years smoked, where pack-years = (number of cigarettes smoked per day × number of years smoked) / 20); one pack-year = 7,305 cigarettes. The cohort smoked 5,760 pack-years, the equivalent of 42,076,800 cigarettes. 20% of the cohort accounted for 68% of the pack-years smoked by the cohort. Males (58%) and females (42%) were equally represented in the smoking sector, χ^2 (940, 1) = 3.71, p = 0.054. These individuals constituted a high-cost group in the smoking sector.

Excess obese kilograms. We measured height and weight during anthropometric assessments at the age 38 assessment. By early midlife, the cohort had put on 2,924 kilograms of excess weight, defined as the total number of kilograms beyond a BMI > 30, the recognized cut-off for obesity; thus, a person with a BMI <= 30 carries 0 excess obese kilograms whereas the excess weight of a person with a BMI > 30 is their actual weight minus the weight predicted for a BMI = 30 based on their height. 20% of the cohort accounted for 98% of excess obese kilograms in the cohort. Males (46%) and females (54%) were equally represented in the excess weight sector, χ^2 (940, 1) = 3.05, p = 0.08. These individuals constituted a high-cost group in the excess weight sector.

Hospital bed-nights. Health data (including hospital, prescription, and accident and injury data) were collected via a National Health Identifier (NHI). The NHI number is a unique code of seven letters and numbers that is assigned to every person who accesses health-related support in New Zealand. The system was instigated in 1993, but was back-loaded with information from pre-existing systems. Matching was done on full names, date of birth, gender, and address. The match was supervised by Unit staff and senior analysts at relevant agencies (e.g., Ministry of Health, ACC). A range of tools was available to the Unit staff to resolve any partial or uncertain matches, including a full history of all previous addresses for Study members and a history of any name changes. We obtained details of admission events to public hospitals from Ministry of Health records. We did not include information about admission events to private hospitals because data from private hospitals in New Zealand tend to be incomplete due to the voluntary nature of returns, and these are much less complete than public hospital data. We do not think this has a pronounced influence on our data, as estimates suggest that approximately 5% of New Zealand hospitalizations are in private hospitals, and most of these are for elective surgeries and are thus less relevant to concerns about the distribution of illnesses and injuries (Baker et al. 2012). The cohort accumulated 8,958 bed-nights in the hospital from January 1988 onwards. 20% of the cohort accounted for 77% of hospital bed-nights in the cohort. Females (71%) were over-represented in the high-cost hospital-stay sector, χ^2 (940, 1) = 49.02, p < 0.001. These individuals constituted a high-cost group in the hospital stay sector.

Prescription drug-fills. We obtained information about prescription drugs filled by pharmacists, from the Pharmaceutical Management Agency (PHARMAC) database. PHARMAC is the New Zealand Crown agency that selects and purchases, on behalf of District Health Boards, medicines and related products that are subsidized for use in the community. This is an accounting database which represents a record of requests from pharmacists for payment of subsidies associated with prescriptions. We note two caveats. First, only medications on the PHARMAC subsidized list can be claimed. Any medications dispensed that are not on the list (all common medications are on the list) will not show in the data, but all medications subsidized by government will be captured. Second, prior to 2005, it was acceptable for pharmacists to submit valid claims without completing the box containing NHI numbers. Claims without NHI numbers may be lost as this is what our search system matches upon. For this reason, we focused our analysis on claims following 2006. From this time period onwards, the cohort filled 66,811 prescriptions. 20% of the cohort accounted for 89% of prescriptions. Females (63%) were over-represented in the high-cost prescription fill sector, χ^2 (940, 1) = 19.14, $p < 0.001$. These individuals constituted a high-cost group in the prescription-fill sector.

Injury insurance-claims. We obtained records of insurance claims for accidents and injuries from the Accident Compensation Corporation (ACC), the sole national provider of comprehensive, no-fault personal injury cover for New Zealanders. Anyone who has suffered an injury, regardless of how it occurred, is eligible for coverage. ACC pays for much of the emergency provision in hospitals, all or some of the costs of immediate care and of rehabilitation, and costs to the person associated with income maintenance or life adaptations. The cohort made 6,919 claims between January 1993 and March 2012. The concentration was not as pronounced for this outcome as for others, perhaps owing to the random nature of many accidents and injuries. Nevertheless, 20% of the cohort accounted for 52% of injury claims in the cohort. Males (74%) were over-represented in the high-cost injury claim sector, χ^2 (940, 1) = 49.67, $p < 0.001$. These individuals constituted a high-cost group in the injury-claim sector.

Convictions for crime. We obtained information about criminal convictions by searching records available to the New Zealand Police containing details of all New Zealand convictions and Australian convictions communicated to New Zealand Police. Police records for the cohort have been searched repeatedly at every data collection phase since age 13 years. Multiple data gathering with multiple checks and balances over time gives outstanding coverage (e.g., subsequently expunged offenses remain in our database). Matching was manually carried out by a team of New Zealand Police data clerks who checked full names, date of birth, gender, and addresses against any record in the Police database. The output from this process contains details about the offender (e.g., current employment, height), offense, and disposal. A range of tools was available to the Unit staff to resolve any partial or uncertain matches, including a full history of all previous addresses for Study members, a history of any name changes, employment status, physical details (e.g., height), and previous convictions. The cohort had 2,141 convictions for adult crimes (excluding routine traffic offenses), beginning at age 15. Convictions included property (e.g., theft of property of value greater than $500, receipt of stolen property, burglary, breaking and entering, shoplifting, credit car theft), court-order violations (e.g., obstructing or resisting police, breaching parole, escaping prison, misleading welfare officer, failing to pay fines, failing to answer summons), drugs (e.g., possessing drug paraphernalia, supplying or procuring hard drugs or prescription medications, selling cannabis), and violence (e.g., aggravated cruelty to animal, common assault, assault with intent to injure with weapon, assault of police officer, robbery, robbery aggravated with firearm, manslaughter, rape, common assault domestic). The concentration was pronounced for this outcome: 20% of the cohort accounted for 97% of convictions in the cohort. Males (76%) were over-represented in the high-cost crime sector, χ^2 (940, 1) = 80.61, $p < 0.001$. These individuals constituted a high-cost group in the crime sector.

Childhood risk factors.

Throughout the cohort's childhood, during the first decade of life, we measured risk factors that are thought to augur poor adult outcomes, including growing up in a socioeconomically deprived family, exposure to maltreatment, low IQ, and poor self-control. We elected to study these risk factors because they are proven predictors of adult health and social outcomes and are high-priority targets in many contemporary early-years intervention programs. All risk factor measures have been described in previous reports about this cohort.

Childhood socioeconomic status (Poulton et al. 2002). Childhood social class was defined as the average of the highest occupational status level of either parent across study assessments from the Study member's birth through 11 years (1=unskilled laborer; 6=professional), on New Zealand's occupational rating of the 1970's (Elley & Irving, 1976).

Childhood maltreatment (Caspi et al., 2002). Exposure to maltreatment includes evidence of (1) maternal rejection assessed at age 3 years by observational ratings of mothers' interaction with the study children, (2) harsh discipline assessed at ages 7 and 9 years by parental report of disciplinary behaviors, (3) 2 or more changes in the child's primary caregiver, and (4) physical abuse and (5) sexual abuse reported by study members once they reached adulthood. For each child, our cumulative index counts the number of maltreatment indicators during the first decade of life; 63.7% of children experienced no maltreatment, 26.7% experienced 1 indicator of maltreatment (hereinafter "probable" maltreatment), and 9.6% experienced 2 or more indicators of maltreatment ("definite" maltreatment).

Childhood intelligence (IQ) (Moffitt et al. 2011). The Wechsler Intelligence Scale for Children – Revised (WISC-R) (Wechsler, 1974) was individually administered at ages 7, 9, and 11 years. IQ scores for the three ages were averaged and standardized.

Childhood self-control (Moffitt et al., 2011). Children's self-control during their first decade of life was measured using nine measures of self-control: observational ratings of children's lack of control (ages 3 and 5 years) and parent, teacher, and self-reports of hyperactivity, lack of persistence, inattention, impulsive aggression and impulsivity (ages 5, 7, 9, and 11 years). The nine measures were positively and significantly correlated. Based on principal components analysis, the standardized measures were averaged into a single composite comprising multiple ages and informants, with strong internal reliability $\alpha = 0.86$.

Age-3 brain health.

At age 3 years, each child in the cohort participated in a 45-minute examination that included assessments of neurological soft signs, intelligence, receptive language, and motor skills, and afterwards the examiners (having no prior knowledge of the child) rated each child's behavior (all described in the Table below). Using this information, we created a summary factor score via confirmatory factor analysis which we termed brain health, a global index of the child's early neurocognitive status (Caspi et al., 2014). The model fit the data well, χ^2(N = 1035, df = 5) = 6.459, p = .2641, CFI = .999, TLI = .997, RMSEA = .017. Factor scores were output and standardized to a Mean = 0 and SD= 1.

Measure / Test	Description
Neurologic soft signs	At age three years, each child was examined by a pediatric neurologist for neurologic signs, including assessment of motility, passive movements, reflexes, facial musculature, strabismus, nystagmus, foot posture, and gait, based on procedures described by Touwen and Prechtl (1970).
Peabody Picture Vocabulary Test	Intelligence was assessed at age three with the Peabody Picture Vocabulary test (Dunn, 1995).
Receptive Language	Receptive language was assessed at age three using the Reynell Developmental Language Scales (Reynell, 1969).
Motor Development	Motor development was assessed at age three years with the Bailey Motor Scales (Bayley, 1969).
Lack of Control	Following the testing, each examiner rated the child's lack of control in the testing session, yielding a behavioral style factor, labeled Lack of Control (Caspi et al., 1995), which characterized children who at age three years were labile, had low frustration tolerance, lacked reserve, were resistant, restless, impulsive, required attention, and lacked persistence in reaching goals.

Data analysis.

Cumulative distributions. We began our work by examining the cumulative distributions of each of the eight outcomes (**Figure 1**, main article). Using these distributions, we operationally defined a high-cost group in each sector as 20% of the cohort members who accounted for a disproportionate share of economically burdensome outcomes in that sector.

Childhood prediction. We tested associations between childhood risk factors and growing up to be a member of a high-cost group using a logit model:

$$\Pr(y_i = 1|\mathbf{x}_i) = \frac{\exp(\mathbf{x}_i\boldsymbol{\beta})}{1 + \exp(\mathbf{x}_i\boldsymbol{\beta})}$$

where y_i = 1 is membership in a high-cost group and x_i are childhood risk factors. We used modified Poisson regression models to estimate robust standard errors and risk ratios (RR) (Zou, 2004). We present bivariate associations between each childhood risk factor and the outcome as well as multivariate associations between all childhood risk factors, estimated simultaneously, and the outcome (**Table 1: Panel A,** main article).

We then added up (0-8) the number of high-cost groups to which each individual belonged. Of the 940 cohort members, 284 (30%) belonged to 0 groups, 252 (27%) belonged to 1 group, 197 (21%) to 2 groups, 72 (7%) to 3, 63 (7%) to 4, 44 (5%) to 5, 18 (2%) to 6, 9 (1%) to 7, and 1 (<1%) to 8. We used Negative Binomial regressions to model incident rate ratios (IRR). We present bivariate associations between each childhood risk factor and this count outcome as well as multivariate associations between all childhood risk factors, estimated simultaneously, and the count outcome (**Table1: Panel B**, main article). Using logit models, we followed up this analysis to test associations between childhood risk factors and membership in the multiple-high-cost sector. We estimated robust standard errors and risk ratios (RR) via a modified Poisson regression model (Zou, 2004). We present bivariate associations between each childhood risk factor and membership in the multiple-high-cost group as well as multivariate associations between all childhood risk factors, estimated simultaneously, and membership in the multiple-high-cost group (**Table 1: Panel C,** main article).

All models included sex as a covariate. Time living outside New Zealand (in months) was added as a covariate in analyses that use New Zealand administrative data. The influence of these covariates on findings is discussed in detail under the section, 'Sensitivity analyses' (see below).

ROC curve analysis. We evaluated predictive accuracy using receiver operating characteristic (ROC) curve analysis to estimate each individual's probability of belonging to a high-cost group in society based on their childhood risks. A ROC curve plots the sensitivity and specificity at various thresholds and yields a metric indexing predictive accuracy: the Area Under the Curve. The Area Under the Curve reflects the probability of correctly classifying any randomly selected pair of cohort members in which one study member belongs to a high-cost group and the other does not. It can take on any value between 0.50 (indicating chance prediction) and 1.00 (indicating perfect prediction). Some pundits grade the values as excellent (0.9 - 1.0), good (0.8 - 0.9), fair (0.7 - 0.8), poor (0.6 - 0.7), and worthless (0.5 - 0.6). Behavioral scientists note that the values of 0.56, 0.64, and 0.71 correspond to Cohen's *d* values of 0.20, 0.50, and 0.80, which are regarded as small, medium, and large effects, respectively (Rice and Harris, 2005). Using the standards of medical research, values approaching 0.8 suggest adequate discrimination for use as a diagnostic tool (Hosmer & Lemeshow, 2004). We present AUCs from bivariate models and multivariate models.

Sensitivity analyses.

Sensitivity analysis 1: Findings were robust to sex differences. Readers will note that, as shown in **Figure 1** of the main article, we defined high-cost groups collapsed across females and males in the cohort using cohort-wide cumulative distributions of economically-burdensome outcomes. Using this definition, we see that males were overrepresented in the high-cost fatherless children, injury claims, and crime sectors and women were overrepresented in the high-cost hospital stays and prescription fills sectors. Nonetheless, there was no significant sex difference in the number of high-cost groups to which females and males belonged.

	Proportion of male and female Study members in the 20% of the cohort who account for disproportionate burden in each sector			
Economically burdensome sector	% Female	% Male	X^2 test of sex difference	p-value
Social welfare	52.4	47.6	1.577	0.209
Fatherless children	37.3	62.7	7.551	0.006
Smoking	42.0	58.0	3.708	0.054
Excess weight	54.0	45.0	3.051	0.081
Hospital stays	71.4	28.7	49.022	< 0.001
Prescription fills	62.7	37.3	19.140	< 0.001
Injury claims	25.8	74.2	49.667	< 0.001
Crime	24.3	75.7	80.610	< 0.001
Number of High-Cost Sectors			**3.327**	**0.344**
0	**52.5**	**47.5**		
1	**48.0**	**52.0**		
2	**44.7**	**55.3**		
3+	**46.4**	**53.6**		

An alternative way to define a high-cost group is to use sex-specific cumulative distributions to identify 20% of women and 20% of men, respectively, who accounted for a disproportionate share of economic burden in each sector. **Supplemental Figure 1** shows the cumulative distribution functions for economically burdensome outcomes in each of the 8 sectors.

Whether we define high-cost groups using cohort-wide or sex-specific distributions does not affect our results. As the next table shows, the cohort-wide high-cost groups and the sex-specific high-cost groups overlap considerably, $\hat{\kappa}_w$= 0.79, 95% CI = (0.77, 0.82).

	Sex-Specific			
Cohort Wide	**0**	**1**	**2**	**3+**
0	26.7%	3.4%	0.1%	0.0%
1	5.4%	18.0%	3.3%	0.1%
2	1.0%	5.6%	11.6%	2.8%
3+	0.0%	0.4%	2.7%	18.9%

Not surprisingly, the results of our prediction analyses are very similar and robust to cohort-wide vs. sex-specific definitions of high-cost. In **Supplemental Tables 1B and**

2B we show the results of our analyses when we use sex-specific cumulative distributions to identify the 20% of males and females who accounted for a disproportionate share in each sector. These results can be compared to the results using cohort-wide cumulative distributions to define high-cost groups, which are shown in Supplemental Tables 1A and 2A (as well as in the main body of the article (**Table 1**, main article). They are very similar.

To evaluate possible sex differences, we re-estimated the prediction results for females and males, separately. Sex-specific results are shown in **Supplemental Tables 1C,D** and **2C,D.** The results document similarity in the predictability of economically-burdensome behavior across the two sexes.

<u>Sensitivity analysis 2: Findings were robust to months spent living outside New Zealand</u>. Our analyses excluded Study members who never lived in New Zealand as adults (operationally defined here as from January 1993 [the year Dunedin Study members turned 21] onwards). Nonetheless, some Study members spent shorter periods of time living outside New Zealand. During these shorter periods, these Study members were outside the New Zealand net of health and social services (e.g., they could not fill prescriptions in New Zealand; in theory, they could not receive welfare benefits from the Ministry of Social Development, etc.). On the one hand, one might argue that during these shorter periods, Study members did not 'cost' their nation anything, and we should not seek to control for the months that they were out of the country. On the other hand, one might argue that we should seek to control for the months they were out of the country because failure to do so underestimates the 'liability' that they represent. In the main body of the article (**Table 1**, main article), we present results controlling for duration of time they were out of the country when we analyze administrative data (but not when we analyze fatherless child-years, tobacco smoking pack-years, and excess kilograms, which we assessed in visits to the Research Unit). In **Supplemental Table 3** we compare the results when we control for duration of time in New Zealand to results when we do not control for this covariate. The results are very similar.

<u>Sensitivity analysis 3: Findings were robust to the method of classifying Study members as belonging to multiple high-cost groups</u>. In the main article, for our analysis of multiple high-cost groups, we simply counted up the number of high-cost groups to which each individual Study participant belonged, and analyzed the count variable. In addition, to check against a different classification approach, we also performed a Latent Class Analysis (LCA). LCA is person-centered approach that classifies individuals into groups or classes based on a profile of variables, in this case membership in the 8 high-cost social, health, and legal sectors. LCA was conducted in MPlus v7.4. To determine the best fitting models, we examined fit statistics for 2 to 5 groups (see next table). The Lo-Mendell-Rubin Adjusted Likelihood Ratio Test and the entropy values indicated that the 2-class solution provided the most parsimonious and best fitting model. Overall, the model fit well: Log likelihood = -3500.07; AIC = 7034.14; BIC = 7116.52; Entropy = 0.81; Lo-Mendell-Rubin Adjusted Likelihood Ratio Test for 2 vs. 3 classes = 83.06, $p < 0.06$.

No. of classes	Loglikelihood	AIC	BIC	Likelihood Ratio χ^2 Estimate	df	p-value	Entropy	Lo-Mendell-Rubin Adjusted Likelihood Ratio Test Estimate	p-value
2	-3500.07	7034.14	7116.52	385.66	238	0.000	0.81	493.77	0.00
3	-3457.87	6967.73	7093.72	301.25	229	0.000	0.60	83.06	0.06
4	-3439.08	6948.15	7117.76	263.67	220	0.023	0.63	36.98	0.26
5	-3425.02	6938.04	7151.25	235.56	211	0.118	0.71	27.67	0.33

The majority of Study members (N=783) were classified in a “low-cost” group. Study members in this group belonged to an average of 1 high-cost group. A minority of Study members (N=157) were classified in a second group whose members belonged to an average of 4.5 high-cost groups. Individuals in this “multiple high-cost” group were more likely to belong to each of the 8 high-cost groups, and this difference was significant for all sectors except the excess weight group.

	Group 1 (N = 783) Mean (SD)	Group 2 (N = 157) Mean (SD)		
Number of High Cost Groups	1.02 (0.95)	4.54 (1.12)		
Range of High Cost Groups	0 - 4	3 - 8		
	% High Cost	% High Cost	RR	95% CI
Social welfare	7.7%	79.6%	10.39	(8.05, 13.42)
Fatherless children	5.6%	57.3%	10.20	(7.43, 14.01)
Smoking	10.6%	66.9%	6.31	(5.01, 7.95)
Excess weight	19.0%	24.2%	1.27	(0.93, 1.74)
Hospital stays	13.0%	52.9%	4.06	(3.21, 5.13)
Prescription fills	12.6%	54.8%	4.33	(3.43, 5.47)
Injury claims	16.1%	43.3%	2.69	(2.12, 3.42)
Crime	17.6%	74.5%	4.23	(3.54, 5.05)

The overlap between this two-group latent class solution and the count of high-cost groups presented in the main article was substantial. All 157 study members who were classified by the latent class analysis as belonging in the multiple-high cost group had been originally identified as belonging to 3 or more high cost groups in our count analysis.

Supplemental Table 4 shows that these two groups could be reliably discriminated on the basis of childhood risk factors, including age-3 brain health. Prediction of membership in the multiple high-cost group vs. low-cost group mirrored results presented in the main article.

Data sharing.

Data for this article were previously collected from study cohort members prior to 2012. The consent form at the last contact with these participants did not address the broad sharing of participants' data, nor the risks associated with broad sharing of these data. Because the population is small and participants' date of birth and location are well known, and because of the lack of information in the consent form, the IRB/ethics committee concluded that it is not appropriate to share these individual-level data collected from existing specimens through any NIH-designated repository or other unrestricted open-access method. Pursuing a re-consent process for these participants is not a viable option due to the time lapse between acquiring the samples and generating the data, and because the participants include members of vulnerable populations (such as, but not limited to, individuals with low cognitive ability, prison inmates, individuals with severe mental illness, pregnant women). At future waves of the Study research participants will be invited to sign a consent form that is consistent with the expectation of broad data sharing, after risks of re-identification are explained to each participant face to face. The Study has operated a successful managed-access data sharing policy for over two decades. Other investigators may contact the principal investigator if interested in collaborating on a project that requires use of the individual-level data.

Access requirements in a nutshell. Proposed data-analysis projects from qualified scientists must have a concept paper describing the purpose of data access, IRB approval at the applicants' university, and provision for secure data access. We offer secure access on the Duke and Otago campuses.

All scripts and analysis files for Dunedin Study published papers are available.

Our data-sharing policy was last approved in 2015 by NIA as part of review of Dunedin Study competing-renewal funding.

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Supplemental Table 1. Childhood predictors of the number of high-cost groups (ranging from 0-8) to which each cohort member belonged. **Panel A** shows results for the cohort-wide classification of high-cost groupings. These results are also shown in the main article (Table 1). **Panel B** shows results for the sex-specific classification of high-cost groupings. **Panel C** shows results for females only. **Panel D** shows results for males only.

	Univariate Models			Multivariate Models		
A. Cohort-Wide Groupings	IRR	IRR 95% CI	p-value	IRR	IRR 95%CI	p-value
Number of High Cost Sectors						
Childhood Low SES	**1.33**	**(1.25, 1.42)**	**< 0.01**	**1.21**	**(1.13, 1.29)**	**< 0.01**
Child Maltreatment	**1.23**	**(1.17, 1.30)**	**< 0.01**	**1.13**	**(1.07, 1.20)**	**< 0.01**
Childhood Low IQ	**1.26**	**(1.18, 1.34)**	**< 0.01**	1.05	(0.98, 1.13)	0.16
Childhood Low Self-Control	**1.32**	**(1.25, 1.40)**	**< 0.01**	**1.18**	**(1.11, 1.26)**	**< 0.01**
Age 3 Brain Health	**1.20**	**(1.13, 1.27)**	**< 0.01**			
B. Sex-Specific Groupings						
Number of High Cost Sectors						
Childhood Low SES	**1.32**	**(1.23, 1.42)**	**< 0.01**	**1.18**	**(1.10, 1.27)**	**< 0.01**
Child Maltreatment	**1.25**	**(1.18, 1.33)**	**< 0.01**	**1.15**	**(1.09, 1.23)**	**< 0.01**
Childhood Low IQ	**1.28**	**(1.20, 1.37)**	**< 0.01**	1.07	(0.99, 1.16)	0.07
Childhood Low Self-Control	**1.34**	**(1.26, 1.42)**	**< 0.01**	**1.19**	**(1.11, 1.28)**	**< 0.01**
Age 3 Brain Health	**1.20**	**(1.12, 1.28)**	**< 0.01**			
C. Females						
Number of High Cost Sectors						
Childhood Low SES	**1.37**	**(1.24, 1.51)**	**< 0.01**	**1.25**	**(1.12, 1.38)**	**< 0.01**
Child Maltreatment	**1.23**	**(1.14, 1.35)**	**< 0.01**	**1.14**	**(1.05, 1.24)**	**< 0.01**
Childhood Low IQ	**1.23**	**(1.12, 1.36)**	**< 0.01**	1.04	(0.93, 1.16)	0.47
Childhood Low Self-Control	**1.35**	**(1.22, 1.49)**	**< 0.01**	**1.19**	**(1.06, 1.33)**	**< 0.01**
Age 3 Brain Health	**1.18**	**(1.07, 1.30)**	**< 0.01**			
D. Males						
Number of High Cost Sectors						
Childhood Low SES	**1.30**	**(1.19, 1.42)**	**< 0.01**	**1.17**	**(1.07, 1.28)**	**< 0.01**
Child Maltreatment	**1.23**	**(1.13, 1.32)**	**< 0.01**	**1.11**	**(1.03, 1.21)**	**0.01**
Childhood Low IQ	**1.28**	**(1.18, 1.40)**	**< 0.01**	1.07	(0.97, 1.18)	0.17
Childhood Low Self-Control	**1.31**	**(1.22, 1.40)**	**< 0.01**	**1.18**	**(1.09, 1.28)**	**< 0.01**
Age 3 Brain Health	**1.22**	**(1.13, 1.31)**	**< 0.01**			

Childhood socioeconomic status (SES), IQ, and self-control are standardized z-scores (M = 0, SD = 1); childhood maltreatment is coded as 0 = none, 1 = probable, 2 = definite maltreatment. All models control for sex and time spent outside New Zealand. IRR = Incidence Rate Ratio; CI = Confidence Interval.

Supplemental Table 2. Childhood factors differentiated cohort members who became, as adults, members of the multiple-high-cost segment of their society. **Panel A** shows results for the cohort-wide classification of high-cost groupings. These results are also shown in the main article (Table 1). **Panel B** shows results for the sex-specific classification of high-cost groupings. **Panel C** shows results for females only. **Panel D** shows results for males only.

	Univariate Models					Multivariate Models				
A. Cohort-Wide Groupings	RR	RR 95% CI	p-value	AUC	AUC 95%CI	RR	RR 95% CI	p-value	AUC	AUC 95% CI
0 vs 3+ High-Cost Sectors = Multiple-High-Cost									0.87	(0.84, 0.90)
Childhood Low SES	**1.49**	**(1.35, 1.64)**	**< 0.01**	0.83	(0.79, 0.86)	**1.31**	**(1.18, 1.45)**	**< 0.01**		
Child Maltreatment	**1.28**	**(1.19, 1.37)**	**< 0.01**	0.80	(0.76, 0.84)	**1.14**	**(1.05, 1.23)**	**< 0.01**		
Childhood Low IQ	**1.35**	**(1.24, 1.47)**	**< 0.01**	0.81	(0.77, 0.85)	1.08	(0.98, 1.20)	0.13		
Childhood Low Self-Control	**1.38**	**(1.27, 1.49)**	**< 0.01**	0.84	(0.80, 0.87)	**1.17**	**(1.07, 1.29)**	**< 0.01**		
Age 3 Brain Health	**1.26**	**(1.17, 1.36)**	**< 0.01**	0.79	(0.75, 0.83)					
B. Sex-Specific Groupings										
0 vs 3+ High-Cost Sectors = Multiple-High-Cost									0.88	(0.85, 0.91)
Childhood Low SES	**1.45**	**(1.31, 1.61)**	**< 0.01**	0.82	(0.79, 0.86)	**1.23**	**(1.10, 1.38)**	**< 0.01**		
Child Maltreatment	**1.25**	**(1.17, 1.35)**	**< 0.01**	0.79	(0.75, 0.83)	**1.12**	**(1.03, 1.21)**	**< 0.01**		
Childhood Low IQ	**1.39**	**(1.28, 1.51)**	**< 0.01**	0.83	(0.79, 0.86)	**1.15**	**(1.03, 1.28)**	**0.01**		
Childhood Low Self-Control	**1.36**	**(1.26, 1.47)**	**< 0.01**	0.85	(0.82, 0.88)	**1.16**	**(1.05, 1.28)**	**< 0.01**		
Age 3 Brain Health	**1.29**	**(1.19, 1.39)**	**< 0.01**	0.81	(0.77, 0.84)					
C. Females										
0 vs 3+ High-Cost Sectors = Multiple-High-Cost									0.86	(0.81, 0.91)
Childhood Low SES	**1.54**	**(1.34, 1.77)**	**< 0.01**	0.82	(0.77, 0.87)	**1.37**	**(1.18, 1.60)**	**< 0.01**		
Child Maltreatment	**1.33**	**(1.20, 1.47)**	**< 0.01**	0.80	(0.74, 0.85)	**1.17**	**(1.05, 1.31)**	**< 0.01**		
Childhood Low IQ	**1.30**	**(1.16, 1.47)**	**< 0.01**	0.78	(0.72, 0.84)	1.09	(0.95, 1.24)	0.23		
Childhood Low Self-Control	**1.38**	**(1.22, 1.55)**	**< 0.01**	0.81	(0.75, 0.86)	**1.14**	**(1.00, 1.30)**	**0.05**		
Age 3 Brain Health	**1.22**	**(1.08, 1.38)**	**< 0.01**	0.77	(0.72, 0.83)					

(Supplemental Table 2, continued)

D. Males	RR	RR 95% CI	p-value	AUC	AUC 95%CI	RR	RR 95% CI	p-value	AUC	AUC 95% CI
0 vs 3+ High-Cost Sectors = Multiple-High-Cost									0.89	(0.85, 0.92)
Childhood Low SES	**1.45**	**(1.26, 1.66)**	**< 0.01**	0.83	(0.78, 0.88)	**1.25**	**(1.08, 1.43)**	**< 0.01**		
Child Maltreatment	**1.23**	**(1.12, 1.36)**	**< 0.01**	0.79	(0.74, 0.85)	1.09	(0.97, 1.22)	0.13		
Childhood Low IQ	**1.39**	**(1.23, 1.57)**	**< 0.01**	0.84	(0.79, 0.89)	1.08	(0.92, 1.27)	0.32		
Childhood Low Self-Control	**1.38**	**(1.25, 1.52)**	**< 0.01**	0.86	(0.81, 0.91)	**1.21**	**(1.06, 1.37)**	**< 0.01**		
Age 3 Brain Health	**1.29**	**(1.17, 1.42)**	**< 0.01**	0.81	(0.75, 0.86)					

Childhood socioeconomic status (SES), IQ, and self-control are standardized z-scores (M = 0, SD = 1); childhood maltreatment is coded as 0 = none, 1 = probable, 2 = definite maltreatment. Models in Panel A and B control for sex and all models control for time spent outside New Zealand. RR = Risk Ratio; CI = Confidence Interval; AUC = Area Under the Curve.

Supplemental Table 3. Childhood predictors of economic-burden outcomes in a birth cohort. This table compares results when controlling versus not controlling for duration of time spent in New Zealand. **Panel A** compares how well childhood factors predicted the number of high-cost groups (ranging from 0-8) to which each cohort member belonged. **Panel B** compares how well childhood factors differentiated cohort members who became, as adults, members of the multiple-high-cost segment of their society.

	Univariate Models					Multivariate Models				
Panel A: Number of High Cost Sectors	IRR	IRR 95% CI	p-value			IRR	IRR 95% CI	p-value		
1. With Control for Time in New Zealand										
Childhood Low SES	**1.33**	**(1.25, 1.42)**	**< 0.01**			**1.21**	**(1.13, 1.29)**	**< 0.01**		
Child Maltreatment	**1.23**	**(1.17, 1.30)**	**< 0.01**			**1.13**	**(1.07, 1.20)**	**< 0.01**		
Childhood Low IQ	**1.26**	**(1.18, 1.34)**	**< 0.01**			1.05	(0.98, 1.13)	0.16		
Childhood Low Self-Control	**1.32**	**(1.25, 1.40)**	**< 0.01**			**1.18**	**(1.11, 1.26)**	**< 0.01**		
Age 3 Brain Health	**1.20**	**(1.13, 1.27)**	**< 0.01**							
2. Without Control for Time in New Zealand										
Childhood Low SES	**1.39**	**(1.30, 1.48)**	**< 0.01**			**1.23**	**(1.15, 1.33)**	**< 0.01**		
Child Maltreatment	**1.23**	**(1.16, 1.31)**	**< 0.01**			**1.12**	**(1.06, 1.19)**	**< 0.01**		
Childhood Low IQ	**1.34**	**(1.26, 1.43)**	**< 0.01**			**1.11**	**(1.03, 1.20)**	**< 0.01**		
Childhood Low Self-Control	**1.37**	**(1.29, 1.46)**	**< 0.01**			**1.19**	**(1.11, 1.27)**	**< 0.01**		
Age 3 Brain Health	**1.26**	**(1.18, 1.34)**	**< 0.01**							
Panel B: 0 vs. 3+ High-Cost Sectors	RR	RR 95% CI	p-value	AUC	AUC 95% CI	RR	RR 95% CI	p-value	AUC	AUC 95% CI
1. With Control for Time in New Zealand									0.87	(0.84, 0.90)
Childhood Low SES	**1.49**	**(1.35, 1.64)**	**< 0.01**	0.83	(0.79, 0.86)	**1.31**	**(1.18, 1.45)**	**< 0.01**		
Child Maltreatment	**1.28**	**(1.19, 1.37)**	**< 0.01**	0.80	(0.76, 0.84)	**1.14**	**(1.05, 1.23)**	**< 0.01**		
Childhood Low IQ	**1.35**	**(1.24, 1.47)**	**< 0.01**	0.81	(0.77, 0.85)	1.08	(0.98, 1.20)	0.13		
Childhood Low Self-Control	**1.38**	**(1.27, 1.49)**	**< 0.01**	0.84	(0.80, 0.87)	**1.17**	**(1.07, 1.29)**	**< 0.01**		
Age 3 Brain Health	**1.26**	**(1.17, 1.36)**	**< 0.01**	0.79	(0.75, 0.83)					

(Supplemental Table 3, continued)

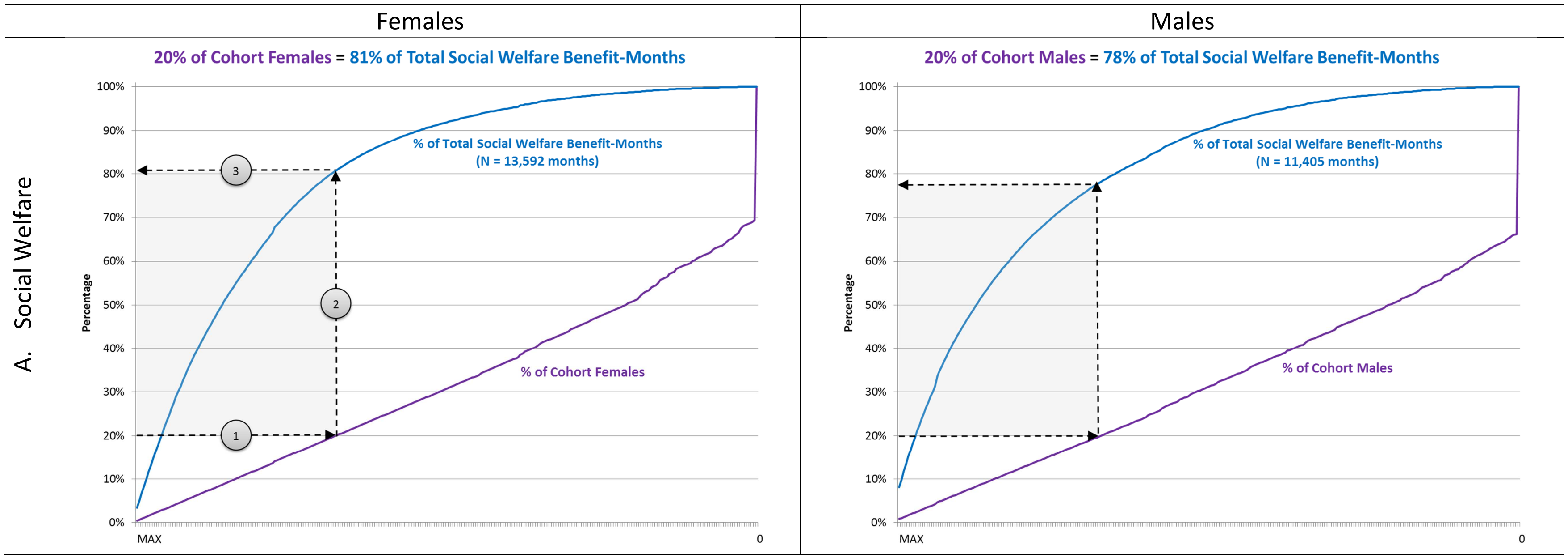
Panel B: 0 vs. 3+ High-Cost Sectors	RR	RR 95% CI	p-value	AUC	AUC 95% CI	RR	RR 95% CI	p-value	AUC	AUC 95% CI
2. Without Control for Time in New Zealand									0.83	(0.79, 0.86)
Childhood Low SES	**1.64**	**(1.49, 1.81)**	**< 0.01**	0.75	(0.70, 0.79)	**1.38**	**(1.24, 1.54)**	**< 0.01**		
Child Maltreatment	**1.31**	**(1.22, 1.42)**	**< 0.01**	0.66	(0.61, 0.71)	**1.13**	**(1.04, 1.23)**	**< 0.01**		
Childhood Low IQ	**1.51**	**(1.38, 1.64)**	**< 0.01**	0.73	(0.69, 0.78)	**1.16**	**(1.04, 1.30)**	**0.01**		
Childhood Low Self-Control	**1.48**	**(1.38, 1.60)**	**< 0.01**	0.77	(0.72, 0.81)	**1.17**	**(1.06, 1.29)**	**< 0.01**		
Age 3 Brain Health	**1.36**	**(1.26, 1.48)**	**< 0.01**	0.69	(0.64, 0.74)					

Childhood socioeconomic status (SES), IQ, and self-control are standardized z-scores (M = 0, SD = 1); childhood maltreatment is coded as 0 = none, 1 = probable, 2 = definite maltreatment. All models control for sex. RR = Risk Ratio; IRR = Incidence Rate Ratio; CI = Confidence Interval; AUC = Area Under the Curve.

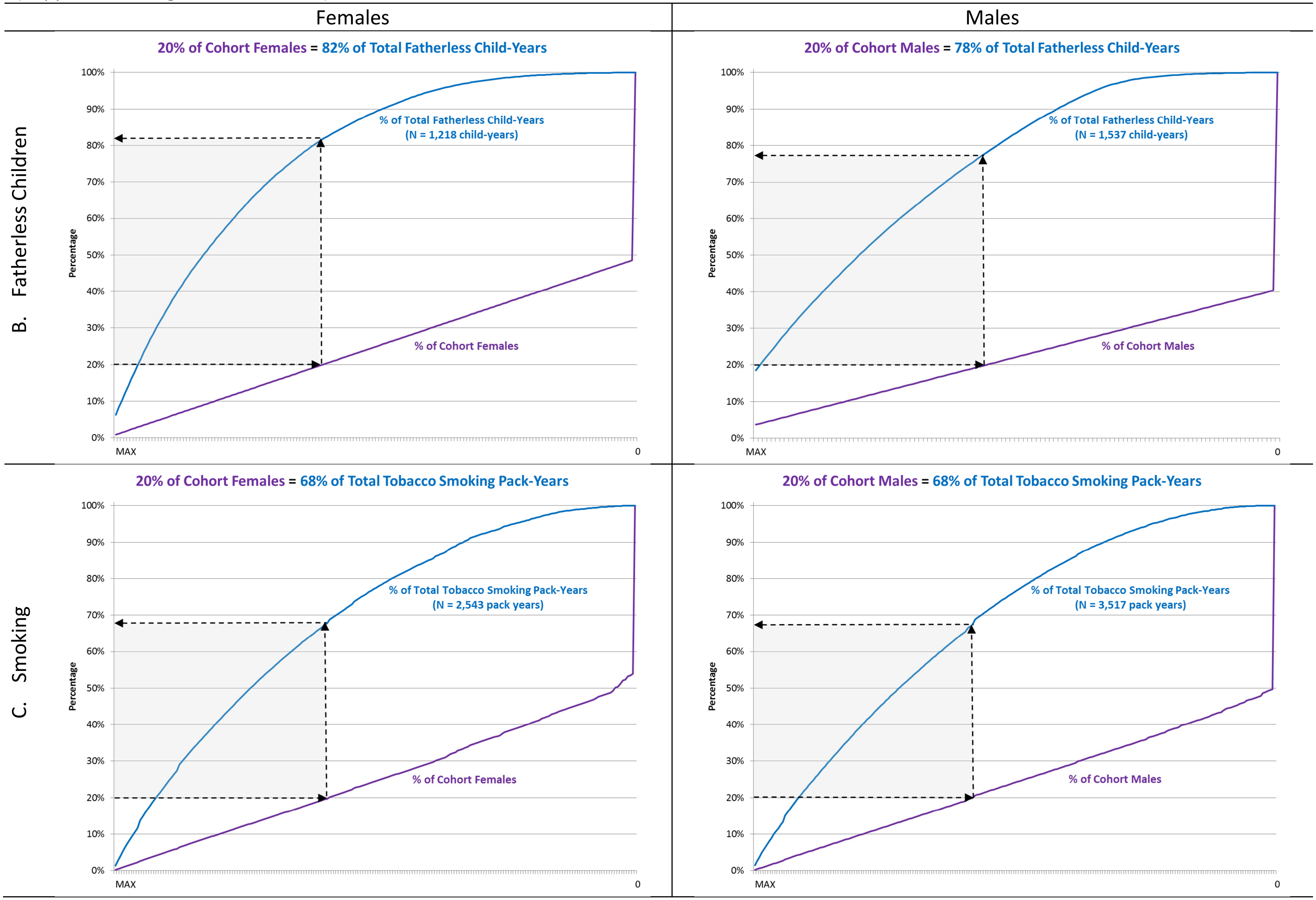
Supplemental Table 4. Childhood predictors of economic-burden outcomes in a birth cohort. This table provides results comparing the high and low-cost groups identified using the Latent Class Analysis.

	Univariate Models							Multivariate Model						
	RR	95% CI		p-value	AUC	AUC 95% CI	RR	95% CI		p-value	AUC	AUC 95% CI
LCA Low-Cost Group vs LCA High-Cost Group											0.81	(0.78, 0.85)
Childhood Low SES	**1.74**	**1.51**	**2.02**	**< 0.01**	0.76	(0.72, 0.80)	**1.41**	**1.21**	**1.66**	**< 0.01**		
Child Maltreatment	**1.51**	**1.35**	**1.69**	**< 0.01**	0.75	(0.71, 0.79)	**1.30**	**1.15**	**1.48**	**< 0.01**		
Childhood Low IQ	**1.49**	**1.32**	**1.67**	**< 0.01**	0.74	(0.70, 0.78)	1.08	0.93	1.25	0.32		
Childhood Low Self-Control	**1.55**	**1.40**	**1.71**	**< 0.01**	0.78	(0.74, 0.82)	**1.28**	**1.13**	**1.46**	**< 0.01**		
Age 3 Brain Health	**1.40**	**1.25**	**1.56**	**< 0.01**	0.73	(0.69, 0.78)						

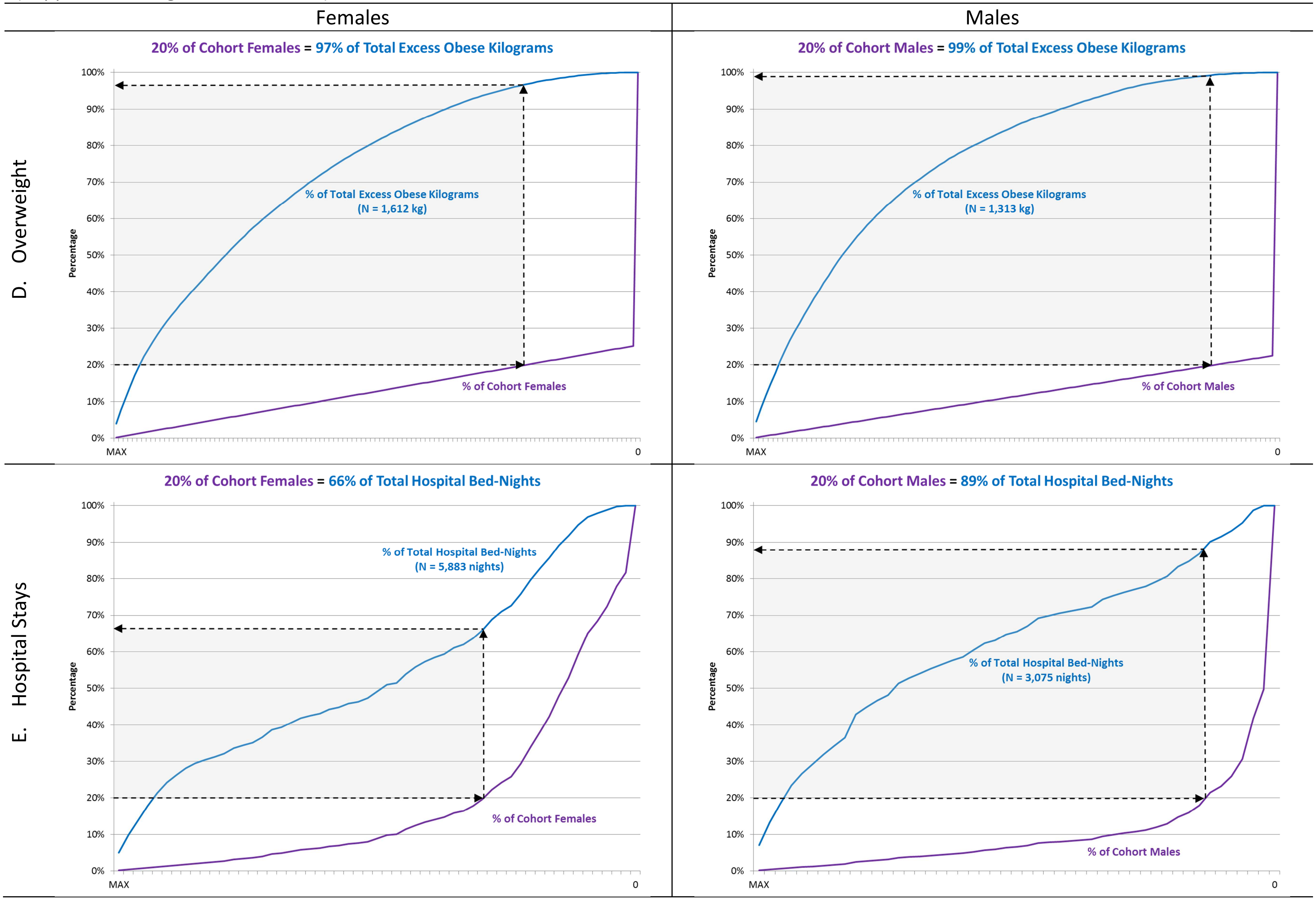
Supplemental Figure 1. The concentration of economic-burden outcomes. The panels show that a minority of individuals accounts for a majority of economic-burden outcomes in a birth cohort, in each of 8 different social and health sectors: social welfare (**Panel A**), fatherless children (**Panel B**), smoking (**Panel C**), excess obese kilograms (**Panel D**), hospital stays (**Panel E**), prescription fills (**Panel F**), injury claims (**Panel G**), and crime (**Panel H**). Each Panel displays the cumulative distribution of each outcome, for females and males in the cohort. To find the proportion of the outcome that 20% of the population accounts for, start at 20% on the vertical axis and follow arrow 1 to the right, to the purple line; then, follow arrow 2 up to the blue line; and then follow arrow 3 to the left, back to the vertical axis to find the corresponding proportion of the total.



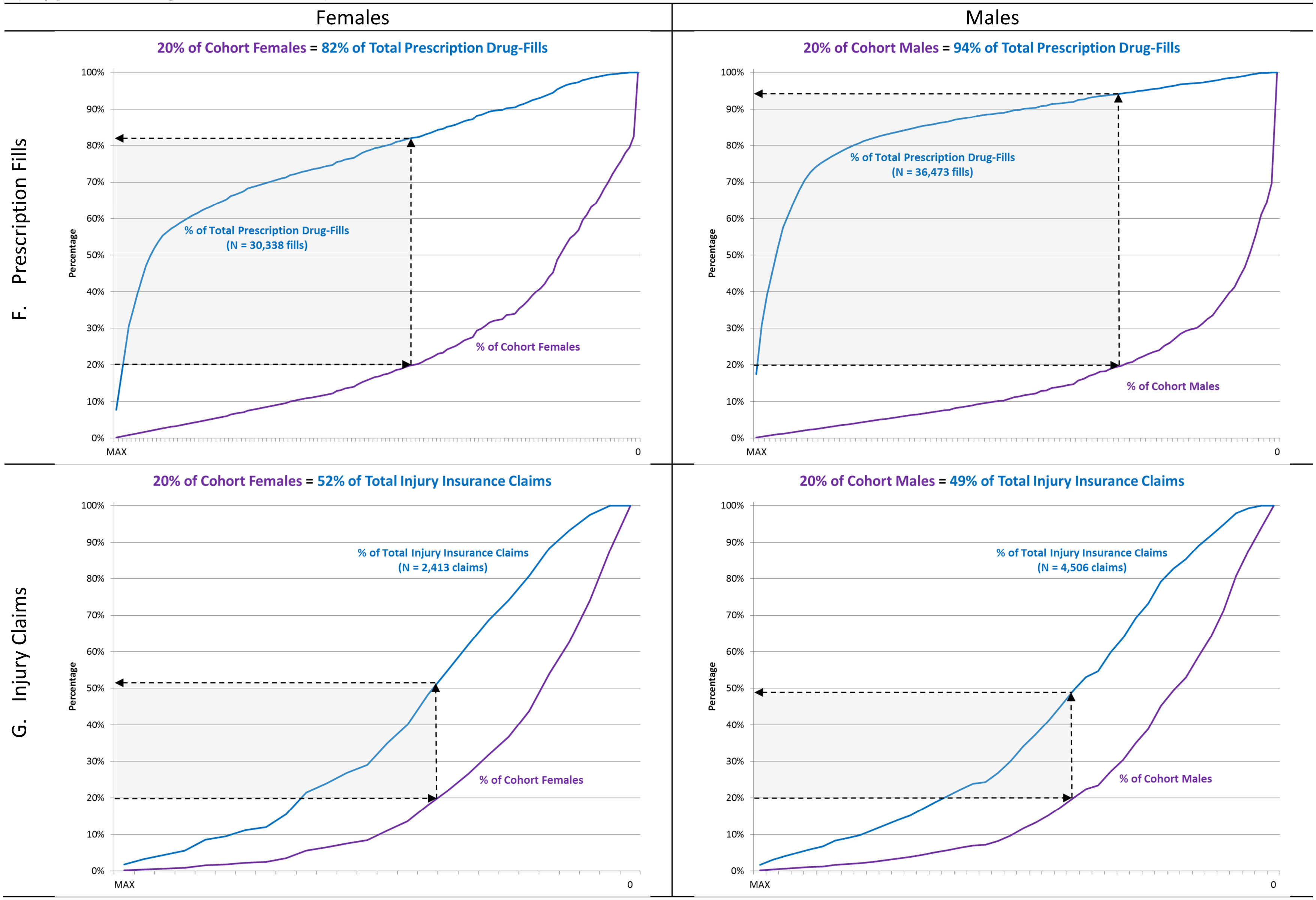
(Supplemental Figure 1, continued)



(Supplemental Figure 1, continued)



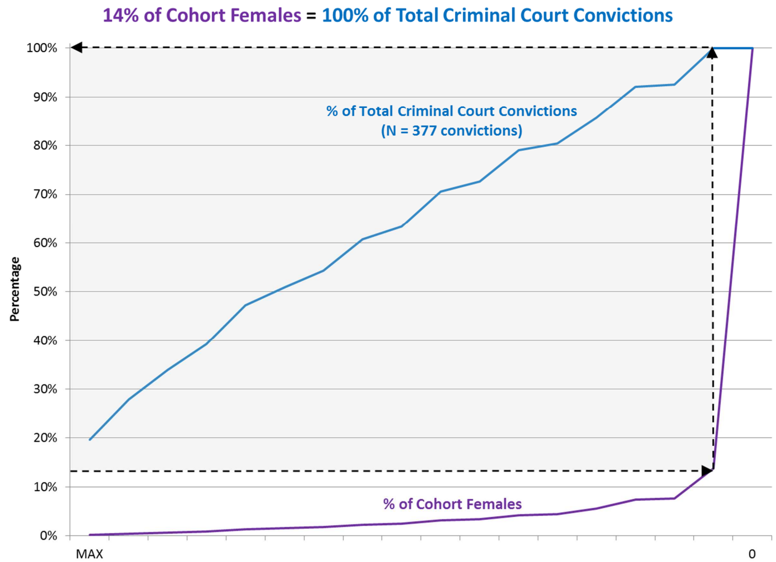
(Supplemental Figure 1, continued)



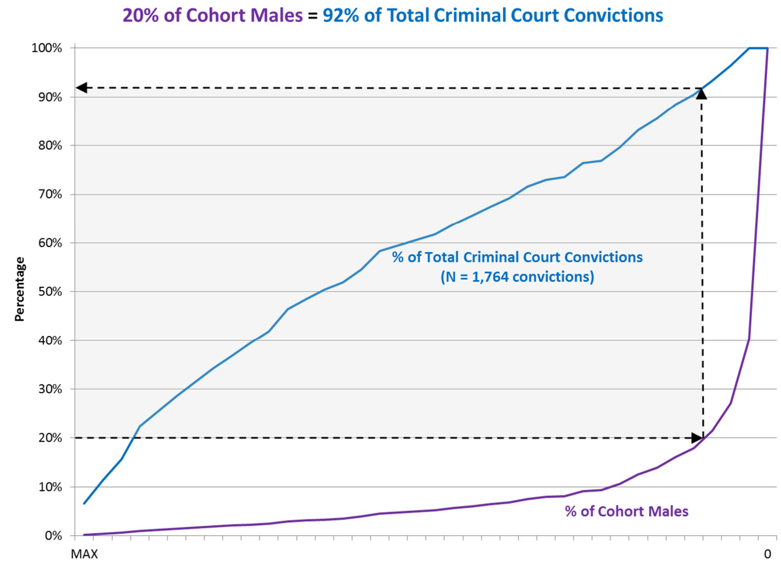
(Supplemental Figure 1, continued)

H. Crime

Females



Males



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