

# Does Secondary Education Affect Mental Health: Evidence from a Regression Discontinuity Design

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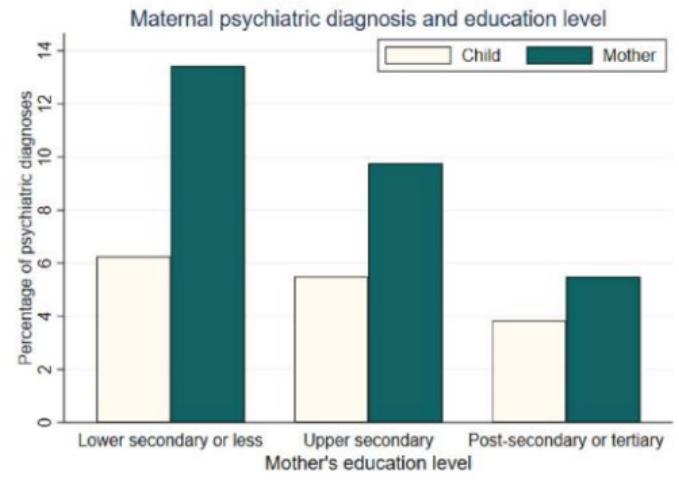
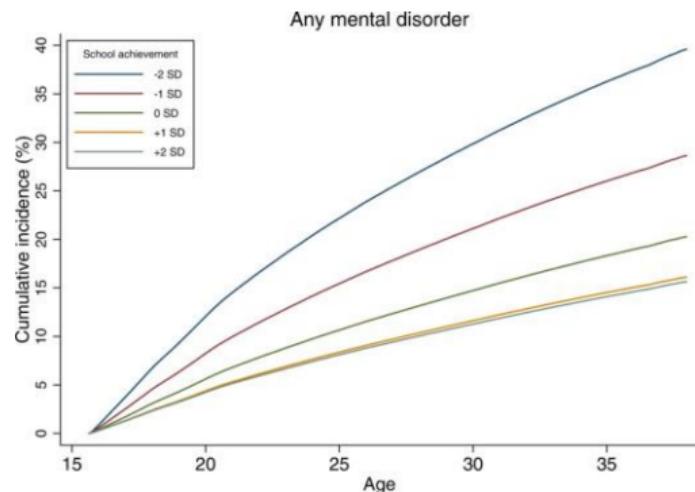
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  - Associated with reduced human capital accumulation, lower labor market productivity, and increased healthcare utilization (Dalsgaard et al., 2020; Lundborg et al., 2014; Mousteri et al., 2019).

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- How does education contribute to these trends?
  - Especially secondary education, as tracked secondary education systems that divide students into vocational and general tracks are common across many high-income countries (OECD, 2023)
  - Globally, nearly 50% of those who will ever receive mental health diagnosis are first diagnosed in late adolescence, by age 18 (Solmi et al., 2022)

# Association between education and mental health ([Weckström et al., 2023](#); [Vaalavuo et al., 2022](#))



- Causal relationship or driven by selection? Can we improve mental health by improving educational opportunities, access to education, etc.?

- we study the impact of secondary school admission on mental health using a regression discontinuity (RD) design and Finnish register data
  - School-program-year specific thresholds: admission score of the last applicant admitted to a given program
  - we build on earlier literature utilizing similar setting (Bütikofer et al., 2023; Huttunen et al., 2023; Johnsen and Jansen, 2024; Kuuppelomäki, 2021; Ollikainen et al., 2024; Silliman and Virtanen, 2022)
- we focus on two margins among the first-time applicants during the years 2008–2013:
  - ① admission to vocational secondary education versus no admission (*vocational margin*), and
  - ② admission to general secondary education versus vocational education (*general margin*)

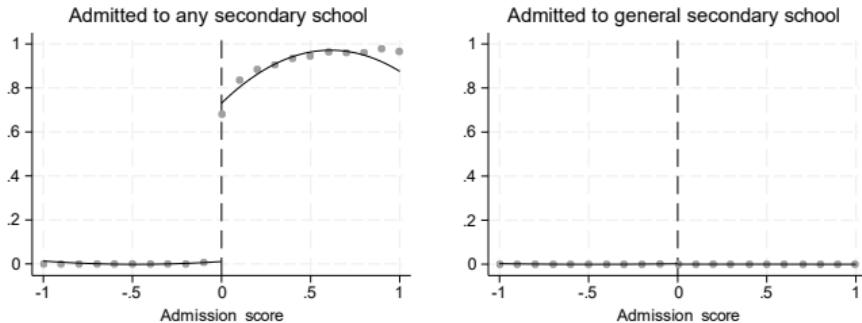
- Admission to vocational education (vs. no admission) reduces psychotropic drug use by 6.5 percentage points (-21%) within seven years.
- Admission to general (vs. vocational) education reduces specialized mental health healthcare visits by 4.5 percentage points (-21%) within seven years.

# Data & Identification

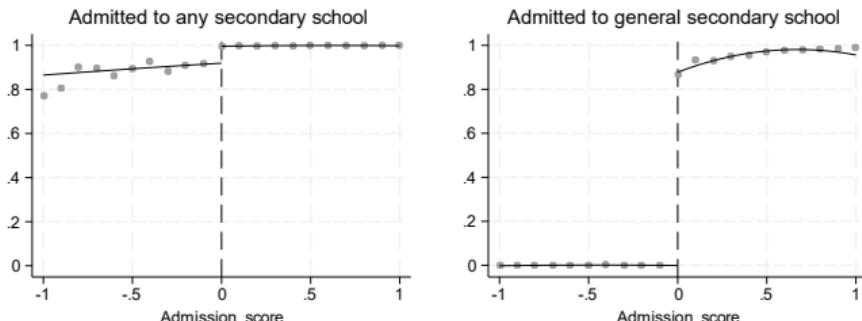
- Finnish Joint Application Registry administrated by Statistics Finland (EDUC-TYHR): first-time applicants applying in spring in 2008-2013 (N=361,932)
- FOLK-modules: data on completed degrees, labor market position and income, as well as parents, cohabitation and marriage, living conditions and demographic characteristics
- KELA: psychotropic drug use from the prescription register ([Appendix 1](#))
- THL: mental health related healthcare use from the Care Register ([Appendix 1](#))

# The probability of secondary school admission

Panel A: Vocational margin

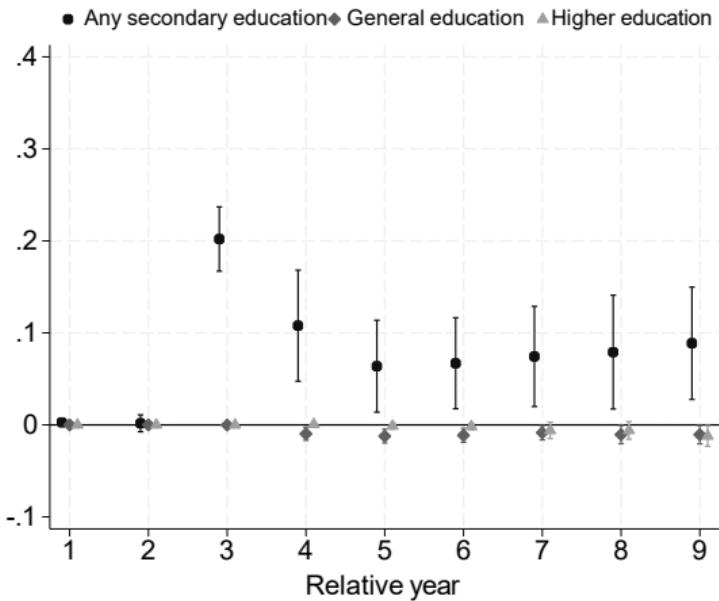


Panel B: General margin



# The effect of crossing the threshold on completed degrees

Panel A: Vocational margin



Panel B: General margin

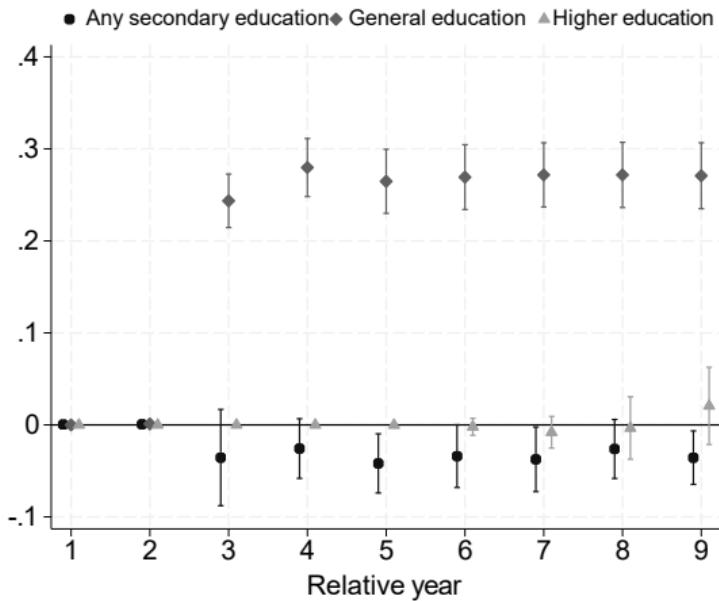
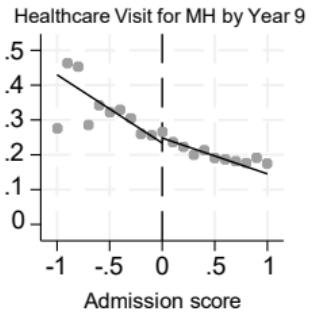
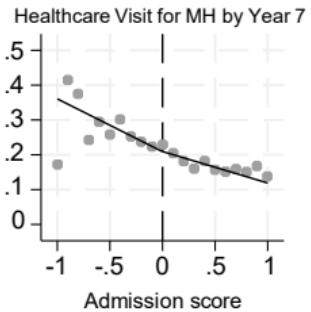
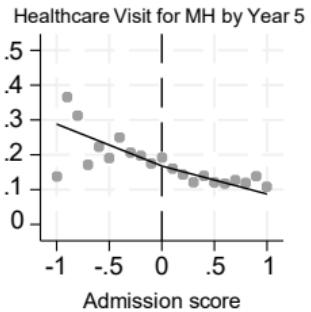
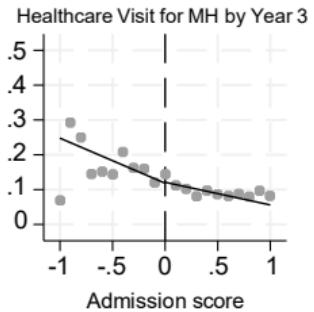
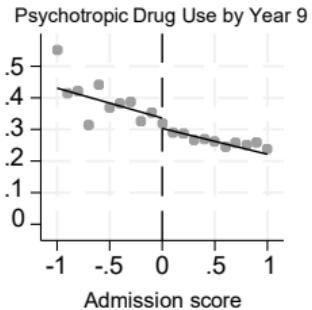
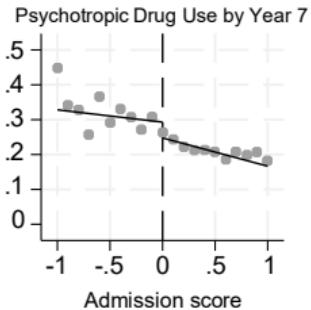
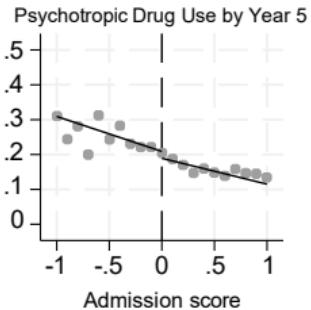
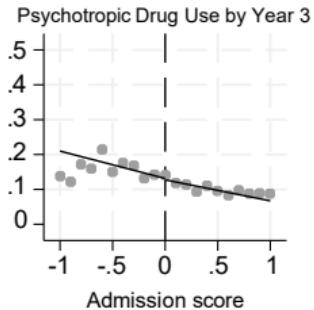


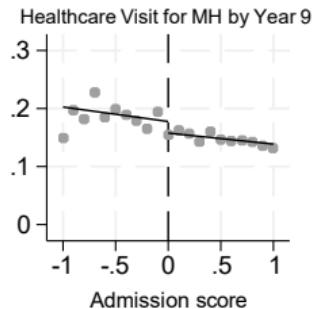
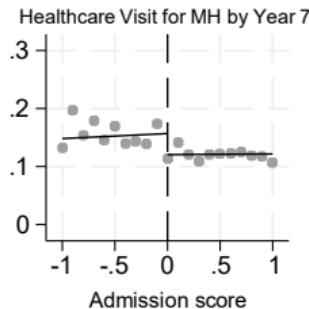
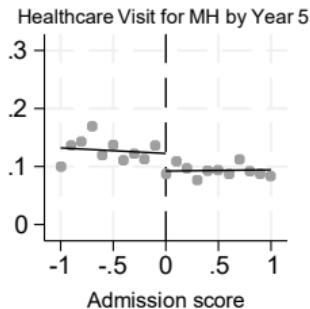
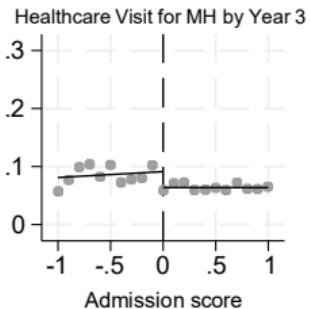
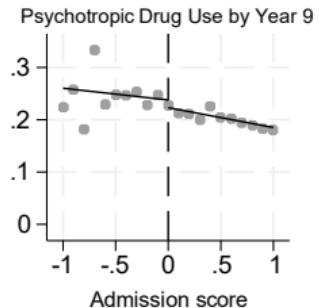
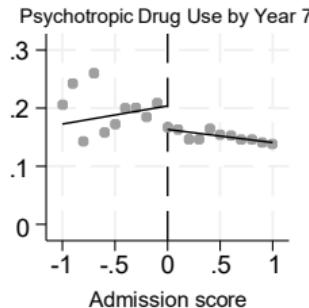
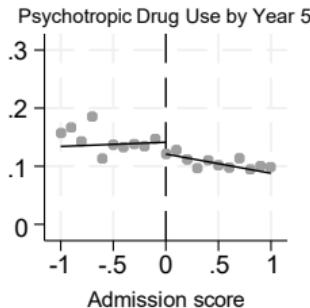
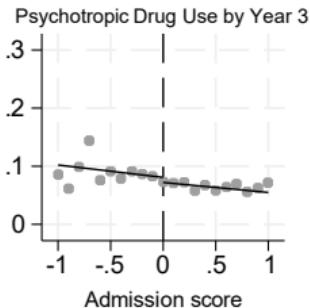
Figure: The effect of crossing the threshold on completed degree

# Main results

## Panel A: Vocational margin



## Panel B: General margin



# Main estimates on mental health (cumulative incidence)

	Year 3	Year 5	Year 7	Year 9
<b>Panel A: Vocational margin</b>				
<i>Psychotropic drug use</i>				
Reduced form	.008 (-.071, .034)	-.002 (-.11, .043)	-.038*** (-.183, -.029)	-.019* (-.138, .008)
Counterfactual outcome	.129	.207	.301	.337
First stage	.605*** (.489, .57)	.605*** (.489, .57)	.605*** (.489, .57)	.605*** (.489, .57)
LATE: Admitted	.014 (-.115, .058)	-.003 (-.181, .071)	-.063*** (-.31, -.056)	-.031* (-.231, .009)
Observations	8274	8252	8228	8209
<i>Healthcare visit for mental health</i>				
Reduced form	.043* (-.007, .128)	.033 (-.039, .097)	.022 (-.073, .073)	.034 (-.078, .093)
Counterfactual outcome	.096	.155	.203	.23
First stage	.605*** (.489, .57)	.605*** (.489, .57)	.605*** (.489, .57)	.605*** (.489, .57)
LATE: Admitted	.071* (-.004, .221)	.054 (-.058, .168)	.036 (-.116, .125)	.056 (-.121, .161)
Observations	8274	8252	8228	8209
<b>Panel B: General margin</b>				
<i>Psychotropic drug use</i>				
Reduced form	-.007 (-.059, .021)	-.014 (-.079, .024)	-.035 (-.122, .043)	-.015 (-.104, .084)
Counterfactual outcome	.088	.151	.215	.249
First stage	.841*** (.771, .862)	.841*** (.771, .862)	.841*** (.771, .862)	.841*** (.771, .862)
LATE: Admitted	-.009 (-.071, .025)	-.017 (-.094, .028)	-.042 (-.146, .049)	-.017 (-.124, .099)
Observations	6023	5998	5976	5938
<i>Healthcare visit for mental health</i>				
Reduced form	-.033*** (-.105, -.024)	-.029** (-.103, -.005)	-.038*** (-.145, -.032)	-.016 (-.111, .014)
Counterfactual outcome	.109	.14	.179	.196
First stage	.841*** (.771, .862)	.841*** (.771, .862)	.841*** (.771, .862)	.841*** (.771, .862)
LATE: Admitted	-.039*** (-.127, -.029)	-.035** (-.123, -.007)	-.045*** (-.174, -.039)	-.019 (-.133, .016)
Observations	6023	5998	5976	5938

# Potential channels?

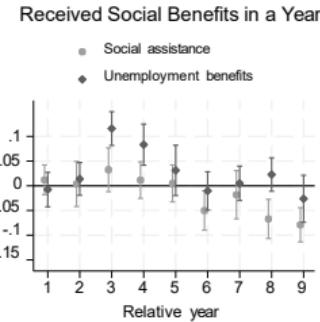
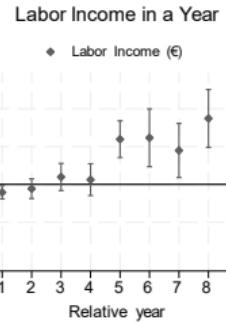
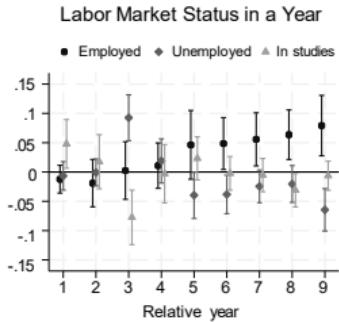
# Effect of crossing the threshold on enrollment and average peer characteristics

	Vocational margin	General margin
<b>Enrollment</b>		
Enrolled in any secondary school	.355*** (.212, .4)	.096*** (.094, .222)
Enrolled in general secondary school	-.022 (-.064, .01)	.485*** (.399, .545)
Enrolled in vocational secondary school	.377*** (.227, .438)	-.388*** (-.398, -.23)
<b>Peer characteristics</b>		
fIPA among peers	-.05 (-.181, .119)	.566*** (.463, .64)
Peers with secondary educated mothers	-.008 (-.039, .07)	.037*** (.017, .045)
Peers with highly educated mothers	-.005 (-.042, .061)	.081*** (.068, .099)
Average income among peers' mothers	675.072 (-3530.608, 2684.048)	2224.392*** (1453.086, 2838.154)
Peers with secondary educated fathers	.018 (-.039, .09)	.064*** (.046, .076)
Peers with highly educated fathers	-.009 (-.096, .026)	.082*** (.061, .097)
Average income among peers' fathers	320.861 (-7007.811, 2583.745)	3860.531*** (2529.207, 4474.102)
Peers with prior psychotropic drug use	.018 (-.025, .088)	-.01 (-.018, .008)
Peers with prior healthcare visits for mental health	-.009 (-.121, .093)	-.033*** (-.049, -.015)
Observations	5030	5616

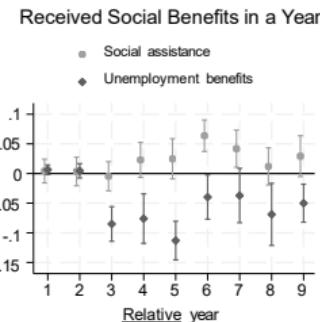
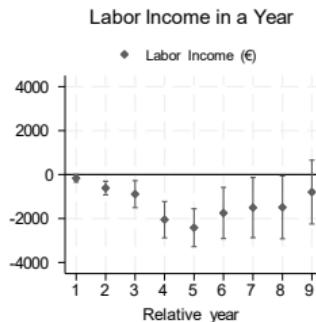
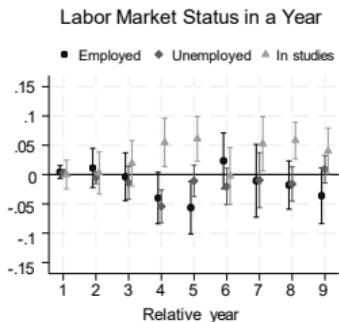
Notes: \* $p<0.1$ ; \*\* $p<0.05$ ; \*\*\* $p<0.01$ . Note that the estimations on peer characteristics only include applicants who eventually gain access to secondary education by the end of the year despite the potential rejection in the first round. Individual level characteristics have been measured one year prior to the application year.

# Labor market outcomes

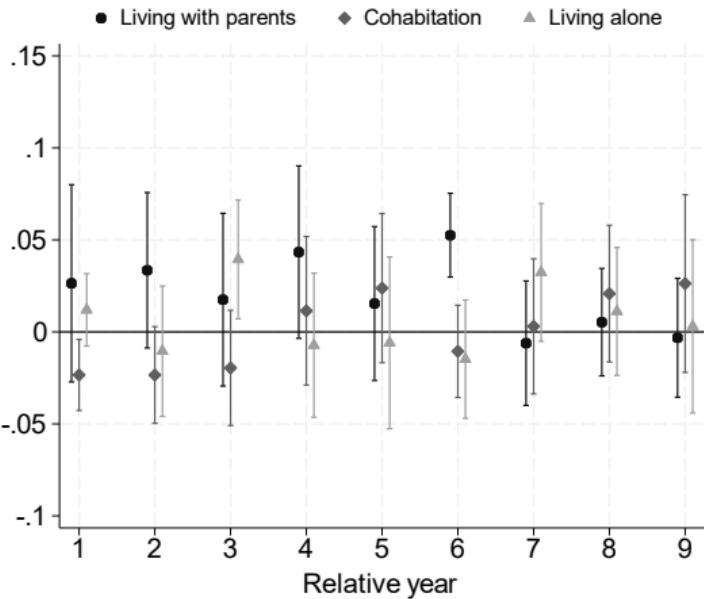
## Panel A: Vocational margin



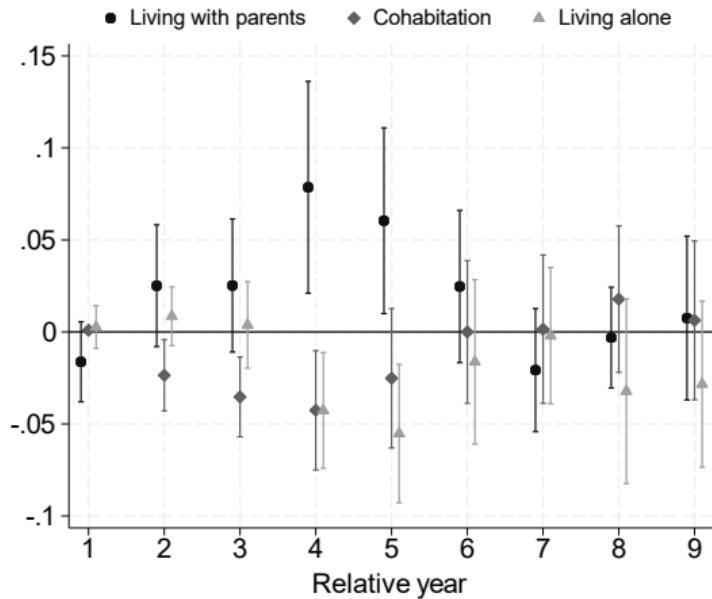
## Panel B: General margin



Panel A: Vocational margin



Panel B: General margin



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  - Peers? Longer parental co-residence and reduced financial strain?

# What should we do?

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- Evidence from randomized controlled trials (RCT) suggests that school-based mental health interventions may effectively reduce depression and anxiety, particularly when implemented in secondary school environment and by certified healthcare professionals ([Zhang et al., 2023](#)).

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- Evidence from randomized controlled trials (RCT) suggests that school-based mental health interventions may effectively reduce depression and anxiety, particularly when implemented in secondary school environment and by certified healthcare professionals (Zhang et al., 2023).
- Given the resource constraints of education budgets, any decision to invest in school-based mental health programs should focus scarce resources on evidence based approaches

# Literature

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# Appendices

# Classification of Mental Health Outcomes by ICD and ATC Codes

## International Classification of Diseases

	ICD-9	ICD-10
Any mental disorder	291*-316*	F04*-F69*, F80*-F99*
Substance-use disorders	291-292, 303-305	F10-F19
Psychotic disorder	295*, 297*-299*	F20*-F29*
Mood disorder	296, 3004	F30*-F39
Bipolar disorders	2962-2967	F30, F31
Depressive disorders	2961, 3004A	F32-F33, F341
Anxiety disorder (incl. dissociative, stress-related, somatoform, and other nonpsychotic mental disorders)	300*	F40*-F489

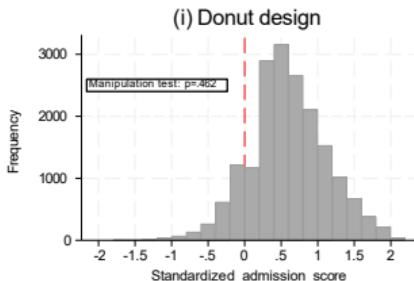
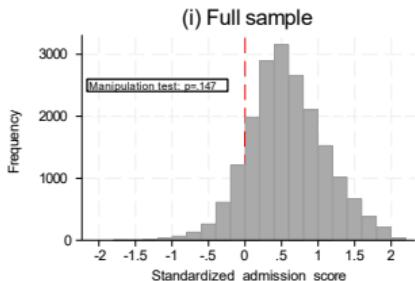
## Anatomical Therapeutic Chemical Classification

	ATC
Antipsychotics	N05A
Anxiolytics	N05B
Hypnotics and sedatives	N05C
Antidepressants	N06A
Antidepressants with psycholeptics	N06CA

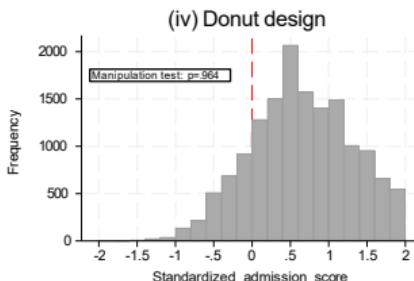
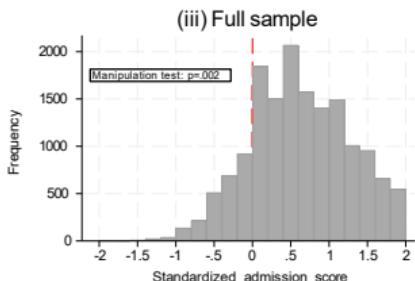
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# Distribution of the estimation samples across the admission score

Panel A: Vocational margin



Panel B: General margin



# Effect of crossing the threshold on pre-determined characteristics

	<b>Vocational margin</b>	<b>General margin</b>
fIPA	.035 (-.052, .11)	.002 (-.004, .011)
Female	.007 (-.109, .12)	-.038 (-.122, .022)
Lives in urban area	-.002 (-.023, .181)	.001 (-.14, .023)
Mother has secondary degree	-.019 (-.091, .105)	-.001 (-.065, .044)
Mother has higher education degree	-.002 (-.03, .082)	.019 (-.036, .08)
Mother's income	609.429 (-1414.493, 4704.208)	1052.982 (-3784.637, 3403.087)
Father has secondary education	-.059 (-.188, .044)	.02 (-.037, .114)
Father has higher education degree	-.008* (-.003, .059)	.011 (-.062, .067)
Father's income	-741.017 (-2576.757, 5659.998)	-1323.089 (-5131.065, 2228.006)
Ever used psychotropic drugs	.028 (-.051, .151)	.014* (-.004, .1)
Ever visited healthcare for mental health	.016 (-.037, .149)	-.006 (-.062, .05)
Observations	8302	6036

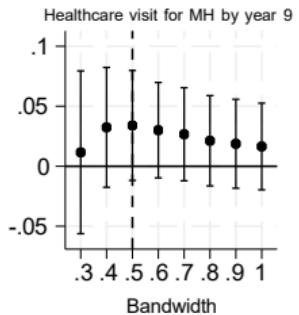
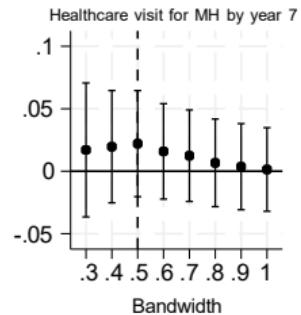
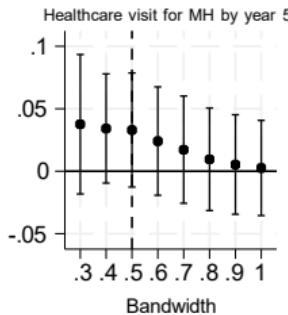
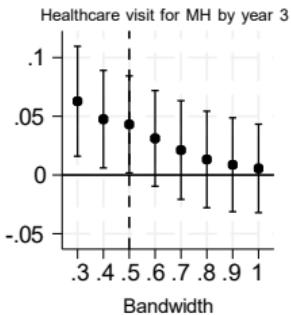
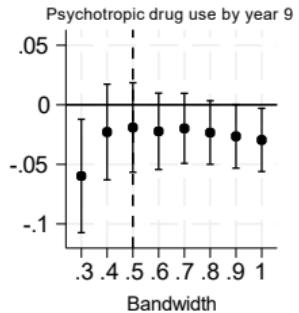
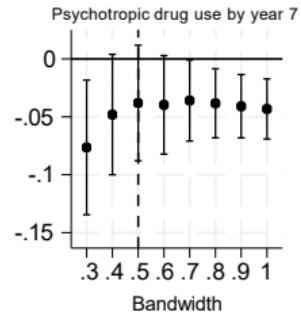
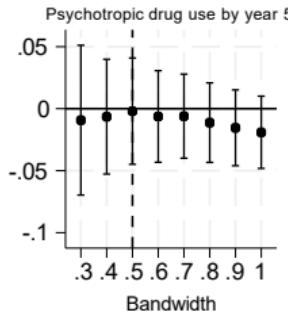
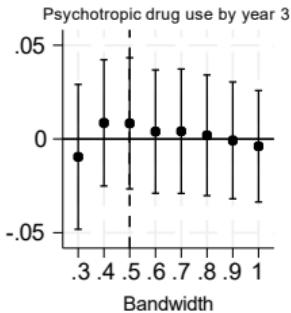
Notes: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

# Alternative specifications

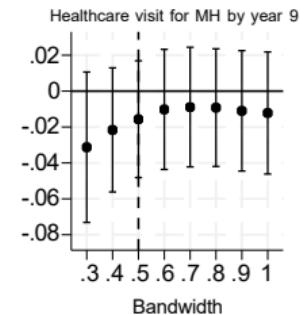
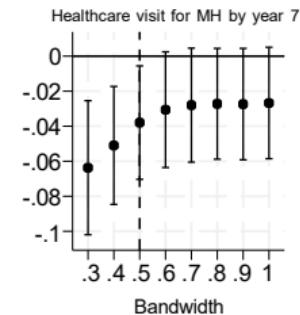
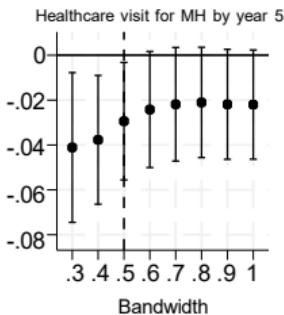
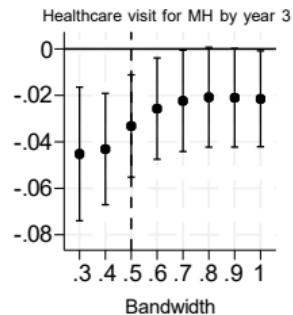
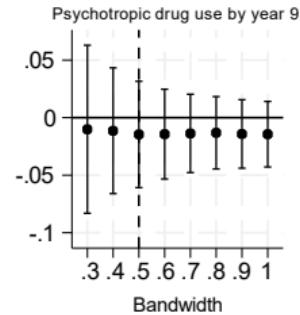
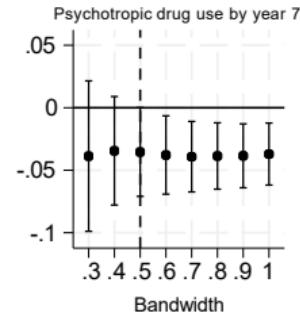
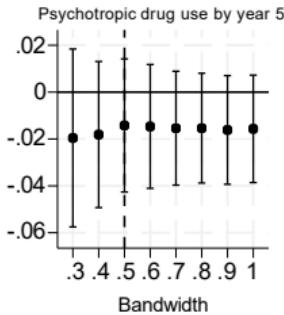
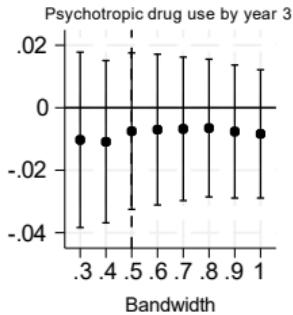
	Year 3	Year 5	Year 7	Year 9
<b>Panel A: Vocational margin</b>				
<i>Psychotropic drug use</i>				
Main estimate	.008 (-.071, .034)	-.002 (-.11, .043)	-.038*** (-.183, -.029)	-.019* (-.138, .008)
Additional covariates	-.001 (-.084, .028)	-.009 (-.123, .061)	-.057** (-.192, -.02)	-.044* (-.163, .006)
Without fixed effects	.006 (-.086, .042)	-.005 (-.127, .046)	-.042*** (-.193, -.029)	-.024** (-.153, 0)
<b>Observations</b>	8274	8252	8228	8209
Donut design	-.003 (-.096, .035)	-.006 (-.112, .063)	-.043** (-.188, -.008)	-.031** (-.173, -.001)
<b>Observations</b>	7459	7439	7419	7401
Optimal window	.008 (-.037, .052)	-.007 (-.072, .06)	-.065** (-.155, -.005)	-.027 (-.095, .025)
<b>Observations</b>	8274	6440	6417	6399
<i>Healthcare visit for mental health</i>				
Main estimate	.043* (-.007, .128)	.033 (-.039, .097)	.022 (-.073, .073)	.034 (-.078, .093)
Additional covariates	.027 (-.025, .11)	.021 (-.037, .089)	.004 (-.075, .05)	.018 (-.084, .065)
Without fixed effects	.039* (-.01, .133)	.029 (-.045, .105)	.02 (-.073, .083)	.029 (-.092, .099)
<b>Observations</b>	8274	8252	8228	8209
Donut design	.032* (-.011, .139)	.022 (-.047, .12)	.012 (-.076, .097)	.024 (-.093, .106)
<b>Observations</b>	7459	7439	7419	7401
Optimal window	.052*** (.021, .126)	.034* (-.006, .101)	.02 (-.032, .083)	.032 (-.036, .103)
<b>Observations</b>	6454	8252	8228	6399
<b>Panel B: General margin</b>				
<i>Psychotropic drug use</i>				
Main estimate	-.007 (-.059, .021)	-.014 (-.079, .024)	-.035 (-.122, .043)	-.015 (-.104, .084)
Additional covariates	-.012 (-.075, .01)	-.015* (-.094, .008)	-.038* (-.139, .011)	-.011 (-.107, .057)
Without fixed effects	-.01 (-.072, .031)	-.02 (-.092, .023)	-.04 (-.129, .036)	-.014 (-.104, .088)
<b>Observations</b>	6023	5998	5976	5938
Donut design	-.024** (-.106, -.01)	-.032** (-.137, -.016)	-.059* (-.174, .005)	-.033 (-.148, .069)
<b>Observations</b>	5464	5441	5420	5385
Optimal window	-.012 (-.045, .017)	-.02 (-.067, .024)	-.035 (-.094, .016)	-.011 (-.078, .048)
<b>Observations</b>	4710	3857	4737	5015

# Alternative windows: Vocational margin

## Panel A: Vocational margin



## Panel B: General margin



# Summary statistics

	All applicants	Vocational margin	General margin
fIPA	7.69	6.76	7.78
Admission score	16.42	23.81	8.10
Applied to general track	0.65	0.00	1.00
Applied to vocational track	0.59	1.00	1.00
Applied to both types of tracks	0.24	0.00	1.00
Female	0.50	0.40	0.43
Lives in urban area	0.66	0.81	0.77
Mother has secondary degree	0.87	0.76	0.90
Mother has higher education degree	0.21	0.08	0.24
Mother's income	34,170	31,235	35,342
Father has secondary education	0.78	0.65	0.81
Father has higher education degree	0.20	0.07	0.22
Father's income	41,372	35,021	43,207
Foreign background	0.03	0.06	0.03
Ever used psychotropic drugs	0.14	0.17	0.13
Ever visited healthcare for mental health	0.12	0.20	0.09
Observations	361,932	19,141	17,155