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# School selectivity, peers, and mental health

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**Abstract**

Although many students suffer from anxiety and depression, and often identify school pressure and concerns about their futures as the main reasons for their worries, little is known about the consequences of a selective school environment on students' mental health. Using a regression discontinuity analysis in the largest Norwegian cities, we show that eligibility to enroll in a more selective high school increases the probability of enrollment in higher education and decreases the probability of diagnosis or treatment of psychological problems. We provide suggestive evidence that changes in both teacher and peers' characteristics are likely drivers of these effects.

**JEL Codes:** I12, I21, I24
**Keywords:** Health, school inputs, selective education.

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# 1 Introduction

Depression and anxiety are among the leading causes of illness and disability among adolescents (WHO, 2019). For instance, roughly one in three high school students in the US report suffering from depression or anxiety symptoms in a given year (HHS, 2017). Adolescent mental illness is also widespread in countries that conventionally rank among the happiest countries according to the World Happiness Report. In Norway, for example, 22% of high school students report depression or anxiety issues (Ungdata, 2018). This is important because mental health problems among adolescents are associated with various costly long-term outcomes such as lower labor market productivity, less marriage stability, and other adult health problems (Currie et al., 2010; Goodman, Joyce and Smith, 2011; Lundborg, Nilsson and Rooth, 2014).

Survey evidence indicates that school pressure is one of the main causes of adolescent worries (see e.g., Eriksen et al., 2017). However, we know little about the relationship between the school environment, and in particular school selectivity, and adolescent mental health. As it stands, the potential effects of school selectivity on mental health are ambiguous. On the one hand, a selective school, with more high-ability peers, might be a more stressful experience negatively affecting student mental health. On the other hand, peers at more selective schools may have different health care usage and display better health behaviors such as lower smoking rates or greater physical activity. Moreover, enrolling in a more selective school could result in different teacher characteristics and may be an inspiring experience that opens up new perspectives. This could positively influence student aspirations and mental health in both the short and long term. Because common determinants likely influence student choice of enrolling in a more selective high school and student health and health behaviors, and because data linking detailed school and health outcomes are not easily available, evidence on the causal effects of the school environment on student mental health remains very scarce.

This paper overcomes these identification and data challenges, providing new insights into how high school selectivity affects mental health. First, to overcome the identification problem, we build on the features of the high school assignment system in the two largest Norwegian cities, which assign students to high schools through a centralized process giving priority to students with the best average grades in middle school. This assignment system enables a regression discontinuity analysis, where we compare the long-term outcomes of students that are very similar at the end of middle school but are eligible to enroll in less or more selective high schools. Second, we link several administrative data sources, including information about educational institutions and school grades, as well as health care take-up, and create a long panel allowing us to document the effects on outcomes during and beyond high school.

The available data also enable us to characterize the features of a more selective school environment with respect to peer and teacher characteristics, school size, and the number of students per teacher. These features may differ across countries and contexts and are therefore important to consider. Abdulkadiroğlu, Angrist and Pathak (2014), for example, demonstrate that going to an exam school in Boston implies going to a school with higher-achieving peers, fewer Black and Hispanic students, more experienced teachers, and larger class sizes. In the context of Romania, Pop-Eleches and Urquiola (2013) also find variations in teacher characteristics across selective schools. In France, where the central administration attempts to equalize resources across schools, Landaud, Ly and Maurin (2020) reveal little variation in teacher characteristics or class sizes across selective Parisian high schools, despite large variation in student ability. Beyond documenting the implications of enrolling in a more selective high school in terms of peers, teachers, and other school features, we make use of the fact that we have variation in which of these school inputs changes more when enrolling in a more selective high school and implement a heterogeneity analysis. In essence, we estimate our regression discontinuity model for each of the 84 admission thresholds and each school feature separately and estimate whether changes in longer-term outcomes are greater when students gain eligibility to schools where peer and teacher characteristics or school resources change by a larger margin at the admission thresholds.

We present four key findings. First, we find that students that are eligible to enroll in a more selective high school are 8.3 percentage points more likely to enroll in the more selective school. Further, we show that eligibility to enroll in a more selective high school increases the likelihood of high school completion by 2.3 percentage points (4.2%) and the likelihood of enrollment in higher education by 1.6 percentage points (4.0%). Second, we document that eligibility to enroll in a more selective school does decrease the likelihood of diagnosis or treatment for mental health issues. In particular, we estimate that eligibility for enrollment in a more selective school reduces the likelihood of mental health diagnosis or treatment (driven by a reduction in anxiety and depression) by 1.7 percentage points (5.2%). Third, we investigate what features of the school environment change at the threshold. We document that eligibility for enrollment in a more selective high school significantly changes the ability level of peers, peers' parental education and income, the number of students per teacher, and the share of female teachers. Lastly, our heterogeneity analysis provides suggestive evidence that changes in both peers and teacher characteristics are important for explaining our main findings. Taken together, our findings provide key implications for ongoing policy debate over the consequences of school selectivity and the role of school inputs for student educational and health outcomes.

This paper particularly contributes to the literature on the relationships between education and health and school selectivity. Most empirical research identifying the causal effects of education on physical or mental health exploits exogenous variations from compulsory schooling reforms, regulations on school starting age, or school tracking (see, e.g., Böckerman et al., 2019; Clark and Royer, 2013; Crespo, López-Noval and Mira, 2014; Dursun and Cesur, 2016; Lager et al., 2016; Lleras-Muney, 2005; Meghir, Palme and Simeonova, 2018). We expand this literature by moving beyond changes in compulsory education, which mostly target individuals at the lower end of the educational distribution, and analyze the extent to which the high school environment links to health. Because the selectivity of higher education institutions correlates with student mental health and wellbeing (Fletcher and Frisvold, 2011, 2014; Frisvold and Golberstein, 2011), it is important to understand better the effect of high school selectivity, as well as the influence of high school peers, teachers, and financial resources on student health. Establishing this link is crucial for education policies aiming at improving the learning environment for students to increase their long-term welfare.

In addition, this paper complements the growing literature on the consequences of school selectivity (see e.g., Abdulkadiroğlu, Angrist and Pathak, 2014; Abdulkadiroğlu et al., 2017; Clark and Del Bono, 2016; Cullen, Jacob and Levitt, 2006; Dobbie and Fryer Jr, 2014; Jackson, 2013; Landaud, Ly and Maurin, 2020; Pop-Eleches and Urquiola, 2013).[1] First, we expand the set of outcomes by studying the effects on health and educational outcomes after high school to provide a more complete longer-term picture of the effects of a more selective school environment. Our second contribution concerns the mechanisms behind the estimates. We combine a unique setting of 84 different school admission thresholds with detailed information on several school inputs (characteristics of peers, teachers, school size, and the number of students per teacher) to investigate which features of a more selective school environment may help explain our findings. Understanding the role of school inputs for educational outcomes or mental health is important for explaining in what context selectivity matters. This could help reconcile why selective schools have negative or no effects in some contexts and positive effects in others.

# 2 Institutional Context

## 2.1 The Norwegian School System

The Norwegian education system consists of four levels: primary school (grades 1–7), middle school (grades 8–10), high school with academic (grades 11–13) and vocational (grades 11–14) tracks, and college and university education. Norwegian compulsory education starts at age six, lasts for 10 years, and consists of primary and middle school. Compulsory schooling is organized by Norwegian municipalities and the vast majority (98%) of pupils attend local public schools. The curriculum is identical in all primary and middle schools, there is no streaming by ability, and all pupils are allocated to schools based on fixed school catchment areas within municipalities.

[1]Note that our paper mostly relates to studies on selectivity in the context of nonelite schools. In our setting, school admission cutoffs are located between the 4$^{th}$ and the 97$^{th}$ percentile of the test score distribution after middle school in the areas of interest and on average located around the 40$^{th}$ percentile. See Figure A1 for the comparison between the distribution of middle school GPA in the cities of Oslo and Bergen for the period studied and the distribution of the admission thresholds in the selective high schools in our sample.

While there are no grades in primary school, the school system becomes more competitive from middle school onward, where exit exams and teacher grades are crucial for admission into the best high schools. At the end of grade 10, all students obtain a diploma with a total grade point average (hereafter, middle school GPA). This is the weighted total of all teacher-awarded grades, combined with the grades from written and oral exams in randomly drawn subjects.[2] The middle school GPAs possible range is from zero to 60, where 60 is the best possible grade.[3] Assignment to high schools varies across counties.[4] The two largest cities in Norway—Oslo and Bergen—have varied their intake systems over recent years. In this paper, we consider those years where they followed a free school choice system with a centralized intake based on the middle school GPA. That is, we study enrollment in general study programs in high schools located in Bergen from 2006 to 2010 and in Oslo from 2009 to 2010.

In contrast to the compulsory middle schools, enrollment in high schools is voluntary. Nevertheless, all students aged 16 to 23 years in Norway have a statutory right to enrollment at this level. However, this right is at the county level and does not ensure enrollment in a specific school or program. First time enrollment in high school in Norway is high: 98% of students enroll in the first year. Students enroll either in general studies (50%), in vocational programs (45%), or in alternative training plans (3%). There is, however, considerable dropout in the second and third years: only 80% of students initially enrolled in general studies programs graduate. Graduation rates for vocational programs are even lower. Graduating in general studies provides students with the required qualifications for enrollment in higher education, while students graduating in the vocational track need to spend an additional year of study before reaching similar qualifications.

Although high school ranks are not important for access to higher education, high school grades and national exams at the end of high school determine access to higher education. In Norway, the intake to public higher education follows a centralized admission system based on total grade points

[2]The subjects of the teacher-awarded grades are written (two courses) and oral Norwegian, written and oral English, mathematics, nature and science, social sciences, religion, home economics, physical education, music, and arts and craft.

[3]The GPA can take decimal values.

[4]Twelve of the 19 counties in Norway had a free school choice system in 2016. In rural counties, geographic criteria still largely determine student high school choice.

from high school (hereafter, high school GPA). For those graduating high school with a general studies degree, about 40% do not enroll in any general higher education program.

## 2.2 High Schools in Oslo and Bergen

There are 15 public high schools in Bergen offering general education programs and 20 in Oslo. For Bergen, we focus on the five cohorts of students completing middle school between 2006 and 2010. For Oslo, we consider the two cohorts of students completing middle school between 2009 and 2010.[5] During these periods, assignment to high schools worked through a centralized system where students ranked schools and education programs, and were then assigned based on their ranked-ordered list and middle school GPA. Students' assignment to high schools and education programs is based on a school-proposing deferred acceptance mechanism. A similar assignment system for secondary education also exists in Finland and Paris, and for college admissions in Norway, Ireland, Taiwan, Tunisia and Turkey (Fack, Grenet and He, 2019). For each education program, students could rank up to six different schools. The key feature of this assignment system is that there is a minimum admission score for enrollment in general studies for each oversubscribed high school. Oversubscribed high school are high schools that receive more applications than they can accommodate. In the years we study, the majority of high schools in Bergen and Oslo were oversubscribed for enrollment in general studies, and we observe significant discontinuities in the rate of enrollment of students at specific cutoff points of the distribution of middle school GPA. This feature makes it possible to implement a regression discontinuity analysis to assess the effect of enrollment in general education programs in more or less selective high schools on subsequent health and educational outcomes.

To help with interpretation, we now briefly describe the Oslo and Bergen high schools. We focus on how they are similar and how they differ along key dimensions, such as peer and teacher quality and financial resources. High schools in Oslo and Bergen have on average about 540

[5] The health data we are using covers the years 2006–2016 which is why we start with the graduating cohort of 2006 in Bergen. For Oslo, we start in 2009 because high school assignment was based on geographical criteria rather than on the middle school GPA for the graduating cohorts between 2006 and 2008.

students per school, and there are about 15 students per teacher. Resources for high schools are centrally allocated and based on the numbers of students, and there is variation across schools in both financial and teacher resources. For example, the top quartile of schools in terms of the students to teacher ratio has just nine students per teacher, while the lowest quartile of schools have 19.8.[6] Similarly, the top quartile of schools in terms of teacher diploma have about 65% of teachers with a master's degree, while the lowest quartile of schools have none. Another key difference across high schools is student ability. The top quartile of schools in terms of student ability have students with an average middle school GPA of 50, while the lowest quartile of schools has students with an average GPA of 37.7.[7] Because middle school GPA is correlated with gender and family background, we also observe significant differences in average student characteristics across high schools. Finally, all general programs offer compulsory core curriculum subjects like languages, natural sciences, and human sciences, but there is greater variety across schools in the availability of more specialized subjects like music, media, arts, and sports. Although schools differ in several dimensions, it is important to note that changes in peer quality and resources are less dramatic than in the context of other countries (see e.g., Abdulkadiroğlu, Angrist and Pathak, 2014; Clark and Del Bono, 2016; Dobbie and Fryer Jr, 2014).

In section 5, we document how school characteristics vary on average at the admission thresholds and leverage this information on differences in school inputs at the thresholds to provide insights into what school characteristics may explain the average effects on health and education.

## 2.3 Health Services in Norway

In Norway, health services are publicly financed and universally accessible for all Norwegian citizens. The services are organized in two levels: primary care and specialist care. Primary health care is the responsibility of the municipalities and includes general practitioners, emergency

[6]Note that the students to teacher ratio does not necessarily reflect classroom size, rather the variety of teachers employed by the school given we measure the number of teachers employed at each school rather than the number of full-time positions.

[7]A middle school GPA of 50 or 37.7 corresponds to the 83$^{rd}$ percentile or the 35$^{th}$ percentile of the distribution of middle school GPA, respectively.

rooms, infant and child health care centers, school health services, and elderly care. Specialist care is the responsibility of the four health regions in Norway and it includes somatic specialist care, psychiatric health services, and private referral specialists.

**Primary and Specialist Health Services.** General practitioners (hereafter GPs) and local emergency rooms (hereafter ERs) are the basis of the primary care services. The vast majority of Norwegian citizens belong to a specific GP's list, and GPs are responsible for providing primary health care services to the patients on their list. GPs diagnose their patients, certify sick leave, prescribe treatments, and refer their patients to specialist care when needed. They also follow up on their patient after they have received care in the specialist system. In general, the GPs serve as gatekeepers to the specialist care system and health-related welfare benefits.

Most specialist care is provided through public hospitals and outpatient care clinics, but contracted private specialists can also provide specialist care. Most importantly, the first contact with specialist care takes place via the referral of the patient by the GP or the ER because it is not possible for a patient to proceed directly to specialist care within the public health care system. Hence, GPs and ERs are crucial gatekeepers in the Norwegian public health care system for all types of diagnosis and treatment including mental health problems.

**School Health Services.** All Norwegian school children and youth are entitled to vaccinations, health education, and guidance, as well as medical examinations and access to health care professionals when needed (Helse- og omsorgsdepartementet, 2003). For school-age children, these are responsibilities of the school health services.[8] School health care services are easily accessible to students and are free of charge. These services are available at school premises during school hours and primarily provided by school nurses. School nurses are employed by municipalities and not by schools and may provide services to more than one school simultaneously. Importantly, the school health services are preventive. For curative purposes, the children are referred to primary

[8] Younger children receive these services in child health care centers that also provide pre- and postnatal services for mothers and newborns.

or specialist care services (Helsetilsyn, 1998). One exception is that school nurses are entitled to prescribe birth control pills (free of charge) to young women aged 16–19 years.

There is no systematic registry of the actual use of school health services by students (Abrahamsen, Ginja and Riise, 2021). Survey information from 2013 shows that about 25% of the students in high school use school health services at least once a year (Bakken, 2018). However, there are substantial gender differences in use: only about 13% of high school boys consult school nurses at least once a year, but 35% of high school girls. The most common reason for using school health services during high school are matters regarding sexuality and contraception.

# 3 Data and Empirical Strategy

## 3.1 Data

The data for this paper is compiled from several Norwegian administrative records, including the national educational registers, tax records, family registers, and health registers. We consider the sample of students that completed 10$^{\text{th}}$ grade between 2006 and 2010 in Bergen and in 2009 or 2010 in Oslo. In total, our sample comprises 19,932 individuals attending 87 different middle schools.

### 3.1.1 Demographic and Socioeconomic Information

The demographic and socioeconomic information is from registers covering the entire resident population in Norway up to 2014, which includes information such as the year and month of birth, gender, immigration status, municipality of residence in each year, and highest educational attainment. Information on earnings is from the tax registers. All registers include unique identifiers, and the population register specifies unique identifiers for the parents of each individual. This enables us to recover for each individual and his/her parents all relevant socioeconomic information.[9]

[9]Both parental income and education are measured when students complete grade 10. For parental income, we specify the sum of the earnings of the mother and father. For parental education, we create an indicator variable taking a value of one if at least one parent completed a higher education degree.

### 3.1.2 Schools and Educational Data

Information on enrollment in middle school, high school, and university is from the national educational registers and is available up to 2014. For each individual in our sample, we observe the middle and high schools attended, as well as the track in which the student enrolled, and the degrees, if any, completed. Educational choices and attainments are reported by the schools directly to Statistics Norway, thereby minimizing any measurement error from misreporting. For each student, we also observe the $10^{\text{th}}$ grade GPA and the GPA upon completion of high school. Finally, these registers contain information about whether individuals enrolled in college up to four years after completion of middle school, including those who enroll in college immediately after graduating from high school or following a gap year.

For each high school, we have information about its staff from the Social Security records. This information allows us to construct proxies for teacher quality and school financial resources. In particular, we specify variables indicating the share of teachers with a master's degree, the average age of teachers, the proportion of female teachers, students per teacher, students per non-educational staff, and the number of students per program. We also use information on student characteristics and high school enrollment to construct variables indicating for each student the average characteristics of peers in high school, such as the middle school GPA of peers, gender, parental education, and parental income.

### 3.1.3 Health Data

Information on visits to GPs and ERs is from the Control and Payment of Health Refunds database (acronym *KUHR* in Norwegian), which is available between 2006 and 2016. GPs and ERs are obliged to report all consultations and relevant International Classification of Primary Care (ICPC-2) codes to this national claims database to receive payment. ICPC codes convey information about the GPs' assessment of the patient's health problems and the type of care provided. Specifically, each ICPC code is made of one letter, indicating where the symptoms or diseases are located in the body, and two numbers indicating whether the GPs assessed health symptoms, diseases, prescribed a screening or preventive procedure, prescribed medication or treatments, analyzed test results, or performed an administrative task.[10]

Using this information, we constructed variables indicating whether and how many times each student visited a GP or ER between middle school completion and up to six years later, that is during the three years of high school and the first three post-high school years. In addition, as a selective school environment may have specific impacts on mental health issues, we constructed for each student a variable indicating whether during any consultation a GP assessed psychological symptoms or disease (ICPC codes beginning with the letter "P").[11] When constructing these variables, we consider academic rather than calendar years, that is, we consider for each year $t$ visits between August $t$ and July $t + 1$.

## 3.2 Cutoff Admission Scores

Our data provide detailed information on student demographic characteristics, school environment, health, and education. However, we do not have information on student applications to and rankings of high schools. As a result, it is not possible directly to identify high school admission thresholds from the data.[12] We, therefore, build on the methodology in Hansen (2000) to overcome this issue. This method was recently used by Hoekstra (2009) to identify admission thresholds and estimate the effect of going to a flagship university in the US and by Landaud, Ly and Maurin (2020) to study the effect of enrollment in selective Parisian high schools.[13] In addition, Porter and Yu (2015) show that this procedure can be used in combination with a standard regression discontinuity (RD) analysis without further adjustment or assumptions. In short, we identify schools for which there exists a significant positive discontinuity in enrollment rates and the procedure selects for

[10]See Appendix B for the list of ICPC-2 codes.

[11]Note that we do not know whether students are diagnosed or treated for a psychological issue for the first time because we only observe GP and ER visits since 2006.

[12]Unlike admissions to universities, which follow a nationwide assignment mechanism used in Kirkeboen, Leuven and Mogstad (2016), at high school level the admission system is decentralized at the county level. Unfortunately, we do not have information on student applications in these decentralized systems.

[13]This approach has also been used in other settings, such as testing for discontinuities in the dynamics of neighborhood racial composition (see e.g., Card, Mas and Rothstein, 2008), or evaluation of social programs (see e.g., Carneiro, Galasso and Ginja, 2019).

each school the threshold that minimizes the number of incorrectly assigned students (i.e., enrolled students below the threshold or unenrolled students above the threshold).

In practice, for each cohort and high school in Bergen, we focus on the sample of 10$^{\text{th}}$ graders in Hordaland county (the county where the city of Bergen is located). For high schools in Oslo, we consider the sample of 10$^{\text{th}}$ graders in Oslo county. For each value $g$ of the 10$^{\text{th}}$ grade GPA score distribution, we define a dummy which takes a value of one if student's $i$ score, $f_i$, is greater than or equal to the cutoff score $g$, $D_i^g = 1[f_i \geq g]$. For each high school $z$ in year $t$, we estimate the following regression for each value $g$ (omitting subscript $t$):

$$E_{iz} = \alpha + \psi_z D_i^g + \varepsilon_{iz}, \tag{1}$$

where $E_{iz}$ takes a value of one if student $i$ enrolls in high school $z$ in year $t$, and zero otherwise. For each high school $z$ in year $t$, we select as admission cutoff, $f_z$, the value of the 10$^{\text{th}}$ grade GPA score $g$ that maximizes the $R^2$ of equation (1) with a significantly positive $\hat{\psi}_z$. Further, we exclude a few admission thresholds with very small estimated discontinuities in enrollment rates around these cutoffs.[14] For each oversubscribed high school $z$, we then define the subsample of 10$^{\text{th}}$ graders whose middle school is located within eight kilometers of $z$.[15] Then, for each student, we define his/her GPA score-distance $f_i - f_z$ to the cutoff admission score of high school $z$, and we use regression discontinuity analysis where we pool all subsamples of students and use $f_i - f_z$ as a running variable.

[14]From the 105 estimated cutoffs, we exclude 21 with estimated discontinuities in enrollment rates below 0.015 percentage points, obtaining 84 oversubscribed high schools during the period of interest. In detail, we obtain 11 oversubscribed high schools in Bergen in 2006, 2008, and 2010, 10 in 2007, and 12 in 2009. For Oslo, we obtain 14 oversubscribed high schools in 2009 and 15 in 2010. Within each city and year, the admission cutoffs vary on average by two points between every two high schools of adjacent selectivity level.

[15]We use this criterion to maximize our first stage results because Fack, Grenet and He (2019) provide evidence that geographical proximity is a strong driver of student preferences over high schools. In addition, about 90% of students graduating from middle schools located in Bergen or Oslo during the years of interest and enrolled in general studies went to high schools located within eight kilometers of their middle school. The results are robust with respect to longer or smaller distance criteria when constructing the working sample.

### 3.3 Empirical Approach

To estimate the effects of a more selective school environment, following Lee and Lemieux (2010), we implement a standard regression discontinuity analysis where we compare students whose middle school GPA fell either just above or below the admission threshold of an oversubscribed high school. For each educational or health outcome $Y_i$ in our data, we start by estimating the following model (omitting subscript $t$):

$$Y_i = \delta + \alpha \mathbb{1}\{f_i - f_z \geq 0\} + \eta(f_i - f_z) + \lambda(f_i - f_z) \times \mathbb{1}\{f_i - f_z \geq 0\} + X_i\gamma + \omega_z + u_i, \qquad (2)$$

where $f_i - f_z$ measures the distance in points between school $z$'s admission threshold and student $i$'s middle school GPA. $X_i$ is a set of control variables, which includes student age, gender, family background, and average GPA in grade 10 in mathematics and Norwegian. We also include as control variables a full set of cutoff dummies, $\omega_z$, and $u_i$ represents the unobserved determinants of student health and education. Under the maintained assumption that there is no discontinuity in the distribution of $u_i$ at the cutoffs, the parameter $\alpha$ can be interpreted as the causal effect of eligibility for admission in a more selective high school on the outcome $Y_i$. The standard errors are clustered at the individual level, and, in our main analyses, we exclude students whose middle school GPA fell within 0.1 points of the admission thresholds from the analysis to avoid measurement error issues due to estimated cutoffs. We follow Calonico, Cattaneo and Titiunik (2014) to choose an optimal bandwidth around admission thresholds, which is 5.19 points. Finally, we use a triangular kernel centered on the admission cutoffs. In the following sections, we show that our results are robust to alternative functional forms, bandwidths, and sets of control variables.

Because we study the effects on a relatively large number of potentially correlated outcomes, we use a stepwise multiple testing procedure that controls for familywise error rate. In particular, we use the procedure in algorithms 4.1 and 4.2 of Romano and Wolf (2005) to account for testing several hypotheses simultaneously; this is an iterative rejection/acceptance method for a fixed level of significance. We use 1,000 block-bootstrap replications to obtain the adjusted critical values (the block is the individual). The result tables indicate whether the coefficients remain significant at a level of 1, 5, or 10 percent after using this procedure.

In our context, the mapping from eligibility to enrollment is not one-to-one because students may not effectively enroll in the high schools for which they are eligible due to, for example, preferences for other programs or locations. Therefore, we present instrumental variable (IV) estimates where enrollment in a given selective high school is instrumented with eligibility for enrollment in this high school (Hahn, Todd and der Klaauw, 2001). Note that these results should be interpreted cautiously because IV requires that the exclusion restriction and monotonicity hold.[16] Eligibility for a more selective school increases enrollment to a preferred school, but could also have indirect effects via changes in psychological factors such as aspirations and disappointment. We provide suggestive evidence that this is unlikely to be a major factor in that the estimated effects on mental health appear mostly after high school, and thus do not reflect the mere short-term effect of enrolling (or failing to enroll) in a preferred school. We also emphasize that we estimate the IV on a set of compliers that may have different characteristics than the average students at the thresholds.

**Descriptive Statistics.** Table A1 provides descriptive statistics for the students in our working sample. For the sake of comparison, the table includes three samples: all students completing 10$^{th}$ grade in Norway between 2006 and 2010, students completing 10$^{th}$ grade in the county of Hordaland (where the city of Bergen is located) between 2006 and 2010 and in Oslo in 2009 and 2010, and our regression discontinuity sample. The main takeaway is that the average student in Hordaland or Oslo (Column (3)) is comparable to our RD sample of students (Column (5)). However, when compared with the average student in Norway (Column (1)), we can see that students in Oslo and Bergen are positively selected on educational outcomes and demographic characteristics. For example, students in Oslo and Bergen area in our RD sample specialize more often in the general

[16] Violations of the monotonicity assumption are unlikely in our setting because this would mean that students eligible to enroll in a more selective school are less likely to enroll in the more selective school compared with the lower-ranked school (see subsection 4.1).

education track compared with the average student in Norway. In addition, these students have better-off peers with higher middle school GPAs. They are also more likely to graduate from high school and enroll in higher education up to four years after commencing high school. Interestingly, students in Oslo and Bergen and our RD sample are as likely to visit a GP or an ER as the average student completing 10$^{\text{th}}$ grade in Norway. There are also no differences in the use primary health care services or likelihood of being diagnosed or treated by GPs for mental health problems.

In section 4, we present the results for the RD sample, and, in addition, separately by the level of school selectivity, where schools with high (low) selectivity levels are schools whose admission threshold fell in the top (bottom) half of the distribution of cutoffs by city and year.

## 3.4 Tests of Identifying Assumptions

Students just above and below the cutoffs differ in their eligibility to enroll in a more selective high school, but we assume that they are similar in all other (observable and unobservable) predetermined dimensions. Below, we present evidence for the validity of our identification assumption.

**Strategic Manipulation around Cutoff.** One threat to identification would be that students willing to enroll in specific high schools manage to earn a score just above the admission thresholds. To provide empirical evidence that there is no strategic manipulation of the running variable at the cutoffs, Figure A2 presents the results when implementing the density tests suggested in McCrary (2008) on the full sample and separately by selectivity level. The panels in the figure illustrate that the density of the running variable is continuous at the cutoffs for the three samples, providing evidence supporting our identifying assumption.

**Covariate Balance.** Further, to assess the validity of our identification assumption of no discontinuity in unobserved determinants of students' health and education at the cutoffs, Table A2 reports the results of estimating model (2) using student baseline characteristics such as gender, nationality, and parental background as dependent variables.[17] Consistent with our identification assumption, we do not observe systematic discontinuities in the predetermined characteristics of students whose middle school GPA fell just above or below the admission threshold of an oversubscribed high school. This is shown in Figure A3 in the Appendix including the corresponding graphical estimates of model (2), excluding controls $X_i$ and $\omega_z$, for the three samples we examine.

The finding that student characteristics are continuous around admission thresholds is not very surprising in the setting we consider in that school admission cutoffs are ex ante impossible to predict precisely or manipulate. First, the GPA scores can take decimal values implying that the admission cutoffs can take a large number of possible values. Second, on average, school admission thresholds vary by 3.4 points from one year to the next, and they are jointly determined by the preferences and middle school GPAs of all 10$^{\text{th}}$ graders in Hordaland or Oslo, which are unknown at the time of application.

Note that the results reported in Table A2 and Figure A3 do not rule out that the average ability of student peers varies discontinuously at the thresholds, along with other characteristics of peers and the school environment. For example, a more selective school might be able to attract better teachers. In section 5, we discuss this in detail and attempt to quantify whether the changes in a high school's environment at the cutoff explains the effects of enrollment in a more selective high school on student education and health.

# 4 Empirical Results

In this section, we first investigate how eligibility for enrollment in a more selective school affects actual enrollment. We then turn to consider the impacts on subsequent education and health.

[17]When estimating model (2) for balancing tests, we include a full set of cutoff/year dummies as control variables but do not control for student baseline characteristics.

## 4.1 First Stage Results

Figure 1 presents our first stage results, that is, the effect of eligibility for enrollment in a more selective school on actual enrollment in this high school. For each figure, the solid lines plot the fitted regression lines after estimating model (2) without controls for student baseline characteristics or cutoff dummies (i.e., $X_i$ and $\omega_z$). The plotted points are the conditional means of the dependent variable for students in a 0.25-points binwidth. At the top of each figure, we report the estimated $\alpha$, which is the estimated effect of eligibility for enrollment in a more selective high school on actual enrollment, and its standard error. There is one figure for each sample under consideration: the whole sample (Panel a), students located around the admission thresholds of schools with above-median selectivity level (Panel b), and students located around the admission thresholds of schools with below-median selectivity level (Panel c). The three figures depict a significant increase in enrollment probability at the cutoffs. More precisely, the figures show that the enrollment probability of students is close to 2% below admission cutoffs, and increases by about eight percentage points for students scoring just above the cutoffs.[18] This indicates that a significant share of students wants to attend a more selective school when offered this opportunity, and student willingness to attend more selective schools is somewhat higher for schools with higher selectivity levels.[19] The estimates for $\alpha$ in model (2) in Column (1) in Table 1 confirm these results.

**Monotonicity in High School Choice.** When we rank the high schools within city and cohorts in our sample by their admission score, on average the thresholds for admissions to different high schools vary by 2-GPA points. To understand how the gradual increase across the school cutoffs within each city and cohort allows to identify the effect of admission to more selective high school, we re-estimate two versions of the first stage model. Within each cohort and city, we rank all high schools by their admission score. Then, we first re-assign to each high school $z$ the admission score of the high school with threshold immediately *lower* to that of high school $z$, denote it the threshold

[18] Note that one reason why the enrollment probability is not zero below the cutoff is that students with special needs (e.g., physical disabilities) may be accepted with a lower GPA to the geographically closest school.

[19] Recall that we do not know individual student preferences, hence many students could have preferences for other programs or school locations, explaining why enrollment is not increasing even more at the threshold.

$z-1$. Thus, all students eligible to high school $z$ would have also been eligible to high school $z-1$, and if the rank in terms of schools' demand is reflected into higher thresholds of admissions, then the enrolment rate for high school $z$ should be continuous around the cutoff of high school $z-1$. Second, we also assign high school $z$ the admission threshold of the high school with the immediately *higher*, that is, the threshold of high school $z+1$; and, the marginal student eligible to enroll in high school $z$ would have a middle school GPA too low to be eligible to high school $z+1$.

Our results for this "placebo" first stage are presented in Table A3. The estimates in Panel A show discontinuities of 2 percentage points in the probability of enrolment at the cutoff, that is are smaller than those in Column (1) of Table 1. This small discontinuity is consistent with students' preferring other programs or school locations beyond the high school with the highest threshold the student is eligible to. Panel B of Table A3 shows no discontinuity in the probability of enrolment in the high school with the threshold just *higher* than $z'$s high school.[20]

## 4.2 Educational Outcomes

Figure 2 and Figure 3 present the estimated effects of eligibility for enrollment in a more selective school on the subsequent education of students. We focus on two outcomes: high school graduation in the general track and enrollment in general higher education, either on time or after a gap year. Figure 2 shows a discontinuity of 2.4 percentage points at the cutoff on the likelihood of high school graduation, driven entirely by the most selective high schools (Panel b). Figure 3 exhibits no average impact on enrollment in higher education (Panel a). However, there is an increase of 2.9 percentage points for the most selective high schools (Panel b). Columns (2) and (3) in Table 1 confirm these results. Note that the main findings remain significant after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

Our finding that eligibility for enrollment in a more selective school has positive effects on student educational outcomes differs from previous studies showing that elite school attendance

[20]We note that the sample sizes are smaller than those in Table 1 because the re-assignment of threshold described above implies that, within each cohort and city, observations around high schools with the lowest (Panel A) and the highest (Panel B) are dropped because they are excluded in the re-assignment.

in the US does not affect educational outcomes (see e.g., Abdulkadiroğlu, Angrist and Pathak, 2014; Abdulkadiroğlu et al., 2017; Dobbie and Fryer Jr, 2014)). However, it is in line with Pop-Eleches and Urquiola (2013) and Jackson (2013) who also consider nonelite settings and document the positive effects of attending more selective schools. To understand in our setting how the distribution of admission thresholds compares to the test score distribution after middle school in the areas of interest we study, Figure A1 plots the density of both GPA and admissions cutoffs; on average the cutoffs are located around the $63^{rd}$ percentile of the GPA distribution. We note that the results that the eligibility for enrollment in a more selective school significantly affects high school completion and enrollment in higher education are similar to the findings of Clark and Del Bono (2016), who focus on individuals born in the 1950s. Hence, our focus on nonelite high schools—implying that the marginal students differ by context—may be an explanation for the differences in effects compared with the US. Other features of the education system, such as the centralized admission system to higher education in Norway, may also play a role in our findings. In particular, student ranks within their class or school are not of direct importance for access to higher education because only their rank in the national high school GPA distribution is crucial for the centralized admission system. This setting is different from the setting in the US or France where rank in a class or school is a central factor in college applications (Dobbie and Fryer Jr, 2014; Landaud, Ly and Maurin, 2020).

Columns (1) and (2) in Table A4 in the Appendix present the IV estimates, where we rescale the intention-to-treat estimates by the probability of enrollment in a selective high school upon gaining eligibility for enrolment. Panel A shows that enrollment in a more selective high school increases the probability of high school graduation and enrollment in higher education by 28 and 19 percentage points, respectively. While these estimates are large, the results are quite imprecise, and we cannot rule out quite modest effects.

## 4.3 Health Outcomes

Next, we analyze the impacts of eligibility for enrollment in a more selective school on student health during and following high school. We first focus on the probability and number of visits to GPs or ERs. We then split the visits into two types: visits during which patients are diagnosed or treated for a mental health issue (i.e., ICPC-02 codes beginning with a "P" as described in Appendix B) and visits for other health assessments or treatments.[21] Figure 4 depicts no discontinuities around the eligibility cutoffs in the probability of consulting with GPs or ERs (for any type of visit) during the six years after middle school graduation. However, Figure 5 shows a reduction of 1.7 percentage points in the likelihood of being diagnosed or treated for a mental health problem during GP or ER visits (Panel a). Individuals gaining access to high schools with above-median selectivity levels (Panel b) drive this fall. The estimates in Columns (4)–(7) in Table 1 present the corresponding point estimates for $\alpha$ in model (2). As shown, the estimated effect on mental health is stronger in the post high school period (see Table A5).[22]

In Table 2, we examine the use of primary health care services in detail. In particular, we use the ICPC-2 codes to classify the different types of mental health problems, and create four categories: anxiety or depression symptoms and diseases, substance use, hyperkinetic disorders, and other psychological symptoms or disorders (see Table A6 for the classification of mental health conditions).[23] As shown, the reduction in visits with depression or anxiety drives the reduction in the likelihood of consultations with mental health diagnoses or treatments. Note that this finding remains significant after adjusting the inference for multiple hypothesis testing.

We then turn to more serious health conditions. We do not find any impacts on behavioral or severe mental health problems for the three samples studied (all sample, and higher and lower

[21] We note that it is possible that there are multiple symptoms and/or diagnoses during a visit to GP or ER.

[22] Columns (3) and (4) in Table A4 in the Appendix present the corresponding IV estimates, carrying with them the same cautiousness in interpretation as discussed for educational outcomes. Enrollment in a more selective high school instrumented by eligibility reduces the likelihood of being diagnosed or treated by a GP or an ER for psychological symptoms and diseases by 21 percentage points.

[23] We bundle anxiety and depression together given the possibility of co-diagnoses and common treatments for both conditions (see, e.g., Pratt, Brody and Gu (2017)). Hyperkinetic disorders include inattention, overactivity, and impulsivity. They include a variety of attention disorders such as attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD).

selectivity high schools). In particular, Table A7 shows no effects on teen pregnancies among females under the age of 20, hospitalizations in general (Column 2) and due to any mental health conditions (Column 3; measured by ICD10 codes F), hospitalizations due to use of psychoactive substances (Column 4; measured by ICD10 codes F10-19) or injuries (Column 5; measured by ICD10 codes S or T including injury, poisoning and certain other consequences of external causes).

There are different explanations for our estimated impacts on mental health. More selective schools could have an incapacitation effect if, for example, students have to study longer hours in more selective schools and do not have time to visit health services. This does not appear as a likely mechanism because we do not find any impact on the extensive or intensive margin of visits to GP/ER (Columns (4) and (5) of Table 1). Alternatively, our effects could reflect differences across schools in the availability or quality of school nurses.[24] To shed light on this potential mechanism, we evaluate year by year how GP or ER consultations with a psychological diagnosis or treatment vary across our sample. If school nurses were substitutes for psychological consultations during high school years, we would expect a sharp rise in the number of consultations with a psychological diagnosis or treatment after high school graduation (i.e., between year three and year four post-middle school graduation). Figure A4 in the Appendix reports the prevalence of mental health diagnoses or treatments upon GP/ER visits in our sample for each year after middle school graduation. The figure depicts a stable increase in the prevalence of primary health services with mental health diagnoses or treatments, which provides suggestive evidence that school nurses do not seem to act as substitutes for GP/ER visits. Finally, in our setting, gaining access to a more selective school also implies gaining access to a preferred school. As discussed earlier, our estimated effects on mental health appear mostly after high school (see Table A5), providing suggestive evidence that our effects do not reflect the mere short-term effect of enrolling (or failing to enroll) in a preferred school. Overall, our results do not seem driven by incapacitation effects, differences in the supply of health services, nor do they seem to link to a short-term feeling of success or failure. Rather, our results suggest that a more selective schooling environment is

[24]As discussed in Section 2.3, school nurses are employed by municipalities not by schools.

protective of mental health. It is still possible that students perceive a more selective high school environment as more stressful, but our results suggest that the positive aspects of a more selective environment outweigh any potential increase in school pressure.

## 4.4 Robustness Checks

To assess the robustness of our results, we check whether our main findings are sensitive to the choice of control variables, to different functional forms, to alternative bandwidths, and to focusing separately on the two cities we consider.

In our main specification, model (2), we control for several predetermined individual characteristics. In Table A8 we check that our main findings are robust to excluding these control variables, or to selecting a smaller set of control variables. Table A8 presents estimates for five outcomes: high school enrollment, high school graduation, enrollment in higher education, the probability of visits to GP/ER, and the probability of mental health diagnosis or treatment. For each outcome in Table A8, the first column does not include controls for the predetermined individual characteristics. In the second column, we select relevant control variables using the double lasso procedure suggested in Belloni, Chernozhukov and Hansen (2013). The point estimates remain nearly unchanged relative to our baseline results.

In addition, the estimates reported in Table A9 show that our main findings are robust to different functional forms for the running variable. Our preferred model controls for a linear spline function of the running variable with triangular weights. Table A9 presents the results with alternative functional forms for each of the five main outcomes. For each of the outcomes in Table A9, we allow for cutoff-specific trends when estimating model (2) in the first column. In the second column, we follow Lee and Lemieux (2010) who propose goodness-of-fit tests as an ancillary means to select an optimal polynomial function. The recommended polynomial presented in the bottom of each panel is in general the linear specification. In the third column, we employ nonparametric estimations using local linear regressions. The results are again similar to our baseline estimates.

In Figure A5, we report the point estimates and confidence intervals for our main outcomes for a wide range of bandwidths. The estimates show that our baseline estimates are highly robust to the choice of bandwidths in the neighborhood of the optimal bandwidth (i.e., the bandwidth that minimizes the mean square error).

In our main sample, we exclude students whose middle school GPA fell within 0.1 points of the admission thresholds due to potential measurement error arising because of estimated threshold. In Table A10 we show that our main results are similar relaxing this restriction and excluding just observations with a GPA exactly equal to the admission threshold.

Lastly, we turn our attention to see if a particular city is driving our main results. Table A11 presents estimates for $\alpha$ in equation 2 separately for each city (Bergen and Oslo). The estimates for $\alpha$ are similar for both cities, suggesting that the main findings are not driven by one city alone. This provides suggestive evidence regarding the external validity of our results across cities.

# 5 Suggestive Mechanisms

Although all public Norwegian high schools follow a similar national curriculum, high schools vary along several dimensions. Because high school assignment is based on middle school GPA, student average ability varies significantly from one high school to another. Further, as a student's middle school GPA is correlated with their gender and family background, the proportion of female students and student parental backgrounds may also vary significantly across high schools. In addition, schools are independent in their hiring decisions resulting in a heterogeneous distribution of teacher characteristics across schools. Moreover, the allocation of financial resources to schools depends on the number of students, so that financial resources also vary by school size. To provide insights into what features of the schooling environment may influence student health and education outcomes, we also investigate changes in school characteristics at the thresholds. In a second step, we implement a heterogeneity analysis where we estimate our regression discontinuity model for each admission threshold and each school feature separately. This helps us to consider whether changes in longer-term educational choices and health outcomes are larger when students gain eligibility to schools where peer characteristics, teacher characteristics, or school resources change by a larger margin at the admission threshold.

First, Table 3 documents changes in peer characteristics at the threshold. Panel A of Table 3 shows that eligibility for enrollment in a more selective school improves the ability level of peers, increasing peer average middle school GPA by 4.4% of a standard deviation.[25] Just above the threshold, peers also have more educated parents with higher income levels. In contrast, we do not identify differences in the gender composition of peers on average (Panel A). The estimated impacts on peer ability are similar for high schools in the top and bottom halves of the selectivity distribution (Panels B and C). However, eligibility to enroll in a more selective school increases the share of female peers for the top half of the selectivity distribution but does not change peer parental background. On the contrary, there is no effect on the share of female peers, but a significant impact on peers' parental income and education for schools with lower selectivity levels.

Next, we explore how eligibility for enrollment impacts the high school educational program and school and teacher characteristics (see Table 4). The estimates in Columns (1) and (2) show that eligibility to enroll in a more selective high school increases the likelihood of enrolling in the general track, and correspondingly decreases the probability of enrolling in the vocational track. There are no impacts on high school programs around the cutoffs of highly selective high schools (Panel B); instead, schools in the bottom half of the selectivity distribution (Panel C) appear to drive this program substitution.

Then, we study school financial resources and the number of teachers and staff members per student. As discussed, the central allocation of financial resources to schools is based on the number of students. Hence, we proxy financial resources by the number of students enrolled in the same program-cohort. The estimates in Column (3) show that eligibility to enroll in a more selective high school is associated with 4.76 extra students in each student's own program at the cutoff (i.e., about 7% of the control mean). This appears driven by high schools in the bottom half of the selectivity distribution. Eligibility to enroll in a more selective high school also decreases

[25]For each student, we computed the average standardized middle school GPA among students enrolled in the same track and high school in August following middle school completion.

the number of students per teacher (Column (4); this effect does not survive adjustment of inference for multiple hypothesis testing) but does not change the number of students per nonteaching staff (Column (5)).

Lastly, we consider variations in teacher characteristics. In particular, we study whether eligibility to enroll in a more selective school changes the proportion of teachers with a master degree, the average age of high school teachers, and the proportion of female teachers. Panel A shows no significant discontinuities in teacher characteristics, except for the proportion of female teachers.

In sum, enrollment in a more selective high school not only directly affects the characteristics of the peers with whom students interact but also the types of programs in which students enroll, the characteristics of their teachers and their number, and the financial resources of their school. The impacts on peers, teachers, and resources vary across the selectivity distribution and motivate the next section where we use these variations to explore the most likely mechanism driving our estimates.

## 5.1 Heterogeneity Analysis by Changes in School Inputs at the Thresholds

### 5.1.1 Empirical Approach

To further our understanding of selective school effects on education and health, we develop a heterogeneity analysis, which makes use of the fact that we have 84 different admission cutoffs with variations in how school characteristics change around these cutoffs. In this section, we analyze whether we obtain larger estimated effects on health and education around thresholds with larger changes in peer characteristics, teacher characteristics, or other school features.

We restrict the analysis to three outcomes of interest: high school graduation, student enrollment in higher education and the probability of diagnosis or treatment of students by GPs or ERs for psychological conditions. We consider 11 different school inputs: the average middle school GPA of peers, the proportion of female students among high school peers, the parental education of peers, peers' parental income, the proportion of teachers with a master degree, the average age of teachers, the proportion of female teachers, the number of students per teacher, school size, the number of students per nonteaching staff, and student probability of enrolling in the general track. For each admission threshold $z$ and each school input $m$, we estimate our standard RD model described in the previous section:

$$Y_{m,z,i} = \delta_{m,z} + \alpha_{m,z}\mathbb{1}\{f_i - f_z \geq 0\} + \eta_{m,z}(f_i - f_z) + \lambda_{m,z}(f_i - f_z) \times \mathbb{1}\{f_i - f_z \geq 0\} + X_i\gamma + u_{m,z,i}. \quad (3)$$

The only difference relative to model (2) is that we estimate model (3) for each admission threshold separately, rather than pooling all admission thresholds with cutoffs by year fixed effects. For each school input and each admission threshold, we obtain the estimated parameters $\widehat{\alpha_{m,z}}$, which indicate the magnitude of the variation in the school input $m$ around the admission threshold $z$. For each school input separately, we then divide the sample depending on whether the estimated effect on the input under consideration is above or below the median estimated effect, $\widetilde{\alpha_{m,z}}$.

For each outcome and school input, we then estimate our basic RD model separately on subsamples characterized by the magnitude of the change in the school input under consideration at the thresholds. We use this heterogeneity analysis to respond to the following question: do larger changes in peer characteristics or teacher characteristics or in other school features coincide with greater estimated effects on student education and mental health?

## 5.2 Findings

Figure 6 provides the results of our heterogeneity analysis. First, Panel a in Figure 6 documents that there are significant differences in how each school input varies at the thresholds. Along all the dimensions we consider, the average change at the threshold in the input under consideration is significantly different for schools with a below- or above-median change. For example, for one group of schools, eligibility for enrollment in a more selective school implies an increase in the share of female peers, while it implies a decrease in the share of female peers in the second group of schools. Similarly, for one group of schools, eligibility for enrollment in a more selective school implies an increase in the ratio of students per teacher, but a decrease in this ratio for the second group of schools. Panel b of Figure 6 reports the RD results on high school graduation using the same subsamples as in Panel a. This figure shows five significant differences: larger changes in peer ability and in the parental background of peers (higher education and income) are associated with larger estimates on high school graduation; but also changes in some characteristics of teachers, namely, students–teacher ratio and the proportion of teachers with a master degree coincide with larger impacts on high school graduation. In Panel c of Figure 6, we show the results for enrollment in higher education; there are two significant differences: larger changes in the student–teacher ratio and the age of teachers coincide with larger estimated effects on enrollment in higher education. Finally, for the probability of diagnosis or treatment by a GP for psychological symptoms or diseases (Panel d of Figure 6), we identify significant differences in the estimated effects depending on the changes in the proportion of female teachers.

Overall, our heterogeneity analysis suggests that both changes in peers and teacher characteristics are probably important to explain the observed positive impacts of attending on educational outcomes on a more selective high school, while for health changes in the characteristics of teachers seem to be more important. Although the impacts on health are detected after high school and our analysis suggests that teachers play a role on such outcome, but this is consistent with more time to detect impacts on (mental) health outcomes.[26]

Note that this analysis is only descriptive and that we should not interpret the findings as causal effects. The estimates do not survive adjustment for multiple hypothesis testing. Moreover, despite including many school-level inputs, this analysis does not exclude alternative mechanisms such as changes in student ambitions or confidence in the future that are unobserved.

[26]See also Almond, Currie and Duque (2018) who review the impacts of childhood circumstances on adult outcomes.

## 6 Conclusion

This paper provides new insights into the relationship between the selectivity of the schooling environment and student educational outcomes and mental health. To identify causal effects, we build on the features of the high school assignment system in the two largest Norwegian cities, where the assignment of middle school students to high school is through a centralized process that gives priority to students with the best average middle school grades. This assignment system enables a regression discontinuity analysis, where we compare the education and health outcomes of students that are similar at the end of middle school but are eligible to enroll in more or less selective high schools. The direction of the effect on health and education outcomes is theoretically ambiguous. On the one hand, a selective school environment might be a stressful experience for marginal students and increase their (mental) health problems. On the other hand, a more selective school with better peers and different teachers might be an inspiring experience that opens up new perspectives and improves student (mental) health in both the short and long term.

Our results show that eligibility for enrollment in a more selective school significantly improves school outcomes, increasing the likelihood of both high school completion and enrollment in higher education. In addition, we document that the eligibility to enroll in a more selective school does not affect the overall use of primary care services up to three years after high school completion, but does decrease a student's likelihood of diagnosis or treatment by a GP for mental health issues. These estimated effects on education and mental health appear driven by access to schools in the top half of the selectivity distribution.

Our heterogeneity analysis exploiting the 84 different admission cutoffs reveals that larger changes in peers ability and parental background, students–teacher ratio and the proportion of teachers with a master degree coincide with larger impacts on high school graduation. Additionally, changes in the student–teacher ratio and age of teachers coincide with larger estimated effects on enrollment in higher education, and that larger changes in the share of female teachers coincide with larger estimated effects on student mental health. Overall, this analysis suggests that both changes in peers and teacher characteristics could be important for explaining the effects of a more selective school environment for a student's subsequent education and health.

Besides complementing the existing literature on the effects of school selectivity on educational outcomes, we provide new knowledge on the relationship between school selectivity and mental health, and demonstrate that access to more selective schools decreases the risk of mental health problems. While a selective school environment might still be a stressful experience for marginal students, our results suggest that the positive effects of enrolling in a more selective school outweigh this extra pressure over the long term. However, there are still open questions for future research: will these improvements be materialized in different labor market outcomes? Are there any impacts on unobservables such as aspirations and noncognitive skills? By identifying effects along a wide interval of the admission cutoff scores, our results are relevant for the impacts of school selectivity in the context of nonelite schools, that are available in most European countries.

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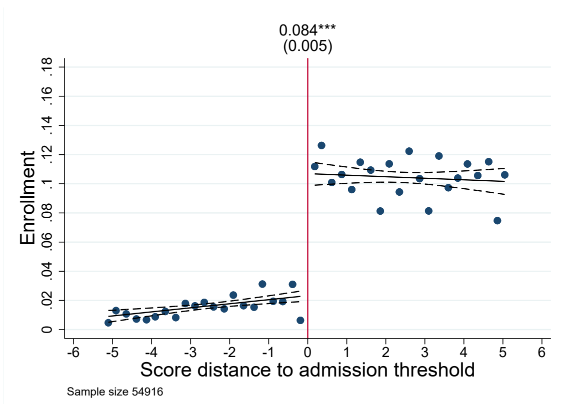
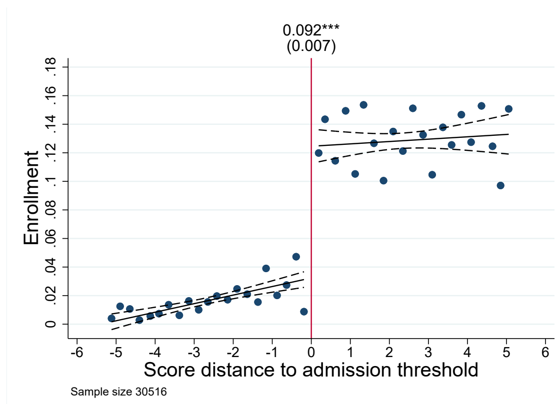
Figure 1 – Enrollment probability

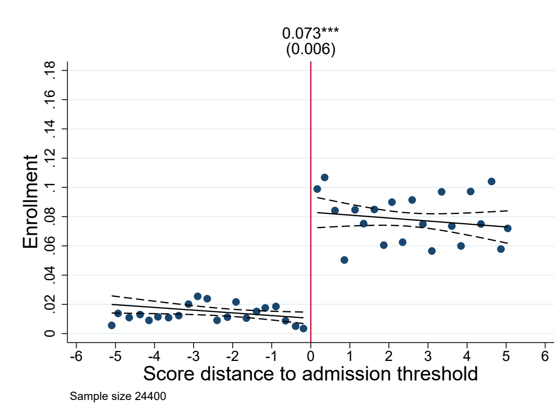
(a) All




(b) Higher selectivity levels



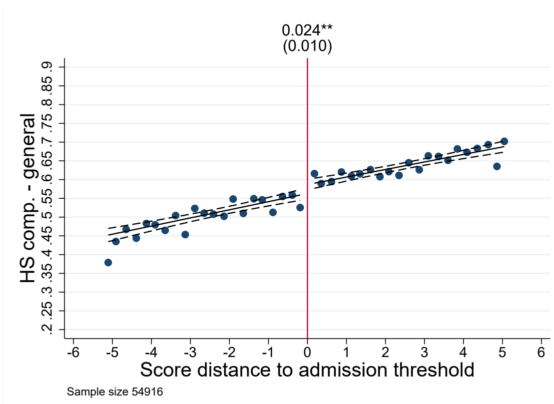

(c) Lower selectivity levels



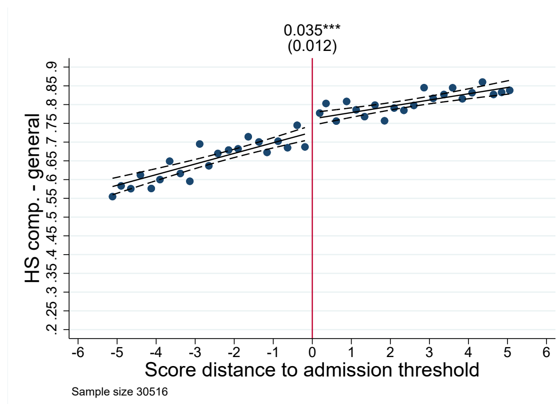

NOTE: These figures plot the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The standard errors for the point estimates are clustered at individual level. The dashed lines are 95 percent confidence intervals. *** p<0.01, ** p<0.05, * p<0.1.

Figure 2 – High School Graduation

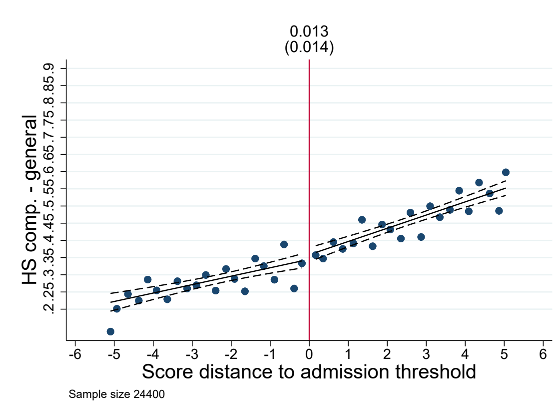
(a) All




(b) Higher selectivity levels



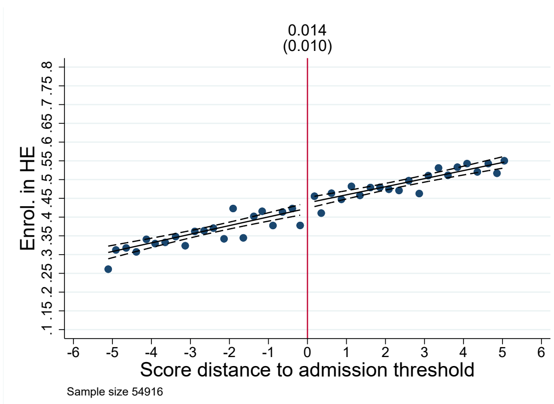

(c) Lower selectivity levels



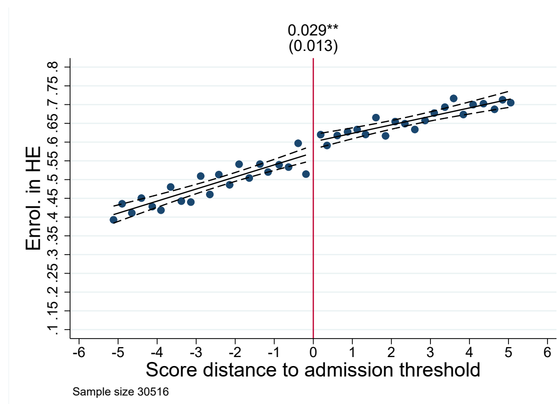

Note: These figures plot the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The standard errors for the point estimates are clustered at individual level. The dashed lines are 95 percent confidence intervals. *** p<0.01, ** p<0.05, * p<0.1.

Figure 3 – Enrollment in Higher Education

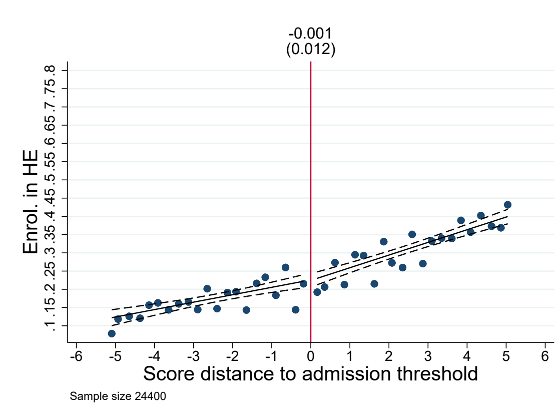
(a) All




(b) Higher selectivity levels



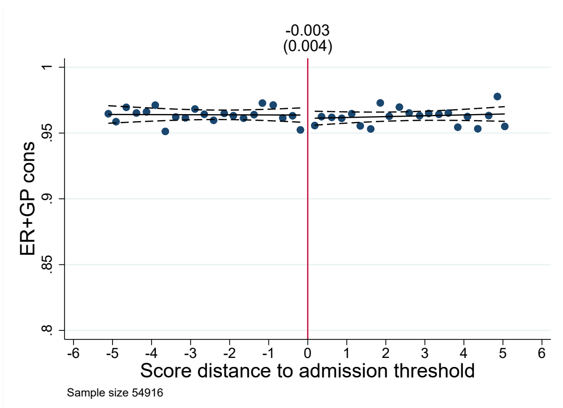

(c) Lower selectivity levels



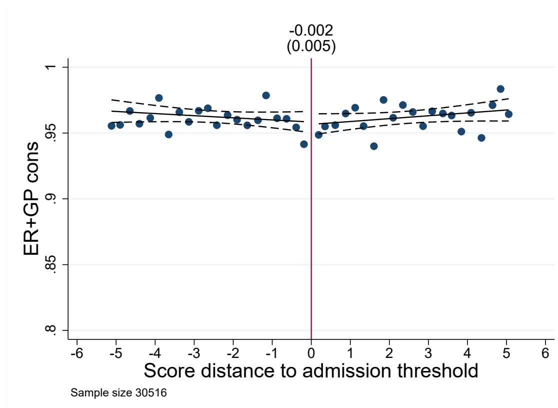

Note: These figures plot the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The standard errors for the point estimates are clustered at individual level. The dashed lines are 95 percent confidence intervals. *** p<0.01, ** p<0.05, * p<0.1.

Figure 4 – Probability of Consulting with a GP or an ER

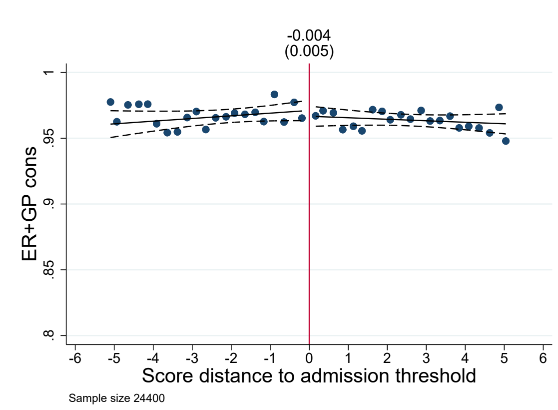
(a) All




(b) Higher selectivity levels



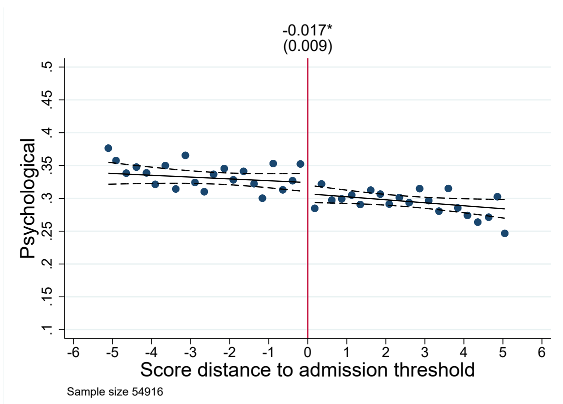

(c) Lower selectivity levels



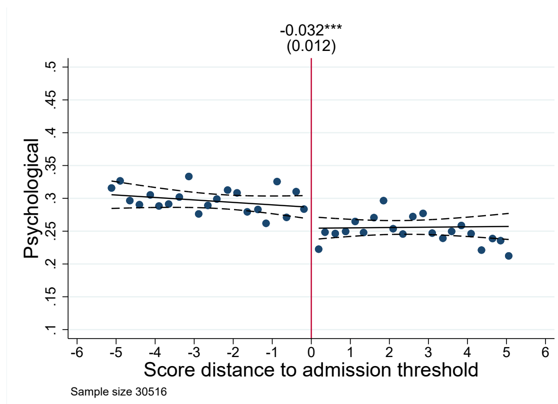

Note: These figures plot the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The standard errors for the point estimates are clustered at individual level. The dashed lines are 95 percent confidence intervals. *** p<0.01, ** p<0.05, * p<0.1.

Figure 5 – Probability of being Diagnosed or Treated for a Mental Health Issue

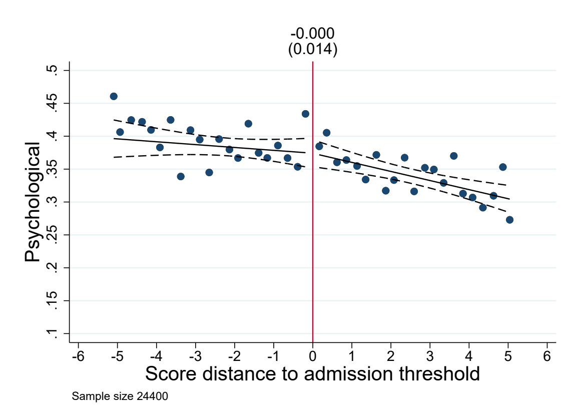
(a) All




(b) Higher selectivity levels



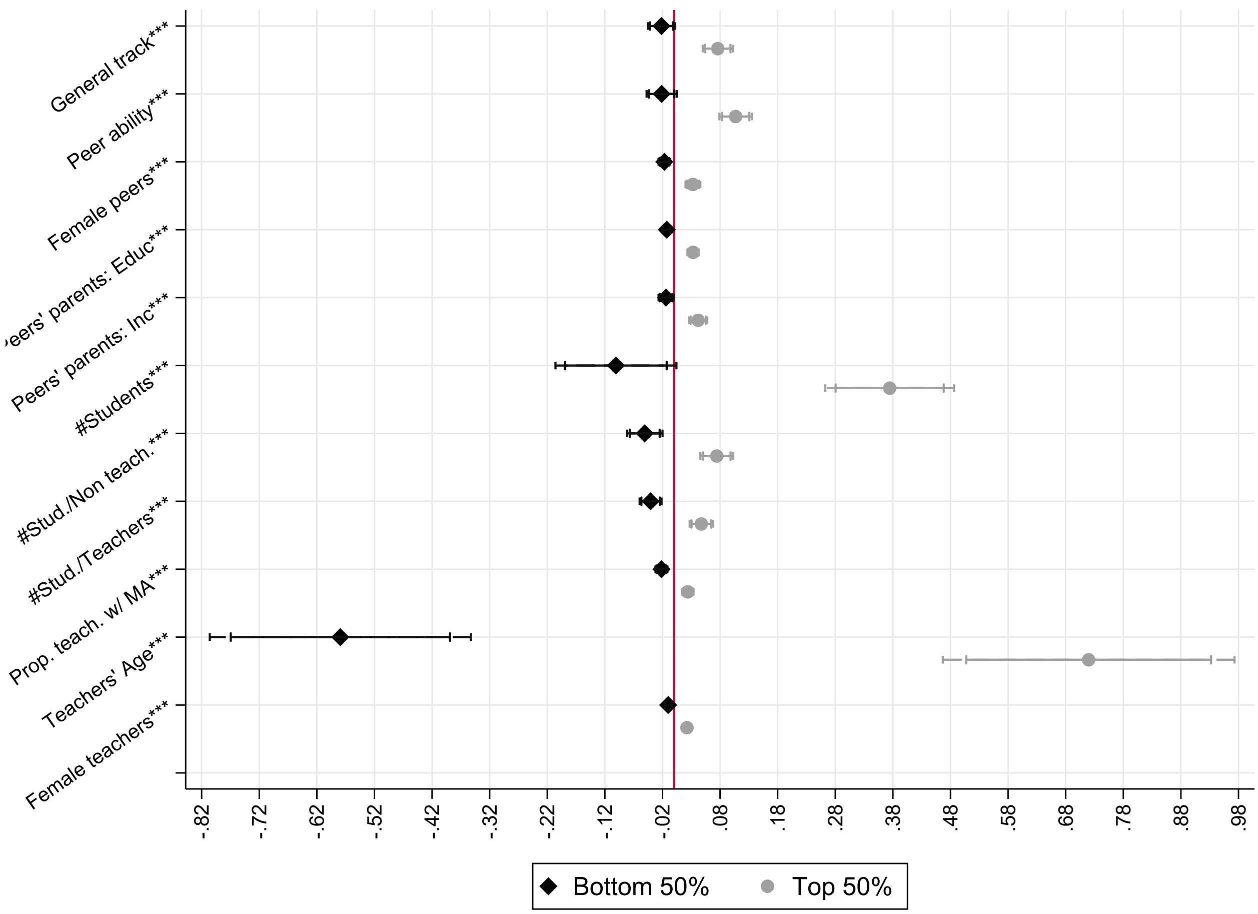

(c) Lower selectivity levels




Note: These figures plot the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The standard errors for the point estimates are clustered at individual level. The dashed lines are 95 percent confidence intervals. *** p<0.01, ** p<0.05, * p<0.1.

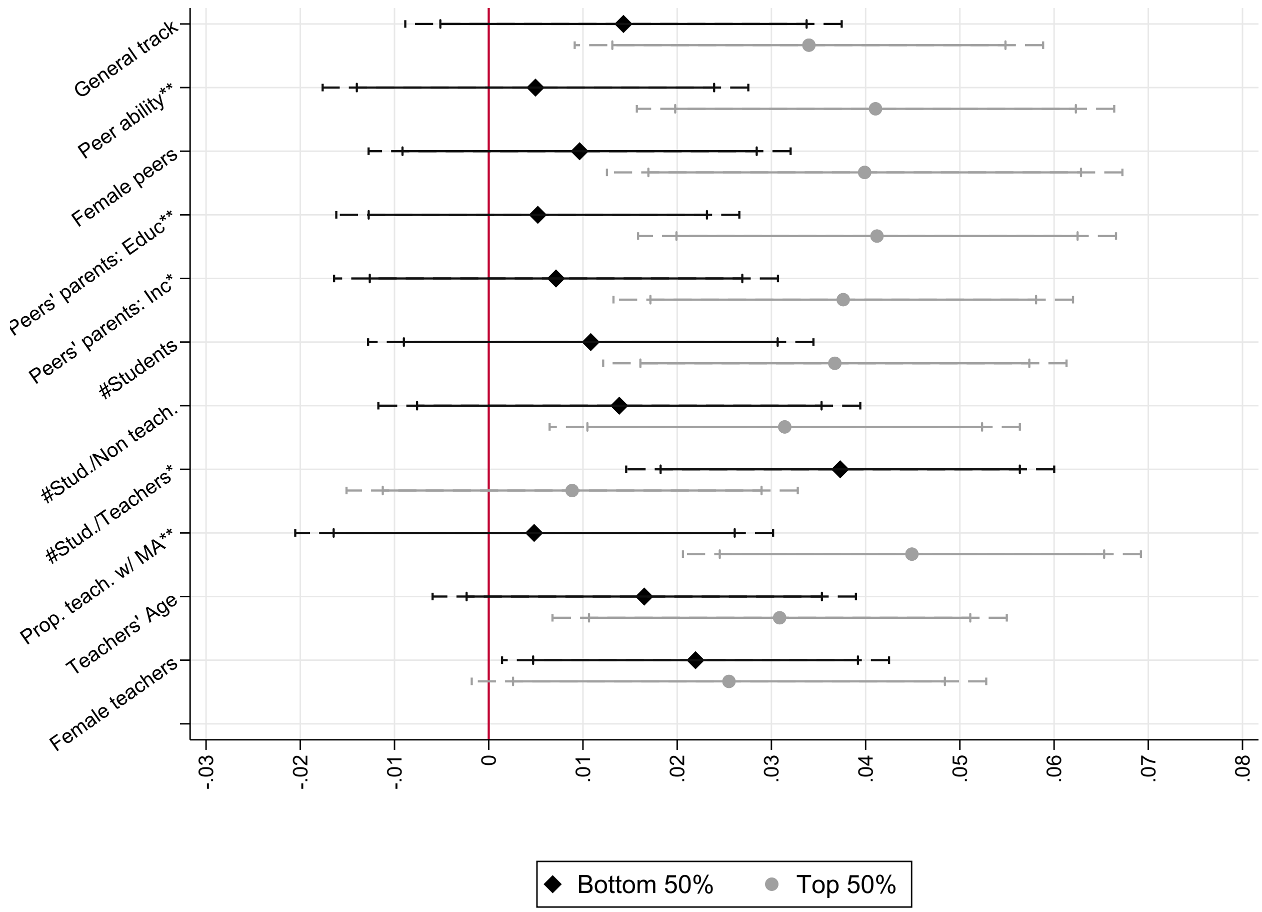
Figure 6 – Heterogeneity of Selective School Effects by Changes in School Characteristics

(a) Changes in School Characteristics at the Thresholds



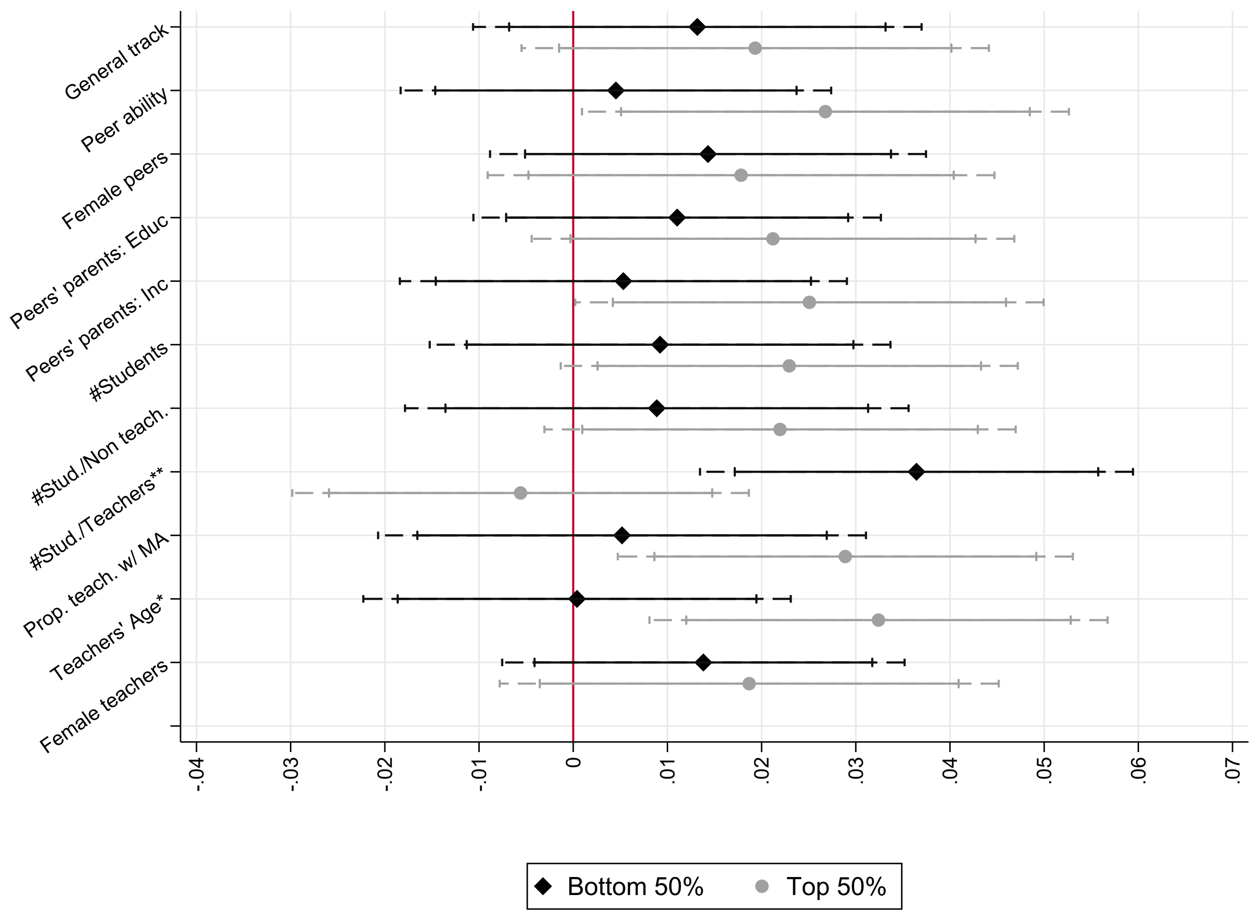

NOTE: Asterisks refer to the results of tests of the null hypothesis of no difference in the changes in inputs above or below the median estimated parameter where *** p<0.01, ** p<0.05, * p<0.1. All estimates are statistically different at the 5% level after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

(b) Changes in School Characteristics and High School Graduation



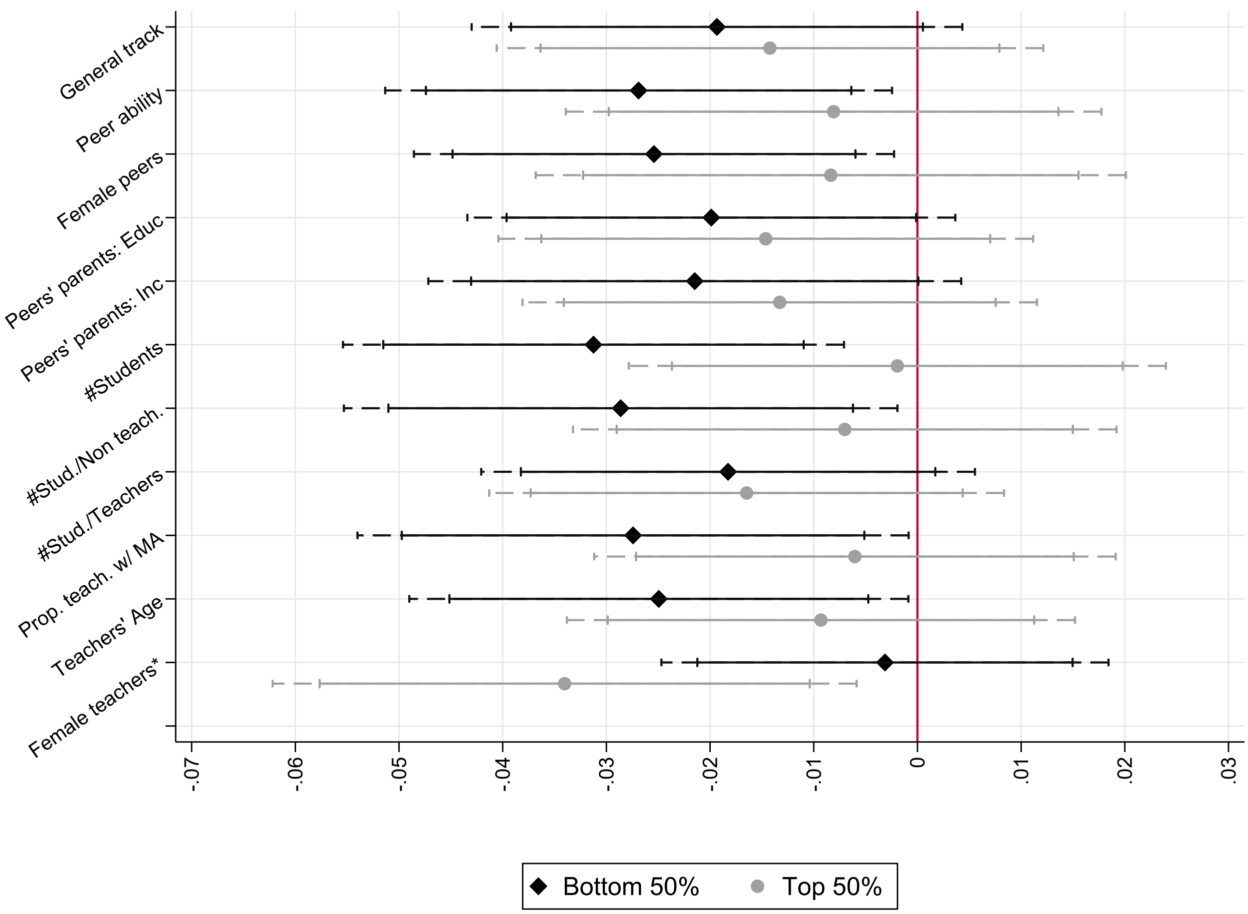

NOTE: Asterisks refer to the results of tests of the null hypothesis of no difference in the changes in inputs above or below the median estimated parameter where *** p<0.01, ** p<0.05, * p<0.1. Joint tests of the estimates are no longer statistically different at the 10% (or lower) level after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

(c) Changes in School Characteristics and Enrollment in Higher Education




NOTE: Asterisks refer to the results of tests of the null hypothesis of no difference in the changes in inputs above or below the median estimated parameter where *** p<0.01, ** p<0.05, * p<0.1. Joint tests of the estimates are no longer statistically different at the 10% (or lower) level after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

(d) Changes in School Characteristics and Mental Health Issues




Note: Asterisks refer to the results of tests of the null hypothesis of no difference in the changes in inputs above or below the median estimated parameter where *** p<0.01, ** p<0.05, * p<0.1. Joint tests of the estimates are no longer statistically different at the 10% (or lower) level after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

Table 1 – High School Selectivity, Education, and Health

| | (1) First stage enrollment | (2) High School graduation | (3) Enrollment in HE | (4) GP - ER cons. | (5) Nb. of GP - ER cons. | (6) Mental health issue | (7) Other health issue |
|---|---|---|---|---|---|---|---|
| ***Panel A: All*** | | | | | | | |
| Eligibility | 0.083*** | 0.023*** | 0.016* | -0.003 | -0.343 | -0.017* | -0.004 |
| | $(0.005)^{+++}$ | $(0.009)^{++}$ | (0.009) | (0.004) | (0.359) | (0.009) | (0.004) |
| Control mean | .021 | .542 | .402 | .964 | 17.7 | .327 | .962 |
| N | 54916 | 54916 | 54916 | 54916 | 54916 | 54916 | 54916 |
| ***Panel B: Higher selectivity Levels*** | | | | | | | |
| Eligibility | 0.091*** | 0.031*** | 0.026** | -0.003 | -0.738 | -0.032*** | -0.004 |
| | $(0.007)^{+++}$ | $(0.011)^{+}$ | $(0.012)^{+}$ | (0.005) | (0.457) | $(0.011)^{+++}$ | (0.005) |
| Control mean | .027 | .696 | .539 | .961 | 16.6 | .291 | .960 |
| N | 30516 | 30516 | 30516 | 30516 | 30516 | 30516 | 30516 |
| ***Panel C: Lower selectivity Levels*** | | | | | | | |
| Eligibility | 0.073*** | 0.015 | 0.004 | -0.005 | 0.185 | 0.002 | -0.006 |
| | $(0.006)^{+++}$ | (0.013) | (0.011) | (0.005) | (0.555) | (0.014) | (0.005) |
| Control mean | .013 | .321 | .206 | .969 | 19.2 | .380 | .965 |
| N | 24400 | 24400 | 24400 | 24400 | 24400 | 24400 | 24400 |

NOTE: This table reports point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1; $^{+++}$ p<0.01, $^{++}$ p<0.05, $^{+}$ p<0.1 after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

Table 2 – High School Selectivity and Mental Health Diagnoses and Treatments

| | (1) Depression/Anxiety | (2) Subs. abuse | (3) ADHD | (4) Other psy. |
|---|---|---|---|---|
| ***Panel A: All*** | | | | |
| Eligibility | -0.015* | 0.001 | -0.004 | -0.008 |
| | (0.008) | (0.004) | (0.003) | (0.007) |
| Control mean | .233 | .0514 | .0334 | .153 |
| N | 54916 | 54916 | 54916 | 54916 |
| ***Panel B: Higher Selectivity Levels*** | | | | |
| Eligibility | -0.028*** | -0.001 | -0.006 | -0.013 |
| | $(0.010)^{+++}$ | (0.005) | (0.004) | (0.009) |
| Control mean | .211 | .0384 | .024 | .134 |
| N | 30516 | 30516 | 30516 | 30516 |
| ***Panel C: Lower Selectivity Levels*** | | | | |
| Eligibility | 0.002 | 0.004 | -0.001 | -0.001 |
| | (0.013) | (0.008) | (0.006) | (0.011) |
| Control mean | .264 | .0701 | .0468 | .18 |
| N | 24400 | 24400 | 24400 | 24400 |

NOTE: This table reports the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1; $^{+++}$ p<0.01, $^{++}$ p<0.05, $^{+}$ p<0.1 after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

Table 3 – Characteristics of High School Peers

| | (1) Peers' av. MS GPA | (2) Prop. of female peers | (3) Parents of Peers Av. inc. (log) | (4) Parents of Peers Education |
|---|---|---|---|---|
| ***Panel A: All*** | | | | |
| Eligibility | 0.044*** | 0.006 | 0.016*** | 0.011*** |
| | (0.010)$^{+++}$ | (0.004) | (0.005)$^{+++}$ | (0.003)$^{+++}$ |
| Control mean | .0644 | .463 | 13.5 | .481 |
| N | 54916 | 54916 | 54916 | 54916 |
| ***Panel B: Higher Selectivity Levels*** | | | | |
| Eligibility | 0.039*** | 0.012*** | 0.011 | 0.007 |
| | (0.012)$^{+++}$ | (0.004)$^{+++}$ | (0.007) | (0.004) |
| Control mean | .353 | .496 | 13.8 | .568 |
| N | 30516 | 30516 | 30516 | 30516 |
| ***Panel C: Lower Selectivity Levels*** | | | | |
| Eligibility | 0.046*** | 0.000 | 0.018*** | 0.015*** |
| | (0.015)$^{+++}$ | (0.007) | (0.007)$^{+++}$ | (0.005)$^{+++}$ |
| Control mean | -.349 | .416 | 13.1 | .357 |
| N | 24400 | 24400 | 24400 | 24400 |

NOTE: This table reports the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1; $^{+++}$ p<0.01, $^{++}$ p<0.05, $^{+}$ p<0.1 after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

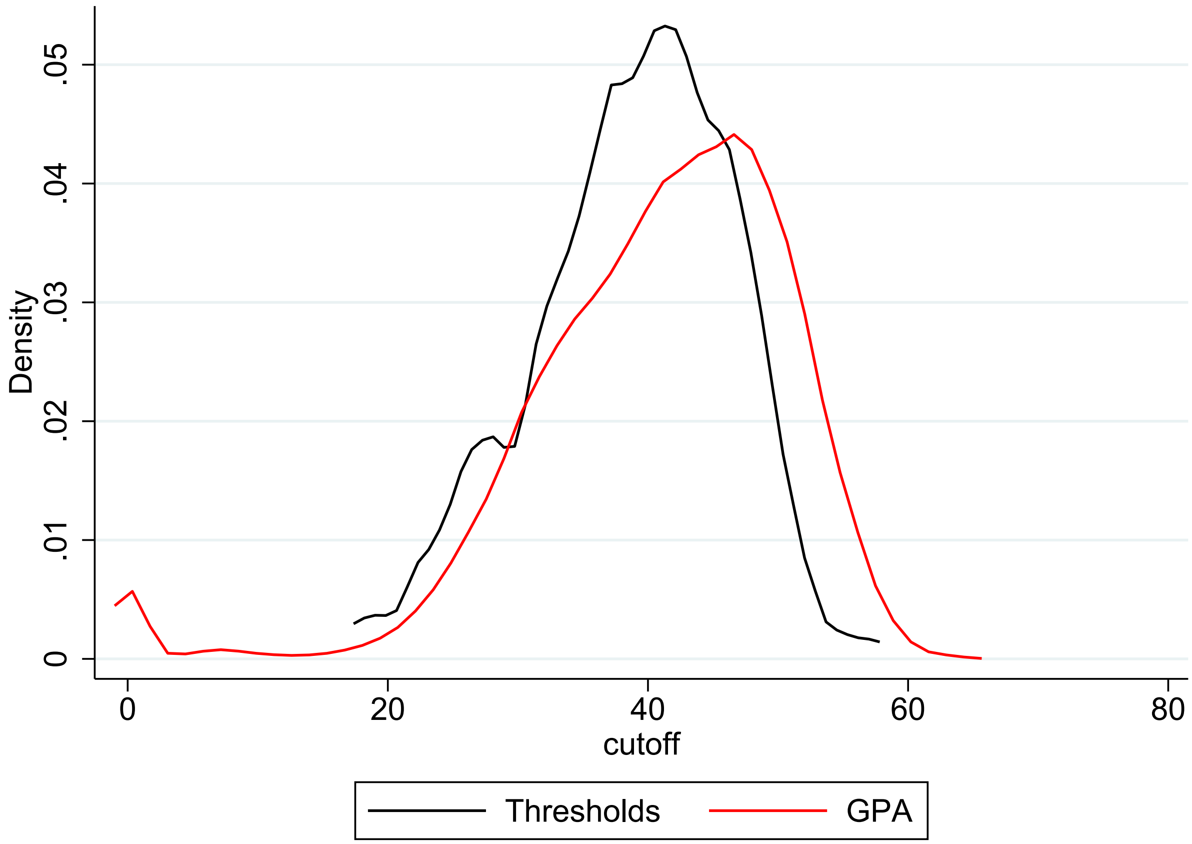
Table 4 – High School Education and Characteristics of High Schools Attended

| | (1) General track | (2) Vocational track | (3) #Stud. own program | (4) #Stud. /teachers | (5) #Stud. /non-teacher | (6) Share teachers w. masters | (7) Teachers' mean age | (8) Share female teachers |
|---|---|---|---|---|---|---|---|---|
| ***Panel A: All*** | | | | | | | | |
| Eligibility | 0.022** | -0.018** | 4.757*** | -0.475* | 0.189 | -0.001 | 0.049 | 0.005** |
| | (0.009)$^{++}$ | (0.008)$^{++}$ | (1.153)$^{+++}$ | (0.280) | (0.348) | (0.003) | (0.089) | (0.002)$^{+}$ |
| Control mean | .539 | .403 | 69.3 | 15 | 21.2 | .225 | 45.6 | .498 |
| N | 54916 | 54916 | 54916 | 54916 | 54916 | 54916 | 54916 | 54916 |
| ***Panel B: Higher Selectivity Levels*** | | | | | | | | |
| Eligibility | 0.007 | -0.002 | 3.032* | -0.539 | -0.142 | -0.007 | 0.104 | 0.005 |
| | (0.012) | (0.010) | (1.671) | (0.351) | (0.430) | (0.005) | (0.124) | (0.003) |
| Control mean | .673 | .241 | 92.1 | 15.6 | 22.8 | .244 | 45.7 | .517 |
| N | 30516 | 30516 | 30516 | 30516 | 30516 | 30516 | 30516 | 30516 |
| ***Panel C: Lower Selectivity Levels*** | | | | | | | | |
| Eligibility | 0.042*** | -0.041*** | 6.890*** | -0.450 | 0.569 | 0.006 | -0.024 | 0.006 |
| | (0.014)$^{+++}$ | (0.013)$^{+++}$ | (1.481)$^{+++}$ | (0.530) | (0.552) | (0.005) | (0.124) | (0.004) |
| Control mean | .346 | .635 | 36.7 | 14.2 | 18.8 | .197 | 45.4 | .472 |
| N | 24400 | 24400 | 24400 | 24400 | 24400 | 24400 | 24400 | 24400 |

NOTE: This table reports the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1; $^{+++}$ p<0.01, $^{++}$ p<0.05, $^{+}$ p<0.1 after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

# Appendix A

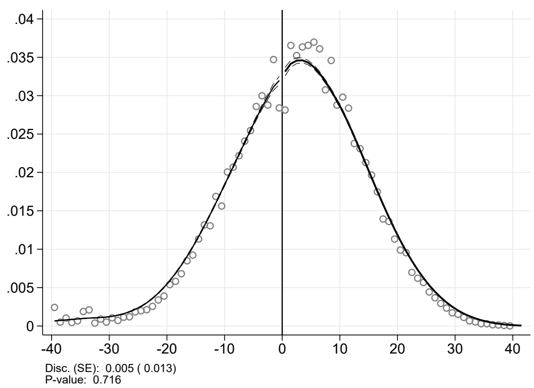
Figure A1 – Distribution of High School Admission Thresholds and Middle School GPA



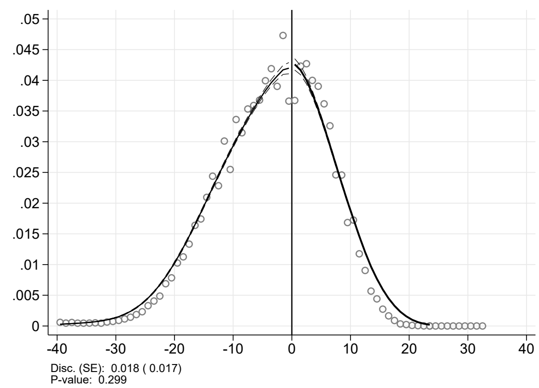

Note: This figure presents for the distribution of middle school GPA in the cities of Oslo and Bergen (red line) and the distribution of the admission thresholds in the selective high schools in our sample (black line) for the period studied.

Figure A2 – Density of Observations around Admission Cutoffs

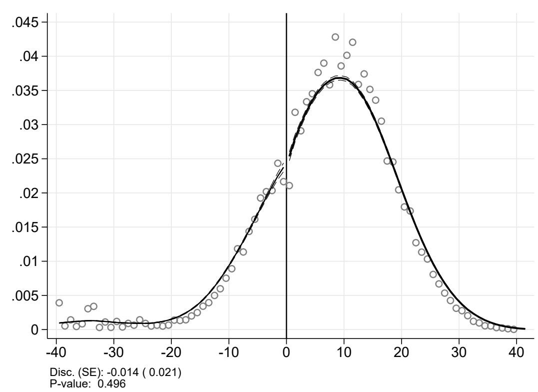
(a) All




(b) Higher selectivity levels



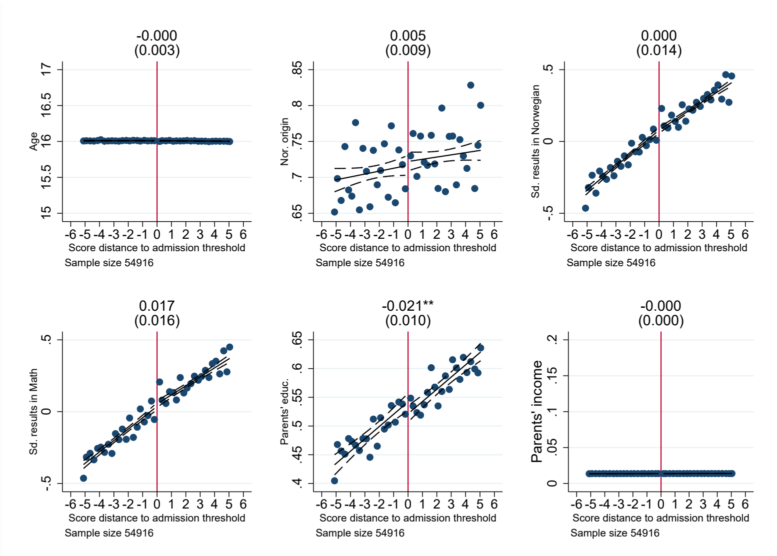

(c) Lower selectivity levels



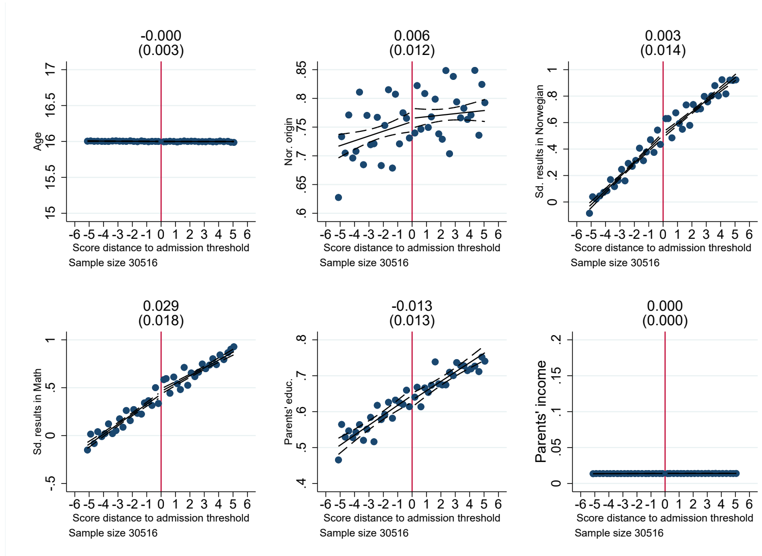

NOTE: These figures present nonparametric estimates of the density of observations on either side of the cutoff score following McCrary (2008). Each circle shows the average frequency of students per bin of the running variable. The solid lines represent estimated density functions, and the dashed lines are the 95 percent confidence intervals around it. The bottom right of each figure includes the estimated discontinuity for the density at the cutoff (standard errors in parentheses).

Figure A3 – Balancing of Covariates

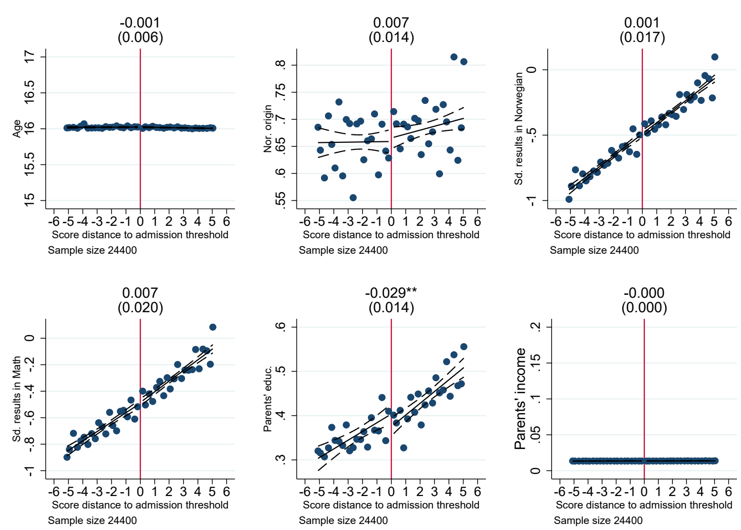
(a) All




(b) Higher selectivity levels




(c) Lower selectivity levels




NOTE: These figures plot the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The standard errors for the point estimates are clustered at individual level. The dashed lines are 95 percent confidence intervals. *** p<0.01, ** p<0.05, * p<0.1.

Figure A4 – Prevalence of Mental Health Diagnoses and Treatments

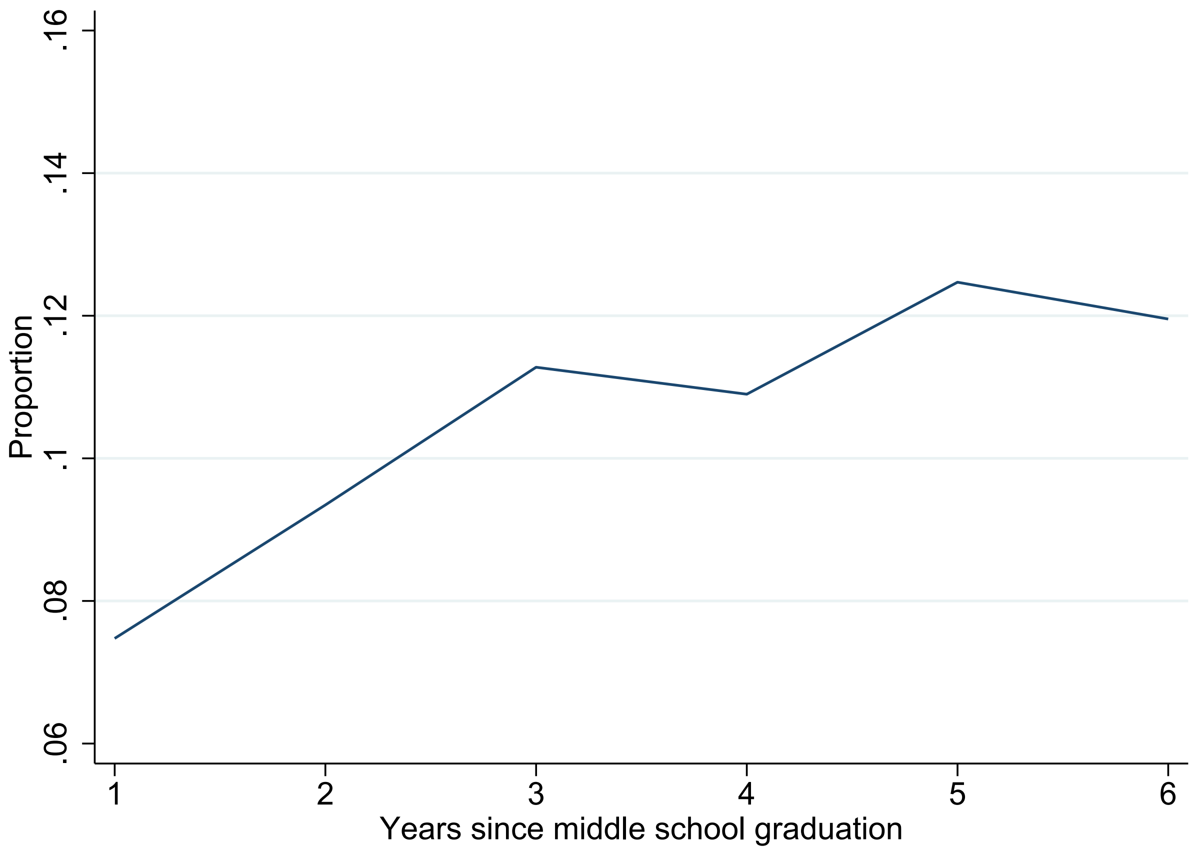
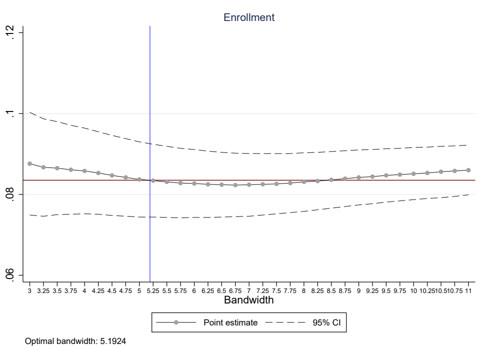
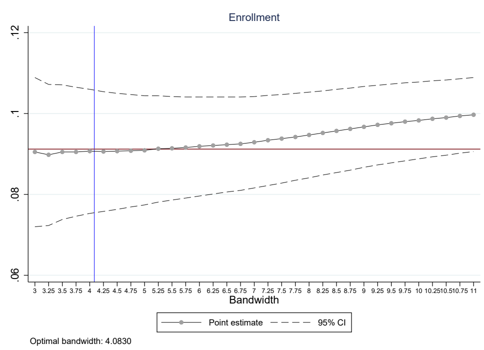


Figure A5 – Robustness to Bandwidth Selection

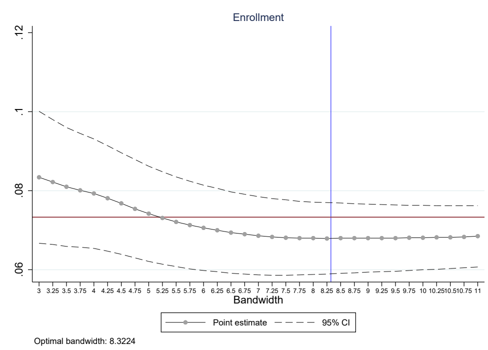
First stage enrollment
All



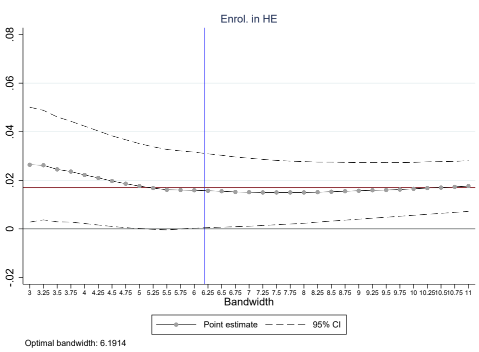

First stage enrollment
Higher selectivity levels



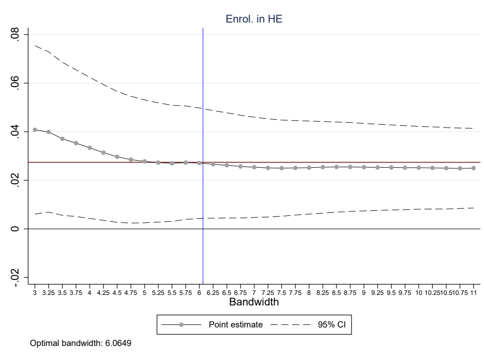

First stage enrollment
Lower selectivity levels



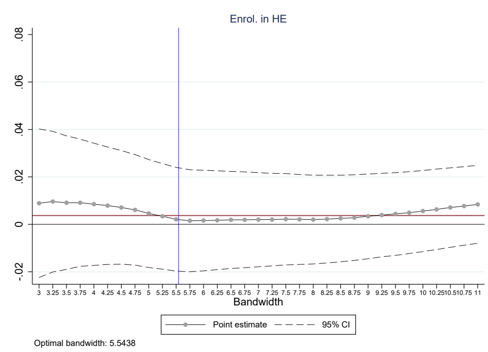

Enrollment in HE
All



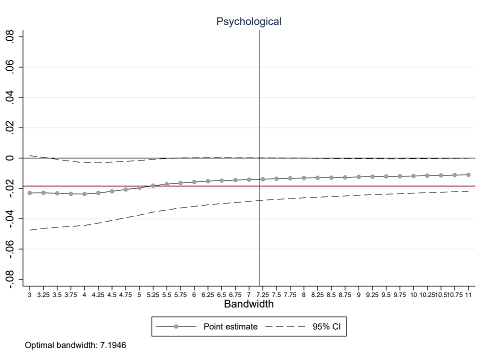

Enrollment in HE
Higher selectivity levels



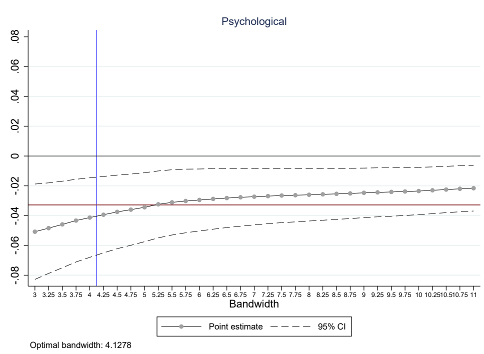

Enrollment in HE
Lower selectivity levels



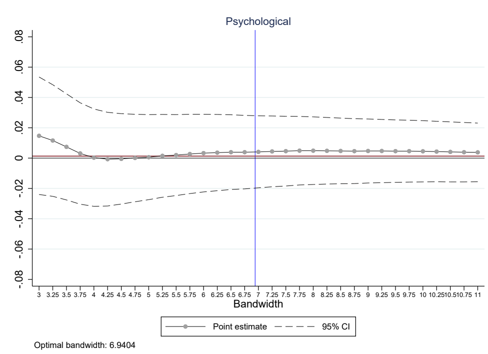

Mental health issues
All




Mental health issues
Higher selectivity levels




Mental health issues
Lower selectivity levels




NOTE: Each point reports $\alpha$ from equation (2) with varying bandwidths. The solid red line represents the point estimates from a global linear specification with triangular weights. The vertical blue line shows the optimal bandwidth. The dashed lines are 95 percent confidence intervals.

Table A1 – Descriptive Statistics

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | All | | Bergen area & Oslo | | RD Sample | |
| | Mean | SD | Mean | SD | Mean | SD |
| Female | 0.486 | 0.500 | 0.486 | 0.500 | 0.476 | 0.499 |
| Age | 16.078 | 0.906 | 16.038 | 0.649 | 16.008 | 0.154 |
| Norwegian origin | 0.827 | 0.378 | 0.793 | 0.405 | 0.734 | 0.442 |
| Sd. results in Norwegian | 0.000 | 0.987 | 0.112 | 0.965 | 0.081 | 0.858 |
| Sd. results in Math | -0.000 | 0.985 | 0.074 | 0.982 | 0.054 | 0.916 |
| **Parental Background** | | | | | | |
| Parents' educ. | 0.429 | 0.495 | 0.460 | 0.498 | 0.516 | 0.500 |
| Parents' income | 1018.177 | 1052.238 | 1091.964 | 1648.111 | 1159.468 | 1355.331 |
| **School Environment** | | | | | | |
| General studies | 0.398 | 0.489 | 0.462 | 0.499 | 0.541 | 0.498 |
| Vocational studies | 0.509 | 0.500 | 0.475 | 0.499 | 0.405 | 0.491 |
| #Students/Teacher | 13.021 | 17.246 | 13.117 | 14.509 | 14.862 | 16.794 |
| #Students/Non-Teacher | 20.701 | 15.225 | 19.922 | 13.803 | 21.084 | 16.145 |
| Share Teachers with Masters | 0.308 | 0.206 | 0.276 | 0.232 | 0.253 | 0.253 |
| Teachers age | 48.308 | 4.031 | 48.122 | 4.379 | 47.470 | 4.628 |
| Sh Female Teachers | 0.508 | 0.125 | 0.499 | 0.133 | 0.518 | 0.132 |
| #Stud own Program | 53.859 | 71.566 | 55.685 | 64.991 | 71.757 | 71.139 |
| **Peers' Characteristics** | | | | | | |
| Peers' mean MS GPA | -0.010 | 0.693 | 0.104 | 0.703 | 0.134 | 0.715 |
| Prop of female peers | 0.461 | 0.285 | 0.462 | 0.277 | 0.472 | 0.251 |
| Av Inc of Peers' parents | 973147.298 | 345181.207 | 1039018.858 | 406465.607 | 1128266.195 | 447111.263 |
| Education of Peers' parents | 0.405 | 0.219 | 0.432 | 0.230 | 0.485 | 0.225 |
| Mental Health of Peers' parents | 0.243 | 0.090 | 0.243 | 0.086 | 0.248 | 0.078 |
| **Education** | | | | | | |
| HS graduation | 0.615 | 0.487 | 0.634 | 0.482 | 0.657 | 0.475 |
| Enrollment in HE | 0.381 | 0.486 | 0.394 | 0.489 | 0.423 | 0.494 |
| **General Health** | | | | | | |
| Any GP - ER cons. since middle school | 0.975 | 0.155 | 0.970 | 0.170 | 0.966 | 0.181 |
| Nb. of GP - ER cons. since middle school | 20.654 | 21.987 | 18.980 | 20.955 | 17.672 | 19.398 |
| Any cons. due physical health problems since middle school | 0.973 | 0.163 | 0.968 | 0.177 | 0.963 | 0.188 |
| Any cons. due mental health problems since middle school | 0.320 | 0.466 | 0.326 | 0.469 | 0.314 | 0.464 |
| **Mental Health Disorders** | | | | | | |
| Depression/Anxiety | 0.220 | 0.414 | 0.232 | 0.422 | 0.223 | 0.416 |
| Substance Use | 0.053 | 0.223 | 0.057 | 0.232 | 0.052 | 0.222 |
| ADHD | 0.041 | 0.199 | 0.035 | 0.185 | 0.031 | 0.174 |
| Other Psychological | 0.155 | 0.361 | 0.153 | 0.360 | 0.143 | 0.350 |
| N | 312267 | | 41306 | | 19932 | |

NOTE: Means and (standard deviations) of background, school environment, education, and health during the period studied between the end and up to six years after completing middle school (i.e., 10$^{th}$ graders completing middle school between 2006 and 2010). The table includes three samples: all students completing the 10$^{th}$ grade in Norway between 2006 and 2010, students completing the 10$^{th}$ grade in the county of Hordaland (where the city of Bergen is located) between 2006 and 2010 and in Oslo in 2009 and 2010, and our regression discontinuity (RD) sample.

Table A2 – Balancing tests

| | (1) Female | (2) Age | (3) Nor. origin | (4) Sd. results in Norwegian | (5) Sd. results in Math | (6) Parents' educ. | (7) Parents' Income (log) |
|---|---|---|---|---|---|---|---|
| ***Panel A: All*** | | | | | | | |
| Eligibility | 0.015 | 0.000 | -0.002 | -0.006 | 0.014 | -0.020** | -0.018 |
| | (0.010) | (0.003) | (0.008) | (0.008) | (0.011) | (0.009)+ | (0.019) |
| Control mean | .451 | 16 | .713 | -.00739 | -.0467 | .532 | 13.8 |
| N | 54916 | 54916 | 54916 | 54916 | 54916 | 54916 | 54916 |
| ***Panel B: Higher Selectivity Levels*** | | | | | | | |
| Eligibility | 0.021 | -0.000 | 0.003 | -0.009 | 0.020 | -0.015 | 0.004 |
| | (0.013) | (0.003) | (0.011) | (0.010) | (0.015) | (0.012) | (0.023) |
| Control mean | .486 | 16 | .748 | .391 | .316 | .622 | 13.9 |
| N | 30516 | 30516 | 30516 | 30516 | 30516 | 30516 | 30516 |
| ***Panel C: Lower Selectivity Levels*** | | | | | | | |
| Eligibility | 0.006 | -0.000 | -0.007 | -0.003 | 0.005 | -0.026* | -0.043 |
| | (0.015) | (0.006) | (0.013) | (0.012) | (0.016) | (0.014) | (0.029) |
| Control mean | .4 | 16 | .664 | -.582 | -.577 | .4 | 13.7 |
| N | 24400 | 24400 | 24400 | 24400 | 24400 | 24400 | 24400 |

NOTE: This table reports the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1; $^{+++}$ p<0.01, $^{++}$ p<0.05, $^{+}$ p<0.1 after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

Table A3 – Placebo First Stage Estimates: Alternative Thresholds

| Sample | (1)<br>All | (2)<br>Higher selectivity | (3)<br>Lower selectivity |
|---|---|---|---|
| ***Panel A: Eligibility to high school $z$ based on $z-1$ threshold*** | | | |
| Eligibility | 0.020*** | 0.014*** | 0.028*** |
| | (0.004) | (0.005) | (0.005) |
| Control Mean | .015 | .016 | .014 |
| N | 44521 | 25894 | 18627 |
| ***Panel B: Eligibility to high school $z$ based on $z+1$ threshold*** | | | |
| Eligibility | -0.001 | 0.016 | -0.016* |
| | (0.007) | (0.010) | (0.009) |
| Control Mean | .060 | .065 | .053 |
| N | 21815 | 12035 | 9780 |

Note: This table reports the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A4 – Local Average Treatment Effects

| | (1) High School Graduation | (2) Enrollment in HE | (3) GR - ER cons. | (4) Mental health issue |
|---|---|---|---|---|
| ***Panel A: All*** | | | | |
| Enrollment | 0.280*** | 0.191* | -0.041 | -0.208* |
| | (0.103)$^{+++}$ | (0.104)$^{+}$ | (0.044) | (0.107)$^{+}$ |
| N | 54916 | 54916 | 54916 | 54916 |
| ***Panel B: Higher selectivity Levels*** | | | | |
| Enrollment | 0.348*** | 0.292** | -0.032 | -0.356*** |
| | (0.127)$^{+++}$ | (0.139)$^{++}$ | (0.057) | (0.129)$^{+++}$ |
| N | 30516 | 30516 | 30516 | 30516 |
| ***Panel C: Lower selectivity Levels*** | | | | |
| Enrollment | 0.208 | 0.055 | -0.064 | 0.025 |
| | (0.176) | (0.155) | (0.071) | (0.191) |
| N | 24400 | 24400 | 24400 | 24400 |

NOTE: This table reports the point estimates when instrumenting enrollment in a higher-ranked school by eligibility for enrollment, using a linear trend specification and triangular weights. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1; $^{+++}$ p<0.01, $^{++}$ p<0.05, $^{+}$ p<0.1 after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

Table A5 – Reduced Form Estimates: Mental Health Impacts During and After High School Years

| | (1)<br>High School Years | (2)<br>Post-High School Years |
|---|---|---|
| ***Panel A: All*** | | |
| Eligibility ($\alpha$) | 0.004 | -0.018** |
| | (0.007) | (0.008)$^{++}$ |
| Control Mean | .182 | .239 |
| N | 54916 | 54916 |
| P-Value: HA: $\alpha_{col1} < \alpha_{col2}$ | 0.008 | |
| ***Panel B: Higher Levels of Selectivity*** | | |
| Eligibility ($\alpha$) | -0.006 | -0.027*** |
| | (0.009) | (0.010)$^{++}$ |
| Control Mean | .155 | .211 |
| N | 30516 | 30516 |
| P-Value: HA: $\alpha_{col1} < \alpha_{col2}$ | 0.036 | |
| ***Panel C: Lower Levels Selectivity*** | | |
| Eligibility ($\alpha$) | 0.018 | -0.006 |
| | (0.012) | (0.013) |
| Control Mean | .220 | .279 |
| N | 24400 | 24400 |
| P-Value: HA: $\alpha_{col1} < \alpha_{col2}$ | 0.048 | |

Note: This table reports the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1; $^{+++}$ p<0.01, $^{++}$ p<0.05, $^{+}$ p<0.1 after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

Table A6 – Classification of Mental Health Conditions

| Mental Health Condition Grouping | |
|---|---|
| Anxiety | P01 Feeling anxious/nervous/tense |
| | P02 Acute stress reaction |
| | P06 Sleep disturbance |
| | P74 Anxiety disorder/anxiety state |
| Depression | P03 Feeling depressed |
| | P76 Depressive disorder |
| | P77 Suicide/suicide attempt |
| Substance Use | P15 Chronic alcohol abuse |
| | P16 Acute alcohol abuse |
| | P17 Tobacco abuse |
| | P18 Medication abuse |
| | P19 Drug abuse |
| Hyperkinetic Disorders | P81 Hyperkinetic disorder |
| Other | P04 Feeling/behaving irritable/angry |
| | P07 Sexual desire reduced |
| | P08 Sexual fulfilment reduced |
| | P09 Sexual preference concern |
| | P10 Stammering/stuttering/tic |
| | P11 Eating problem in child |
| | P12 Bedwetting/enuresis |
| | P13 Encopresis/bowel training problem |
| | P20 Memory disturbance |
| | P22 Child behaviour symptom/complaint |
| | P23 Adolescent behav. Symptom/complt. |
| | P24 Specific learning problem |
| | P25 Phase of life problem adult |
| | P27 Fear of mental disorder |
| | P28 Limited function/disability (p) |
| | P29 Psychological symptom/complt other |
| | P70 Dementia |
| | P71 Organic psychosis other |
| | P72 Schizophrenia |
| | P73 Affective psychosis |
| | P75 Somatization disorder |
| | P78 Neuraesthenia/surmenage |
| | P79 Phobia/compulsive disorder |
| | P80 Personality disorder |
| | P82 Post-traumatic stress disorder |
| | P85 Mental retardation |
| | P86 Anorexia nervosa/bulimia |
| | P98 Psychosis NOS/other |
| | P99 Psychological disorders, other |

NOTE: This table presents the grouping of mental health problems based on the ICPC-02 diagnoses.

Table A7 – Reduced Form Estimates: Risky Behaviors

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Teenage | | Hospitalizations | | |
| | Childbearing | Any Cause | Mental Health | Substance Use | Injuries |
| ***Panel A: All*** | | | | | |
| Eligibility | 0.001 | 0.001 | -0.002 | -0.001 | 0.002 |
| | (0.005) | (0.010) | (0.003) | (0.002) | (0.009) |
| Control Mean | .026 | .553 | .031 | .010 | .324 |
| N | 25561 | 54916 | 54916 | 54916 | 54916 |
| ***Panel B: Higher Selectivity Levels*** | | | | | |
| Eligibility | 0.001 | 0.002 | -0.002 | -0.001 | 0.004 |
| | (0.004) | (0.013) | (0.004) | (0.002) | (0.012) |
| Control Mean | .009 | .525 | .024 | .006 | .303 |
| N | 15575 | 30516 | 30516 | 30516 | 30516 |
| ***Panel C: Lower Selectivity Levels*** | | | | | |
| Eligibility | -0.000 | -0.001 | -0.003 | 0.000 | -0.000 |
| | (0.010) | (0.014) | (0.006) | (0.003) | (0.014) |
| Control Mean | .055 | .593 | .040 | .014 | .354 |
| N | 9986 | 24400 | 24400 | 24400 | 24400 |

NOTE: This table reports the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A8 – Robustness Checks: Controls

| | First stage enrollment | | High School Graduation | | Enrollment in HE | | GR - ER cons. | | Mental health issue | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No controls | Double Lasso | No controls | Double Lasso | No controls | Double Lasso | No controls | Double Lasso | No controls | Double Lasso |
| ***Panel A: All*** | | | | | | | | | | |
| Eligibility | 0.083*** | 0.082*** | 0.024*** | 0.022** | 0.017** | 0.015* | -0.003 | -0.003 | -0.016* | -0.018** |
| | (0.005) | (0.005) | (0.009) | (0.009) | (0.009) | (0.009) | (0.004) | (0.004) | (0.009) | (0.009) |
| ***Panel B: Higher Selectivity Levels*** | | | | | | | | | | |
| Eligibility | 0.090*** | 0.091*** | 0.033*** | 0.032*** | 0.029** | 0.025** | -0.002 | -0.002 | -0.031*** | -0.032*** |
| | (0.007) | (0.007) | (0.011) | (0.012) | (0.013) | (0.012) | (0.005) | (0.005) | (0.012) | (0.011) |
| ***Panel C: Lower Selectivity Levels*** | | | | | | | | | | |
| Eligibility | 0.073*** | 0.070*** | 0.015 | 0.015 | 0.004 | 0.001 | -0.004 | -0.005 | 0.001 | -0.000 |
| | (0.006) | (0.006) | (0.013) | (0.012) | (0.012) | (0.011) | (0.005) | (0.005) | (0.014) | (0.014) |

NOTE: In this table, for each outcome presented, the first column reports estimates of model (2) without any control variable for the predetermined individual characteristics. The second column provides the point estimates of $\alpha$ where the relevant control variables are selected using the double lasso procedure in Belloni, Chernozhukov and Hansen (2013). Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A9 – Robustness Checks: Functional Forms

| | (1) | (2) First stage enrollment | (3) | (4) | (5) High School Graduation | (6) | (7) | (8) Enrollment in HE | (9) | (10) | (11) GR - ER cons. | (12) | (13) | (14) Mental health issue | (15) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cutoffs trends | Optimal | Local linear | Cutoffs trends | Optimal | Local linear | Cutoffs trends | Optimal | Local linear | Cutoffs trends | Optimal | Local linear | Cutoffs trends | Optimal | Local linear |
| ***Panel A: All*** | | | | | | | | | | | | | | | |
| Eligibility | 0.084*** | 0.083*** | 0.084*** | 0.025*** | 0.023*** | 0.024** | 0.017* | 0.016* | 0.014 | -0.004 | -0.003 | -0.003 | -0.019** | -0.017* | -0.017* |
| | (0.005) | (0.005) | (0.005) | (0.009) | (0.009) | (0.011) | (0.009) | (0.009) | (0.011) | (0.004) | (0.004) | (0.004) | (0.009) | (0.009) | (0.010) |
| *Degree of opt. poly.* | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | |
| ***Panel B: Higher selectivity Levels*** | | | | | | | | | | | | | | | |
| Eligibility | 0.091*** | 0.091*** | 0.092*** | 0.033*** | 0.054*** | 0.035*** | 0.027** | 0.026** | 0.029** | -0.003 | -0.003 | -0.002 | -0.033*** | -0.052*** | -0.032** |
| | (0.007) | (0.007) | (0.007) | (0.012) | (0.018) | (0.013) | (0.013) | (0.012) | (0.014) | (0.005) | (0.005) | (0.006) | (0.012) | (0.018) | (0.013) |
| *Degree of opt. poly.* | | 1 | | | 2 | | | 1 | | | 1 | | | 2 | |
| ***Panel C: Lower selectivity Levels*** | | | | | | | | | | | | | | | |
| Eligibility | 0.073*** | 0.089*** | 0.073*** | 0.015 | 0.015 | 0.013 | 0.004 | 0.004 | -0.001 | -0.005 | -0.005 | -0.004 | 0.001 | 0.036 | -0.000 |
| | (0.006) | (0.010) | (0.006) | (0.013) | (0.013) | (0.015) | (0.011) | (0.011) | (0.014) | (0.005) | (0.005) | (0.006) | (0.014) | (0.033) | (0.016) |
| *Degree of opt. poly.* | | 2 | | | 1 | | | 1 | | | 1 | | | 3 | |

NOTE: In this table, for each outcome presented, the first column reports estimates of model (2) controlling for cutoff-specific trends. The second column provides the point estimates of $\alpha$ where the polynomial is obtained from a bins test (i.e., estimating models with a full set of score dummies together with the different parametric trends for order 1 to 4 polynomials, and where the recommended polynomial is the specification in which the set of bin dummies are jointly insignificant). The third column reports point estimates of $\alpha$ using local linear estimations. All estimates include triangular weights. *** p<0.01, ** p<0.05, * p<0.1.

Table A10 – High School Selectivity, Education, and Health: Exclude Observations with Score equal to Admission Thresholds.

| | (1) First stage enrollment | (2) High School graduation | (3) Enrollment in HE | (4) GP - ER cons. | (5) Nb. of GP - ER cons. | (6) Mental health issue | (7) Other health issue |
|---|---|---|---|---|---|---|---|
| ***Panel A: All*** | | | | | | | |
| Eligibility | 0.085*** | 0.026*** | 0.014* | -0.005 | -0.372 | -0.015* | -0.006 |
| | $(0.004)^{+++}$ | $(0.008)^{+++}$ | $(0.008)^{+}$ | (0.003) | (0.343) | $(0.008)^{+}$ | (0.004) |
| Control mean | .021 | .542 | .403 | .964 | 17.7 | .327 | .962 |
| N | 57657 | 57657 | 57657 | 57657 | 57657 | 57657 | 57657 |
| ***Panel B: Higher selectivity Levels*** | | | | | | | |
| Eligibility | 0.096*** | 0.032*** | 0.016 | -0.003 | -0.828* | -0.035*** | -0.003 |
| | $(0.006)^{+++}$ | $(0.011)^{+++}$ | (0.012) | (0.005) | (0.462) | $(0.011)^{+++}$ | (0.005) |
| Control mean | .0269 | .695 | .543 | .962 | 16.7 | .293 | .96 |
| N | 32915 | 32915 | 32915 | 32915 | 32915 | 32915 | 32915 |
| ***Panel C: Lower selectivity Levels*** | | | | | | | |
| Eligibility | 0.071*** | 0.021* | 0.013 | -0.008* | 0.263 | 0.007 | -0.010** |
| | $(0.006)^{+++}$ | (0.012)+ | (0.010) | $(0.005)^{+}$ | (0.507) | (0.013) | $(0.005)^{++}$ |
| Control mean | .0119 | .306 | .188 | .969 | 19.2 | .378 | .965 |
| N | 24742 | 24742 | 24742 | 24742 | 24742 | 24742 | 24742 |

NOTE: This table reports point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1; $^{+++}$ p<0.01, $^{++}$ p<0.05, $^{+}$ p<0.1 after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

Table A11 – Robustness Checks: Analysis by City

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | First stage enrollment | | High School Graduation | | Enrollment in HE | | GR - ER cons. | | Mental health issue | |
| | Bergen | Oslo | Bergen | Oslo | Bergen | Oslo | Bergen | Oslo | Bergen | Oslo |
| ***Panel A: All*** | | | | | | | | | | |
| Eligibility | 0.099*** | 0.066*** | 0.022** | 0.024* | 0.015 | 0.018 | -0.003 | -0.004 | -0.015 | -0.018 |
| | (0.007)$^{+++}$ | (0.006)$^{+++}$ | (0.011)$^{+}$ | (0.013) | (0.011) | (0.014) | (0.005) | (0.006) | (0.011) | (0.014) |
| Control mean | 0.029 | 0.013 | 0.547 | 0.537 | 0.352 | 0.455 | 0.966 | 0.962 | 0.334 | 0.321 |
| N | 28516 | 26400 | 28516 | 26400 | 28516 | 26400 | 28516 | 26400 | 28516 | 26400 |
| ***Panel B: Higher selectivity Levels*** | | | | | | | | | | |
| Eligibility | 0.107*** | 0.075*** | 0.030** | 0.035** | 0.025 | 0.030* | -0.002 | -0.004 | -0.028* | -0.035** |
| | (0.011)$^{+++}$ | (0.008)$^{+++}$ | (0.015)$^{+}$ | (0.017)$^{+}$ | (0.017) | (0.018) | (0.007) | (0.008) | (0.015) | (0.017)$^{+}$ |
| Control mean | .040 | .014 | .718 | .676 | .498 | .577 | .960 | .963 | .282 | .299 |
| N | 14809 | 15707 | 14809 | 15707 | 14809 | 15707 | 14809 | 15707 | 14809 | 15707 |
| ***Panel C: Lower selectivity Levels*** | | | | | | | | | | |
| Eligibility | 0.090*** | 0.052*** | 0.016 | 0.012 | 0.005 | 0.002 | -0.005 | -0.004 | -0.001 | 0.007 |
| | (0.009)$^{+++}$ | (0.008)$^{+++}$ | (0.017) | (0.020) | (0.014) | (0.019) | (0.007) | (0.008) | (0.018) | (0.021) |
| Control mean | .015 | .012 | .336 | .302 | .172 | .249 | .974 | .961 | .398 | .356 |
| N | 13707 | 10693 | 13707 | 10693 | 13707 | 10693 | 13707 | 10693 | 13707 | 10693 |

NOTE: This table reports the point estimates of $\alpha$ from equation (2) using a linear trend specification and triangular weights. Equation (2) estimated separately for students located in Hordaland (Bergen) or Oslo. The calculated mean of the outcome variable is for the control group, i.e., those with a score distance to admission cutoffs at most two points below the cutoff. Clustered standard errors (at individual level) in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$; $^{+++}$ $p<0.01$, $^{++}$ $p<0.05$, $^{+}$ $p<0.1$ after accounting for multiple hypothesis testing using the procedure described in Romano and Wolf (2005).

# Appendix B

# ICPC-2 – English

**International Classification of Primary Care – 2nd Edition**

**Wonca International Classification Committee (WICC)**

## Process codes

-30 Medical Exam/Eval-Complete
-31 Medical Examination/Health Evaluation-Partial/Pre-op check
-32 Sensitivity Test
-33 Microbiological/Immunological Test
-34 Blood Test
-35 Urine Test
-36 Faeces Test
-37 Histological/Exfoliative Cytology
-38 Other Laboratory Test NEC
-39 Physical Function Test
-40 Diagnostic Endoscopy
-41 Diagnostic Radiology/Imaging
-42 Electrical Tracings
-43 Other Diagnostic Procedures
-44 Preventive Immunisations/Medications
-45 Observe/Educate/Advice/Diet
-46 Consult with Primary Care Provider
-47 Consultation with Specialist
-48 Clarification/Discuss Patient's RFE
-49 Other Preventive Procedures
-50 Medicat-Script/Reqst/Renew/Inject
-51 Incise/Drain/Flush/Aspirate
-52 Excise/Remove/Biopsy/Destruction/Debride
-53 Instrument/Catheter/Intubate/Dilate
-54 Repair/Fixate-Suture/Cast/Prosthetic
-55 Local Injection/Infiltration
-56 Dress/Press/Compress/Tamponade
-57 Physical Medicine/Rehabilitation
-58 Therapeutic Counselling/Listening
-59 Other Therapeutic Procedure NEC
-60 Results Tests/Procedures
-61 Results Exam/Test/Record
-62 Administrative Procedure
-63 Follow-up Encounter Unspecified
-64 Encounter Initiated by Provider
-65 Encounter Initiated third person
-66 Refer to Other Provider (EXCL. M.D.)
-67 Referral to Physician/Specialist/Clinic/Hospital
-68 Other Referrals NEC
-69 Other Reason for Encounter NEC

## General and Unspecified A

A01 Pain general/multiple sites
A02 Chills
A03 Fever
A04 Weakness/tiredness general
A05 Feeling ill
A06 Fainting/syncope
A07 Coma
A08 Swelling
A09 Sweating problem
A10 Bleeding/haemorrhage NOS
A11 Chest pain NOS
A13 Concern/fear medical treatment
A16 Irritable infant
A18 Concern about appearance
A20 Euthanasia request/discussion
A21 Risk factor for malignancy
A23 Risk factor NOS
A25 Fear of death/dying
A26 Fear of cancer NOS
A27 Fear of other disease NOS
A28 Limited function/disability NOS
A29 General symptom/complaint other
A70 Tuberculosis
A71 Measles
A72 Chickenpox
A73 Malaria
A74 Rubella
A75 Infectious mononucleosis
A76 Viral exanthem other
A77 Viral disease other/NOS
A78 Infectious disease other/NOS
A79 Malignancy NOS
A80 Trauma/injury NOS
A81 Multiple trauma/injuries
A82 Secondary effect of trauma
A84 Poisoning by medical agent
A85 Adverse effect medical agent
A86 Toxic effect non-medicinal substance
A87 Complication of medical treatment
A88 Adverse effect physical factor
A89 Effect prosthetic device
A90 Congenital anomaly OS/multiple
A91 Abnormal result investigation NOS
A92 Allergy/allergic reaction NOS
A93 Premature newborn
A94 Perinatal morbidity other
A95 Perinatal mortality
A96 Death
A97 No disease
A98 Health maintenance/prevention
A99 General disease NOS

## Blood, Blood Forming Organs and Immune Mechanism B

B02 Lymph gland(s) enlarged/painful
B04 Blood symptom/complaint
B25 Fear of aids/HIV
B26 Fear cancer blood/lymph
B27 Fear blood/lymph disease other
B28 Limited function/disability
B29 Sympt/complt lymph/immune other
B70 Lymphadenitis acute
B71 Lymphadenitis non-specific
B72 Hodgkin's disease/lymphoma
B73 Leukaemia
B74 Malignant neoplasm blood other
B75 Benign/unspecified neoplasm blood
B76 Ruptured spleen traumatic
B77 Injury blood/lymph/spleen other
B78 Hereditary haemolytic anaemia
B79 Congen.anom. blood/lymph other
B80 Iron deficiency anaemia
B81 Anaemia, Vitamin B12/folate def.
B82 Anaemia other/unspecified
B83 Purpura/coagulation defect
B84 Unexplained abnormal white cells
B87 Splenomegaly
B90 HIV-infection/aids
B99 Blood/lymph/spleen disease other

PROCESS CODES
SYMPTOMS/COMPLAINTS
INFECTIONS
NEOPLASMS
INJURIES
CONGENITAL ANOMALIES
OTHER DIAGNOSES

## Digestive D

D01 Abdominal pain/cramps general
D02 Abdominal pain epigastric
D03 Heartburn
D04 Rectal/anal pain
D05 Perianal itching
D06 Abdominal pain localized other
D07 Dyspepsia/indigestion
D08 Flatulence/gas/belching
D09 Nausea
D10 Vomiting
D11 Diarrhoea
D12 Constipation
D13 Jaundice
D14 Haematemesis/vomiting blood
D15 Melaena
D16 Rectal bleeding
D17 Incontinence of bowel
D18 Change faeces/bowel movements
D19 Teeth/gum symptom/complaint
D20 Mouth/tongue/lip symptom/complt.
D21 Swallowing problem
D23 Hepatomegaly
D24 Abdominal mass NOS
D25 Abdominal distension
D26 Fear of cancer of digestive system
D27 Fear of digestive disease other
D28 Limited function/disability (d)
D29 Digestive symptom/complaint other
D70 Gastrointestinal infection
D71 Mumps
D72 Viral hepatitis
D73 Gastroenteritis presumed infection
D74 Malignant neoplasm stomach
D75 Malignant neoplasm colon/rectum
D76 Malignant neoplasm pancreas
D77 Malig. neoplasm digest other/NOS
D78 Neoplasm digest benign/uncertain
D79 Foreign body digestive system
D80 Injury digestive system other
D81 Congen. anomaly digestive system
D82 Teeth/gum disease
D83 Mouth/tongue/lip disease
D84 Oesophagus disease
D85 Duodenal ulcer
D86 Peptic ulcer other
D87 Stomach function disorder
D88 Appendicitis
D89 Inguinal hernia
D90 Hiatus hernia
D91 Abdominal hernia other
D92 Diverticular disease
D93 Irritable bowel syndrome
D94 Chronic enteritis/ulcerative colitis
D95 Anal fissure/perianal abscess
D96 Worms/other parasites
D97 Liver disease NOS
D98 Cholecystitis/cholelithiasis
D99 Disease digestive system, other

## Eye F

F01 Eye pain
F02 Red eye
F03 Eye discharge
F04 Visual floaters/spots
F05 Visual disturbance other
F13 Eye sensation abnormal
F14 Eye movements abnormal
F15 Eye appearance abnormal
F16 Eyelid symptom/complaint
F17 Glasses symptom/complaint
F18 Contact lens symptom/complaint
F27 Fear of eye disease
F28 Limited function/disability (f)
F29 Eye symptom/complaint other
F70 Conjunctivitis infectious
F71 Conjunctivitis allergic
F72 Blepharitis/stye/chalazion
F73 Eye infection/inflammation other
F74 Neoplasm of eye/adnexa
F75 Contusion/haemorrhage eye
F76 Foreign body in eye
F79 Injury eye other
F80 Blocked lacrimal duct of infant
F81 Congenital anomaly eye other
F82 Detached retina
F83 Retinopathy
F84 Macular degeneration
F85 Corneal ulcer
F86 Trachoma
F91 Refractive error
F92 Cataract
F93 Glaucoma
F94 Blindness
F95 Strabismus
F99 Eye/adnexa disease, other

## Ear H

H01 Ear pain/earache
H02 Hearing complaint
H03 Tinnitus, ringing/buzzing ear
H04 Ear discharge
H05 Bleeding ear
H13 Plugged feeling ear
H15 Concern with appearance of ears
H27 Fear of ear disease
H28 Limited function/disability ear
H29 Ear symptom/complaint other
H70 Otitis externa
H71 Acute otitis media/myringitis
H72 Serous otitis media
H73 Eustachian salpingitis
H74 Chronic otitis media
H75 Neoplasm of ear
H76 Foreign body in ear
H77 Perforation ear drum
H78 Superficial injury of ear
H79 Ear injury other
H80 Congenital anomaly of ear
H81 Excessive ear wax
H82 Vertiginous syndrome
H83 Otosclerosis
H84 Presbyacusis
H85 Acoustic trauma
H86 Deafness
H99 Ear/mastoid disease, other

## Cardiovascular K

K01 Heart pain
K02 Pressure/tightness of heart
K03 Cardiovascular pain NOS
K04 Palpitations/awareness of heart
K05 Irregular heartbeat other
K06 Prominent veins
K07 Swollen ankles/oedema
K22 Risk factor cardiovascular disease
K24 Fear of heart disease
K25 Fear of hypertension
K27 Fear cardiovascular disease other
K28 Limited function/disability (k)
K29 Cardiovascular sympt./complt. other
K70 Infection of circulatory system
K71 Rheumatic fever/heart disease
K72 Neoplasm cardiovascular
K73 Congenital anomaly cardiovascular
K74 Ischaemic heart disease w. angina
K75 Acute myocardial infarction
K76 Ischaemic heart disease w/o angina
K77 Heart failure
K78 Atrial fibrillation/flutter
K79 Paroxysmal tachycardia
K80 Cardiac arrhythmia NOS
K81 Heart/arterial murmur NOS
K82 Pulmonary heart disease
K83 Heart valve disease NOS
K84 Heart disease other
K85 Elevated blood pressure
K86 Hypertension uncomplicated
K87 Hypertension complicated
K88 Postural hypotension
K89 Transient cerebral ischaemia
K90 Stroke/cerebrovascular accident
K91 Cerebrovascular disease
K92 Atherosclerosis/PVD
K93 Pulmonary embolism
K94 Phlebitis/thrombophlebitis
K95 Varicose veins of leg
K96 Haemorrhoids
K99 Cardiovascular disease other

## Musculoskeletal L

L01 Neck symptom/complaint
L02 Back symptom/complaint
L03 Low back symptom/complaint
L04 Chest symptom/complaint
L05 Flank/axilla symptom/complaint
L07 Jaw symptom/complaint
L08 Shoulder symptom/complaint
L09 Arm symptom/complaint
L10 Elbow symptom/complaint
L11 Wrist symptom/complaint
L12 Hand/finger symptom/complaint
L13 Hip symptom/complaint
L14 Leg/thigh symptom/complaint
L15 Knee symptom/complaint
L16 Ankle symptom/complaint
L17 Foot/toe symptom/complaint
L18 Muscle pain
L19 Muscle symptom/complaint NOS
L20 Joint symptom/complaint NOS
L26 Fear of cancer musculoskeletal
L27 Fear musculoskeletal disease other
L28 Limited function/disability (l)
L29 Sympt/complt. Musculoskeletal other
L70 Infections musculoskeletal system
L71 Malignant neoplasm musculoskeletal
L72 Fracture: radius/ulna
L73 Fracture: tibia/fibula
L74 Fracture: hand/foot bone
L75 Fracture: femur
L76 Fracture: other
L77 Sprain/strain of ankle
L78 Sprain/strain of knee
L79 Sprain/strain of joint NOS
L80 Dislocation/subluxation
L81 Injury musculoskeletal NOS
L82 Congenital anomaly musculoskeletal
L83 Neck syndrome
L84 Back syndrome w/o radiating pain
L85 Acquired deformity of spine
L86 Back syndrome with radiating pain
L87 Bursitis/tendinitis/synovitis NOS
L88 Rheumatoid/seropositive arthritis
L89 Osteoarthrosis of hip
L90 Osteoarthrosis of knee
L91 Osteoarthrosis other
L92 Shoulder syndrome
L93 Tennis elbow
L94 Osteochondrosis
L95 Osteoporosis
L96 Acute internal damage knee
L97 Neoplasm benign/unspec musculo.
L98 Acquired deformity of limb
L99 Musculoskeletal disease, other

## Neurological N

N01 Headache
N03 Pain face
N04 Restless legs
N05 Tingling fingers/feet/toes
N06 Sensation disturbance other
N07 Convulsion/seizure
N08 Abnormal involuntary movements
N16 Disturbance of smell/taste
N17 Vertigo/dizziness
N18 Paralysis/weakness
N19 Speech disorder
N26 Fear cancer neurological system
N27 Fear of neurological disease other
N28 Limited function/disability (n)
N29 Neurological symptom/complt. other
N70 Poliomyelitis
N71 Meningitis/encephalitis
N72 Tetanus
N73 Neurological infection other
N74 Malignant neoplasm nervous system
N75 Benign neoplasm nervous system
N76 Neoplasm nervous system unspec.
N79 Concussion
N80 Head injury other
N81 Injury nervous system other
N85 Congenital anomaly neurological
N86 Multiple sclerosis
N87 Parkinsonism
N88 Epilepsy
N89 Migraine
N90 Cluster headache
N91 Facial paralysis/bell's palsy
N92 Trigeminal neuralgia
N93 Carpal tunnel syndrome
N94 Peripheral neuritis/neuropathy
N95 Tension headache
N99 Neurological disease, other

## Psychological P

P01 Feeling anxious/nervous/tense
P02 Acute stress reaction
P03 Feeling depressed
P04 Feeling/behaving irritable/angry
P05 Senility, feeling/behaving old
P06 Sleep disturbance
P07 Sexual desire reduced
P08 Sexual fulfilment reduced
P09 Sexual preference concern
P10 Stammering/stuttering/tic
P11 Eating problem in child
P12 Bedwetting/enuresis
P13 Encopresis/bowel training problem
P15 Chronic alcohol abuse
P16 Acute alcohol abuse
P17 Tobacco abuse
P18 Medication abuse
P19 Drug abuse
P20 Memory disturbance
P22 Child behaviour symptom/complaint
P23 Adolescent behav. Symptom/complt.
P24 Specific learning problem
P25 Phase of life problem adult
P27 Fear of mental disorder
P28 Limited function/disability (p)
P29 Psychological symptom/complt other
P70 Dementia
P71 Organic psychosis other
P72 Schizophrenia
P73 Affective psychosis
P74 Anxiety disorder/anxiety state
P75 Somatization disorder
P76 Depressive disorder
P77 Suicide/suicide attempt
P78 Neuraesthenia/surmenage
P79 Phobia/compulsive disorder
P80 Personality disorder
P81 Hyperkinetic disorder
P82 Post-traumatic stress disorder
P85 Mental retardation
P86 Anorexia nervosa/bulimia
P98 Psychosis NOS/other
P99 Psychological disorders, other

## Respiratory R

R01 Pain respiratory system
R02 Shortness of breath/dyspnoea
R03 Wheezing
R04 Breathing problem, other
R05 Cough
R06 Nose bleed/epistaxis
R07 Sneezing/nasal congestion
R08 Nose symptom/complaint other
R09 Sinus symptom/complaint
R21 Throat symptom/complaint
R23 Voice symptom/complaint
R24 Haemoptysis
R25 Sputum/phlegm abnormal
R26 Fear of cancer respiratory system
R27 Fear of respiratory disease, other
R28 Limited function/disability (r)
R29 Respiratory symptom/complaint oth.
R71 Whooping cough
R72 Strep throat
R73 Boil/abscess nose
R74 Upper respiratory infection acute
R75 Sinusitis acute/chronic
R76 Tonsillitis acute
R77 Laryngitis/tracheitis acute
R78 Acute bronchitis/bronchiolitis
R79 Chronic bronchitis
R80 Influenza
R81 Pneumonia
R82 Pleurisy/pleural effusion
R83 Respiratory infection other
R84 Malignant neoplasm bronchus/lung
R85 Malinant neoplasm respiratory, other
R86 Benign neoplasm respiratory
R87 Foreign body nose/larynx/bronch
R88 Injury respiratory other
R89 Congenital anomaly respiratory
R90 Hypertrophy tonsils/adenoids
R92 Neoplasm respiratory unspecified
R95 Chronic obstructive pulmonary dis
R96 Asthma
R97 Allergic rhinitis
R98 Hyperventilation syndrome
R99 Respiratory disease other

PROCESS CODES
SYMPTOMS/COMPLAINTS
INFECTIONS
NEOPLASMS
INJURIES
CONGENITAL ANOMALIES
OTHER DIAGNOSES

## Skin S

S01 Pain/tenderness of skin
S02 Pruritus
S03 Warts
S04 Lump/swelling localized
S05 Lumps/swellings generalized
S06 Rash localized
S07 Rash generalized
S08 Skin colour change
S09 Infected finger/toe
S10 Boil/carbuncle
S11 Skin infection post-traumatic
S12 Insect bite/sting
S13 Animal/human bite
S14 Burn/scald
S15 Foreign body in skin
S16 Bruise/contusion
S17 Abrasion/scratch/blister
S18 Laceration/cut
S19 Skin injury other
S20 Corn/callosity
S21 Skin texture symptom/complaint
S22 Nail symptom/complaint
S23 Hair loss/baldness
S24 Hair/scalp symptom/complaint
S26 Fear of cancer of skin
S27 Fear of skin disease other
S28 Limited function/disability (s)
S29 Skin symptom/complaint other
S70 Herpes zoster
S71 Herpes simplex
S72 Scabies/other acariasis
S73 Pediculosis/skin infestation other
S74 Dermatophytosis
S75 Moniliasis/candidiasis skin
S76 Skin infection other
S77 Malignant neoplasm of skin
S78 Lipoma
S79 Neoplasm skin benign/unspecified
S80 Solar keratosis/sunburn
S81 Haemangioma/lymphangioma
S82 Naevus/mole
S83 Congenital skin anomaly other
S84 Impetigo
S85 Pilonidal cyst/fistula
S86 Dermatitis seborrhoeic
S87 Dermatitis/atopic eczema
S88 Dermatitis contact/allergic
S89 Diaper rash
S90 Pityriasis rosea
S91 Psoriasis
S92 Sweat gland disease
S93 Sebaceous cyst
S94 Ingrowing nail
S95 Molluscum contagiosum
S96 Acne
S97 Chronic ulcer skin
S98 Urticaria
S99 Skin disease, other

## Endocrine/Metabolic and Nutritional T

T01 Excessive thirst
T02 Excessive appetite
T03 Loss of appetite
T04 Feeding problem of infant/child
T05 Feeding problem of adult
T07 Weight gain
T08 Weight loss
T10 Growth delay
T11 Dehydration
T26 Fear of cancer of endocrine system
T27 Fear endocrine/metabolic dis other
T28 Limited function/disability (t)
T29 Endocrine/met./sympt/complt other
T70 Endocrine infection
T71 Malignant neoplasm thyroid
T72 Benign neoplasm thyroid
T73 Neoplasm endocrine oth/unspecified
T78 Thyroglossal duct/cyst
T80 Congenital anom endocrine/metab.
T81 Goitre
T82 Obesity
T83 Overweight
T85 Hyperthyroidism/thyrotoxicosis
T86 Hypothyroidism/myxoedema
T87 Hypoglycaemia
T89 Diabetes insulin dependent
T90 Diabetes non-insulin dependent
T91 Vitamin/nutritional deficiency
T92 Gout
T93 Lipid disorder
T99 Endocrine/metab/nutrit. dis. other

## Urological U

U01 Dysuria/painful urination
U02 Urinary frequency/urgency
U04 Incontinence urine
U05 Urination problems other
U06 Haematuria
U07 Urine symptom/complaint other
U08 Urinary retention
U13 Bladder symptom/complaint other
U14 Kidney symptom/complaint
U26 Fear of cancer of urinary system
U27 Fear of urinary disease other
U28 Limited function/disability urinary
U29 Urinary symptom/complaint other
U70 Pyelonephritis/pyelitis
U71 Cystitis/urinary infection other
U72 Urethritis
U75 Malignant neoplasm of kidney
U76 Malignant neoplasm of bladder
U77 Malignant neoplasm urinary other
U78 Benign neoplasm urinary tract
U79 Neoplasm urinary tract NOS
U80 Injury urinary tract
U85 Congenital anomaly urinary tract
U88 Glomerulonephritis/nephrosis
U90 Orthostatic albumin./proteinuria
U95 Urinary calculus
U98 Abnormal urine test NOS
U99 Urinary disease, other

## Pregnancy, Childbearing, Family Planning W

W01 Question of pregnancy
W02 Fear of pregnancy
W03 Antepartum bleeding
W05 Pregnancy vomiting/nausea
W10 Contraception postcoital
W11 Contraception oral
W12 Contraception intrauterine
W13 Sterilization
W14 Contraception other
W15 Infertility/subfertility
W17 Post-partum bleeding
W18 Post-partum symptom/complaint oth.
W19 Breast/lactation symptom/complaint
W21 Concern body image in pregnancy
W27 Fear complications of pregnancy
W28 Limited function/disability (w)
W29 Pregnancy symptom/complaint other
W70 Puerperal infection/sepsis
W71 Infection complicating pregnancy
W72 Malignant neoplasm relate to preg.
W73 Benign/unspec. neoplasm/pregnancy
W75 Injury complicating pregnancy
W76 Congenital anomaly complicate preg.
W78 Pregnancy
W79 Unwanted pregnancy
W80 Ectopic pregnancy
W81 Toxaemia of pregnancy
W82 Abortion spontaneous
W83 Abortion induced
W84 Pregnancy high risk
W85 Gestational diabetes
W90 Uncomplicate labour/delivery live
W91 Uncomplicate labour/delivery still
W92 Complicate labour/ delivery livebirth
W93 Complicate labour/delivery stillbirth
W94 Puerperal mastitis
W95 Breast disorder in pregnancy other
W96 Complications of puerperium other
W99 Disorder pregnancy/delivery, other

## Female Genital X

X01 Genital pain female
X02 Menstrual pain
X03 Intermenstrual pain
X04 Painful intercourse female
X05 Menstruation absent/scanty
X06 Menstruation excessive
X07 Menstruation irregular/frequent
X08 Intermenstrual bleeding
X09 Premenstrual symptom/complaint
X10 Postponement of menstruation
X11 Menopausal symptom/complaint
X12 Postmenopausal bleeding
X13 Postcoital bleeding
X14 Vaginal discharge
X15 Vaginal symptom/complaint other
X16 Vulval symptom/complaint
X17 Pelvis symptom/complaint female
X18 Breast pain female
X19 Breast lump/mass female
X20 Nipple symptom/complaint female
X21 Breast symptom/complt. female other
X22 Concern breast appearance female
X23 Fear sexually transmitted disease (f)
X24 Fear of sexual dysfunction female
X25 Fear of genital cancer female
X26 Fear of breast cancer female
X27 Fear genital/breast disease other (f)
X28 Limited function/disability (x)
X29 Genital symptom/complt female oth.
X70 Syphilis female
X71 Gonorrhoea female
X72 Genital candidiasis female
X73 Genital trichomoniasis female
X74 Pelvic inflammatory disease
X75 Malignant neoplasm cervix
X76 Malignant neoplasm breast female
X77 Malignant neoplasm genital other (f)
X78 Fibromyoma uterus
X79 Benign neoplasm breast female
X80 Benign neoplasm female genital
X81 Genital neoplasm oth/unspecied (f)
X82 Injury genital female
X83 Congenital anomaly genital female
X84 Vaginitis/vulvitis NOS
X85 Cervical disease NOS
X86 Abnormal cervix smear
X87 Uterovaginal prolapse
X88 Fibrocystic disease breast
X89 Premenstrual tension syndrome
X90 Genital herpes female
X91 Condylomata acuminata female
X92 Chlamydia infection genital (f)
X99 Genital disease female, other

## Male Genital Y

Y01 Pain in penis
Y02 Pain in testis/scrotum
Y03 Urethral discharge
Y04 Penis symptom/complaint other
Y05 Scrotum/testis sympt/complt. other
Y06 Prostate symptom/complaint
Y07 Impotence NOS
Y08 Sexual function sympt./complt.(m)
Y10 Infertility/subfertility male
Y13 Sterilization male
Y14 Family planning male other
Y16 Breast symptom/complaint male
Y24 Fear of sexual dysfunction male
Y25 Fear sexually transmitted dis. male
Y26 Fear of genital cancer male
Y27 Fear of genital disease male other
Y28 Limited function/disability (y)
Y29 Genital sympt./complt.male other
Y70 Syphilis male
Y71 Gonorrhoea male
Y72 Genital herpes male
Y73 Prostatitis/seminal vesiculitis
Y74 Orchitis/epididymitis
Y75 Balanitis
Y76 Condylomata acuminata male
Y77 Malignant neoplasm prostate
Y78 Malign neoplasm male genital other
Y79 Benign/unspec. neoplasm gen. (m)
Y80 Injury male genital
Y81 Phimosis/redundant prepuce
Y82 Hypospadias
Y83 Undescended testicle
Y84 Congenital genl anomaly (m) other
Y85 Benign prostatic hypertrophy
Y86 Hydrocoele
Y99 Genital disease male, other

## Social Problems Z

Z01 Poverty/financial problem
Z02 Food/water problem
Z03 Housing/neighbourhood problem
Z04 Social cultural problem
Z05 Work problem
Z06 Unemployment problem
Z07 Education problem
Z08 Social welfare problem
Z09 Legal problem
Z10 Health care system problem
Z11 Compliance/being ill problem
Z12 Relationship problem with partner
Z13 Partner's behaviour problem
Z14 Partner illness problem
Z15 Loss/death of partner problem
Z16 Relationship problem with child
Z18 Illness problem with child
Z19 Loss/death of child problem
Z20 Relationship prob. parent/family
Z21 Behaviour problem parent/family
Z22 Illness problem parent/family
Z23 Loss/death parent/family member
Z24 Relationship problem friend
Z25 Assault/harmful event problem
Z27 Fear of a social problem
Z28 Limited function/disability (z)
Z29 Social problem NOS

## Abbreviations

| | |
|---|---|
| Anom | anomaly |
| behav. | behaviour |
| bronch. | bronchus |
| complicat. | complication |
| congen. | congenital |
| dis. | disease |
| eval. | evaluation |
| exam. | examination |
| gen. | genital |
| malig. | malignant |
| metab. | metabolic |
| musculo. | musculoskeletal |
| NEC | not elsewhere classified |
| NOS | not otherwise specified |
| nutrit. | nutrition |
| oth | other |
| preg. | pregnancy |
| prob. | problem |
| RFE | reason for encounter |
| sympt. | symptom |
| unspec. | unspecified |
| w | with |
| w/o | without |