

# Selected determinants may account for dropout risks among medical students

Anne Mette Mørcke, Lotte O'Neill, Inge Trads Kjeldsen & Berit Eika

## ABSTRACT

**INTRODUCTION:** The dropout level from the Danish medical schools is high, but we have only little insight into this problem. The purpose of this study was to qualify the ongoing discussions concerning dropout.

**MATERIAL AND METHODS:** In this retrospective cohort study, relevant variables were extracted from the established database of Aarhus University for the 639 students initiating medicine studies between 1 January 1999 and 31 December 2000. A multivariate pre-admission and post-admission model was examined.

**RESULTS:** Of the 639 medical students, 20% dropped out. Most students dropped out during their first year. The type of admission exam was a strong predictor of dropout in the pre-admission model, whereas previous higher education protected against dropout. Obtaining leave was a very strong predictor of dropout in the post-admission model, whereas high grades protected against dropout.

**CONCLUSION:** The dropout rate has been decreasing during the past decade. Young people considering studying medicine could be advised to choose natural science subjects in high school, and a number of research questions concerning preparedness for medical school are worth pursuing. Leave or very low grades during the first and second study years might serve as red flags to supervisors.

**FUNDING:** Study research was funded by Aarhus University.

**TRIAL REGISTRATION:** Not relevant, register-based research with no biological human material cannot be notified to the Danish Committee System. The Danish Data Protection Agency allows schools to conduct anonymized, non-sensitive, educational analyses without notification.

Dropout from medical school is a loose-loose situation. The individual student dropping out obviously has plenty to loose, but the medical school also misses revenue; and to society a high dropout rate means wasted resources invested in the student and ultimately fewer medical doctors than was planned for and needed. Consequently, all affected parties have a shared interest in minimising dropout.

The dropout rate from Danish medical schools is among the highest of internationally reported dropout rates. In 1999, Christensen & Juul published a paper on dropout from the Medical School at Aarhus University reporting a dropout rate of 27% [1]. In comparison, the

dropout rates from medical school in the UK and the US are usually reported to lie around 3-4% [2, 3], increasing to 6% with minority or disadvantaged students [4]. Australia and the Netherlands have reported a 12-20% dropout rate from medical schools [5-7]. In contrast to the USA, Australia, the Netherlands and Denmark all have direct entry from high school to medical school. Generally, medical student dropout tends to be higher in countries where students have direct entry from high school to medical school than in countries that have no such entry [8].

A recent literature review of factors associated with dropout from medical school included 13 studies [9]. The review concluded that a broad range of entry qualifications seems to be associated with a lower risk of dropping out, particularly among those having earned a prior degree, but also A-levels in natural sciences and high admission test scores were associated with low dropout rates [10, 11]. In addition, struggling academically in medical school might be strongly associated with dropout. By contrast, demographic variables such as gender, age and ethnicity were not identified as particularly important factors. The effects of socio-economic, psychological and educational variables on dropout were not well investigated. Christensen & Juul found results compatible with

## ORIGINAL ARTICLE

Centre for Medical Education,  
Aarhus University

Dan Med J  
2012;59(9):A4493



Why do some students drop out? Would it be possible to identify early predictors – red warning flags – that could be used to guide our students better?

 TABLE 1

Results of the extracted variables for all students in the sample, the group of accomplishing students and the group of students dropping out.

Variable	All students (N = 639)	Accomplishers (N = 510)	Dropouts (N = 128)
<i>Gender, n</i>			
Females	401	320	80
Males	238	190	48
Average age at admission, years	21.9	21.7	22.3
<i>Nationality, n</i>			
Danish	597	479	117
Non-Danish	42	31	11
<i>Type of admission exam, n</i>			
STX (science)	443	372	71
STX (arts)	78	61	17
Non-Danish	58	43	15
HF	41	20	20
HHX	9	6	3
HTX	8	7	1
Admission GPA	9.36	9.36	9.24
Average duration of sabbatical period, years	2.2	2.2	2.3
<i>Previously enrolled, n</i>			
No	598	443	125
Yes	41	37	3
Medical school GPA	6.76	6.76	3.41
<i>Exam re-sits, n</i>			
0	300	235	55
1	120	106	14
≥ 2	219	169	49
<i>Exemptions, n</i>			
0	547	445	101
1	71	54	17
≥ 2	21	11	9
<i>Leave, n</i>			
No	584	481	68
Yes	55	29	12

GPA<sup>a</sup> = grade point average; HF = 2-year higher preparatory examination; HHX = 3-year high school program focusing on business; HTX = 3-year high school program focusing on technology; STX (arts) = 3-year high school program focusing on arts; STX (science) = 3-year high school program focusing on natural sciences.

a) The weighted mean value of all grade points earned by the student during for example high school or medical school.

those of the review: the probability that a Danish student would drop out of medical school was significantly influenced by type of upper secondary school, A-level subjects attended and scores achieved [1].

After 1999, only few studies on dropout from medical school have been conducted in Denmark. The dropout rates from Danish universities are public, but figures are reported at faculty level. In 2009 and 2010, the dropout rate among all bachelors at the Faculty of Health, Aarhus University, was thus 15%, which was similar to the dropout rate from the universities of Copenhagen and Southern Denmark [12]. These figures are aggregate figures. They therefore comprise health-related bachelor studies other than medicine and the

specific dropout rate and profile from the Danish medical schools is not routinely presented. Only one recent status concerning the predictive value of admission tests has discussed dropout in Denmark [13]. Thus, although the dropout level found in 1999 was high, only few published studies have provided follow-up and give more insight into the problem.

The purpose of our study was to qualify the current discussions concerning dropout from Danish medical schools. The research questions were:

1. What is the dropout pattern of the 1999 and 2000 intake at the Medical School of Aarhus University?
2. Which correlations can be established between dropout and variables concerning demographic data, pre-admission qualifications upon entering medical school and post-admission academic activity?
3. Would it be possible to identify early predictors for dropout (red warning flags) that could be used to guide, supervise and mentor medical students?

## MATERIAL AND METHODS

This was a retrospective cohort study. A number of variables potentially associated with dropout were identified based on the literature. In a dialogue with Aarhus University, University Studies Office, we established which of these factors were routinely collected. For each medical student, an administrative staff member was able to extract the following variables from the student database at Aarhus University (Delfi):

### 1. Demographic variables

- a. Gender
- b. Age when admitted was calculated by subtracting the date of admission from the student's birth date
- c. Nationality was divided into Danish students and students originating from other countries.

### 2. Pre-admission qualification variables

- a. Type of entry exam was extracted as six types of entry exams: STX (science) 3-year high school program focusing on natural sciences, STX (arts) 3-year high school program focusing on arts, HHX 3-year high school program focusing on business, HTX 3-year high school program focusing on technology, and HF 2-year higher preparatory examination. Non-Danish entry exams were not sub-classified. In the final model, entry exam was dichotomized into STX (science) and non-STX (science)
- b. Entry grade point average (GPA) was extracted using the 7-point grade scale (from 12 to -3) adopted in Denmark as from 2007
- c. Duration of sabbatical was calculated by subtracting

the date of the final entry examination from the admission date

- d. Previous enrolment at another university course. All previous enrolments at university level were extracted. College and vocational training were not registered in the university database.

### 3. Post-admission academic variables

- Medical school GPA
- Number of examination re-sits. The students were divided into two groups: Students' with no examination re-sits and students doing one or more re-sits during medical school
- Exemptions in special cases where the medical school granted a student an exemption (dispensation) from provisions concerning the number of examination re-sits and the maximum study length. We categorized the students into two groups: Students with no exemptions and students with one or more exemptions granted by the medical school
- Leave. The students were categorized into two groups: Students with no leave period and students with one or more leaves for any reason during medical school.

### 4. Status (accomplishment, on-going or dropout).

The 1999 and 2000 intakes were chosen as these students should all have either finished medical school or dropped out irrespective of any delays. Data were extracted from the database for all students starting Medicine at Aarhus University in the period between 1 January 1999 and 31 December 2000, a total of 639 students.

The Danish Data Protection Agency (Datatilsynet) allows schools to conduct analyses concerning educational questions without notification. During analysis, data were anonymized and individual students were identified with a random number from two to 640 only. Anonymized data were kept secure as generally recommended.

First, we plotted the last finished semester based on registered European Credit Transfer System (ECTS) points for each student who had dropped out. Before analysis, all pair-wise variable combinations were systematically checked for collinearity and zero cells by inspection of matrix graph plots, 2 × 2 tables and box plots. Individual predictors were identified by univariate logistic regression analysis and predictor variables with p-values < 0.1 were specified in the models. The multivariate models of medical student dropout were based on multivariate logistic regression analysis. Post-estimation diagnostics of the presented models consisted of examining linearity assumptions and influential data points (residuals), i.e. data points for which the models

fitted poorly, in order to identify potential outlier cases for removal where justifiable. Linearity was examined with Box-Tidwell transformations, and if necessary by inspection of Lowess smoothed plots of the probability of dropout for the involved independent variable.

Influential data points were identified by inspection of deviance residuals, leverage and Pregibon's delta-beta influence statistics. We chose not to model interactions (additivity assumed) due to the relatively small number of dropout cases available to avoid over-fitting the models presented.

We examined two dropout models: a pre-admission and a post-admission model. In the pre-admission model, we specified only the significant variables available to the university at the time of admission. In the post-admission model, we specified significant variables of university performance only, as these are, in practice, the only variables by which the university can identify struggling medical students after admission without giving rise to any ethical concerns. Hence, the presented models do not represent theory-testing of dropout; they are rather a search for plausible and useful predictors in two rather different situations or realities, with the limitations that this entails.

*Trial registration:* Not relevant, register-based research with no biological human material cannot be notified to the Danish Committee System. The Danish Data Protection Agency allows schools to conduct anonymized, non-sensitive, educational analyses without notification.

 FIGURE 1

Number of student dropouts by semester and dropout groups 1-3.

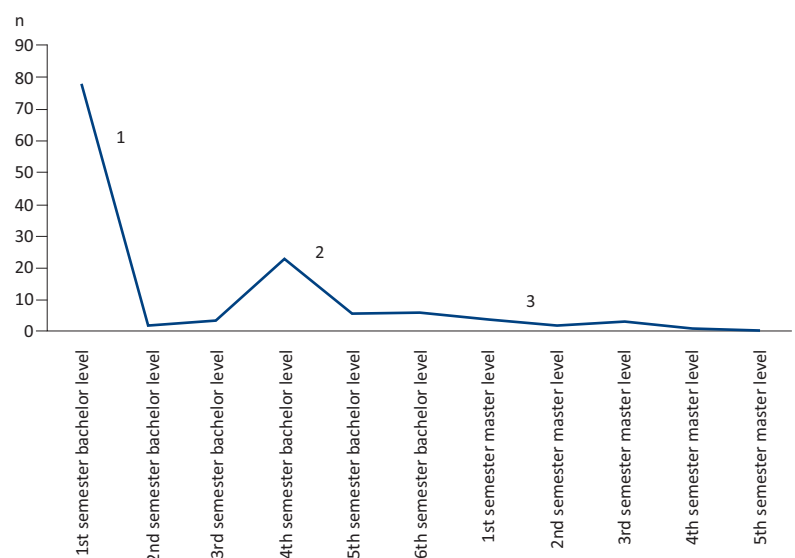


 TABLE 2

Characteristics of the three dropout groups shown in Figure 1.

Variable	Group 1	Group 2	Group 3
Dropout during, year	1st	2nd	3rd-6th
Students in group, n	80	26	22
Medical school GPA	0.9	5.4	5.0
Students with a minimum of one leave period, n	12	11	3

GPA<sup>a</sup> = grade point average.

a) The weighted mean value of all grade points earned by the student during medical school.

## RESULTS

### Variables

The relevant dropout-related variables from the existing administrative system at Aarhus University (Delfi) are shown in **Table 1**. Of the 639 medical students starting at Aarhus University in 1999 and 2000, 79.8% (510) had completed, 2% (1) was still pending and 20% (128) had dropped out by 2010.

### Dropout pattern

The dropout showed a distinct pattern of three dropout groups (**Figure 1**). A large group of 80 students dropped out early during the first year of medical school (Group 1). In this group, we included 12 students who were not registered in the administrative database for any credits, passed exams, grades, or re-sits, and, therefore, perhaps never turned up or left medical school very early during the first semester. The remaining 68 students were registered with credits, passed exams or re-sits, but left medical school during their first year. Another group counting 26 students dropped out later during the sec-

ond year of medical school (Group 2). The last 22 students dropped out late during the third, fourth or fifth year of medical school (Group 3).

We performed separate descriptive analyses for the three groups. Comparing frequency distributions between the three groups, we found no substantial differences concerning the demographic and qualification variables. However, differences between the three groups could be identified concerning the academic variables (**Table 2**). In Group 1, 45 of the 80 students dropped out without any exam results having been recorded. The remaining 35 students in Group 1 achieved non-acceptable fail grades (average 0.9) during their first year, and were thus “academic strugglers”. In comparison, the accomplishing group achieved good grades (GPA 6.8 at graduation). Also, the descriptive analysis showed that Group 2 was characterised by students taking leave, as 11 of 26 (42%) had been away during their first two years of medical school before dropping out (Table 2).

### Two dropout models

**Table 3** presents the univariate analysis and the two multivariate models for dropout. Gender, nationality, average sabbatical period duration between high school and university, and number of examination re-sits during medical school were not statistically significant predictors of dropout.

Model 1 (Table 3) is a pre-admission model using the significant variables available to the University at the time of deciding upon admission. Type of admission exam is a strong predictor of dropout in the model, whereas previous enrolment at another university course protects well against dropout from medical school. Concerning type of admission exam, Table 1 show the distribution between the types, and particularly students holding an HF are at high risk, as 20 of 41 (49%) dropped out.

Model 2 (Table 3) is a post-admission model using the registered variables concerning academic performance of the admitted students. Obtaining leave during the completion of the study programme is a very strong predictor of dropout, whereas a higher GPA during studies protects against dropout from medical school.

## DISCUSSION

We found the overall dropout rate of the 1999-2000 cohorts to be 20%. This is a pronounced decrease in dropout rate from the 27% found in 1999 [1]. However, we can only speculate as to the reasons, as dropout is not well-studied in Danish medical schools.

The type of admission exam is an important predictor of dropout. Particularly students holding an HF were at high risk of dropping out. In 1999, 56% of the HF students dropped out [1]; in our study 49% of these stu-

 TABLE 3

Predictors of dropout among students starting in 1999 and 2000 at Aarhus University Medical School.

Variable	Univariate analysis		Multivariate model 1		Multivariate model 2	
	OR	p-value	OR	p-value	OR	p-value
Female	1.01	0.959	–	–		
Non-Danish	1.45	0.307	–	–		
Sabbatical + 1 year	1.08	0.234	–	–		
Student's age + 1 year	1.15	0.003	1.12	0.042		
Non-STX (science)	2.14	0.000	1.93	0.003		
Admission GPA + 1	0.65	0.013	0.72	0.073		
Previously enrolled	0.31	0.052	0.29	0.049		
Medical school GPA + 1	0.45	0.000			0.46	0.000
Exam re-sits	0.83	0.341			–	–
Exemptions	1.75	0.030			0.88	0.730
Leave	4.23	0.000			4.62	0.001

GPA<sup>a</sup> = grade point average; OR = odds ratio; STX (science) = a 3-year high school program focusing on natural sciences.

a) The weighted mean value of all grade points earned by the student during for example high school or medical school.

dents dropped out. It seems clear that the HF programme is not particularly suitable as preparation for medical school, and young people considering studying medicine may be advised to choose STX (science). Offering all non-STX (science) students special counselling during the first year of medical school is probably not feasible, but giving HF students such an offer may be considered.

We also found that students who have studied at university before medical school are protected against dropout. There may be several explanations for this. The international trend shows that dropout rates are low in countries where students may enter medical school just after college [8]. Attending college courses possibly prepares the student for medical school and spending time on preparatory courses perhaps motivates the student. These factors may be worth pursuing in further research.

It is noteworthy that an overwhelming majority of the dropouts in our study occurred during the first year. The second wave of dropout during the second year was much more limited, and only few dropouts occurred in each of the remaining four years. During medical school, particularly two predictors stood out. Firstly, leave was a very strong predictor and, secondly, medical school GPA was a predictor of dropout. When analysing the dropout pattern, leave during the first or second study year or very low grades during the first study year were clearly red warning flags to supervisors. Interestingly, we found no correlation between dropout and the number of examination re-sits. It seems that a "try again behaviour" after a fail can safely be encouraged.

Our study has a number of limitations. Some potentially relevant variables could not be extracted from the existing database. For example neither entry A levels in natural sciences, quota 1 and 2, nor reasons for leave were registered. In light of the identified importance of leave, one might consider systematically registering the reasons why students obtain leave in order to inform dropout prevention decisions. Furthermore, this study primarily informs us about the students who drop out early. Very late dropouts are (fortunately) few, and it would require a very large sample of students to predict dropout in this group.

Furthermore, this study does not provide information as to the students' personal reasons for dropping out. A very large study of higher education dropout in Germany concluded that students did not contemplate dropout because of stress or lack of ability, but primarily because of weak commitment to their course [14]. Potential dropouts were characterized by a low identification with the role as student and with their subject, a low achievement motivation and limited class attendance. The institutional influence on the tendency to

dropout was modest (only 5% of the variance) and basically limited to teaching quality. Therefore, future studies could follow up with a focus on a possible link between Danish medical students' commitment (identification, motivation, attendance and achievement) and their dropout risk.

We conclude that variables associated with dropout could feasibly be extracted from the existing administrative system. Regular analyses of dropout patterns could thus be conducted to guide decisions concerning dropout from the Danish medical schools. We would also recommend projects testing how the Danish medical schools may improve support of admitted students, particularly when students return after being on leave or when they get a low grade.

**CORRESPONDENCE:** Anne Mette Mørcke, Brendstrupgaardsvej 102, 8210 Aarhus N, Denmark. E-mail: amm@medu.au.dk

**ACCEPTED:** 14 June 2012

**CONFLICTS OF INTEREST:** none

#### LITERATURE

- Christensen J, Juul S. Admission qualifications and the medical education in Denmark. *Ugeskr Læger* 1999;161:257-62.
- Arulampalam W, Naylor RA, Smith JP. Dropping out of medical school in the UK: explaining the changes over ten years. *Med Educ* 2007;41:385-94.
- Stetto JE, Gackstetter GD, Cruess DF et al. Variables associated with attrition from Uniformed Services University of the Health Sciences Medical School. *Mil Med* 2004;169:102-7.
- Strayhorn G. Participation in a pre-medical summer programme for under-represented minority students as a predictor of academic performance in the first three years of medical school: two studies. *Acad Med* 1999;74:435-47.
- Ward AM, Kamien M, Lopez DG. Medical career choice and practice location: early factors predicting course completion, career choice and practice location. *Med Educ* 2004;38:239-48.
- Urlings-Strop LC, Stijnen T, Themmen APN et al. Selection of medical students: a controlled experiment. *Med Educ* 2009;43:175-83.
- Cohen-Schotanus J, Muijtjens AMM, Reinders JJ et al. The predictive validity of grade point average scores in a partial lottery medical school admission system. *Med Educ* 2006;40:1012-9.
- McGaghie WC. Student selection. In: Norman GR, Vleuten Cvd, Newble DI. *International handbook of research in medical education*. Netherlands, Dordrecht: Kluwer Academic Publishers, 2002.
- O'Neill LD, Wallstedt B, Eika B et al. Factors associated with dropout in medical education: a literature review. *Med Educ* 2011;45:400-54.
- Andrioli DA, Jeffe DB. Prematriculation variables associated with suboptimal outcomes for the 1994-1999 cohort of U.S. medical-school matriculants. *JAMA* 2010;304:1212-9.
- Reibnegger G, Caluba HC, Ithaler D et al. Dropout rates in medical students at one school before and after the installation of admission tests in Austria. *Acad Med* 2011;86:1040-8.
- <http://dkuni.dk/Statistik/Universiteternes-statistiske-beredskab> (19 July 2011).
- O'Neill LD, Wallstedt B, Hartvigsen J et al. Admission tests for medical education. *Ugeskr Læger* 2012;174:560-2.
- Georg W. Individual and institutional factors in the tendency to drop out of higher education: a multilevel analysis using data from the Konstanz Student Survey. *Stud High Educ* 2009;34:647-61.