

Administrative data analysis of student attrition in Hungarian Medical Training

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Abstract

Background

Even though dropout is a well-researched topic in tertiary education, it is still not clear which variables have an impact on it beyond individual attributes. There is numerous empirical evidence supporting that college students studying in STEM fields are characterized by a higher risk of attrition than their peers. Even though medicine is not traditionally considered to be part of STEM disciplines, some suggest to include it, as the field of medicine is an important area in research focusing on student attrition. Since Hungarian medical training attracts more and more international students every year, the issue of attrition in this field of study can have a global impact too.

Methods

In our study we examined the dropout behavior of all medical students who started their studies in 2010 in Hungary (N = 977) by analyzing longitudinal administrative data of the students between 2010 and 2017, which unlike self-reported questionnaires made it possible for us to analyse data that without any kind of distortion. Since we analyzed the data of all students studying medicine in this period in Hungary, we conducted descriptive statistics and revealed the risk and protective factors of dropout using binary logistic regression.

Results

Our results indicate that the risk of dropout can be increased by a low number of credits and passive semesters and the tuition-based forms of finance, although dormitory placement can serve as a protective factor.

Conclusions

Relieving the rigidity of the training network, more educational attention, targeted mentoring in the case of learning difficulties and dormitory placement in support of learning communities can be formulated as a policy proposal.

Background

The role of professional socialization – a potential protective factor of dropout

The professional socialization of future doctors, the process of shaping their professional identity and the identification of the factors supporting this are all important research topics. It is also a relevant question whether medical students' successful identification with their future role is determined by their social and demographical characteristics or by the circumstances given during their studies [1]. According to previous findings it is clear that insufficient professional socialisation can result in dropout from medical courses and medical professionals quitting the field, which can lead to serious labour shortage in the healthcare system. The difference in student dropout rates between various fields has drawn attention to the fact that those who choose different majors are affected by dissimilar factors when it comes to deciding on whether they should continue their studies. The early formation of professional identity is strengthened by attachments to disciplinary values and relationship nets, as well as by high admission requirements and favorable career possibilities, which can limit the rate of student dropout [2, 3].

High dropout rates and the growing need for workforce are factors that the literature traditionally associates with STEM fields [4]. We argue that medicine should be included in STEM research. This can be done by viewing medicine as an applied form of science that is already included in STEM or by adding medicine to it. Even though some use the form of the acronym that covers medicine too (STEMM standing for Science, Technology, Engineering, Mathematics and Medicine [5]) STEM is more widespread and frequently used, so we suggest to expand its meaning instead of using STEMM as an alternative. Since the COVID-19 pandemic has already shown that there is a high demand for medical professionals on the labour market, in our study we wanted to examine if tendencies in attrition could possibly support the inclusion of medicine in STEM research. We argue that medical fields could strongly benefit from being viewed as a part of the STEM superdiscipline by receiving the scientific and governmental interest and support that STEM education have been given in the past few years.

Dropout among medical students – Risk and protective factors and international practices

The way students finance their studies in higher education varies all across the world. In many countries there are tuition fees and cost-sharing, where students and their families contribute to the costs financially. The majority of European countries, on the other hand, provide education for free or at a low tuition cost. In the Western world there is a significant indebtedness deriving from tuition fees among doctors who are at the beginning of their careers. At the same time, dropout results in a severe loss of public resources, not to mention the fact that the excessive length of studies has negative effects on the mental health of the students involved, which can be viewed as a loss of individual resources.

At the turn of the millennium, in response to the appearance of the shortage of workforce qualified in medicine, the government of the UK increased the number of students admitted to these fields and initiated special development programmes and examinations in favour of their retention [6]. In other countries the increase in the dropout of medical students was examined in terms of changing the structure of higher education, and it was stated that the temporal distortion of studies increased the risk

of dropout [7]. High school results, admission scores and the year of admission were proved to be good predictors of students' success in terms of obtaining a degree, while the admission score indicated whether an individual would complete their studies without overrunning the period specified in the curriculum [8]. According to data from longitudinal analyses, the increase in dropout rates can be explained by admission policies, the structure of the higher education curriculum, the ratio of theoretical and practical courses and increasing tuition fees as well [9, 10, 11]. Dropout is further influenced by the hardships of meeting educational costs, the negative effects of having a job during college, and the fear of being in debt due to high tuition fees [12, 13, 14, 15]. Some researchers have also come to the conclusion that tuition fees can reduce dropout rates. Others conclude that even though on the surface tuition fees can appear to have benefits regarding dropout behaviour, the reason behind this increase in dropout might be that students with lower SES are less likely to enroll in higher education when there is a higher potential of becoming indebted [16]. Good practices aiming to limit dropout rates include providing support for students in the form of frequent formative rating, learning methodology courses and group studying, increasing the proportion of practical, problem-based studying, and counselling for time-management and stress-handling [17].

Although Hungarian higher education is mostly financed by the state and is tuition free, 40% of BA/BSc students still leave higher education without a degree. Qualitative research in 2018 examined those students who had started a course more than 10 years earlier did not graduate. According to the results three significant groups of reasons caused their dropout: most of them dropped out due to financial reasons, because the students and their families could not cover the cost of travelling and living that comes with participating in higher education. Others stated that learning difficulties, the negative attitude of teachers and administrators, the lack of support and information caused their dropout. Although they entered the training with high scores, most of medical students belonged to this category. According to the third group, the reason for dropout was the students' disillusionment with their major or institution and their disappointment caused by the discrepancy between their experiences and prior expectations [1].

Hungarian tertiary education and medical training

In Hungarian medical training no multi-cycle courses were introduced, unlike in other areas following the Bologna procedures at the turn of the millennium. So, for example, while 3 + 2 year BA/BSc and MA/MSc courses were introduced in the field of economics, the one-cycle educational structure was kept in medical, legal, pedagogical and theological fields. This means that future doctors have to study for 6 years in order to obtain a degree. Regarding the admission process and the requirements for the completion of courses, medicine is highly selective in comparison with other fields in the Hungarian higher education system. Medical students start their internships and residency years after obtaining their degree so that they can take their medical specialist exam at the end of their 3–5 year long medical courses. This extremely long period of studies keeps medical students from becoming self-sufficient and starting their own family. Optimistic future expectations are demolished by the extremely high requirements during their studies and the high proportion of unsuccessful exams. Since the Hungarian healthcare system is publicly funded, Hungarian medical professionals are also underpaid compared to

those working and living in Western countries. To be able to have a more favourable financial state, Hungarian doctors usually need to take part-time or second jobs, which can cause them to be burned out and overwhelmed. The inadequate pace of the process of obtaining a degree causes labour shortages in certain areas, which is exacerbated by students quitting, moving abroad and by the aging of medical society [18, 19].

In the extremely expensive medical training programmes a 20% dropout rate leads to a great waste of resources at both individual and national levels [20]. In Hungarian medical training there are 3 groups of students based on the form of funding. Students with Hungarian citizenship are financed by the state if they have reached the required scores at admittance and if the period of their studies has not exceeded 7 years. Only some Hungarian students who started their second degrees or who did not get admitted to the government funded form complete their studies in self-financing courses. However most foreign students from European and Asian countries study in self-financed courses in English or German. The third group includes those foreign students from developing countries within the framework of the Stipendium Hungaricum scholarship, whose studies are financed by the Hungarian state with scholarships. The contemporary relevance of our research is given by the fact that in 2015, a new system of financing was introduced for Hungarian students, which also affected Hungarian medical students who had been studying free of charge up to that point. This new system monitors the study performance and grades of students annually, and those whose grade-point averages do not reach 3.00 (rated on a 5-point scale), and who do not get at least 36 credits yearly, lose their state financed status and have to pay tuition fees. Considering the average income of Hungarian families, the yearly expense of \$ 8000 can lead to a significant growth in dropout.

In 2012, public funding for the first degree was also debated. Due to the increasing international mobility, the lack of doctors in Western Europe and the desire to gain experience and have better earnings, many young doctors moved abroad right after graduating in Hungary. As this can also be interpreted as a situation in which the return of the Hungarian state's investment in human capital was paid off in other states, the Hungarian government came to the decision that it was not worth financing everyone's studies. In 2012, student contracts were introduced, which stated that after obtaining state-financed degrees, students have to work in the country for a certain period. Then, in the middle of the decade, the higher education ministry decided that in order to reduce the burden on the state budget, students who cannot meet certain requirements should cover the expenses of their studies on their own. It is also possible to pay tuition fees on credit in Hungary so as a result, medical training has been placed on a market basis for certain groups, which can lead to the accumulation of huge debts. Considering this, students who would get better grades in the next semester may choose to drop out, so that they can avoid becoming indebted.

Hypotheses

In our research we focused on the selection and admission policies and attrition risk factors characterizing Hungarian medical training. We also wanted to contribute to the illumination of similarities

and differences between medical training and traditional STEM fields, hence in our hypotheses we focused on the selectivity of medical training, the commitment of students applying to this field and the role that the form of finance, passive semesters and the pattern of credit accumulation potentially play in attrition. As a potential protective factor, we analyzed the role of living in a dormitory.

H1: Regarding to the admission process, Hungarian medical training is highly selective, therefore students applying to this field are usually characterized by a strong commitment to their chosen profession, so they often apply to medical training in more than one university and re-apply when they do not get the acceptance for the first time.

H2. The form of finance plays a significant role in student dropout: dropout rates are lower among those who study in state financed form compared to their peers who carry out their studies in self-financed form.

H3. The patterns of credit accumulation can be significant predictors of dropout: those who collect credits at an easy pace from the beginning of their studies have a higher risk of dropping out than their peers who collect at least the expected number of credits/semester from the beginning of medical training.

H4. The number of passive semesters significantly increase the probability of attrition: those students who have more passive semesters are characterized by a higher risk of dropout than those who do not pause their studies.

H5. Staying at a dormitory during higher education can serve as a protective factor against dropout.

Methods

The aim of our research was to examine the dropout behaviour of Hungarian medical students in the educational structure before the governmental reforms. The majority of research studies dealing with medical students are based on examinations with databases of fewer cases and self-reported questionnaires, and they often analyse samples of only a few institutions. In this study we analyse data from an anonymous individual higher education database [9, 20] provided by the Hungarian Educational Authority, that is collected for statistical purposes and is accumulated and stored by the Hungarian Higher Education Information System. In this analysis we focused on the progress of students from four Hungarian universities who started their studies in 2010. The database included longitudinal administrative data of these students between 2010 and 2018. The examination this individual higher education database provided us with valid information on the progress of students in certain samples. During the analysis we worked with the following variables: the gender of the student, the age of the student, whether the student lived in a dormitory (hall of residence), the categorised variable of the number of passive years (i.e. years that the student officially spent without participating in higher education), the form of finance and the number of credits obtained in a given semester.

During our research, we used descriptive analysis, in which we examined the proportion of dropout in the case of continuous variables, while in the case of discrete variables we examined and compared frequencies in certain groups. In order to explore the reason(s) behind dropout, we conducted binary logistic regressive analysis and we applied the Forward Wald method. We regarded $p < 0.05$ as a significant result. Analyses were done with the IBM SPSS Statistics 25.0 program package (SPSS, Chicago, IL). The limitation of our study is that our analysis focused on the year 2010, because the data is owned by the ministry and - exceptionally - we received data for that year, however, our previous findings, based on questionnaires and interviews also confirmed the results presented here [1, 21, 22].

Results

Since high admission requirements can strengthen the early formation of professional identity, first we analyzed the ratios of students who got accepted to medical training. In the general medical course in Hungary the number of applicants and participants is quite stable. We can state that the chance of being accepted to this field, considering the proportion of first-time applicants and participants is quite low compared to other undivided courses (i.e. single BA/BSc courses), as it is usually around 50%. The peculiarity of the 6-year undivided form of training is that it has dedicated applicants. According to our results, in case of an unsuccessful application, 75-76% of the applicants choose this same field as their first choice when it comes to re-applying. In the undivided dentist major this proportion is around 40-45%. The fact that most of the applicants who choose medicine as their first option also mark it as their second choice (two thirds of applicants) and even as their third option (half of the applicants) at different institutions also supports the assumption that those studying medicine in Hungary are quite committed to their career choice (Table 1).

Table 1. The number of applicants and those accepted to medical majors (2010-2018).

Year	All applicants	Applying to state-financed form	Applying as their first choice	Accepted	Accepted to state-financed form
2010	2772	2761	2098	1046	982
2011	2815	2782	2144	1066	989
2012	2958	2929	2208	1155	1113
2013	2476	2454	1859	1148	1127
2014	2839	2818	2159	1068	1064
2015	2950	2929	2249	1073	1058
2016	2927	2910	2189	1022	986
2017	2780	2763	2089	1029	983
2018	2722	2704	2087	1029	1025

Source: General Application System Hungary, Hungarian Educational Authority, own edition

Although, as we mentioned above, there are more students studying medicine, as numerous foreign students participate in medical training in Hungary, this group is typically admitted through a special application process. In the academic year 2017/18, for instance, 52.8% of the 12,400 medical students in Hungary were from foreign countries. The number of medical students coming from non-European countries who obtained the Stipendium Hungaricum scholarship is growing dynamically, increasing from 146 in 2017 to 297 in 2018.

We also examined dropout rates in Hungarian medical training to see if our hypothesis stating that medicine resembles STEM fields can be confirmed by data. According to national data showing the number of those who graduated between 2015 and 2017, a quarter of the students accepted in Hungary dropped out. The number of qualified doctors is between 1200 and 1400, 450-750 of whom are non-foreign individuals (Table 2). If we compare this to the number of admitted students, then we can still see that the difference between the number of those accepted to medicine and those who actually obtain a degree on time is high.

Table 2. The number of students who finished their studies in medicine (2015-2017).

Year	Number of students participating in the final examination	Number of students statistically graduating	Foreign students
2015	1188	1287	450 (35%)
2016	1374	1371	531 (39%)
2017	1406	1406	618 (47%)

Source: Higher Education Information System Hungary, Hungarian Educational Authority, own edition

When examining the risk factors of dropout we analyzed the role of passive semesters and self-financed form of funding. According to data, passive semesters have a pre-indicating role in terms of dropout: while only 12% of those who finished their studies had 1 or 2 passive semesters, the corresponding figure for dropout students was 60%, and 21% of these students had even more passive semesters. The tuition fees in medical training are rather high in Hungary, amounting to 8,000 USD (around 5,000 Euros) in 2010. It is no coincidence that only a few students can afford to cover the expenses of their studies, and very few apply to a self-financed form as their first choice. In 2010 8% of students had started their studies in self-financed form, half of whom covered their expenses throughout their studies, while those with higher grades and performance could shift to a state-financed form. In 2010, only 8% of those who had been accepted on a state-financed form were transferred to a self-financed course and the proportion of those who remained on state-financed courses was only 83.6%.

There is a significant relationship between dropout and form of funding and shifting from one form to another (Pearson Chi2 $p < 0.001$). The dropout rate was 63.4% amongst those students who remained on

self-financed courses, while it was 9.4% amongst those who remained state-financed throughout their studies. Dropout rates were drastically higher in the case of those students who had been transferred from state-financed to self-financed form than amongst those who had shifted from self-financed form to state-financed form during their studies. However, the coherence between the two variables does not necessarily mean there is cause-effect relationship, as there can be financial and educational hardships in the background as well. An examination of the success of students provides very interesting information based on our database (Figure 1). We can see that dropout is the lowest (8% and 9%) among those studying in state-financed form while it is the highest (56% and 63%) among students that cover the expenses of their studies for themselves (self-financed form).

In order to test our hypothesis, we used a binary logistic regression model on our data in which the dependent variable was dropout (dropped out or not), while as background variables we considered the following: the gender of the student, the age of the student, whether he/she lived in a dormitory, the categorised variables of the number of passive semesters and the form of finance. Besides these, we used the number of credits as a continuous covariant variable. By applying the Forward Wald method, we obtained a model in which the form of funding and its change did not increase the chance of dropout. Academic factors (the number of credits and passive semesters) proved to be significant explanatory variables: a higher value of the former decreased the chance of dropout, while the latter increased it (Table 3).

Table 3. Model 1. Results of the binary logistic regression.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	Reference class
1-2 passive semesters	2.303	.496	21.536	1	< .001	10.008	none
3 or more passive semesters	2.950	.645	20.952	1	< .001	19.110	none
Credit value	-.031	.003	81.927	1	< .001	.969	continuous variable
Constant	2.909	.486	35.885	1	< .001	18.342	

Source: Higher Education Information System Hungary, Hungarian Educational Authority, own edition

Our model was also tested with the number of credits excluded from it. In this case, besides the number of passive semesters, self-financed status and transferring to it had predicted a greater chance of dropout (Table 4). In this model, staying in a dormitory appeared as a preventive factor, just as it did in Astin's (1984) research: those who lived in a dormitory during the course had a lower chance of dropping out.

Table 4. Model 2. Results of binary logistic regression.

Variants	B	S.E.	Wald	df	Sig.	Exp(B)	Reference class
Self-financed throughout their studies	2.425	.415	34.153	1	<.001	11.303	state-financed throughout their studies
Started in state-financed form, shifted to self-financed	1.213	.305	15.840	1	<.001	3.362	state-financed throughout their studies
Started in self-financed form, shifted to state-financed	-.848	.657	1.668	1	.197	.428	state-financed throughout their studies
1 or 2 passive semesters	2.387	.249	91.853	1	<.001	10.883	none
3 or more passive semesters	2.950	.645	20.952	1	<.001	19.110	none
Lived in dormitory	-.665	.271	6.046	1	.014	.514	none
Constant	-3.161	.212	221.821	1	<.001	.042	

Source: Higher Education Information System Hungary, Hungarian Educational Authority, own edition

Discussion

Even though medical studies are of high cost – from a national and individual perspective as well - the international research literature rarely deals with the problem of attrition among medical students. There is a view that dropout is positive because low performers are not required in this profession, but from another point of view it can also indicate the consequences of a backward form of education, and therefore dropout is considered a waste of resources. In our study we aimed to add to the research on this topic by highlighting significant experiences acquired from a longitudinal examination of students entering medical training in 2010. In Hungarian medical training students can be admitted if they have outstanding academic results and dedication and there is no other field in higher education which has such a varied group of students. Statistical analysis shows that only half of medical students starting in 2010 were able to graduate within the time frame laid down in the curriculum and only 70% of them could obtain an ‘absolutorium’ (a certificate of successful completion of all courses without obtaining a degree) by the time their state-financed semesters had ended. More than four fifths of those in the sample examined had been studying in state-financed form throughout their studies. There were few students who took the opportunity of paying 5,000 dollars at the beginning to continue their studies in self-

financed form, given that this sum is genuinely high compared to the average wage in Hungary. Our results showed that the dropout rates are significantly higher among those students who were transferred to the self-financed form during their 14 semesters despite the fact that they started their studies in the state-financed form compared to their peers.

According to our results dropout can be predicted by an early and marked slowing in the process of credit accumulation, and by a higher number of passive semesters. Slow credit accumulation indicates difficulties in study performance due to the specifics of the curricula of medical training which includes numerous courses that are hierarchically building to others meaning that failing one exam can expand the period of the studies by 1 or 2 semesters. Due to academic difficulties and slow credit accumulation medical students are further selected during the first 2 years and a third of those who drop out throughout their studies actually leave college at this point. In our sample, dropout rates were really low (9.4 %) amongst students who studied in state-financed form throughout their studies. In spite of this, 63% of those studying in self-financed form and 56% of those who were transferred to self-financed form dropped out at some point.

Based on the student data in the database we carried out a multi-variant analysis in order to identify the factors that influence the chance of dropout the most. The logistic regression models confirmed that in the examined sample dynamically collected credits reduced the chance of dropout, while a higher number of passive semesters increased it. These two phenomena are not fully independent from each other, since students with poor academic performance who are unable to pass their exams often take passive semesters. After the passive period, students who have previously failed exams still have the opportunity to continue their studies in state-financed form. In contrast, students who have passed their exams but have not reached a grade point average high enough are transferred to self-financed form. Finishing studies in self-financed form was itself a factor which increased the possibility of dropout, although it affected very few students.

Conclusions

It can be concluded in overall terms, that studying the phenomenon of dropout is an important issue for the higher education system as a whole. Providing state-financed higher education is costly for the state, but if students drop out, it can be extremely wasteful, not only in terms of public resources, but also considering the money that parents invest in their childrens' studies. The chances of dropping out are increased by study-related (a low number of credits, passive semesters) and finance related factors. Hungarian medical students enter with high performance and a dedicated attitude, but despite this, every second student graduates only after the official course period has ended, and one third of them is unable to pass the graduation exam by the end of their studies. In medical training dropout is increased by low credit numbers and passive semesters and the self-financed form. However, staying in a dormitory can serve as a protective factor, as it limits the costs of participating in higher education and gives students the opportunity to gain social capital that can promote better academic performance.

It is an important limitation of our study that the database we used provides information regarding the progression of only one sample. One-third of the medical students were still continuing their studies after the closure of database so their results are unknown. We could have made further important connections by examining academic grades, but on the basis of the database we can only draw conclusions on unsuccessful course performance, and we do not have access to any data about academic grades in the current higher education context. Since the filter processes based on academic grades means a new selection is made, and the accompanying costs are really high, the restrictions for those who have entered since the educational reforms may have caused radical changes. It will be important to examine the effect of change in the future, as well.

Beyond taking a step forward to understand the phenomenon of attrition, the results of our study has implications for STEM research as well. In the last decade understanding the typical challenges characterizing STEM (Science, Technology, Engineering and Maths) fields has come to the forefront of international research, however it is still not clear exactly which fields are included in the acronym. Even though the word science could refer to medicine as an applied form of natural sciences, the existence of an alternative typology that explicitly includes medicine (STEMM standing for Science, Technology, Engineering Mathematics and Medicine) implies that it is not strictly considered to be part of the original and most frequently used version: STEM. Since the reason standing behind the growing need for STEM workforce is that professionals qualified in these fields are essential for us to be able to handle the typical challenges of the 21st century, we argue that according to this aspect medicine could and should be viewed as a part of STEM. COVID-19 pandemic proved that medical fields are unequivocally describable by this parameter. In Hungary and multiple other countries it has been shown that there is high need for workforce for healthcare system to work solidly during a challenging time such as this pandemic, and that now there is labour shortage that could only be solved by medical students working in the frontlines. Our research also illuminated the fact that this problem could be managed (at least partially) by reducing dropout rates in the fields of health sciences and medicine - that also links them to traditional STEM fields.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

The data that support the findings of this study are available from the Hungarian Authority of Education but restrictions apply to the availability of these data, which were used under license for the current study,

and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Hungarian Authority of Education.

Competing interests

All financial and non-financial competing interests must be declared in this section.

The authors declare that they have no competing interests.

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Authors' contributions

GP analyzed and interpreted the database and has also been responsible for conceptualization, methodology and data curation. GP and ZSK have been responsible for the preparation of the original draft. ZSK has also been responsible for the English translation. EA has been responsible for reviewing and editing the English translation, adding STEM perspective to the Background and editing the figures and tables. All authors read and approved the final manuscript.

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Figures

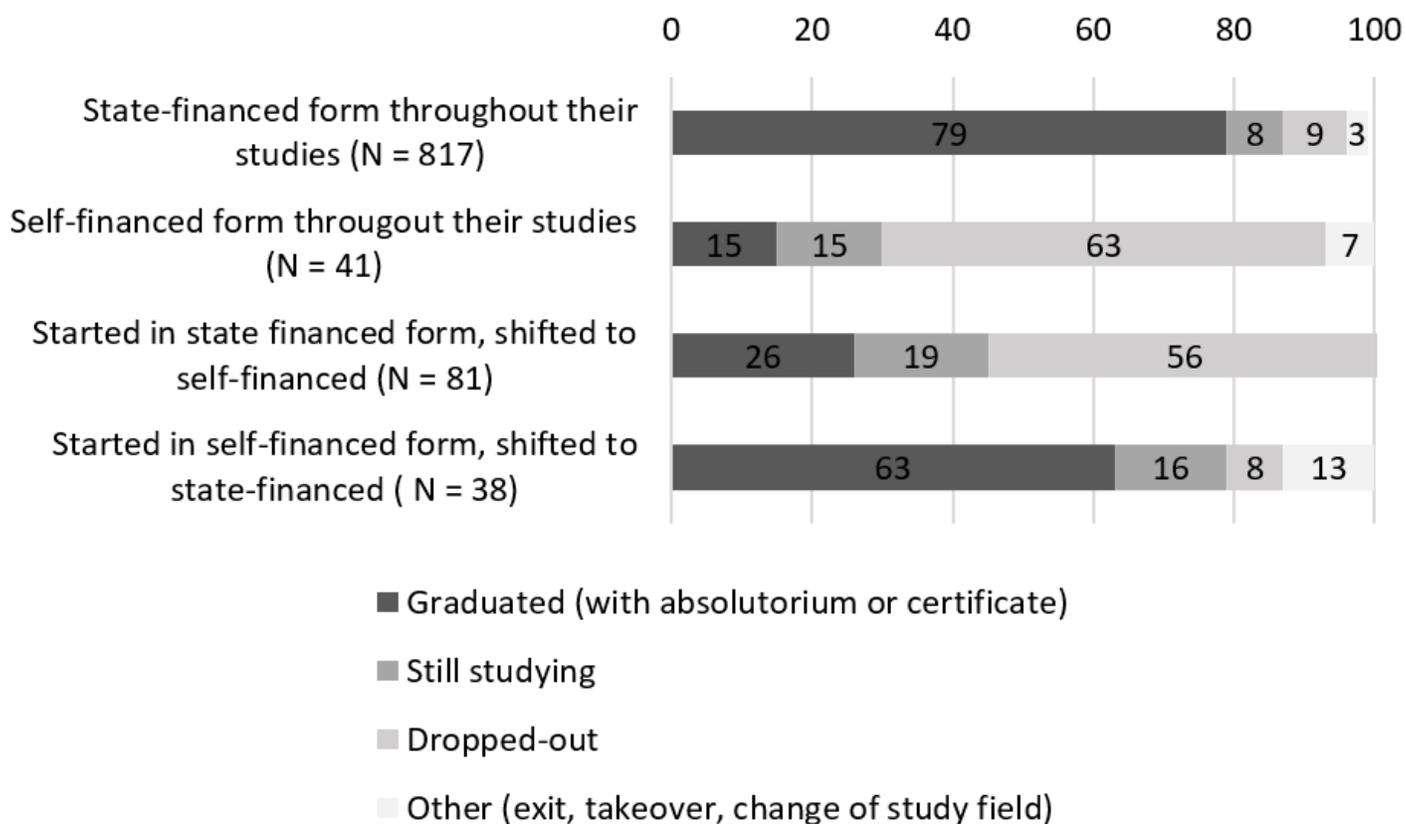


Figure 1

Academic success of students belonging to certain finance groups. Source: Higher Education Information System Hungary, Hungarian Educational Authority, own edition