

# DO ADMISSION CRITERIA ACCURATELY ASSESS THE RISK OF ATTRITION FROM MASTER'S DEGREE OF PUBLIC HEALTH PROGRAMME?

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## Abstract

### Introduction:

Undertaking studies in the field of public health is not always an educational success. There are numerous potential factors that may have influence on the risk of failure during studies. To minimize the ratio of resignations / cross-outs from the list of students, appropriately selected criteria concerning accuracy should be applied during admissions. From the point of view of selecting the best candidates, criteria considered more beneficial are such that are characterised by a greater specificity allowing to avoid a situation in which there would be people with an inadequate level of preliminary competences among the candidates.

### Aim of study:

Assessment of selected socio-demographic factors and admission criteria as potential predictors of educational success of MA students at the Public Health Department at the Medical University of Warsaw (MUW).

### Materials and Methods:

151 students of the Public Health Department who undertook studies of the 2nd degree at the Faculty of Health Sciences at MUW in 2007 qualified for the study. The age average was  $22.8 \pm 2.03$ ; about 77% of the studied group was women; 87% of the students completed their 1st degree at MUW. The failure coefficient was 32.4%. Predictive analysis was performed using the method of logistic regression. In the suggested logistic model, four predictors were used that belonged to the group of socio-demographic factors: gender, age, place of completing the 1st degree, and professional title. Moreover, the model also included the score obtained by the candidate at the entry exam test in the following five areas: *Epidemiology, Organization in Healthcare, Methodology and Statistics, Health and Human nutrition, and Social science*. Whereas the dichotomous variable, dependent on the analysed model, was the fact of completing / not completing studies (a variable coded as 0 and 1, respectively). Estimation method of quasi-Newton was applied here with the determination of asymptotic standard errors.

### Results:

The suggested model of logistic regression, which would assess the influence of potential predictors on the risk of failing to complete studies, showed no statistical relevance ( $\chi^2 = 9.515$ ,  $P = 0.484$ ). No variable in the group of socio-demographic factors, nor admission criteria proved relevant predictors of failure during studying.

### Conclusions:

Admission criteria applied during the recruitment process are characterised by insufficient validity in the evaluation of candidates' competences on entry as they do not contribute to the efficient selection of those candidates for whom the risk of failure in studying is high. It is necessary to increase the validity of the selection process by introducing additional admission criteria. Further monitoring of the quality of the accepted admission policy at the Public Health Department at the MUW is necessary.

**Keywords:** educational status, school admission criteria, student dropouts.

# 1 INTRODUCTION

Every year higher schools engage their staff and funds in order to perform the admission procedure in a reliable manner, so that the best candidates for a particular major are chosen. In most western countries, various forms of entrance examinations, including multiple choice questions test (MCQs), are used as an admission criterion. Until now, no systematic observational studies have been performed in Poland that would allow for estimating the size of the issue and identifying the main reasons of attrition / dropout from tertiary education. The absence of this kind of studies makes it impossible to undertake effective measures that would support the process of selecting appropriate candidates, which would decrease the risk of student attrition due to the improper selection of admission criteria [1].

The appropriate level of competence of public health professionals is the key element for the proper scientific advancement and efficient introduction of a well-planned health care policy [2,3]. Only an apt and reliable selection of candidates for studies gives students the opportunity to gain all the necessary competence to become an expert, advisor or consultant as well as to be managers in public health care institutions. In this context, all of the schools and programs have admissions criteria to select the best candidates for their public health programs. However, we do not have enough evidence to support that each requisite or criterion specific for the programs is a predictor of academic success [4]. Moreover, although some of the criteria are objective, much subjectivity is present during the admissions process.

Student attrition from tertiary education is often related to the change of the career path and professional plans of a student as well as unsatisfactory progress at school. A high level of dropout contributes to a measurable financial loss. As far as the education of public health professionals is concerned, there are no available data concerning this issue. However, it is estimated that the annual financial losses with reference to the major of Nursing in the United Kingdom reach as much as 57 million pounds [1, 5]. Apart from measurable financial losses, dropout from tertiary education affects also an increased time-related engagement of academics, which, however, does not improve the quality of education. The lecturers' attention is scattered on all students of a particular major, both those that will succeed and complete the programme and those that will be struck from the register. It is important here to define the reasons of the discontinuation of studies. Students who consciously resign from the studies (dean's leave, change of major/school) should be treated in a different way compared to those who are struck from the register because of unsatisfactory progress at school. This information is crucial especially for the academic community, since the following reasons are mentioned as the factors contributing to the number of students that do not graduate: an inadequate structure of the curriculum [6], lack of effective strategy of supporting students in academic adaptation, especially in the first period of studies, as well as lack of adjustment of the classes to the educational needs, especially in relation to clinical subjects [7]. Therefore, it needs to be emphasised that student attrition is not always caused by a student, but by an academic institution as well [8].

The assessment of predictive power of selected forms of entrance examinations constitutes an important aspect of study of the quality of the admission policy. The present analysis includes estimation to what extent the results of initial competence determination allow for an apt prediction of educational achievements of students. Ferguson et al. [9] underlined that it is necessary to conduct a well-planned, reliable and long-term study that aims to establish a real predictive value of selected cognitive and non-cognitive factors in relation to predicting the future careers of students.

## 2 AIM OF STUDY

Assessment of selected socio-demographic factors and admission criteria as potential predictors of educational success of MA students at the Public Health Department at the Medical University of Warsaw (MUW).

## 3 MATERIALS AND METHODS

### 3.1 Data Collection

The study enrolled a total of 151 students of Public Health who started a full-time Master's degree programme at MUW in the academic year 2007/08. The mean age of students amounted to  $22.8 \pm 2.03$  years; women constituted over 75% of the study group; 87% of the students graduated from a Bachelor's degree at MUW. The level of dropout among students was 32.4% and concerned the first and second years equally. See Table 1 for detailed characteristics of the study group.

**Table 1.** Characteristics of the study group of Master's degree students of Public Health at the Medical University of Warsaw

<b>Mean age <math>\pm</math> SD</b>		22.8 $\pm$ 2.03
<b>Number of students beginning studies</b>		151
<b>Number of graduates</b>		102
<b>Number of attrition</b>	1 <sup>st</sup> year	24
	2 <sup>nd</sup> year	25
<b>Gender</b>	Women	116
	Men	35
<b>Place of completing the 1<sup>st</sup> degree</b>	MUW	131
	Other	20
<b>Professional title</b>	Public Health	28
	Other	123

SD – standard deviation; MUW – Medical University of Warsaw

### 3.2 Description of the admissions selection process

Faculty of Health Sciences at the MUW is one of the 11 academic units at Polish medical universities that train public health professionals in both degrees [17]. Annually, over a hundred MUW students graduate from a Master's degree in Public Health in three different specializations: General, Health Promotion and Epidemiology, and Management in Health Care. Graduates from Bachelor's degree programmes in Public Health, other medical majors, and other majors that meet the minimum curriculum for Public Health may be admitted to the admission procedure. In practice, graduates of the following majors are admitted to the admission procedure for the Master's degree programme: Dietetics and Food Science, Electroradiology, Emergency Medicine, Nursing and Midwifery, Physiotherapy, as well as Dental Hygiene and Dental Technology.

Between 2008 and 2012, MUW organised recruitment of candidates on the basis of scores achieved in a multiple-choice questions (MCQs) exam and the Bachelor's studies GPA (between 2008 and 2011 the results of the Bachelor's degree exam were additionally included). Each MCQ exam comprised 50 questions in the "best answer from a list of possible answers" format with five possible answers for each question. In accordance with the test content outlines, five subtests were distinguished for each MCQs exam and they included the following thematic fields: (1) Epidemiology, (2) Organization in Healthcare, (3) Methodology and Statistics, (4) Health and Human nutrition, and (5) Social science. Examination questions were categorised in two domains: general and specialised knowledge and the use of knowledge in practice.

### 3.3 Statistical analysis

An initial assessment of differences between a group of students who graduated and a group of those who did not graduate was performed based on a comparison of entrance test exam scores achieved during the admission procedure (Mann-Whitney U test). A non-linear estimation model such as logistic regression was used to assess the predictive factors that can potentially influence the risk of not completing tertiary education. The following four predictors belonging to the socio-demographic factors were used in the logistic model: gender, age, place of graduation with Bachelor's degree, and professional title. Moreover, the model included also a score achieved by a candidate in the entrance test exam covering the five thematic fields: Epidemiology, Organization in Healthcare, Methodology and Statistics, Health and Human nutrition, and Social science. The fact of graduating / not graduating (coded as 0 and 1, respectively) was the dependent dichotomous variable in the model. A Quasi-Newton estimation method with asymptotic standard errors was used in the analysis. The odds ratio (OR) with a 95% confidence interval was estimated for each predictor in order to define the risk of not graduating [10].

STATISTICA statistical package version 12 (StatSoft, Inc.) licensed to MUW was used in the analysis. The *a priori* significance level was established for all analyses at  $\alpha < 0.05$ .

## 4 RESULTS

The results of comparison of scores achieved by students during the admission procedure for the Master's degree programme by graduation status demonstrated a lack of statistically significant

differences in this respect. Both the summative scores and scores for particular subtests were similar in both groups of students (Table 2 and Figure 1).

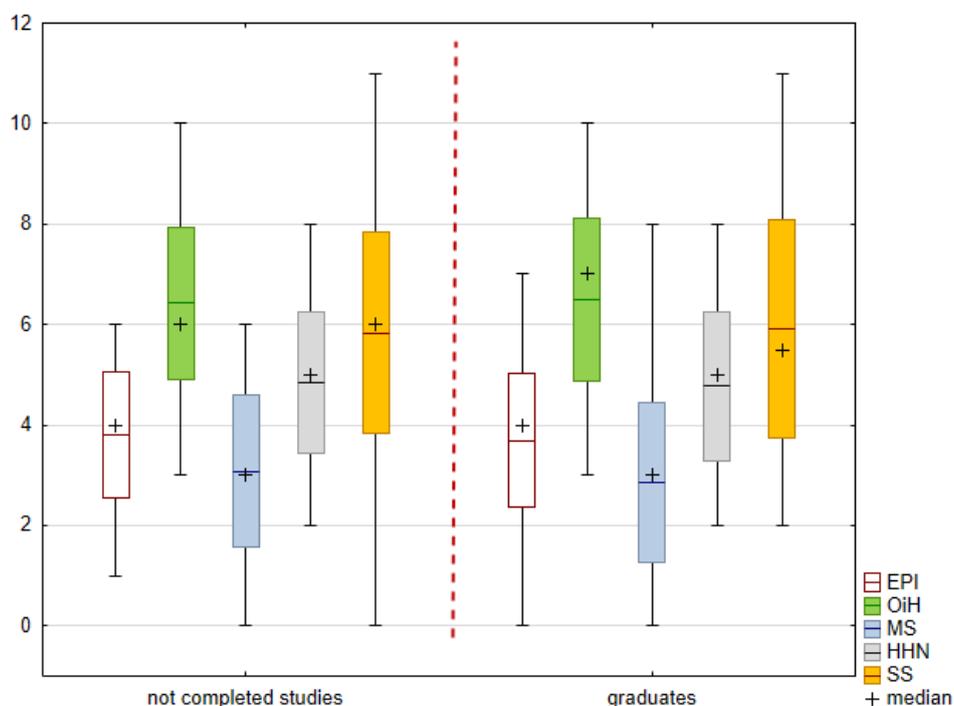
The logistic regression model used to assess the risk of dropout was statistically insignificant ( $\chi^2 = 9.2258$ ,  $P = 0.417$ ). The estimation of the parameters of the regression function with the highest credibility demonstrated that only one out of four socio-demographic factors had significantly influenced the probability of failure: the professional title. The analysis showed that students with a professional title other than public health professional, BSc were less likely to fail the Master's degree programme ( $OR = 0.211$ ; the Wald Chi-Square test = 5.594,  $P = 0.018$ ). Simultaneously, the probability of attrition was not dependant on scores for particular subtests achieved by a student in the entrance exam for the Master's degree programme. See Table 3 for detailed results of the logistic regression model.

**Table 2.** Comparison of entrance exam results for the Master's degree programme in Public Health by graduation status

	Rank sum: non-graduation	Rank sum: graduation	U statistic	Z statistic	P-value*
<b>Total scores</b>	3825.0	7651.0	2398.0	0.399	0.690
<b>Subtest scores of <i>Epidemiology</i></b>	3845.0	7631.0	2378.0	0.479	0.632
<b>Subtest scores of <i>Organization in Healthcare</i></b>	3647.5	7828.5	2422.5	-0.302	0.763
<b>Subtest scores of <i>Methodology and Statistics</i></b>	3984.0	7492.0	2239.0	1.031	0.302
<b>Subtest scores of Health and <i>Human nutrition</i></b>	3814.0	7662.0	2409.0	0.356	0.722
<b>Subtest scores of <i>Social science</i></b>	3784.5	7691.5	2438.5	0.238	0.812

\*Mann-Whitney U test

**Figure 1.** Descriptive statistics parameter for scores achieved during recruitment for Master's degree programme in Public Health by groups of students who graduated and not graduated (plot: box – standard deviation, whisker – minimum-maximum range, centerline – mean).



EPI - subtest scores of Epidemiology; OiH - subtest scores of Organization in Healthcare; MS - subtest scores of Methodology and Statistics; HHN - subtest scores of Health and Human nutrition; SS - subtest scores of Social science

**Table 3.** Logistic regression model for graduation from Master's degree programme in Public Health at the Medical University of Warsaw

Independent variable	Odds ratio	95% confidence interval		Wald statistic	P-value
		lower	upper		
<b>Intercept term</b>	25.167	0.190	3325.356	1.705	0.192
<b>Age on entry</b>	1.026	0.856	1.230	0.077	0.781
<b>Gender*</b> 0: Woman 1: Man	0.610	0.262	1.418	1.343	0.247
<b>Place of completing the 1<sup>st</sup> degree*</b> 0: MUW 1: Other	0.529	0.175	1.596	1.301	0.254
<b>Professional title*</b> 0: Public Health 1: Other	0.211	0.057	0.774	5.594	0.018
<b>Subtest scores of Epidemiology</b>	0.960	0.718	1.284	0.075	0.784
<b>Subtest scores of Organization in Healthcare</b>	0.981	0.769	1.250	0.025	0.875
<b>Subtest scores of Methodology and Statistics</b>	0.868	0.676	1.115	1.244	0.265
<b>Subtest scores of Health and Human nutrition</b>	0.931	0.717	1.210	0.290	0.590
<b>Subtest scores of Social science</b>	0.916	0.743	1.128	0.695	0.405

\*binary variable (dichotomous variable); MUW – Medical University of Warsaw

## 5 DISCUSSION

A number of studies have been published over the last decade describing predictive analyses on the efficiency of an admission procedure with reference to the educational results obtained by students in the course of studies. These publications focused on the training of doctors [9], dentists [11] and nurses [12]. Analyses of factors influencing student attrition from tertiary education are available to a much lesser extent. This issue has been discussed in the world literature mostly with reference to the training of doctors [13] and nurses [8]. However, there are no long-term observations devoted to this issue as far as the training of public health professionals is concerned, which makes the present study results innovative. Due to the lack of relevant evidence relating to the factors affecting dropout among Public Health students, it is necessary to base on findings specific to other medical professions.

In 1975, Vincent Tinto put forward a theory of conditions influencing attrition from tertiary education [14]. Tinto's theory assumes that the main cause of the problem is an improper course of "academic integration" and "social integration". According to the above-mentioned theory, factors such as the student's personal attributes (socio-demographic background, entry qualifications, psychological attributes, etc.) and certain environmental forces (family, economy, other) play a much lesser role in the entire process. However, a later empiric study gave reason to revise these assumptions which had also been slightly criticised by Tinto himself [15,16]. At present, predictive studies focus mainly on an analysis of the aforementioned socio-demographic and environmental factors as well as student's individual predispositions, and deal in less detail with social integration.

Gender is an important socio-demographic predictor of dropout from tertiary education. However, our study does not show gender differences with respect to the risk of student attrition ( $P = 0.247$ ). The aforementioned observation is not completely consistent with the findings of other authors in that regard [17-19]. It is indicated that differences between women and men in rates of student attrition from tertiary education may be caused by a different mechanism of dealing with learning difficulties. For instance, Carroll et al. [18] studied pharmacy students for using different learning strategies and observed significant gender differences. Males most frequently reported the use of recall ability, followed by

general organization and planning and then environmental restructuring; whereas females reported greater reliance on general organizing and planning followed by recall ability and environmental restructuring [18]. Two other studies report that female students use self-regulated learning strategies more frequently than male counterparts [20, 21]. In general, most researchers indicate that it is women who do better at university than men [19]. Basing on a systematic literature review, Ferguson et al. [9] recommend taking gender into account as an important factor in predictive studies concerning training in medical specializations. With reference to student attrition from medicine studies, Arulampalam et al. [22] conducted a study in the UK and demonstrated that men were at a greater risk of dropout than women (OR = 1.19). However, a later study showed quite the opposite results (OR = 0.81) [23]. Furthermore, a study performed among participants of military medical programme demonstrated that women were at greater risk of dropout compared to men (OR = 2.4) [24]. In the case of training in dental school, men were also more likely to get higher scores in practical tests and better grade averages, but there are no data on the assessment of the risk of attrition in this major [25]. All in all, authors investigating the issue of dropout from medical tertiary education have not demonstrated the presence of gender differences in that regard [26,27]. In the context of potential influence of gender on the risk of attrition among Public Health students, further studies are needed to resolve the problem of importance of this demographic variable to the attrition prediction.

The age of a candidate (the *age on entry* variable) may also affect the dropout. However, our study results do not indicate that student's age plays an important role in attrition ( $P = 0.781$ ). Results of several predictive studies on the training of health professionals (e.g. nursing) demonstrated that the age variable was positively correlated with the scores achieved during the course of studies [8, 28-33]. In general, older students obtained significantly better results than their colleagues who began their studies being under 26 years of age, regardless of having additional qualifications [28, 31]. Studies on the reasons of withdrawing from studying nursing demonstrated that young age constituted a negative predictor [8, 29, 33]. As stated by Ferguson et al. [8] age on entry had a moderate impact on the timely graduation from Nursing. On the other hand, a study by Arulampalam et al. [22] conducted in the UK demonstrated that medicine students at the age over 21 years were at a significantly greater risk of attrition compared to their younger colleagues (OR = 1.46). However, these findings were not confirmed in later studies [23]. The age-related risk of attrition from a medicine faculty was also analysed in two studies performed in the US [24, 34] and one conducted in Australia [35]. The results of these studies did not provide any clear confirmation that the student's age had a crucial predictive value in relation to anticipating unfavourable results of education [27]. As with the gender variable, the assessment of the impact of the age on entry on the risk of attrition from a faculty of public health also needs to be analysed.

The place of graduation from a Bachelor's degree programme was a variable examined in the present study that belonged to the economic/environmental factors. This variable referred to the fact whether a Master's degree student was a Bachelor's degree graduate from MUW. However, the results of the logistic regression for the attrition outcome variable do not show a significant impact of this predictor on the assessment of the risk of dropout from a faculty of public health ( $P = 0.254$ ). These findings demonstrate that the risk of attrition from a Master's degree programme is similar regardless of the fact which university a student graduated from with a Bachelor's degree. It needs to be emphasised here that the admission procedure is based on a test exam prepared by MUW academics, which may raise concerns whether the tool is objective in the assessment of competence of all candidates. It is problematic to estimate whether the selection tool developed by MUW academics is not overfitting to the training offered in a Bachelor programme in Public Health at this university. The problem of "an excessive adjustment" was described by Cronbach [36] who pointed to the fact that, if the test content reflects the subject matter covered e.g. in lectures rather than new competencies obtained in the learning process, then such a tool does not provide valid measurement results [36]. To sum up, it can be stated that, if it is possible to significantly improve the reliability of the MCQs exam, in the case when the exam is not standardised on a control group of students outside MUW, validity of this tool may turn out to be largely encumbered with "an excessive adjustment".

The assessment of the influence of candidate's qualifications on entry (*professional title* variable) on the probability of success in studying was analysed in several studies on the training of health professionals [28, 31, 33]. However, it is difficult to compare findings on the influence of qualifications on entry from studies devoted to the training of nurses, midwives, and emergency workers with findings on the enrolment in a Master's degree programme in Public Health. Contrary to the expectations, the present study does not demonstrate that a Bachelor's degree in Public Health has a positive influence on the results obtained during the course of studies. The regression analysis demonstrated that students without such a professional title were significantly less likely to withdraw compared to students with Baccalaureate in Public Health (OR = 0.211,  $P = 0.018$ ). These findings support the existing principles

of admission policy for Public Health that allows Bachelor graduates in the following diverse majors: Dietetics and Food Science, Electroradiology, Emergency Medicine, Nursing and Midwifery, Physiotherapy, Dental Hygiene, and Dental Technology to enrol in the Master's degree programme. A wide range of candidate's qualifications on entry does not constitute an obstacle to succeed in the studies and their education outcomes may be even better than those of Bachelor graduates in public health.

A reliable and valid assessment of predispositions of a candidate for a particular major constitutes one of the key elements of a properly conducted selection of candidates. If we want to have a good candidate selection procedure, we follow the principle of choosing those who have possessed a minimum of knowledge and skills and represent certain predispositions for this particular profession. Using tools of educational measurement that are inadequate to the assessment of features important for an effective studying contributes to a considerable proportion of dropouts. The analysis of the logistic regression for the attrition outcome variable did not show a significant change in the level of risk associated with dropouts by the scores achieved in the entrance test exam. None of the subtests were an important negative predictor in the regression model analysed here. This may be surprising, since "favouring" candidates with high qualifications and great motivation for studying and a negative selection of persons with an insufficient level of competencies on entry should be an expected outcome of a well-performed admission procedure. Specificity of a particular assessment tool consists in its capacity to select those candidates who are not supposed to be admitted to the programme (negative selection). Criteria of significant specificity are most valuable for the selection of best candidates so that persons with insufficient level of initial competencies are not admitted to the course. Assuming that in the case of students who were at the bottom of the ranking list, the risk of attrition should be significantly higher than in the case of students with better scores.

In the world literature, the influence of the entry qualifications on the risk of attrition was studied with respect to training doctors [27] and nurses [8]. In their literature review, O'Neil et al. [27] stated that, in general, in the case of doctor training, students with low readiness for studying were more likely to withdraw. Prymachuk et al. [8] had similar findings in relation to the training of nurses. However, it needs to be emphasised that the issue of the assessment of entry qualifications in predictive studies is complex due to huge differences concerning competencies under analysis, not only between various professions, but also within the same major. A vast catalogue of qualifications comprise, among others, the following: prior university degrees to performance on admission or aptitude tests, performance at summer school, formal pre-university academic / non-academic qualifications and even extracurricular achievement. Such a vast variety of particular studies make it impossible to simply perform a comparison and draw firm conclusions on the role of this variable in the assessment of the risk of student attrition. It is undisputed that the admission procedure, and the selection criteria in particular, does not effectively fulfil its role if a particular group of students cannot meet the expectations due to the lack of certain characteristics and predispositions that were not adequately assessed and verified during the admission to academic institutions.

## **6 LIMITATIONS**

One of the main limitations of retrospective studies is lack of possibility to expand the data base by additional variables. This limitation is of particular importance in predictive studies. In majority of cases it is not possible or it is too costly to reach participants of the study and complete the data base with additional data. The analyses that are carried out are thus limited to only these variables that can be catalogued on the basis of accessible academic data. Another significant barrier that limits the possibility of generalise conclusions over a big population of students is the fact that the analysis of narrowed to one geographical a cultural area. That is why, the findings presented in this work ought to be treated with a certain reserve, including the local conditionings and a different specificity of education of pharmacists and chemists in different regions of the world.

## **7 CONCLUSIONS**

Admission criteria applied during the recruitment process are characterised by insufficient validity in the evaluation of candidates' competences on entry as they do not contribute to the efficient selection of those candidates for whom the risk of failure in studying is high. It is necessary to increase the validity of the selection process by introducing additional admission criteria. Further monitoring of the quality of the accepted admission policy at the Public Health Department at the MUW is necessary.

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