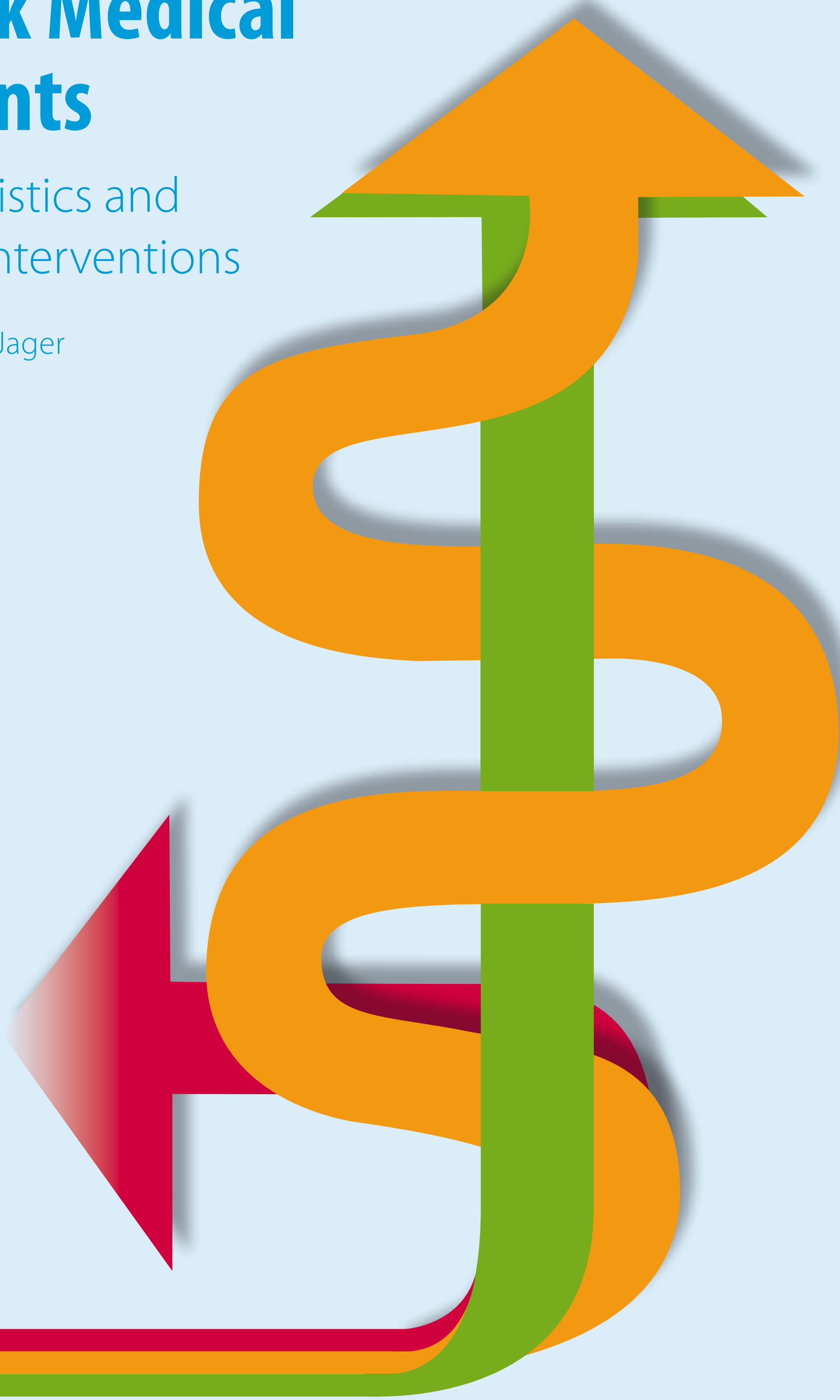
At-Risk Medical Students

Characteristics and Possible Interventions

Karen Stegers-Jager



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At-Risk Medical Students: Characteristics and Possible Interventions

Geneeskundestudenten met risico op studie-uitval en -vertraging: kenmerken en mogelijke interventies

Proefschrift

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	Prof.dr. E.W. Steyerberg

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Chapter 1

Introduction

"To wit, although I stand by the statement that the health professions attract some of the best and brightest students society has to offer, I feel equally confident stating that one of the professions' dirty little secrets is that there are students among them who struggle mightily to learn the material and often graduate without the skill or knowledge that should define them as being prepared for the next level of training". [1]

This recent statement by Eva shows one of the dilemmas medical education faces: although medical students in general are regarded as the more talented and highly motivated students, still some of them are struggling. Since their numbers are likely to be small they are difficult to study, but these students "probably account for the greatest challenges faced by educators and may require more attention than all the other students combined".[1] Equally important, if medical schools neglect to do something about this, these students will probably not become doctors, - or worse - fail to become good doctors. The aim of this thesis is to early identify these struggling students and to determine what medical schools can do to help them.

THE PROBLEM: STUDY DELAY AND DROPOUT

Higher education institutions worldwide are faced with large numbers of dropouts and students taking too long to complete their courses. On average almost a third of students in OECD countries withdraw from higher education before obtaining a degree.[2] A substantial proportion of students drop out in their first year. In the UK and Australia an average of 20% of Year 1 students discontinue their enrolment after one year.[3,4] In the Netherlands, about 10% of Year 1 students drop out from university, while another 25% switch to other courses within or after one year.[5]

In general, medical students are a positive exception with respect to success rates and time needed for graduation.[6] However, retrospective data averaged over eight schools and ten generations of Dutch medical students showed that still about 17% fails to complete the six-year curriculum within nine years of study and that the mean study duration of those graduated is 7.31 years.[7] In 2004, the Quality Assurance Netherlands Universities (QANU) reported that for the 1995 to 1999 cohorts of all eight Dutch medical schools on average 64% of the students completed their Year 1 course within one year and 86% within two years.[8] Data from two cohorts of UK medical students revealed an average dropout rate of 10%.[9] About half of these dropouts left within the first year of their studies.

Dropout and delays in study are considered unfavourable for students, medical schools and society. For the student, dropout or delay may be associated with economic loss, lack of transferable formal qualifications and social side-effects, as well as serious dents in their motivation, self-confidence and self-esteem. For medical schools, student dropout and delay may result in increased costs and reduced revenues. Dutch medical schools, for example, receive funding based on the number of graduates, rather than the number of students enrolled. In addition, they only receive funding for the official duration of the course per student. Delay and dropout may also harm a school's reputation. For society at large, dropouts constitute a direct economic loss and a reduction in the stream of medical doctors entering the general workforce. This reduction may compromise both the health care and welfare of a society.

Although dropout rates are often lower in medical education than in other university programmes, the large investment involved in a medical student's training for students and society combined with the fierceness of the selection process justifies the effort to reduce student dropout and delay at medical school.[10-12]

If medical schools wish to reduce delay or dropout, they will need to identify at an early stage students who are experiencing academic difficulties and to provide them with timely intervention through access to support programmes or, when appropriate, to refer them to another degree programme. Despite the fact that the importance of early identification and intervention is well recognised, little is known about successful strategies for identifying and supporting struggling medical students.[10,13,14]

IDENTIFICATION OF AT-RISK STUDENTS

Year 1 medical students who struggle with the demands and expectations of the curriculum are often reluctant to seek help.[14-17] Therefore, a proactive approach that depends on a consistent procedure for selecting the right students for support programmes might be more appropriate.[14,15,18,19] A first approach is to use student characteristics known before admission to label students as 'at risk'. Pre-admission characteristics reported to be related to academic failure are ethnic minority status, maturity, male gender and lower levels of previous academic performance, in particular low Medical College Admission Test (MCAT) scores and low science grade point averages (GPA).[9,10,12,20,21] The risk of failure also appears to be influenced by the type of admission to medical school.[22,23] However, pre-admission characteristics do not explain all variation in student failure or success.[24]

Study delay or dropout can be seen as the result of a mismatch between the student and the academic environment.[25,26] Therefore, identification based on the first results of the interaction between these two might be more accurate. Several studies have confirmed the relationship between student performance during the first months at university and subsequent performance.[27-29] Unfortunately, the predictive value of both pre-admission characteristics and early performance at medical school remains imperfect. Therefore, their use in predicting student failure inevitably leads to prediction errors. Knowing which students succeed despite predictions of failure and which students fail despite predictions of success, and what differentiates these two groups of students from students whose predictions proved correct, might help improve identifying students in need of academic support.[30]

A first step in understanding why some students succeed whereas others fail might be to look at what students are actually doing while in medical school. Several researchers have used self-regulated learning (SRL) theory to describe how students engage in academic tasks. They found that different components of self-regulated learning, such as appropriate motivational beliefs and learning strategies are positively related to academic performance.[31-34] Others have focused on student participation in scheduled learning activities to explain differences in performance. They found student participation, such as in lecture attendance, to be predictive of academic performance.[35,36] Although student participation may be considered part of SRL, the relationships between commonly measured components of SRL and participation, and their joint contribution to predicting medical school performance have not been thoroughly investigated. Participation may mediate the relationships between motivational beliefs and learning strategies, and medical school performance, but these factors may also make unique contributions to performance.[35] Further insight into these relationships would benefit medical schools that seek to enhance their students' performance.

STRATEGIES FOR SUPPORTING AT-RISK STUDENTS

Over recent decades, many studies have identified factors that affect study progress. Most of these studies used the interaction approach, which assumes that study progress is the result of a complex interaction between a student and the academic and social environments.[37-39] This suggests that not only student-related factors may hamper progress, but that characteristics of the academic environment, such as teaching methods and styles, examination rules and the presence of remedial support, also affect study progress.[6,40-44] Apparently, it is possible for medical schools to improve study progress if they succeed in positively influencing the study efforts of their students.[6,42,45]

One strategy to enforce satisfactory study progress and to identify and help failing medical students is the implementation of an academic dismissal policy. Failure to meet set standards first leads to an academic warning and/or academic probation, and if the sub-standard progress continues it will result in academic dismissal. Students who receive an academic warning or who are on probation are offered academic support to assist them to overcome their academic difficulty. Academic dismissal policies are common at US universities and more recently also at Dutch universities. However, there is little evidence that this intuitively appealing policy indeed positively affects students' progress.

Most medical schools provide some form of academic support to underperforming students, in a variety of voluntary programmes.[46,47] The most common forms of intervention appear to be individual sessions with academic support faculty, the use of senior students and introductory workshops on study skills for new students.[47,48] However, evidence of the effect of these forms of intervention on medical school performance is scarce.[47,49,50] A first reason is that it is not common to evaluate support practices, and if they are evaluated the focus is mostly on their short-term effect.[13] Little is known about the extent to which knowledge and skills learned in support programmes positively influence performance beyond the first upcoming exam or resit. A second reason is the often less than optimal study design used in intervention studies. Several studies have reported positive outcomes for support programmes, but they either had small sample sizes,[48,51] had to rely on historical controls,[17] or were restricted by a retrospective design.[52] There appears to be a need for studies that include a contemporaneous control group of low performers who do not receive remediation.

OUTLINE OF THE THESIS

As described above, study delay or dropout can be seen as the result of a mismatch between the student and the academic environment. Therefore, this thesis focuses both on student characteristics related to progress in medical school and on what medical schools can do to create an environment that stimulates students to succeed.

Characteristics of at-risk students

The studies presented in chapters 2 to 4 focus on student-related factors that could be used to identify and characterise students that are most likely to benefit from support. Several attempts to identify at-risk students have been reported, using either pre-admission variables or early performance at medical school.[10,11,14,21,53] However, the imperfect predictive value of the applied methods means there are unexpected student failures and successes. The retrospective study described in **Chapter 2** aimed to learn from such unexpected student failures and successes by examining these students' pre-admission characteristics together with their participation and progress throughout their first year of medical school. The at-risk status and the prediction of failure or success were based on the students' early performance at medical school and were in accordance with a previously developed model.[54]

Research from numerous medical schools has shown that ethnic minority students underperform compared to majority students.[55-58] However, little is known about why this underperformance occurs and whether there are performance differences between ethnic minority groups. Therefore, the study presented in **Chapter 3** aimed to determine whether underperformance occurs across ethnic minority groups in undergraduate pre-clinical and clinical training and the extent to which this underperformance can be explained by age, gender, pre-university grade point average (pu-GPA), and additional socio-demographic characteristics. We hereto undertook a longitudinal, prospective cohort study of six successive cohorts of medical students.

Findings from nonmedical contexts have suggested that low- and high-performing students can be distinguished from one another based on differences in their motivational, cognitive, and behavioural engagement in learning activities.[34] The study described in **Chapter 4** examined how motivational beliefs, deep learning strategies and resource management, and participation in scheduled learning activities relate to Year 1 performance in medical school. A hypothesised model was tested and cross-validated with a new independent sample, using structural equation modelling.

Supporting at-risk students

Chapter 5 and 6 describe studies that focused on what medical schools can do to help more of their students succeed.

In the study presented in **Chapter 5**, we explored the effectiveness of an Academic Dismissal (AD) Policy as a strategy to enforce satisfactory study progress and to identify and help failing medical students. We compared the study progress during the first two years at medical school of four consecutive student cohorts, of which two entered before and two entered after the implementation of the AD policy. In addition, we evaluated the extent to which the AD policy helped us to identify and support students with academic difficulties. We investigated whether struggling students in the AD cohorts accessed the support offered more often than struggling students in the non-AD cohorts, and whether accessing the support was related to improved study progress.

The main objective of the study described in **Chapter 6** was to measure the effect of the addition of a short integrated group-based study skills programme to the standard academic support intervention on the study progress of 'students at risk'. This study adds to previous studies by utilising a randomised controlled design to study the short, medium and long-term benefits of a voluntary academic support programme for students who were considered most at risk of failure based on their first-semester results.

In **Chapter 7** a general discussion of the findings of this thesis is provided, which covers methodological considerations, the implications for medical schools and recommendations for further research.

English and Dutch summaries are also provided at the end of the thesis. Since each study was written to be read on its own, repetition and overlap across chapters are inevitable.

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Chapter 2

Unexpected medical student failure or success: pre-admission factors, progress and exam participation

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Submitted for publication

ABSTRACT

A challenge for medical schools is identifying at-risk students and providing them with timely support. Current identification methods, using pre-admission characteristics or early performance in medical school, are not infallible. This retrospective study aimed to distinguish incorrectly from correctly predicted at-risk students by their pre-admission characteristics and first-year study participation and progress. Medical students from five consecutive cohorts who failed at least one exam during their first four months (n = 834) were considered 'at-risk'. Their progress in months 4-6 was used to predict successful completion of the first-year curriculum within two years. Combining predictions and outcomes resulted in four groups of students (True and False Negatives and True and False Positives), which were compared on pre-admission characteristics, credits earned, exam participation and exam success during the first year. False Negatives were less often older or admitted by national lottery and – at all measurement moments – had earned more credits and had higher exam participation and exam success than True Negatives. False Positives were more often older, had more often a lower-than-average pre-university Grade Point Average or a non-Western pre-university education, and – at all measurement moments – had earned fewer credits and had lower exam success than True Positives. Exam participation was significantly lower for False Positives from eight months onwards only. Incorrectly predicted students differ from correctly predicted students on pre-admission characteristics, study progress and exam participation. Adding factors that affect exam participation – such as motivation and study skills – and constantly monitoring student progress may further improve the early identification of at-risk students.

INTRODUCTION

Not all students cope successfully with the demands of medical school, and this may result in study delay or dropout. In view of the large investment in a medical student's training made by both the student and society, preventing delays and student dropout is an important goal of medical schools. Student failure – delay or dropout – can be seen as the result of a mismatch between the student and the academic environment.[1,2] If medical schools wish to reduce student failure, they will need to identify at an early stage the students who are experiencing academic difficulty in order to provide timely intervention in the form of support programmes or, where appropriate, to refer them to another degree programme. Although several attempts to identify at-risk students have been reported,[3-8] the imperfect predictive value of the applied methods means there are unexpected student failures and successes. In this retrospective study, we aimed to learn from these unexpected student failures and successes by examining these students' pre-admission characteristics together with their participation and progress throughout their first year of medical school. A better understanding of these incorrect predictions might help improve the future identification of at-risk students and the support provided to them.

First-year medical students who struggle with the demands and expectations of the curriculum are often reluctant to seek help.[5,9-11] Therefore, a proactive approach that depends on a consistent procedure for selecting the right students for support programmes might be more appropriate.[5,9,12] Studies predicting academic failure at medical school have mainly focussed on predictors of academic success known before admission, such as previous academic performance and, to a lesser extent, personality and learning styles.[13] Although these factors are associated with academic success, it is not clear how well they predict student failure.[8] In recent research, risk factors for academic failure have been identified and these include ethnic minority status, maturity, male gender and lower levels of previous academic performance, in particular low Medical College Admission Test (MCAT) scores and low science Grade Point Averages (GPA).[6,8,14,15] The risk of failure also appears to be influenced by the type of admission to medical school.[16]

Both lower-than-average MCAT scores and lower-than-average science GPAs have been used to label students as 'at risk'.[9,17] A recent study used a set of personal background characteristics to identify and quantify students' non-cognitive and cognitive academic performance risks.[7] However, pre-admission characteristics do not explain all variation in student failure or success.[13] Therefore, the usability of pre-admission characteristics for identifying at-risk students is limited.

In view of the role of both the student and the academic environment in academic success or failure, a prediction based on the first results of the interaction between these two might be more accurate. Several studies have confirmed the relationship between student performance during the first months at university and subsequent performance.[18-20] In some cases, academic results during the first semester have been used to identify medical students in need of academic support.[21,22] Another study revealed that passive learning behaviour is predictive for experiencing academic difficulty during the first two years of medical school.[23]

Unfortunately, the predictive value of both pre-admission characteristics and early performance at medical school remains imperfect. Therefore, their use in predicting student failure inevitably leads to prediction errors. Knowing which students succeed despite predictions of failure and which students fail despite predictions of success, and what differentiates these two groups of students from students whose predictions proved correct, might help improve the identification of students in need of academic support.[24] As far as we know, no studies have specifically focussed on student characteristics with respect to these unexpected failures and successes. Therefore, the main objective of this retrospective study was to compare the pre-admission characteristics as well as study participation and progress throughout the first year of correctly and incorrectly predicted at-risk medical students. The at-risk status and the prediction of failure were based on the students' early performance at medical school and were according to a previously developed model.[8]

METHODS

Context

The present study was carried out at the Erasmus MC Medical School in the Netherlands. The integrated and theme-oriented curriculum of the Erasmus MC Medical School was implemented in 2001 and consists of a 4-year pre-clinical phase followed by a 2-year clinical phase. The first pre-clinical year consists of three thematic blocks of 7 to 19 weeks and includes 10 examinations. One resit per examination is offered in the summer. Each examination qualifies the candidate for a fixed number of credits under the European Credit Transfer System (ECTS). One credit equals 28 hours of study; 60 credits represent the maximum number achievable in 1 year.

Model to predict student failure

In a previous study, we developed a model to predict failure to complete the first-year curriculum within two years that is based on study progress during the first six months of medical school.[8] Students who had failed at least one exam during the first four months were considered 'at risk'. For these at-risk students, the best predictor for failure was 'passed no exams between months 4 and 6'. In predicting student failure, the model had a sensitivity of 66.7% and a specificity of 84.5%.

Participants and procedure

The participants in this study were the 834 at-risk students from the 2001-2005 cohorts of Erasmus MC Medical School (total *n* = 1795). According to the model described above, the study progress of the students during months 4-6 was used to predict successful completion of the first-year curriculum within two years. Combining the prediction with the outcome after two years resulted in four groups: True Negatives (Correctly predicted to fail; *n* = 156), False Negatives (Incorrectly predicted to fail; *n* = 93), False Positives (Incorrectly predicted to succeed; *n* = 78) and True Positives (Correctly predicted to succeed; *n* = 507) (see Figure 1). The data were derived from the university student administration system, and anonymity was guaranteed. Since data were collected as part of regular academic activities and only aggregated data are reported, individual consent was not necessary.

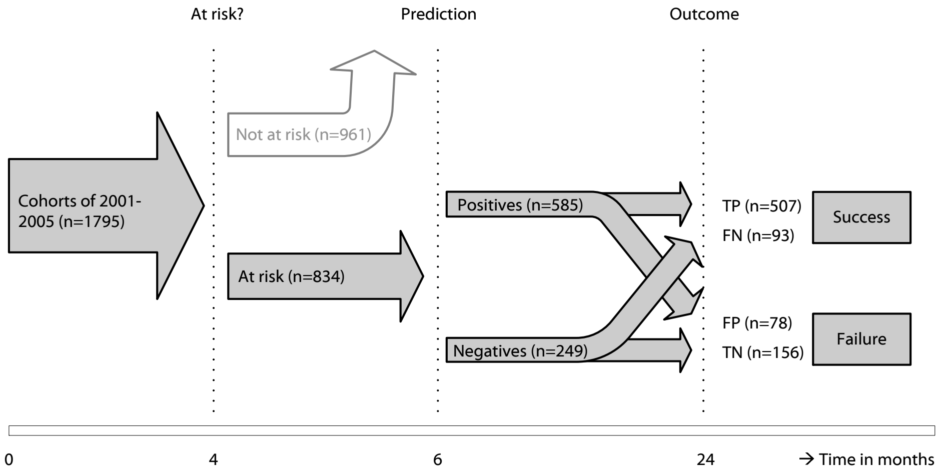

Figure 1 Identification of correctly and incorrectly predicted at-risk students. At risk = failed at least one of three exams in the first four months; Prediction = failure on exams 4 and 5 is negative; Outcome = success/failure to complete first-year curriculum at 24 months after enrolment

Variables

The independent variable was membership of one of the four aforementioned groups. Two sets of dependent variables were applied: (i) pre-admission characteristics and (ii) study participation and progress.

Pre-admission characteristics

This study included the following pre-admission risk factors: male gender, older (= aged over 21), admission by national lottery, lower-than-average pre-university Grade Point Average (pu-GPA) and a non-Western pre-university diploma.

In the Netherlands there are three options for admission to medical school: direct admission (pu-GPA ≥ 8), admission by national lottery (minimum of 50% of intake) and admission by a local selection procedure. Students admitted by the local selection procedure at Erasmus MC medical school have been shown to be 2.6 times less likely to drop out than students admitted by national lottery.[16]

The pu-GPA represented a student's mean grade obtained during the final year of pre-university education. Final grades were based half on school examinations and half on the national examination. No pu-GPA was available for students with a foreign pre-university education or for those with a non-standard Dutch pre-university education.

The students who were admitted with a non-Western pre-university diploma mainly came from Surinam or the Netherlands Antilles. Others completed their pre-university education in countries such as Afghanistan or Iraq.

For the analyses, all pre-admission variables were dichotomized and expressed as percentages.

Study participation and progress

Three variables were included for measuring study participation and progress: credits earned, exam participation and exam success.

C*redits Earned* was defined as the number of credits earned at a certain point in time divided by the maximum number of credits that could have been earned by that point in time. It was calculated for credits in the first-year curriculum at 4, 6, 8, 10 and 12 months after enrolment.

E*xam Participation* was defined as the number of exams taken in a certain period of time divided by the number of exams that could have been taken in that period of time. It was calculated for five periods during the first year: months 0-4, 4-6, 6-8, 8-10 and 10-12. For the resits (months 10-12), exam participation was calculated by dividing the number of exams taken by the number of exams still required in order to complete the first-year curriculum.

Exam Success was defined as the number of exams passed divided by the number of exams taken. It was calculated for five periods of time during the first study year: months 0-4, 4-6, 6-8, 8-10 and 10-12.

Statistical analysis

We tested for differences between the pre-admission variables of the True and False Negatives and between the True and False Positives using chi-squared tests.

To test whether the groups differed on credits earned, exam participation and exam success, we used linear regression with the Generalized Estimating Equations methodology (GEE).[25] We chose this approach because it takes into account the correlations due to the multiple responses per student. Furthermore, it is robust against violations of the normal distribution assumption of the response variables and thereby accommodates the extremely positively skewed distribution of each response variable. For each of the outcome measures, a linear regression model was fitted to the data using GEE. The dependent variables were Credits Earned, Exam Participation and Exam Success, and the independent variables were time, group and the interaction of 'time x group'. The Quasi Likelihood under Independence Model Criterion (QIC) was used to select the most appropriate working correlation, which turned out to be independent for credits earned and exam participation and unstructured for exam success. A p-value of < 0.05 was considered statistically significant. For the post-hoc analyses of the differences between the incorrectly and correctly predicted groups, a Bonferroni correction was applied, so these differences are reported at a 0.025 (0.05/2) level of significance.

RESULTS

Pre-admission characteristics

Within the total group of at-risk students, males failed to complete the first-year curriculum within two years significantly more often than females (36% versus 23%, OR = 1.87; $\chi^2_{(1)} = 16.50$, $p < 0.001$) and students aged over 21 failed more often than students under 21 (47% versus 25%, OR = 2.57; $\chi^2_{(1)} = 20.61$, $p < 0.001$). Likewise, students with a lower-than-average pu-GPA failed more often than students with a higher-than-average pu-GPA (32% versus 17%; OR = 2.31; $\chi^2_{(1)} = 18.54$, $p < 0.001$), and students with a non-Western pre-university diploma failed more often than students with a Western pre-university diploma (56% versus 27%; OR = 3.41; $\chi^2_{(1)} = 9.97$, $p < 0.01$). Lottery students failed to complete the first-year curriculum within two years more often than selected students, but this was of borderline significance (30% versus 23%; OR = 1.43, $\chi^2_{(1)} = 3.78$; $p = 0.052$).

Table 1 Percentage comparisons of pre-admission characteristics for True and False Negatives and True and False Positives

	Negatives			Positives		
	True (TN) (*n* = 156)	**False (FN) (*n* = 93)**	X^2	**False (FP) (*n* = 78)**	**True (TP) (*n* = 507)**	X^2
Pre-admission characteristics						
% male	55.8	46.2	2.12	43.6	34.5	2.42
% age ≥ 21	21.8	9.7	5.99*	19.2	9.3	7.07†
% admitted by national lottery	81.7	64.5	9.16†	70.5	72.2	0.07
% lower-than-average pu-GPA‡	83.3	84.4	0.05	78.9	62.7	7.07†
% non-Western pre-university education	4.5	2.2	0.91	9.0	1.8	13.17§

* $p < 0.05$
† $p < 0.01$
‡ *n* (TN) = 144, *n* (FN) = 90, *n* (FP) = 71, *n* (TP) = 483
§ $p < 0.001$
TN = True Negative, FN = False Negative, FP = False Positive, TP = True Positive

Students who were incorrectly predicted to fail (False Negatives) were significantly less often aged over 21 and less often admitted by lottery than those correctly predicted to fail (True Negatives) (Table 1). No significant differences were found between these groups in the proportions of males, of students with a lower-than-average pu-GPA and of students with a non-Western pre-university diploma. Students who were incorrectly predicted to succeed (False Positives) were significantly more often aged over 21, had more often a lower-than-average pu-GPA or a non-Western pre-university diploma than those correctly predicted to succeed (True Positives) (Table 1). There were no significant differences between these groups in the proportions of males and of lottery students.

Credits Earned

The four groups differed significantly with respect to the number of credits earned at all five measurement moments during the first year (Table 2, Figure 2a). From four months onwards, the False Negatives (incorrectly predicted to fail) had earned significantly more credits than the True Negatives (correctly predicted to fail) and the False Positives (incorrectly predicted to succeed) had earned significantly fewer credits than the True Positives (correctly predicted to succeed).

Exam Participation

There were significant differences between the four groups with respect to their exam participation at all periods (Table 2, Figure 2b). The exam participation of the False Negatives was significantly higher than that of the True Negatives throughout the first year. The exam participation of the True and False Positives was not significantly different in the periods 0-4, 4-6 and 6-8 months. However, in the periods 8-10 and 10-12 months the exam participation of the False Positives was significantly lower than that of the True Positives.

Table 2 Mean scores on Credits Earned, Exam Participation and Exam Success by group

	TN(*n* = 156) (SE)	**FN (*n* = 93) (SE)**	**FP (*n* = 78) (SE)**	**TP (*n* = 507) (SE)**	**Significant differences between groups***
Credits Earned					
After 4 months	0.23 (0.02)	0.40 (0.02)	0.35 (0.03)	0.53 (0.01)	TN<FN; FP<TP
After 6 months	0.14 (0.01)	0.25 (0.02)	0.48 (0.02)	0.65 (0.01)	TN<FN; FP<TP
After 8 months	0.13 (0.01)	0.28 (0.02)	0.43 (0.02)	0.66 (0.01)	TN<FN; FP<TP
After 10 months	0.17 (0.01)	0.37 (0.02)	0.45 (0.02)	0.71 (0.01)	TN<FN; FP<TP
After 12 months	0.26 (0.02)	0.66 (0.03)	0.59 (0.02)	0.90 (0.01)	TN<FN; FP<TP
Exam participation					
0-4 months	0.84 (0.02)	0.95 (0.01)	0.97 (0.01)	0.97 (0.01)	TN<FN
4-6 months	0.74 (0.03)	0.94 (0.02)	0.98 (0.01)	1.00 (0.00)	TN<FN
6-8 months	0.70 (0.03)	0.97 (0.01)	0.96 (0.02)	0.99 (0.00)	TN<FN
8-10 months	0.57 (0.04)	0.95 (0.02)	0.89 (0.03)	0.99 (0.00)	TN<FN; FP<TP
10-12 months	0.45 (0.03)	0.79 (0.03)	0.69 (0.04)	0.87 (0.01)	TN<FN; FP<TP
Exam success					
0-4 months	0.21 (0.02)	0.36 (0.03)	0.30 (0.03)	0.50 (0.01)	TN<FN; FP<TP
6-8 months	0.11 (0.02)	0.36 (0.04)	0.28 (0.04)	0.68 (0.02)	TN<FN; FP<TP
8-10 months	0.28 (0.03)	0.58 (0.04)	0.45 (0.04)	0.81 (0.01)	TN<FN; FP<TP
10-12 months	0.24 (0.03)	0.57 (0.03)	0.41 (0.03)	0.74 (0.01)	TN<FN; FP<TP

* Credits earned, exam participation and exam success differed significantly across the four groups at all times ($p < 0.001$). Wald Chi-square tests were used for post-hoc comparisons. A Bonferroni correction was applied, so all group differences are reported at a 0.025 level of significance.
TN = True Negative, FN = False Negative, FP = False Positive, TP = True Positive

Exam success

The four groups differed significantly with respect to their exam success at all periods (Table 2, Figure 2c). Throughout the first year – from beginning to end – the exam success of the False Negatives was significantly higher than that of the True Negatives, while the exam success of the False Positives was significantly lower than that of the True Positives. By definition, the exam success of the True and False Negatives is zero in the period of 4-6 months and therefore the differences for this period were not statistically tested.

DISCUSSION

This study indicates that both pre-admission characteristics and data on study participation and progress can help distinguish between students whose outcomes are correctly or incorrectly predicted. The students who were incorrectly predicted to fail (False Negatives; 11% of at-risk students) were less often older or admitted by national lottery and – at all measurement moments – had earned more credits and had a higher exam participation and

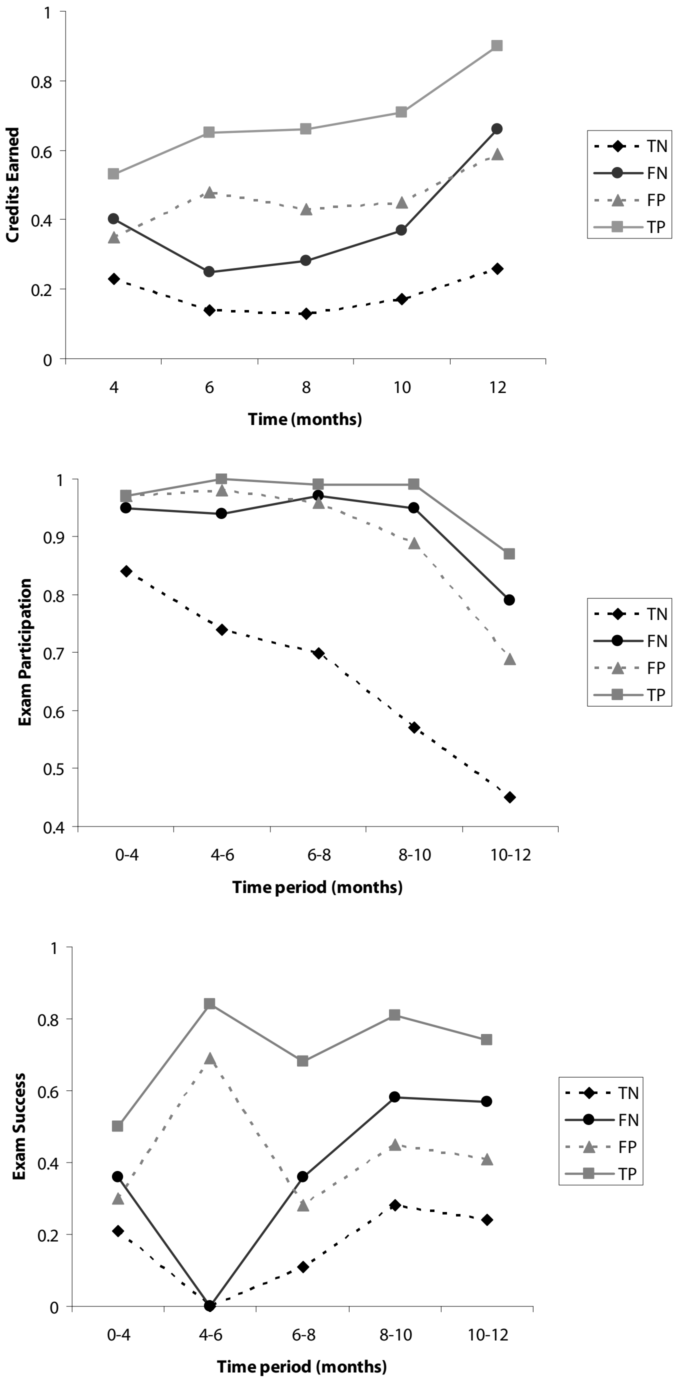

Figure 2 Mean scores on Credits Earned (a), Exam Participation (b), and Exam Success (c) for four groups of at-risk students: True Negatives (TN), False Negatives (FN), False Positives (FP) and True Positives (TP).

exam success than students correctly predicted to fail (True Negatives; 19%). Meanwhile, the students incorrectly predicted to succeed (False Positives; 9%) were more likely to be older, had more often a lower-than-average pu-GPA or a non-Western pre-university diploma and – at all measurement moments – had earned fewer credits and had higher exam success than students correctly predicted to succeed (61%). While similar at first, towards the end of the year the exam participation of students incorrectly predicted to succeed became lower than that of students correctly predicted to succeed.

Although our study confirmed most of the pre-admission risk factors mentioned in the literature, there were differences in risk factors for expected failure (True Negatives) and unexpected failure (False Positives). Being older was a risk factor for belonging to both groups, while admission by lottery was only a risk factor for expected failure (True Negative). Meanwhile, a lower-than-average pu-GPA or a non-Western pre-university diploma appeared to be the only distinguishing factor between students who were correctly and incorrectly predicted to succeed (True and False Positives). Other studies have reported that risk factors for poor performance varied at different stages throughout medical school.[6,12] Our study adds to this by suggesting that this also applies to different stages of the first year. It is remarkable that even though male students were more often predicted to fail and actually failed more often, the male gender could not be used to differentiate clearly between correctly and incorrectly predicted students. A possible explanation is that the likelihood of unexpected failure and success does not differ between males and females.

The False Negatives completed the first-year curriculum within two years, despite their lower levels of previous academic performance both before admission and during the first months of medical school. A possible explanation for their unexpected success is that these students overcome their initial adjustment problems with a high level of motivation and perseverance. The fact that these students are more often admitted by a local selection procedure also points in that direction, as several studies have reported a higher motivation in students admitted by selection.[26,27] Further research is needed to confirm whether the False Negatives score higher on characteristics such as conscientiousness and autonomous motivation, both known to be associated with enhanced pre-clinical performance.[13,28]

Admission with a non-Western pre-university diploma was a risk factor for belonging to the False Positives (and the student thus failing unexpectedly) but not for belonging to the True Negatives (and the student thus failing as expected), which suggests that these students perform relatively well during the first months but – for unknown reasons – perform less well later on. It might be that towards the end of the second term they become increasingly distracted from studying by feelings of loneliness and homesickness, as was suggested in a study on international medical students in Australia.[29]

The differences in credits earned can only partly be explained by differences in exam participation. Exam participation of the True Negatives was lower than that of the False Negatives throughout the year and decreased rapidly over the year to a level below fifty percent during the resits, which suggests a loss of motivation for at least some of this group. However, it is hard to say whether this lack of motivation is the cause or the effect of the low exam success in this group. Exam participation of the False Positives, on the other hand, was high during most of the first year, suggesting that these students were at least motivated enough to sit the exams. However, their low exam success indicates that these students were either insufficiently or improperly prepared. Future research on factors such as motivation, procrastination and study skills might reveal which of the two is the case. In addition, it might be worthwhile investigating the relationship between exam participation and classroom attendance, as a recent meta-analysis has revealed that class attendance is a better predictor for college grades than any other known predictor of academic performance.[30]

This study has some practical implications for the identification and support of at-risk students. The first group of students that should be offered support are those who are predicted to fail at six months after enrolment: the True and False Negatives. Within this group, special attention should be paid to older students and students admitted by lottery as our data revealed that these students were more likely to fail. Our suggestion would be to offer support on a voluntary basis, since the willingness to accept support can be seen as an indicator of commitment to complete medical school.[31] In addition, a tool to screen class attendance and study habits, skills and attitudes might be used to identify those students who may benefit from study-skills training.[30,31]

A second group of students that should be offered support would be the False Positives. As this group's need for support only becomes apparent later on in the first year, our advice would be constantly to monitor the progress of all students identified as at risk. Within the group of students predicted to succeed, special attention should be paid to students aged over 21, students with a lower-than-average pu-GPA and students with a non-Western pre-university diploma. Timely support might prevent these apparently more vulnerable groups from turning into unexpected failures.

The strength of this study is the inclusion of at-risk students from five cohorts. A limitation is the use of information available in the university databases, which do not include data on, for example, the actual time invested by students, classroom attendance or motivation to complete medical school. Collecting these data prospectively might be considered for future studies. It should also be mentioned that the included cohorts of students all came from a single medical school. Although specific characteristics of our curriculum might have influenced the results, the cohorts were representative of all Dutch medical students with regard to entrance variables and first-year completion rates.[33]

CONCLUSION

There appear to be differences between correctly and incorrectly predicted at-risk students. Combining pre-admission characteristics and study progress with exam participation appears to be the best way of identifying the students most in need of help. We therefore suggest that adding factors that affect exam participation – such as motivation and study skills – and constantly monitoring student progress may further improve the identification of at-risk students.

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Chapter 3

Ethnic disparities in undergraduate pre-clinical and clinical performance

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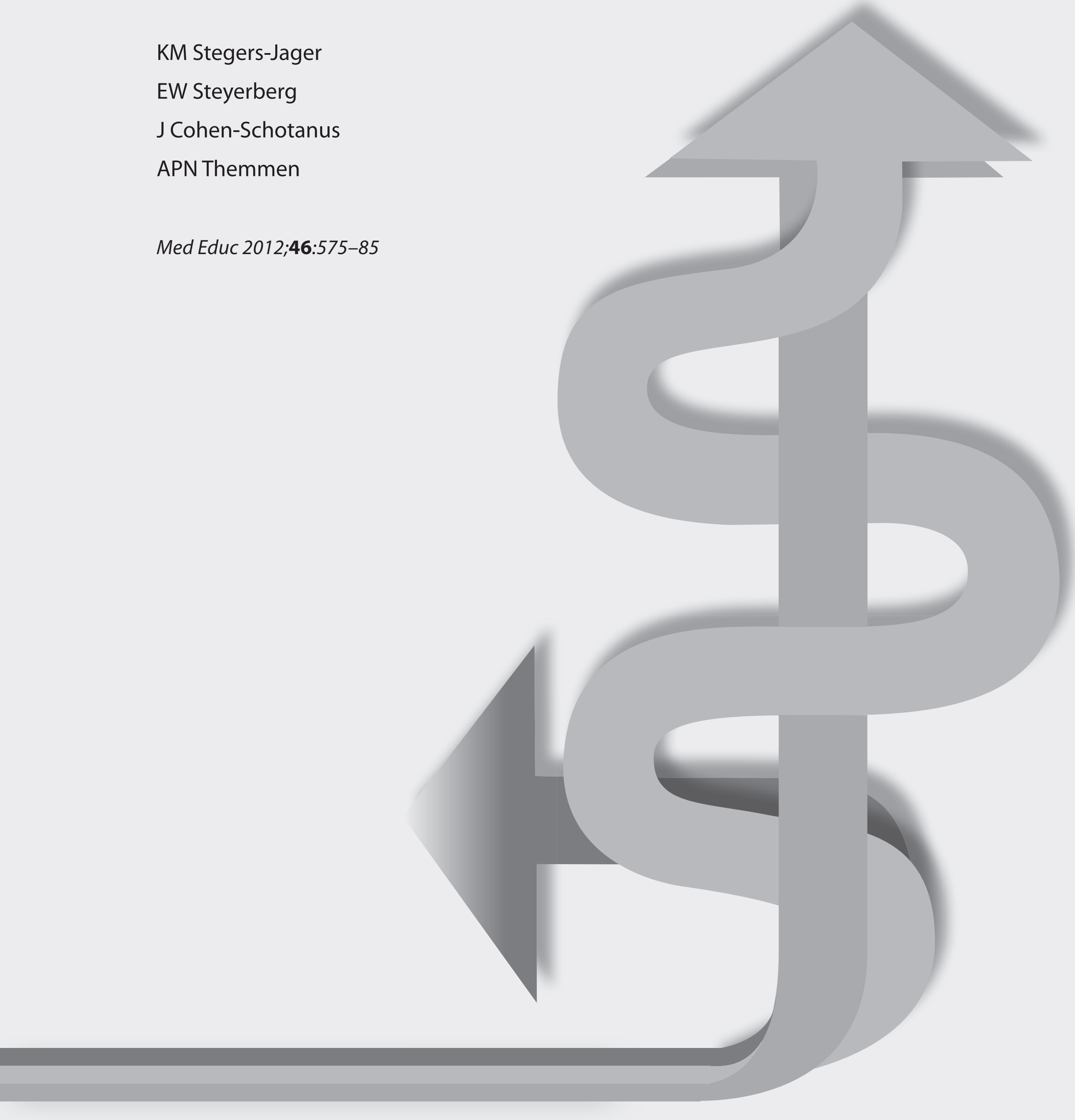

ABSTRACT

Context: Research from numerous medical schools has shown that students from ethnic minorities underperform compared with those from the ethnic majority. However, little is known about why this underperformance occurs and whether there are performance differences among ethnic minority groups.

Objectives: This study aimed to investigate underperformance across ethnic minority groups in undergraduate pre-clinical and clinical training.

Methods: A longitudinal prospective cohort study of progress on a 6-year undergraduate medical course was conducted in a Dutch medical school. Participants included 1661 Dutch and 696 non-Dutch students who entered the course over a consecutive 6-year period (2002-2007). Main outcome measures were performance in Year 1 and in the pre-clinical and clinical courses. Odds ratios (ORs) with 95% confidence intervals (CIs) were estimated by logistic regression analysis for ethnic subgroups (Surinamese/Antillean, Turkish/Moroccan/African, Asian, Western) compared with Dutch students, adjusted for age, gender, pre-university grade point average (pu-GPA), additional socio-demographic variables (first-generation immigrant, urban background, first-generation university student, first language, medical doctor as parent) and previous performance at medical school.

Results: Compared with Dutch students, Surinamese and Antillean students specifically underperformed in the Year 1 course (pass rate: 37% versus 64%; adjusted OR 0.40, 95% CI 0.27–0.60) and the pre-clinical course (pass rate: 19% versus 41%; adjusted OR 0.57, 95% CI 0.35–0.93). On the clinical course all non-Dutch subgroups were less likely than Dutch students to receive a grade of ≥ 8.0 (at least three of five grades: 54-77% versus 88%; adjusted ORs: 0.17–0.45).

Conclusions: Strong ethnic disparities exist in medical school performance even after adjusting for age, gender, pu-GPA, and socio-demographic variables. More subjective grading cannot be ruled out as a cause of lower grades in clinical training, but other possible explanations should be studied further to mitigate the disparities.

INTRODUCTION

In recent decades, student populations in medical schools in Western societies have become more diverse with respect to ethnicity and social background.[1,2] The entry of more students from non-traditional backgrounds raises questions of whether these new groups of students have similar chances of success in medical school as students from more traditional backgrounds. If students from particular groups are more likely to fail than other students, it is important to know why and when they are at risk and, subsequently, what medical schools can do to reduce the risk for failure. Answers to these questions are important not only from the perspective of equal opportunities policies, but also from a pragmatic point of view: each medical student's training involves significant investment by both the student and society.

A recent systematic review and meta-analysis showed that UK medical students from minority ethnic groups academically underperform throughout medical school compared with their White counterparts.[3] Similar results have been reported for Year 1 ethnic minority students in Australia[4] and final-year ethnic minority students in both Australia and the USA.[5,6] Despite this accumulating evidence of underperformance by ethnic minority students throughout medical school, it is still not clear why it occurs.

As underperformance can be seen as the result of a mismatch between the student and the academic environment,[7,8] explanations can be identified from both perspectives. It has been suggested specifically that the more subjective examination methods used in clinical assessments may lead to examiner bias and therefore disadvantage ethnic minority students.[9] However, this does not explain underperformance on examinations marked by computers, which are common in pre-clinical courses.[3] Another possible explanation is that the initial situation of ethnic minority students is less favourable. However, lower pre-university grades[10] and socio-demographic variables, such as first language[7,11-13] and socio-economic status[13] can only explain a small part of the ethnicity-related disparities in performance found in previous studies. As these variables have been studied primarily in isolation, studies that adopt a multivariable approach and take into account the different stages of medical training are required.[3,11] Additionally, little is known about performance differences across ethnic groups. Usually, the academic performance of ethnic minority/non-White students as a single group is compared with the performance of ethnic majority/White students.[3] However, this approach ignores the reported variation in performance among different ethnic minority groups.[12,13]

This study aimed to determine whether underperformance occurs across ethnic minority groups in undergraduate pre-clinical and clinical training and the extent to which this underperformance can be explained by age, gender, pre-university grade point average (pu-GPA), and additional socio-demographic characteristics. The investigation involved a longitudinal, prospective cohort study of six successive cohorts of medical students.

METHOD

Context

This study was conducted at the Erasmus MC Medical School, Rotterdam, the Netherlands, which has a relatively large number of ethnic minority students compared with other Dutch medical schools. The integrated and theme-oriented curriculum of the Erasmus MC Medical School was implemented in 2001 and consists of a 4-year pre-clinical phase followed by a 2-year clinical phase. Year 1 includes 10 written examinations and three practical examinations. The remainder of the pre-clinical years include 22 written examinations and nine practical examinations. The clinical phase consists of two parts with a fixed sequence of clinical rotations. A period of 15 weeks of general clinical training precedes 69 weeks of discipline-specific clerkships comprising 12 different rotations. Clinical grades are based on global performance ratings (GPRs) attained during the clerkships, and a patient-related and oral examination undertaken at the end of each clerkship. The GPR represents a global rating awarded by a supervisor, which covers a student's performance on a number of clinically relevant competencies over a certain period.[14] Clinical grades range from 5 (unsatisfactory) to 10 (outstanding).

Participants and procedure

This study included all 2357 students who entered Erasmus MC Medical School during 2002-2007. These six consecutive cohorts were selected for two reasons: (i) the curriculum was unchanged during this period, and (ii) data on ethnicity were available for these cohorts from a national database of students in higher education in the Netherlands (1cijferHO). Data on academic performance were derived from the university student administration system and anonymity was guaranteed. Because data were collected as part of regular academic activities, individual consent was not necessary.

Additional data on ethnicity and social background were collected for 284 Year 4 students in 2006 (86%) and 387 Year 1 students in 2007 (95%). These students completed a questionnaire at the end of a compulsory practical session. This questionnaire was developed by a committee dedicated to *diversity among students*, which included both students and faculty members. The questionnaire included items on factual aspects of ethnicity and social background (Table 1). This part of the study was designed with the help and approval of the Dutch Data Protection Authority. Students were informed about the study, participation was voluntary and anonymity was guaranteed.

Table 1 Data recorded for each student

Source and type of data	Comment
From 1cijferHO	
Ethnicity	1 Dutch 2 Turkish/Moroccan/African 3 Surinamese/Antillean (Dutch Guyana) 4 Asian (including Chinese) 5 Western 6 Other
First-generation immigrant	Ethnic minority students born outside the Netherlands
*By questionnaire**	
First language	'Dutch' or 'Non-Dutch'
First-generation university student	Students whose parents did not attend university (either a research university or a university of applied sciences)
Medical doctor as parent	Parental profession as provided by the students was used to determine whether or not they had at least one parent who was a medical doctor
Urban background	Self-defined
From university student administration	
Gender	
Age	At course entry, categorised as < 19 years, 19-21 years, > 21 years
Pre-university GPA	Mean grades obtained during the final year of pre-university education (10-point scale: 1 = very poor, 10 = excellent). Final grades based on school examinations (50%) and the national examination (50%). Not available for all students
Cohort	2002-2007
Nominal Year 1 course completion	Passed all Year 1 examinations within 1 year
Nominal pre-clinical course completion	Passed all pre-clinical examinations within 4 years
Good clinical performance	Achieved at least three of five clerkship grades of ≥ 8.0

* Collected for Year 4 students in 2006 and Year 1 students in 2007
GPA = grade point average

Variables

According to Statistics Netherlands (CBS; www.cbs.nl), an individual belongs to an ethnic minority group if at least one of his or her parents was born outside the Netherlands. Based on the countries of birth of their parents, ethnic minority students were classified into one of five ethnic subgroups: Surinamese/Antillean; Turkish/Moroccan/African; Asian; Western, and 'Other'[13] (Table 1). The 'Other' category included only a small number of students and its data were excluded from the statistical analyses.

Gender, pre-university GPA (pu-GPA) and age are known to be associated with performance at medical school.[7,11,15-17] Pre-university GPA was included in the analyses as a continuous variable. As pu-GPA was not available for students with a foreign or a non-standard Dutch pre-university education, a categorical variable - 'missing pu-GPA' - was added to the analyses.

Admission criteria for students with a foreign pre-university education are similar to those for students with a Dutch pre-university education: diplomas should be of a comparable level and certain subjects are required. Entrance examinations include examinations in Dutch, English, chemistry, biology and mathematics.

Three measures were defined to represent medical school performance: nominal completion of the Year 1 course; nominal completion of the pre-clinical course, and good clinical performance. 'Nominal completion' refers to completion within the prescribed time (i.e. without delay). Failure to complete clinical training is rare (about 1% at this medical school), but clinical grades are known to play a key role in selection for residency.[18] Therefore, 'good clinical performance' was defined as the achievement of at least three of five grades of ≥ 8.0. Marks of ≥ 8.0 represent 'good' (8.0) or 'very good' (9.0) performance. The average grade on the first five clerkships at this medical school is just below 8.0.[19] We considered that achieving an above-average grade more than half of the time (at least three of five grades) represented good clinical performance. In addition, a grade of 8.0 is often considered the minimum required for admission to specialty training. In order to also include students who entered clinical training with delay (reflecting study delay in the pre-clinical course), we restricted the analysis of clinical performance to the cohorts of 2002-2004 and to the first five clerkships (internal medicine, surgery, paediatrics, psychiatry, neurology). Grades on the first five clerkships have been shown to be representative of grades on all 10 clerkships.[19]

Statistical analysis

We assessed associations between ethnicity and the other independent variables using chi-squared tests for categorical variables and analysis of variance (ANOVA) for pu-GPA. We used logistic regression to calculate an odds ratio (OR) for the effect of ethnicity on each of the three outcome measures (Table 1). Statistical interaction terms were used to study the potentially differential effects of ethnicity by student characteristics. For example, to assess whether ethnicity had the same associations with Year 1 course completion for men and women, we included the interaction term 'ethnicity x gender' in a model that also included ethnicity and gender as main effects.

We hypothesised that any differences in performance during medical school might be explained by confounders or additional socio-demographic characteristics associated with ethnicity. These variables were sequentially considered in multivariable regression models for each of the three outcomes. Firstly, we adjusted for key confounders (age, gender, pu-GPA). Secondly, we adjusted for key confounders and socio-demographic characteristics (first-generation immigrant, language spoken at home, urban background, first-generation university student, medical doctor as parent). Finally, we adjusted for key confounders, socio-demographic variables and previous performance at medical school.

Missing values on the four variables collected by questionnaire (Table 1) were statistically imputed based on their correlation with the other variables in the logistic regression models (Table S1).[20] Missing values were imputed five times using five independent draws from the imputation model. The combined estimates over the imputed datasets were used. Odds ratios were compared between analyses of the imputed dataset (multiple imputed) and the unimputed dataset (complete case) (see Table S1 for details). As the absence of data on these four variables was systematically related to cohort, we considered the missing-at-random assumption to be reasonable.

Analyses were performed using PASW Statistics Version 18.0 (SPSS, Inc., Chicago, IL, USA). We present 95% confidence intervals (CIs) for unadjusted and adjusted ORs, which indicate statistical significance if they do not include a value of 1.0.

RESULTS

Student characteristics

Data for Year 1 and pre-clinical performance pertained to 1661 (70%) Dutch and 696 (30%) non-Dutch students. Non-Dutch students were older, had a lower or a missing pu-GPA and more often had an urban background. Asian students were more often male and Turkish/Moroccan/African students were more often first-generation university students (Table 2). On the qualifying date (1 January 2011), 76% (range: 71-85%) of the cohorts of 2002-2004 had passed the first five discipline-specific clerkships. Thus, data for 623 (76%) Dutch and 195 (24%) non-Dutch students (Table 3) were included in the analysis of clinical performance. Differences in socio-demographic characteristics and with respect to age and gender were generally similar to those reported in Table 2.

Year 1 course completion

Dutch students were more likely to complete the Year 1 course within 1 year (64%) compared with Surinamese/Antillean and Asian students (37% and 50%, respectively) (Table 2). These differences correspond to unadjusted ORs of 0.33 ($p < 0.001$) for Surinamese/Antillean students and 0.55 ($p < 0.001$) for Asian students (Table 4). These disparities were partly explained by the confounders (adjusted ORs: 0.40 and 0.67, respectively) and socio-demographic characteristics (adjusted ORs: 0.72 and 0.40, respectively). Details of the regression analyses, with both complete cases and multiple imputations, are presented in Table S1. We found a statistically significant differential effect of ethnicity by pu-GPA (interaction test, $p < 0.001$, d.f. = 4), with especially low Year 1 completion rates among Surinamese/Antillean and Asian students for whom a pu-GPA was missing (11% and 18%, respectively, versus 78% for both Western and Dutch students).

Table 2 Characteristics of 2336 students in the cohorts of 2002-2007

	2002-2007 (*n* = 2336*)										
	Dutch (*n* = 1661, 71%)		**Surinamese/ Antillean (*n* = 162, 7%)**		**Turkish/Moroccan/ African (*n* = 126, 5%)**		**Asian (*n* = 147, 6%)**		**Western (*n* = 240, 10%)**		**p-value**
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	
Socio-demographic characteristics											
First-generation immigrant	–	–	62	38	21	17†	103	70‡	67	28†	< 0.001§
First language non-Dutch (*n* = 667)	3	0.6	14	9‡	25	74†	35	85†	26	41‡	< 0.001§
First-generation university student (*n* = 659)	141	30	15	31	21	68‡	15	39	10	16†	< 0.001
Medical doctor as parent (*n* = 658)	69	15	9	19	1	3	3	8	8	13	0.23
Urban background (*n* = 627)	194	43†	34	83‡	26	81‡	30	75‡	41	68‡	< 0.001
Confounders											
Male	613	37	57	35	39	31	76	52‡	97	40	0.003
Age, years											< 0.001
< 19	978	59‡	84	52	55	44	45	31	109	45	
19-21	510	31	56	35	52	41	64	43‡	99	41‡	
> 21	173	10	22	13	19	15	38	26‡	31	13	
Pre-university GPA											
Missing**	50	3†	37	23‡	8	6	17	12‡	18	8	< 0.001
Mean (SD)	7.04 (0.55)		6.86 (0.60)††		6.94 (0.63)		6.83 (0.55)**		6.96 (0.57)		< 0.001
Cohort											0.11
Dependent variables											
Passed Year 1 course in ≤ 1 year	1064	64‡	60	37†	70	56	73	50†	145	60	< 0.001
All pre-clinical examinations in ≤ 4 years	674	41‡	31	19†	39	31	35	24†	88	37	< 0.001

* 20 students in category 'other' and 1 student whose ethnicity was unknown were excluded from analyses; the percentages relevant to each variable refer to the number of participants for which data is available; † Percentage significantly lower than overall average; ‡ Percentage significantly higher than overall average; § Category Dutch excluded from analysis; ** Number of students with a foreign pre-university education: Dutch, *n* = 11; Surinamese/Antillean, *n* = 31; Turkish/Moroccan/African, *n* = 3; Asian, *n* = 13; Western, *n* = 13; †† Pre-university GPA significantly lower than for Dutch students
GPA = grade point average, SD = standard deviation

Table 3 Characteristics of 818 students in the cohorts of 2002-2004 who finished the first five clerkships

	2002-2004($n = 818$*)										
	Dutch ($n = 623$, 76%)		**Surinamese/ Antillean ($n = 37$, 4.5%)**		**Turkish/Moroccan/ African ($n = 37$, 4.5%)**		**Asian ($n = 40$, 5%)**		**Western ($n = 81$, 10%)**		**p-value**
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	
Socio-demographic characteristics											
First-generation immigrant	–	–	15	41	7	19†	29	73‡	20	25†	< 0.001§
First language non-Dutch ($n = 251$)	–	–	5	39	9	82‡	9	82‡	5	21†	0.001§
First-generation university student ($n = 249$)	66	35	4	31	8	73‡	5	50	3	13†	0.01
Medical doctor as a parent ($n = 250$)	25	13	3	23	–	–	–	–	4	17	0.31
Urban background ($n = 226$)	67	39†	8	80‡	7	78‡	8	73	14	64	0.001
Confounders											
Male	207	33	12	32	13	35	23	58‡	27	33	0.041
Age											< 0.001
< 19	389	62‡	19	51	17	46	12	30†	40	49	
19-21	169	27†	14	38	14	38	13	33	33	41‡	
>21	65	10†	4	11	6	16	15	38‡	8	10	
Pre-university GPA											
Missing**	19	3†	5	14‡	3	8	6	15‡	4	5	< 0.001
Mean (SD)	7.03 (0.55)		6.88 (0.64)		6.87 (0.62)		6.89 (0.52)		6.91 (0.52)		0.07
Cohort											0.10
Dependent variable											
At least three clerkship grades of ≥ 8	545	88‡	20	54†	25	68†	23	58†	62	77†	< 0.001

* 13 students in category 'Other' were excluded from analyses; only students who completed the first five clerkships were included, the percentages relevant to each variable refer to the number of participants for which data is available; † Percentage significantly lower than overall average; ‡ Percentage significantly higher than overall average; § Category 'Dutch' excluded from analysis; ** Number of students with a foreign pre-university education: Dutch $n = 4$; Surinamese/Antillean, $n = 3$; Turkish/Moroccan/African, $n = 1$; Asian, $n = 5$; Western, $n = 2$

GPA = grade point average; SD = standard deviation

Table 4 Relationship between ethnicity and Year 1 course completion, pre-clinical course completion and clinical performance*

	Year 1 course completion (*n* = 2336)		**Pre-clinical course completion (*n* = 2336)**		**Clinical performance (*n* = 818)**	
Characteristic	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Ethnicity effect unadjusted						
Dutch	1.00	–	1.00	–	1.00	–
Surinamese/Antillean	**0.33**	0.24–0.46	**0.35**	0.23–0.52	**0.17**	0.09–0.34
Turkish/Moroccan/African	0.70	0.49–1.01	**0.66**	0.44–0.97	**0.30**	0.14–0.62
Asian	**0.55**	0.40–0.78	**0.46**	0.31–0.68	**0.19**	0.10–0.38
Western	0.86	0.65–1.13	0.85	0.64–1.12	**0.47**	0.27–0.82
Ethnicity effect adjusted for confounders† and cohort						
Dutch	1.00	–	1.00	–	1.00	–
Surinamese/Antillean	**0.40**	0.27–0.57	**0.40**	0.26–0.61	**0.19**	0.09–0.38
Turkish/Moroccan/African	0.73	0.49–1.08	0.68	0.45–1.03	**0.33**	0.16–0.70
Asian	**0.67**	0.47–0.98	**0.55**	0.36–0.83	**0.24**	0.12–0.49
Western	0.95	0.70–1.28	0.95	0.70–1.27	**0.51**	0.28–0.91
Ethnicity effect adjusted for confounders†, cohort, and socio-demographic characteristics‡						
Dutch	1.00	–	1.00	–	1.00	–
Surinamese/Antillean	**0.40**	0.27–0.60	**0.42**	0.27–0.66	**0.16**	0.07–0.36
Turkish/Moroccan/African	0.78	0.51–1.20	0.71	0.44–1.14	**0.38**	0.15–0.98
Asian	0.72	0.45–1.14	0.64	0.38–1.08	**0.20**	0.08–0.53
Western	0.99	0.71–1.37	0.97	0.72–1.40	**0.45**	0.24–0.85
Ethnicity effect adjusted for confounders†, cohort, socio-demographic characteristics‡, and previous performance at medical school§						
Dutch	–	–	1.00	–	1.00	–
Surinamese/Antillean	–	–	**0.57**	0.35–0.93	**0.17**	0.08–0.39
Turkish/Moroccan/African	–	–	0.76	0.46–1.25	0.39	0.15–1.02
Asian	–	–	0.68	0.39–1.20	**0.22**	0.08–0.60
Western	–	–	1.01	0.71–1.45	**0.45**	0.23–0.85

* Figures in bold denote significant odds ratios ($p < 0.05$)
† Age, gender, pre-university grade point average
‡ Socio-demographic characteristics included first-generation immigrant, first language, first-generation university student, medical doctor as parent, and urban background
§ Year 1 performance for pre-clinical course completion; pre-clinical course completion for clinical performance
OR = odds ratio; 95% CI = 95% confidence interval

Pre-clinical course completion

Dutch students were also more likely to complete the pre-clinical course within 4 years (41%) compared with Surinamese/Antillean and Asian students (19% and 24%, respectively) (Table 2). Unadjusted ORs were 0.35 and 0.46 for Surinamese/Antillean and Asian students, respectively (Table 4). The confounders, socio-demographic characteristics and previous performance at medical school all failed to explain these differences.

Clinical performance

Of the 623 Dutch students who finished the first five clerkships, 545 (88%) received three or more grades of ≥ 8.0. This percentage was significantly lower for all other ethnic subgroups, ranging from 54% to 77%. The differences in percentages correspond to unadjusted ORs, ranging from 0.17 for Surinamese/Antillean students to 0.47 for Western students. Again, these differences were not explained by confounders, socio-demographic characteristics or previous performance at medical school (Tables 4 and S1).

DISCUSSION

This study found that in pre-clinical training, only two of four ethnic minority groups (Surinamese/Antillean and Asian) underperformed, whereas in clinical training all minority groups achieved lower grades. The ethnicity-related disparities in performance, especially in clinical training, remained after adjustments for age, gender, pu-GPA and socio-demographic variables, including parental education and first language, and previous performance at medical school.

Explanation of the study's findings

The distinctions among ethnic groups may point to different mechanisms for ethnicity-related disparities in medical school performance. The underperformance of Surinamese/Antillean and Asian students in pre-clinical training is explained only partly by age, gender and pu-GPA. Thus, students in these subgroups who had received Dutch secondary education also performed less well than students from other ethnic groups. Surprisingly, factors related to social background further explained the differences for Asian students, but not for Surinamese/Antillean students. Although this is counterintuitive, it may be explained by the fact that Surinamese/Antillean students often speak Dutch at home. It may be that first language is a proxy for cultural differences in communication rather than for language skills.[21] Therefore, cultural differences in communication between Dutch and Surinamese/Antillean students may be masked by the fact that these students speak the same language. Further research, specifically in the medical school context, is required to explore other causes of poorer performance, such as differences in motivation for studying medicine.[22]

All of the non-Dutch subgroups achieved lower grades in clinical training, even after adjustments for pre-clinical performance. This suggests that the mechanisms by which this occurred differ between pre-clinical and clinical training. A first possible explanation refers to a deficit in practical clinical knowledge in ethnic minority students, as suggested by Woolf and colleagues.[23] These authors found ethnic differences in practical clinical knowledge and skills, but not in theoretical medical knowledge.[23] Further research is required to determine whether non-Dutch students are less well prepared for clinical training, despite receiving the same pre-clinical training and, if so, why this is.

As clinical grades are, at least partly, based on medical students' interactions with faculty staff or patients, differences in communication styles may represent a second explanation for the lower grades. Although several studies have reported that students from ethnic minority groups achieve lower scores on the communication part of clinical performance examinations,[21,24] differences in communication styles failed to explain all of the variance in clerkship grades.[25]

A third explanation may refer to stereotype threat, which suggests that underperformance in ethnic groups can be caused by increased anxiety that arises in response to the prospect of being negatively stereotyped.[26] Thus far, stereotyping has been reported for Asian medical students in the UK,[27] but further research is required to confirm that stereotyping applies to other ethnic minority groups at medical school. A related issue worthy of attention concerns whether, as a result of the more subjective process of grading, stereotype threat is more prominent in clinical than pre-clinical training.

A final possible explanation is that the more subjective grading in clinical training[28] leads to examiner bias. Inevitably, people tend to trust those who are similar to themselves or who are similar to people they like (a phenomenon known as the 'similarity principle'[29]) and people will have more positive views of those they believe to be part of their group (referred to as 'in-group bias'[30]).Therefore, it is likely that Dutch examiners will tend to give Dutch students higher marks than non-Dutch students, unless they are aware of and attempt to control these automatic reactions[26] or use more objective criteria to mark the students.[9] In line with the growing prominence of faculty development in medical education,[31] the training of examiners has received increasing attention at our medical school. However, as examiners at our medical school are mainly Dutch and have not yet received specific training in cultural competency, the possibility of examiner bias cannot be ruled out.

A recent review[3] suggested that examiner bias and candidate communication skills were not the main causes of ethnic differences in performance because similar effects were found in both machine- and examiner-marked tests. However, in the present study we found dissimilar effects at the group level between pre-clinical assessments, which are mainly marked by machine, and clinical assessments, which are mainly marked by examiner. Further studies are needed to replicate and explain our findings. More detailed experimental or ethnographic studies might assist us to understand what happens in clinical assessments.

Comparisons with other studies

Our study confirms that ethnic minority students underperform throughout medical school,[3] but also reveals differences in performance among ethnic minority groups. According to a recent review, several studies on ethnicity and academic performance have adjusted their data for gender, and some have done so for age, pre-university grades, first language, or socio-economic group.[3] We systematically adjusted for the combination of all of these factors. Our analyses confirmed the expected associations of the confounders with performance at medical school (Table S1). The main predictor of underperformance in pre-clinical training was a lower pu-GPA,[11] whereas male gender was associated with poorer performance in both pre-clinical and clinical training.[11,17,32] Students aged > 21 years performed relatively well in pre-clinical training after adjustment for the other variables.[17] The additional socio-demographic factors were less important for performance at medical school, except for the 'first-generation university student' factor, which was associated with lower clerkship grades. Further studies are required to explore why these students achieve lower clerkship grades despite showing comparable, or even better, performance in pre-clinical training.

Strengths and limitations of the study

Our study used data for a large number of students (2336 from six entire year cohorts), of whom 696 (30%) had a non-Dutch background. The large sample size and the large number of non-Dutch students gave us the opportunity to extend our analysis beyond a White/non-White comparison, to which most studies on ethnicity and academic performance are restricted.[3] The use of a longitudinal design, which is also uncommon in studies on factors associated with academic performance in medical school,[11] enabled us to note performance differences among ethnic groups in pre-clinical and clinical training. Unlike previous studies, we were not compelled to use less reliable methods such as self-report, or to use names or photographs,[3] and only one student whose ethnicity was unknown had to be excluded from the analysis.

A limitation of our study is that data on four of the additional socio-demographic factors (first language, first-generation university student, urban background, medical doctor as parent) were collected for a restricted number of participants. However, the multiple imputation technique applied is generally accepted as a suitable method for dealing with missing values.[20] The imputation of missing values allows the use of data that are available for other predictors and that would otherwise be lost. Generally speaking, imputation methods, especially multiple imputations, are therefore superior to complete case analysis.[20,33,34] In our study, the ORs calculated in the imputed dataset were similar and, if different, were generally more conservative than the ORs in the unimputed dataset (Table S1).

Implications for practice

This study has some practical implications for medical schools that are confronted with increasingly diverse student populations. As students from certain groups are more likely to fail than other students, the provision of targeted or proactive support for these groups might be appropriate. For example, additional support during Dutch pre-clinical training may be required for Surinamese/Antillean and Asian students, especially for those who do not have a Dutch pre-university education.

The lower clerkship grades achieved by all non-majority students also call for action. In addition to possible causes related to the student or the academic environment, the consequences require attention: do non-majority students enter residency training less often, especially the speciality of their first choice? Finally, interventions for improvement should be considered. A first step is to make assessment less subjective or at least to ensure that students from ethnic minorities are not disadvantaged. To this end, diversity should be considered both in test construction and implementation.[9]

A second step is to create awareness of cultural bias and to develop a greater understanding of cultural differences through cultural competency training for both faculty staff and students.[25] This is in line with the increase in the attention paid to cultural competency training as a mechanism to improve intercultural patient-doctor interaction.[35]

In conclusion, strong ethnicity-related disparities exist in medical school performance even after adjustments for age, gender, pu-GPA and socio-demographic variables. A more subjective grading process cannot be ruled out as a cause of the lower grades in clinical training achieved by students from ethnic minority groups, but other explanations require further investigation. In order to give all students a fair chance of academic success, medical schools must set up support programmes that are appropriate for diverse student populations and implement examination systems that take this diversity into account.

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Table S1 Detailed description of the multivariable models used to adjust the relationship of ethnicity with performance throughout medical school*

Characteristic	**Year 1 performance**		**Pre-clinical performance**		**Clinical performance**	
	MI (*n* = 2336) OR (95% CI)	**CC (*n* = 614) OR (95% CI)**	**MI (*n* = 2336) OR (95% CI)**	**CC (*n* = 614) OR (95% CI)**	**MI (*n* = 818) OR (95% CI)**	**CC (*n* = 224) OR (95% CI)**
Ethnicity						
Dutch	1.00	1.00	1.00	1.00	1.00	1.00
Surinamese/Antillean	**0.40** (0.27–0.60)	**0.28** (0.12–0.64)	**0.57** (0.35–0.93)	0.62 (0.23–1.65)	**0.17** (0.08–0.39)	**0.07** (0.01–0.48)
Turkish/Moroccan/African	0.78 (0.51–1.20)	1.07 (0.37–3.11)	0.76 (0.46–1.25)	0.41 (0.14–1.17)	0.39 (0.15–1.02)	0.36 (0.04–3.38)
Asian	0.72 (0.45–1.14)	0.86 (0.31–2.42)	0.68 (0.39–1.20)	0.34 (0.11–1.09)	**0.22** (0.08–0.60)	**0.09** (0.01–0.79)
Western	0.99 (0.71–1.37)	1.21 (0.59–2.50)	1.01 (0.71–1.45)	1.10 (0.54–2.22)	**0.45** (0.23–0.85)	0.71 (0.16–3.12)
First-generation immigrant	1.09 (0.74–1.61)	0.77 (0.33–1.80)	0.82 (0.53–1.29)	0.92 (0.36–2.31)	1.46 (0.67–3.19)	2.25 (0.43–11.8)
First language non-Dutch	0.75 (0.45–1.25)	0.62 (0.28–1.40)	0.99 (0.55–1.77)	1.11 (0.48–2.57)	1.00 (0.43–2.29)	2.35 (0.39–14.0)
First-generation university student	1.21 (0.68–2.15)	1.30 (0.83–2.02)	1.09 (0.82–1.46)	1.26 (0.83–1.92)	**0.39** (0.19–0.83)	**0.32** (0.13–0.77)
Medical doctor as parent	0.65 (0.40–1.04)	0.64 (0.38–1.08)	0.85 (0.55–1.29)	0.71 (0.41–1.22)	1.42 (0.28–7.24)	1.52 (0.35–6.59)
Urban background	0.87 (0.70–1.07)	0.83 (0.56–1.22)	1.05 (0.78–1.41)	1.13 (0.79–1.63)	0.87 (0.36–2.12)	0.85 (0.35–6.59)
Male	**0.71** (0.59–0.86)	0.83 (0.56–1.22)	**0.74** (0.61–0.91)	0.85 (0.57–1.25)	0.68 (0.45–1.02)	0.66 (0.28–1.54)
Age, years						
< 19	1.00	1.00	1.00	1.00	1.00	1.00
19 to 21	1.03 (0.84–1.27)	1.13 (0.74–1.76)	0.82 (0.65–1.04)	0.76 (0.49–1.18)	0.78 (0.49–1.24)	0.70 (0.26–1.86)
> 21	**2.00** (1.45–2.77)	**1.95** (1.02–3.75)	1.25 (0.89–1.76)	1.29 (0.69–2.42)	0.88 (0.45–1.72)	0.53 (0.15–1.88)
Pre-university GPA						
Missing	**0.54**(0.36–0.83)	0.59 (0.23–1.48)	0.85 (0.52–1.38)	0.58 (0.20–1.64)	0.45 (0.19–1.03)	0.90 (0.13–6.15)
Continuous†	**5.08** (4.10–6.28)	**4.33** (2.85–6.57)	**2.06** (1.68–2.53)	**2.04** (1.40–2.97)	1.23 (0.80–1.88)	0.89 (0.37–2.15)
Year 1 performance			**8.51** (6.61–11.0)	**7.04** (4.24–11.7)		
Pre-clinical performance					**1.81** (1.16–2.82)	**3.03** (1.15–8.01)

* Figures in bold denote significant odds ratios ($p < 0.05$)

† Missing values for pre-university GPA were substituted with the mean in an analysis with Missing pu-GPA and continuous pu-GPA included

GPA = grade point average; OR = odds ratio, CI = confidence interval, MI = multiple imputed, CC= complete cases

Chapter 4

Motivation, learning strategies, participation and medical school performance

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ABSTRACT

Background: Medical schools wish to better understand why some students excel academically and others have difficulty in passing medical courses. Components of self-regulated learning (SRL), such as motivational beliefs and learning strategies, as well as participation in scheduled learning activities, have been found to relate to student performance. Although participation may be a form of SRL, little is known about the relationships among motivational beliefs, learning strategies, participation and medical school performance.

Objectives: This study aimed to test and cross-validate a hypothesised model of relationships among motivational beliefs (value and self-efficacy), learning strategies (deep learning and resource management), participation (lecture attendance, skills training attendance and completion of optional study assignments), and Year 1 performance at medical school.

Methods: Year 1 medical students in the cohorts of 2008 (n = 303) and 2009 (n = 369) completed a questionnaire on motivational beliefs and learning strategies (sourced from the Motivated Strategies for Learning Questionnaire) and participation. Year 1 performance was operationalised as students' average Year 1 course examination grades. Structural equation modelling was used to analyse the data.

Results: Participation and self-efficacy beliefs were positively associated with Year 1 performance (β = 0.78 and β = 0.19, respectively). Deep learning strategies were negatively associated with Year 1 performance (β = - 0.31), but positively related to resource management strategies (β = 0.77), which, in turn, were positively related to participation (β = 0.79). Value beliefs were positively related to deep learning strategies only (β = 0.71). The overall structural model for the 2008 cohort accounted for 47% of the variance in Year 1 grade point average and was cross-validated in the 2009 cohort.

Conclusions: This study suggests that participation mediates the relationships between motivation and learning strategies, and medical school performance. However, participation and self-efficacy beliefs also made unique contributions towards performance. Encouraging participation and strengthening self-efficacy may help to enhance medical student performance.

INTRODUCTION

Medical schools wish to better understand why some students excel academically and others have difficulty in passing medical courses. Such an understanding may provide clues with which struggling students can be identified at an early stage and offered timely and specific support, and may also offer medical schools insight into how they might positively influence overall student performance.[1-3] Several researchers have used self-regulated learning (SRL) theory to understand successful learning. Most of these authors have used self-report measures and have found that different components of SRL, such as appropriate motivational beliefs and learning strategies, are positively related to academic performance.[4-7] Others have focused on student participation in scheduled learning activities to explain differences in performance. Student participation, such as in lecture attendance, has been found to be predictive of academic performance.[8,9] Although student participation may be considered part of SRL, the relationships between commonly measured components of SRL and participation, and their joint contribution to predicting medical school performance have not been thoroughly investigated. Participation may mediate the relationships between motivational beliefs and learning strategies, and medical school performance, but these factors may also make unique contributions to performance.[8] Further insight into these relationships would benefit medical schools that seek to enhance their students' performance. Therefore, this prospective study examined the relationships between early measures of motivational beliefs, learning strategies and participation, and performance at medical school.

Self-regulated learning has been defined as learning that occurs when one is 'metacognitively, motivationally, and behaviourally proactive in the learning process'.[10] Thus, self-regulated learners: (i) monitor their own progress towards self-set goals and are therefore able to reflect on the effectiveness of their learning approaches; (ii) tend to view the learning task as intrinsically interesting and worthwhile, and have high levels of self-efficacy, and (iii) engage in and persist with learning behaviours that maximise the degree to which learning occurs.[10,11] One instrument developed to assess SRL as a metacognitive, motivational and behavioural construct is the Motivated Strategies for Learning Questionnaire (MSLQ).[11] The MSLQ has two major sections: Motivation, and Learning Strategies. The Motivation section consists of scales that involve expectancy, value and affect. The Learning Strategies section is further divided into a cognitive-metacognitive section and a resource management section. The motivation, cognitive-metacognitive and resource management sections correspond, respectively, to the three components in the definition of SRL.[10]

In the general education literature, several relationships among the three components of SRL and academic performance have been described. Firstly, the use of deep (cognitive) learning strategies, such as elaboration and organisation, and metacognitive self-regulatory activities, such as planning and monitoring, are related to better academic performance.[12,13] Secondly, higher levels of intrinsic goals for learning, self-efficacy and task value tend to lead to more deep-processing strategies and metacognitive regulation and, consequently, to improved performance.[14-17] Finally, high levels of resource management, using strategies such as effort regulation and time and study environment management, are also related to better academic performance.[11,18] Although it has been suggested that the effect of motivations on academic performance may be mediated by learning strategies,[4,12] studies that incorporated motivations, learning strategies and performance, and tested their inter-relationships, are scarce.[19] In addition, the few studies examining the effects of the different components of SRL on medical student performance showed conflicting results; associations of motivational beliefs, deep learning and resource management with medical school performance were found to be positive, small or even non-present.[20-24]

A specific type of study behaviour is participation in scheduled learning activities. In a recent review, Credé *et al.* [8] showed that physical presence at lectures or other modes of instruction was a better predictor of academic performance than any other known predictor, including pre-admission grade point average (GPA), study skills and number of hours spent studying. However, in modern medical curricula, participation involves more than just attending lectures. Participation in small-group work (such as tutorials or skills training) and efficient use of individual study time are also crucial to medical school success.[25] A recent study among nursing students showed that homework completion was a stronger predictor of success than lecture attendance.[9] However, participation in scheduled learning activities appears to be influenced by medical students' personal learning preferences and learning needs at particular times.[26,27]

Aim and hypotheses

In this study we examined how motivational beliefs (value and self-efficacy), learning strategies (deep learning and resource management) and participation relate to Year 1 performance in medical school. On the basis of the reviewed literature, we hypothesised several positive relationships between these variables (Figure 1). Our aim was to test the hypothesised relationships and to cross-validate our findings with a new, independent sample.

METHOD

Context

This study was performed at the Erasmus MC Medical School, Rotterdam, the Netherlands. The integrated and theme-oriented curriculum at this school comprises a 3-year bachelor degree course followed by a 3-year masters degree course. The first year of the Bachelor of

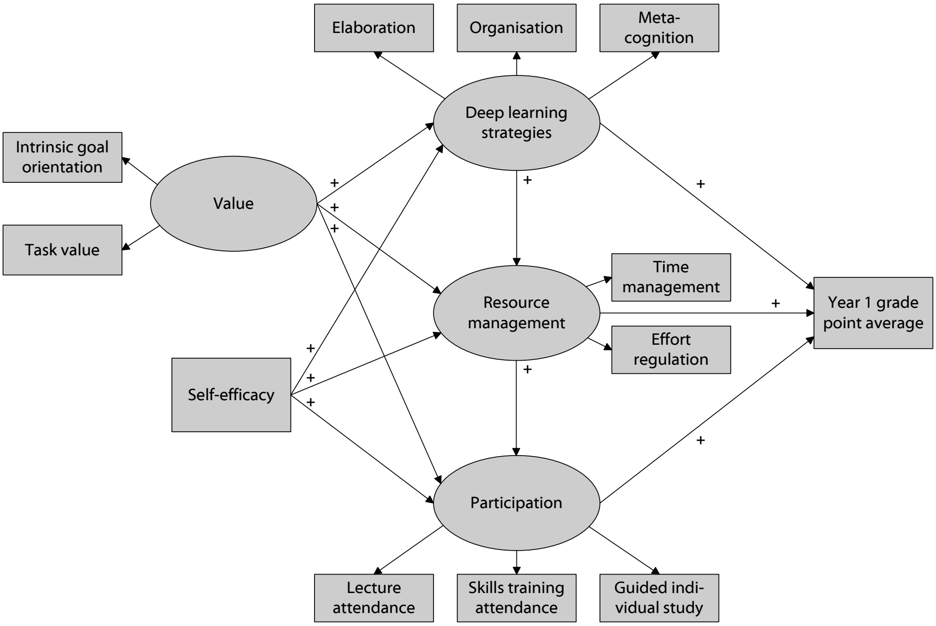

Figure 1 Hypothesised model of Year 1 performance

Medicine is divided into three thematic blocks of 11–16 weeks, which are organised around pathophysiological systems and cover subjects, starting from the basic sciences, up to and including clinical practice. Each study week covers one topic, such as heart failure, which is dealt with in various learning activities, including large-group learning (lectures and patient demonstrations; 8 hours), small-group learning (skills training and tutorials; 8 hours) and both guided (study assignments; 16 hours) and unguided (8 hours) individual study. Large-group sessions and guided study assignments are undertaken on a voluntary basis; for about a quarter of the small-group sessions student participation is compulsory. The first year includes nine written examinations, consisting of open-ended and multiple-choice questions.

Participants and procedure

The participants in this study were Year 1 students entering in 2008 (n = 408) and 2009 (n = 409). Two months after enrolment, students were invited to return an online questionnaire on SRL and participation, which took 15-20 minutes to complete. Upon completion, participants received automatically generated feedback on the strengths and weaknesses of their study approach, along with tips for improvement. The students were informed about the study, in which participation was voluntary and anonymity was guaranteed. No plausible harm to participants could arise from the study. According to Dutch law, this study was exempt from ethical approval requirements.

Instrument

To measure the three components of SRL, we used parts of a validated Dutch version of the MSLQ.[28,29] Some minor changes to the wording of the items were made to make them more suitable for our medical school context. The MSLQ consists of 81 items divided into six motivation subscales and nine learning strategies subscales. Items are scored on a 7-point Likert scale (1 = not at all true of me, 7 = very true of me). As the MSLQ subscales are designed to be modular, they can be used to fit the needs of a particular study.[12] The present study used eight subscales of the MSLQ, comprising 49 items.

To measure students' motivational beliefs, we used three motivation subscales: Intrinsic Goal Orientation, Task Value, and Academic Self-Efficacy. Deep learning strategies were measured using three subscales on cognitive and metacognitive strategies: Elaboration; Organisation, and Metacognitive Self-Regulation. To measure the extent to which students manage their resources we used two resource management subscales: Time and Study Environment, and Effort Regulation. Figure 2 shows example items from the selected subscales.

Three items were added to the questionnaire to measure participation. Students were asked to rate their lecture attendance, skills training attendance and completion of individual study assignments using a 5-point scale.

Motivational beliefs
'In a course like this, I prefer course material that arouses my curiosity, even if it is difficult to learn' *(Intrinsic Goal Orientation)*
'Understanding the subject matter of this course is very important to me.' *(Task Value)*
'I expect to do well in this course.' *(Academic Self-Efficacy)*
Deep learning strategies
'When I study for this course, I pull together information from different sources, such as lectures, readings and discussions' *(Elaboration)*
'When I study the readings for this course, I outline the material to help me organize my thoughts' *(Organisation)*
'I ask myself questions to make sure I understand the material I have been studying for this course' *(Metacognitive Self-Regulation)*
Resource management
'I make sure I keep up with the weekly readings and assignments for this course' *(Time and Study Environment Management)*
' I work hard to do well on this course even if I don't like what we are doing' *(Effort Regulation)*

Figure 2 Example items from the subscales selected from the Motivated Strategies for Learning Questionnaire

Outcome measure - Year 1 performance

Year 1 performance was calculated as the mean of the grades obtained on the nine course examinations. We considered only grades obtained at the first attempt. Grades were given on a 10-point scale (1 = poor, 10 = excellent) and 5.5 was the cut-off pass/fail mark. Student grades were retrieved from the university student administration system.

Statistical analysis

Prior to statistical analyses, datasets were screened for accuracy of data entry and missing values, and study variables were checked for normality. Next, the subscales of the MSLQ were subjected to reliability analysis, and descriptive statistics and Pearson correlations were calculated for the study variables. We used *t*-tests to identify differences in variable scores between the cohorts of 2008 and 2009. Data were then subjected to structural equation modelling (SEM), using AMOS 18.0 (SPSS, Inc., Chicago, IL, USA).[30] Structural equation modelling is a statistical tool that builds on techniques such as correlation, regression, factor analysis and analysis of variance (for an explanation of SEM, see Violato and Hecker[31]). We used SEM to test the significance of the hypothesised relationships among variables and the fit of the overall model. The final model derived for the 2008 cohort was cross-validated using data from the 2009 cohort.

A two-stage approach, as recommended by Anderson and Gerbing,[32] was used to test the hypothesised model. The first stage involved testing the validity of the measurement model. To this end, two separate confirmatory factor analyses (CFAs) were conducted; one of these applied to the three latent factors measured by the MSLQ (Value, Deep learning, Resource Management), and one applied to the latent factor Participation (Figure 1). Self-efficacy beliefs were not hypothesised to load on a latent variable and therefore were not included in the CFAs. The second stage involved testing the full structural model depicted in Figure 1.

Maximum likelihood estimations were used to estimate the model's parameters and a chi-squared test was conducted to assess model fit. Although, in general, a non-significant chi-squared result indicates a good model fit, the chi-squared test is influenced by the sample size and the magnitudes of the correlations between variables. Therefore, several additional fit indices were considered, including: the chi-squared statistic divided by the degrees of freedom (CMIN/d.f.); the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). A well-fitting model should have a CMIN/d.f. of < 3.0,[33] a CFI of ≥ 0.95 and an RMSEA of ≤ 0.06.[34]

To improve model fit, we first added paths one at a time based on the modification indices, and then dropped paths one at a time based on Wald tests of the significance of the structural coefficients (at an α-level of 0.05). Theory was taken into account in both the adding and dropping of paths.[31,35] To compare non-nested models, we used the expected cross-validation index (ECVI). The model with the smallest ECVI value is considered best.[35]

A risk of adding and dropping paths (i.e. post hoc model fitting) is that model modification may be driven by characteristics of the particular sample on which the model was tested.[35] One approach to addressing this risk for over-fitting involves employing a cross-validation strategy whereby the final model derived from the post hoc analyses is tested on a second independent sample from the same population. In this study, the 2008 cohort served as the calibration sample and the 2009 cohort as the validation sample; the final model for the 2008 cohort was tested on the 2009 cohort. We tested across the two cohorts for invariance related to the measurement and structural model. Both the chi-squared difference and CFI difference were used to determine whether the parameters tested (i.e. factor loadings and structural paths) were operating equivalently across the groups. The chi-squared difference should be non-significant and the CFI difference should be < 0.01.[35]

RESULTS

Respondents

In 2008, 303 students (74%), of whom 97 (32%) were male, completed the questionnaire. Their mean ± standard deviation (SD) age at the start of medical school was 19.3 ± 1.49 years. In 2009, 369 students (90%), of whom 135 (37%) were male, completed the questionnaire. Their mean ± SD age at the start of medical school was 19.4 ± 1.59 years. These gender and age distributions were representative of those of the total student cohorts for 2008 and 2009 and differences between the two cohorts were not statistically significant. Furthermore, pre-university GPA did not differ between the two cohorts. All respondents completed all items on the questionnaire.

Descriptive statistics and Pearson correlations

The reliabilities of the subscales from the MSLQ ranged from 0.62 to 0.88 (Cronbach's α; Table 1). Table 1 also presents the descriptive statistics for the study variables and their correlations. All study variables were positively related to one another; only Organisation was not related to Year 1 performance.

Confirmatory factor analyses

For the first CFA, the MSLQ subscales for Intrinsic Goal Orientation and Task Value were hypothesised to load on the latent variable Value Beliefs. The subscales for Elaboration, Metacognitive Self-Regulation and Organisation were hypothesised to load on the latent variable Deep Learning, and the subscales for Time Management and Effort Regulation were

Table 1 Descriptives, Cronbach's α-values and Pearson correlations for the study variables (2008 cohort, *n* = 303)

Variable	M	SD	Mdn	α	Items, *n*	1	2	3	4	5	6	7	8	9	10	11	12
Motivational beliefs																	
1 Intrinsic goal orientation	5.67	0.79	5.75	0.62	4	–	0.63*	0.51*	0.52*	0.31*	0.38*	0.34*	0.36*	0.23*	0.21*	0.19*	0.22*
2 Task value	5.73	0.78	5.83	0.84	6		–	0.49*	0.46*	0.32*	0.38*	0.36*	0.43*	0.26*	0.20*	0.23*	0.21*
3 Self-efficacy	4.77	0.89	4.75	0.88	8			–	0.44*	0.18*	0.39*	0.35*	0.27*	0.13†	0.15†	0.14†	0.25*
Cognitive strategies																	
4 Elaboration	4.88	0.94	5.00	0.75	6				–	0.60*	0.61*	0.57*	0.51*	0.25*	0.31*	0.27*	0.21*
5 Organisation	4.66	1.17	4.75	0.71	4					–	0.52*	0.49*	0.45*	0.25*	0.28*	0.19*	0.10
6 Metacognition	4.05	0.91	4.00	0.78	9						–	0.48*	0.44*	0.21*	0.24*	0.17*	0.18*
Resource management																	
7 Time management	4.64	1.09	4.80	0.82	8							–	0.69*	0.27*	0.53*	0.29*	0.32*
8 Effort regulation	4.93	1.12	5.00	0.76	4								–	0.31*	0.50*	0.35*	0.38*
Participation																	
9 Lecture attendance	4.69	0.66	5.00	–	1									–	0.30*	0.56*	0.34*
10 Study assignments	4.14	1.08	5.00	–	1										–	0.31*	0.45*
11 Skills training attendance	4.53	0.76	5.00	–	1											–	0.38*
Year 1 performance																	
12 Year 1 GPA	6.00	1.01	–	–	–												–

* $p < 0.01$
† $p < 0.05$
M = mean; SD = standard deviation; Mdn = median, GPA = grade point average

hypothesised to load on the latent variable Resource Management (Figure 1). This proposed measurement model showed a good fit with the data (χ^2 [11, n = 303] = 22.15, p = 0.02; CMIN/d.f. = 2.01; CFI = 0.99, RMSEA = 0.058). For the second CFA, the three items Lecture Attendance, Skills Training Attendance and Guided Study Assignments were hypothesised to load on the latent factor Participation. This model also showed a good fit with the data (χ^2 [1, n = 303] = 1.145, p = 0.29; CMIN/d.f. = 1.15, CFI = 0.99, RMSEA = 0.022).

Evaluating the structural model

The hypothetical model for Year 1 performance, as displayed in Figure 1, was tested with SEM. This model did not fit the data well and could not be accepted (χ^2 [45, n = 303] = 146.56, p = 0.00; CMIN/d.f. = 3.26, CFI = 0.93, RMSEA = 0.086). Modification indices suggested that an error covariance should be added between Lecture Attendance and Skills Training Attendance and a link should be included between Self-Efficacy and Year 1 GPA. Both suggestions were incorporated because they were considered substantively meaningful. This resulted in a model with a good fit (χ^2 [43, n = 303] = 79.89, p = 0.001; CMIN/d.f. = 1.86, CFI = 0.97, RMSEA = 0.053, ECVI = 0.496). One-at-a-time deletion of the non-significant relationships in this model resulted in a final model that included only significant relationships (Figure 3). This model also represented a good fit with the data (χ^2 [49, n = 303] = 87.70, $p < 0.001$; CMIN/d.f. = 1.79, CFI = 0.97, RMSEA = 0.051). The smaller ECVI value of 0.482 signals that this final, and most parsimonious, model represents the best fit to the data.

Value Beliefs was positively related to Deep Learning, but did not have a statistically significant association with Resource Management or Participation (Figure 3). Self-Efficacy had a positive direct relationship with Year 1 Performance. Deep Learning was positively associated with Resource Management, but negatively associated with Year 1 Performance. Resource Management was positively related to Participation, but did not have a direct association with Year 1 Performance. Participation was positively associated with Year 1 Performance.

The resulting model explained 50% of the variance in Deep Learning, 59% of the variance in Resource Management, 63% of the variance in Participation and 47% of the variance in Year 1 Performance.

Cross-validation of the model

The stability of the final model was tested in a new, independent sample, the 2009 cohort. Initially conducted t-tests revealed only one statistically significant difference between the 2008 and 2009 cohorts: Intrinsic Motivation was slightly higher for the 2009 cohort than for the 2008 cohort (t[597.6]= - 2.08, $p < 0.05$; mean difference = 0.12, effect size = 0.17). The configural model, in which no equality constraints are imposed, showed good fit (χ^2 [98, n = 303] = 254.30, p = 0.00; CMIN/d.f. =2.60, CFI = 0.95, RMSEA = 0.049). Testing for measurement

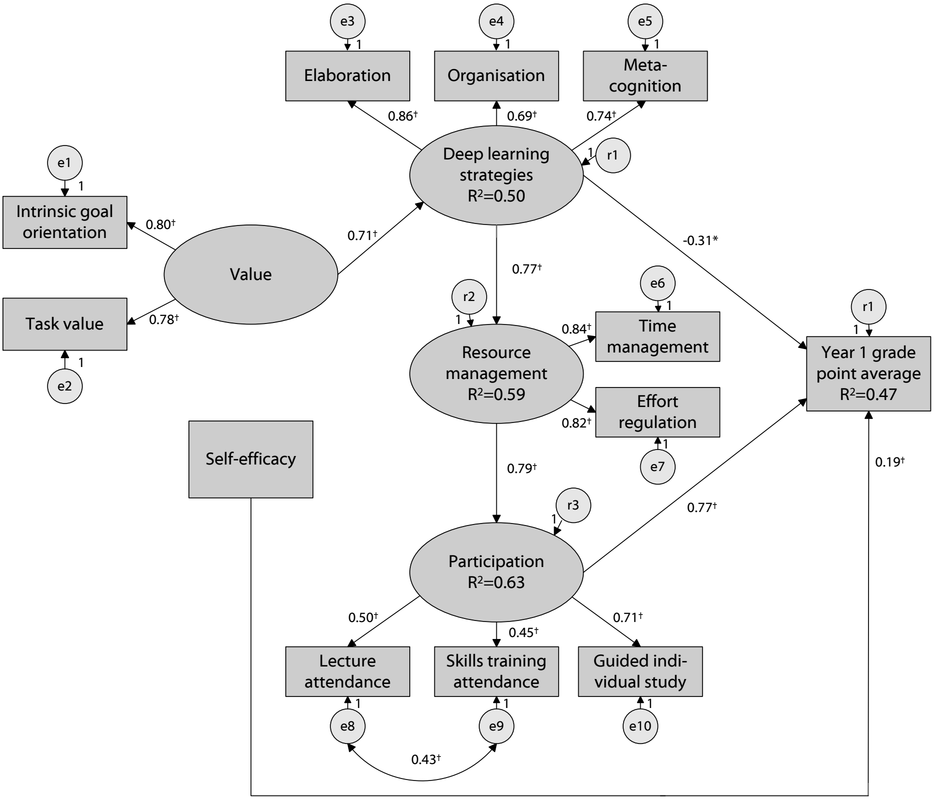

Figure 3 Final model of Year 1 performance (2008 cohort). Reported path values are standardised regression weights. R^2 is the percentage of variance explained for that specific variable. For clarity, correlations among exogenous variables were omitted. e = error (measurement error of observed variables); r = residual (error in the prediction of endogenous factors from exogenous factors);
* $p < 0.01$; † $p < 0.001$

and structural invariance indicated that the factor loadings (models 2 and 3) and structural paths (model 3) were the same across the 2008 and 2009 cohorts (Table 2).

DISCUSSION

This study showed that participation and self-efficacy beliefs were positively associated with Year 1 performance. Deep learning strategies were negatively associated with Year 1 performance, but positively related to resource management strategies. Resource management strategies were positively related to participation. Value beliefs were positively related to deep learning strategies only.

Table 2 Goodness-of-fit statistics for tests of measurement and structural invariance across the 2008 and 2009 cohorts

Model description	Comparative model	X^2	df	CMIN/ d.f.*	ΔX^2	Δd.f.	p-value†	CFI‡	ΔCFI§	RMSEA**
1 Configural model; no equality constraints imposed	–	254.30	98	2.60	–	–		0.947	–	0.049
2 Measurement model, all factor loadings constrained equal	2 versus 1	263.63	103	2.56	9.32	5	NS	0.945	0.002	0.048
3 Structural model, all factor loadings and structural paths constrained equal	3 versus 1	271.44	109	2.49	17.14	11	NS	0.945	0.002	0.047

* CMIN/d.f.= chi-squared statistic divided by degrees of freedom, which is required to be < 3.0 to indicate a reasonable fit of a hypothetical model
† ΔX^2 should be non significant
‡ CFI: the comparative fit index compares the fit of the particular model under test with a model in which none of the variables are related. A CFI of ≥ 0.95 indicates that the tested model fits the data well
§ ΔCFI should be < 0.01
** RMSEA: the root mean square error of approximation represents the root square of the chi-squared statistic divided by the number of degrees of freedom. This value is required to be < 0.06 to be considered acceptable

One of the most striking outcomes is the finding that, despite a positive indirect relationship, the use of *deep learning strategies* had a negative direct relationship with Year 1 performance. This result suggests that the use of deep learning strategies may lead to academic success, but only if it is combined with good resource management and participation. This finding may explain why in previous studies the association of deep learning with medical school grades was found to be weaker than expected[36] or even absent.[37] The importance of resource management strategies – time management and effort regulation – over the use of deep learning strategies in the explanation of academic performance has also been reported by others.[4,24] An alternative explanation may be that characteristics of the learning environment, such as the examination methods used, influence the degree to which the deep learning strategies affect performance.[4,36] For example, Year 1 examinations, which are mainly machine-marked, may (despite efforts to prevent this) reward the use of memorisation rather than the use of deep learning.

The hypothesis that *resource management* would have a direct positive association with Year 1 performance was also not confirmed, despite the strong correlations found between effort regulation and time management and Year 1 performance. Our findings suggest that the positive effect of effort regulation and time management on medical school performance is mediated by participation. Thus, only if a student's resource management strategies stimulate the student to participate in the variety of learning activities offered will these strategies positively influence the student's grades.

In line with the results of earlier studies among medical and nursing students,[9,38] *participation* was found to be strongly related to Year 1 performance, confirming our hypothesis. There may be several explanations for this finding.[8] Firstly, participation in various learning activities may allow students to obtain information that is not contained in the course material. Secondly, regular participation in various learning activities (lectures, skills training and independent study) around the same topic may represent a form of distributed practice (in which study effort is distributed over several study sessions), which is known to have a positive effect on performance. Finally, consistent participation may offer the possibility for the overlearning of material, especially when lectures are combined with tutorials, skills training and (guided) independent study. The importance of a highly structured course and active participation within and outside class has recently been reported with reference to science classes.[39]

However, an alternative explanation is that students with better rates of participation achieve higher grades not because they comprehend the material better, but because explicit or implicit cues to the content of examinations are given during class.[8,38] There is also the possibility that participation is a marker for individual differences between students that have not been measured. However, Credé *et al.*[8] reported only weak relationships between participation and student characteristics such as conscientiousness and cognitive ability. One theory that appears promising in explaining voluntary participation is Higgin's regulatory focus theory.[40,41] According to this theory, students may participate in learning activities either because they 'want to' (promotion focus) or because they feel they 'have to' (prevention focus).

The finding that the relationship of *academic self-efficacy* with Year 1 performance was direct and not mediated by learning strategies contradicts our hypothesis. A possible explanation for this direct relationship is that students with high levels of self-efficacy do not always need to participate to a great degree in order to be successful. Several studies have revealed the existence of a group of better or more confident students who are less likely to attend classes on a regular basis.[8,27,38] However, whether these students are more confident because they have performed well in early examinations or whether their higher initial self-efficacy results in better performance at the end of the year is a matter of debate.[21] The impact of self-efficacy on medical school performance may be an interesting area for further research, especially because self-efficacy may be used as a factor to aid in the early identification of students who are at risk for poor performance at medical school. In addition, self-efficacy can relatively easily be influenced by medical educators.[42]

There are some limitations to our study. Firstly, it is not possible to infer causality on the basis of correlational data, despite the fairly robust associations among the study variables that were suggested by our findings and the longitudinal nature of this study. The ascertaining of definitive causal pathways requires more controlled experimental studies. Secondly, it should be noted that structural models are only approximations of reality.[43] Therefore, it is likely that our model omits some relevant variables and associated relationships. For example, a confounding variable is suggested by the added error covariance between Lecture Attendance and Skills Training Attendance. It may well be that students participate in both activities because of their tendencies towards conformity or compliance.[44] Nevertheless, the proposed model was grounded in theory, modified taking theory into account, and cross-validated with an independent sample from the same population. Thirdly, the present study relied heavily on student self-reports of strategies and participation. However, as the questionnaire was used to provide students with an overview of the strengths and weaknesses of their study approaches, we expect the risk for social desirability bias to be low. Finally, this study was performed within one medical school. Although two cohorts of students were used, future replication studies are needed to establish whether the present results can be generalised to other populations. We would like to encourage others to test our model in settings in which learning is more active, such as in problem-based learning (PBL) curricula.

A first practical implication of this study is that medical schools should stimulate students to participate in learning activities. Although it might be tempting to make participation mandatory, it is questionable whether this is necessary[8] or even desirable. Medical schools should, rather, aim to stimulate participation by enhancing students' value beliefs. A recent review suggests that intrinsic motivation may be enhanced by measures such as PBL and small-group work, and early contact with patients.[45] Participation that extends beyond physical presence and includes intensive practice – via active-learning exercises – is likely to be most beneficial for all students.[39] Secondly, medical schools should aim to facilitate the maintenance or growth of self-efficacy levels. The most powerful source of self-efficacy beliefs is past performance, but student self-efficacy is also influenced by vicarious experiences (observing others perform), encouragement by others and students' own feelings.[46] To increase self-efficacy, medical schools should help students to monitor their own progress and build their confidence in their ability to learn. Possible strategies are to focus feedback on the competencies mastered rather than on those that have not yet been mastered, to provide students with authentic tasks that fit their skill development level, and to create 'safe' learning environments.[42] Thirdly, our results suggest that the collection of data on SRL and on participation may help medical schools to identify students who are at risk for poor performance early in their training. In addition, these data enable the identification of areas for improvement and consequently can be used to offer proactive and targeted types of support.

In conclusion, we tested and cross-validated an integrated model of motivation, learning strategies, participation and Year 1 medical student performance. Our study suggests that participation mediates the relationships between motivation and learning strategies, and medical school performance. In other words, value beliefs, deep learning strategies and resource management were only indirectly related to performance through participation. However, participation and self-efficacy beliefs also made unique contributions towards performance. Encouraging participation and strengthening self-efficacy may help to enhance medical student performance.

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Chapter 5

Academic dismissal policy for medical students: effect on study progress and help-seeking behaviour

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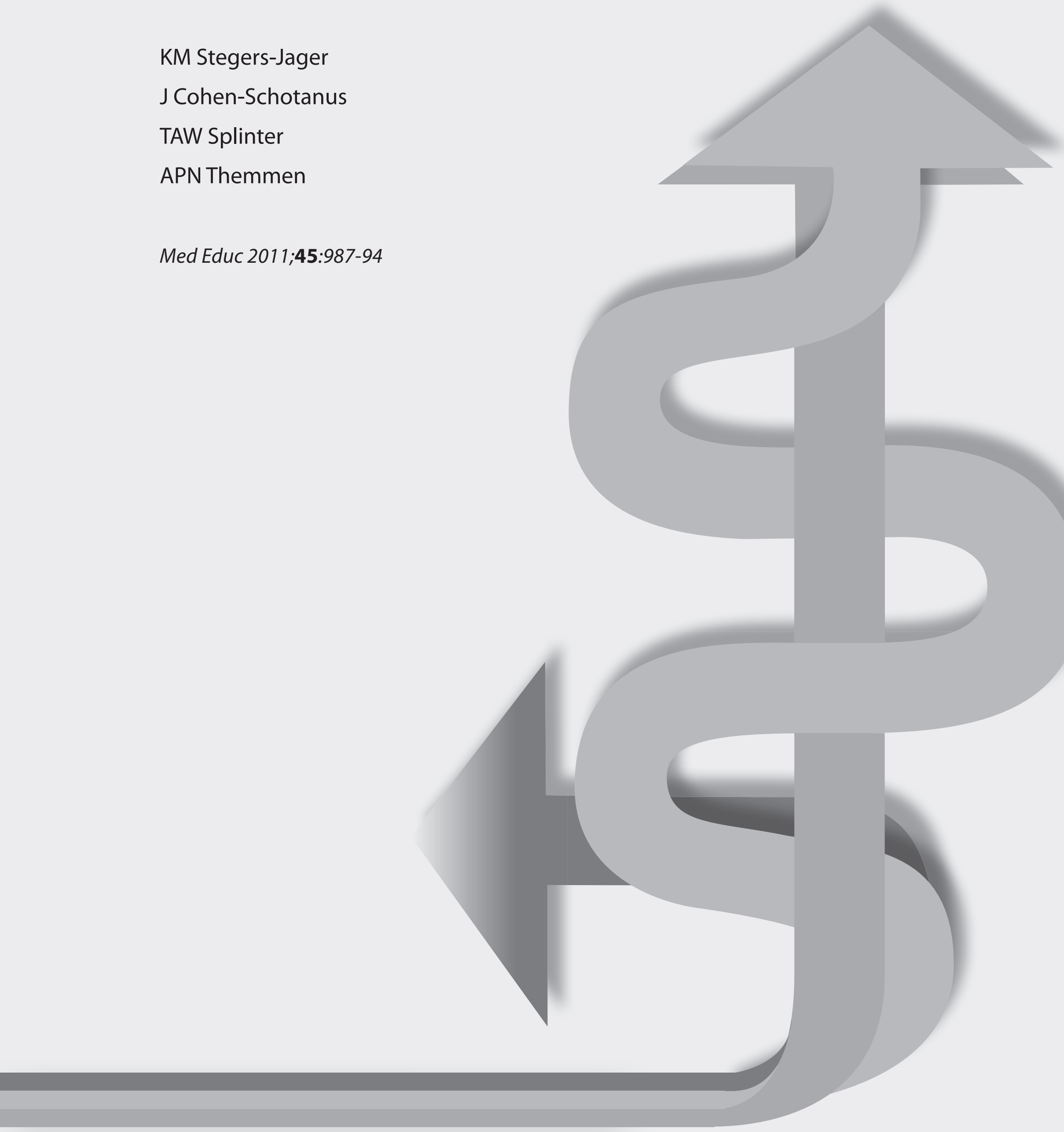

ABSTRACT

Context: Medical students often fail to finish medical school within the designated time. An academic dismissal (AD) policy aims to enforce satisfactory progress and to enable early identification and timely support or referral of struggling students. In this study, we assessed whether the implementation of an AD policy improved study progress in the first 2 years of medical school. Additionally, we analysed its effect on the help-seeking behaviour of struggling students.

Method: We compared two AD cohorts (entering in 2005 and 2006, respectively) and two non-AD cohorts (entering in 2003 and 2004, respectively) on dropout rates, Year 1 curriculum completion rates and the percentage of students with an optimal study rate (i.e. all modules completed) at 1 and 2 years after enrolment. We also measured the effect on study progress of attending the support meetings offered.

Results: The AD (n = 809) and non-AD cohorts (n = 809) did not differ significantly in dropout rate at 5 months, in Year 1 completion rate at 2 years and in the percentage of optimally performing students at 1 year after enrolment. At 2 years after enrolment, more students from the AD cohorts had left and more non-AD students demonstrated optimal performance, but effect sizes (ESs) for these differences were small. Voluntary support at 4 months was attended by AD students more often than by non-AD students (68.9% versus 39.8%; $\chi^2_{(1)} = 43.95$, $p < 0.001$, ES = 0.29). The AD students who attended the support meetings completed the Year 1 curriculum more often than those who did not (73.4% versus 52.5%; $\chi^2_{(1)} = 10.92$, $p < 0.001$, ES = 0.20). Attending the obligatory support meeting at 7 months had a similar effect (70.5% versus 33.3%; $\chi^2_{(1)} = 13.60$, $p < 0.001$, ES = 0.23).

Conclusions: The presence of an AD policy did not lead to earlier dropout, higher completion rates or an improved study rate during the first 2 years at medical school. However, uptake of the support offered increased to almost 70%. Although support participants finished the Year 1 curriculum more often than non-participants, the current support system was not sufficient to improve overall study progress.

INTRODUCTION

Medical schools worldwide increasingly seek measures to improve their students' progress.[1,2] A major motive is the large investment involved in a medical student's training for both the student and society. Lack of study progress can be seen as the result of a mismatch between the student and the academic environment.[3,4] The impact of student-related factors on progress in medical school has been widely studied,[5-7] but less is known about what medical schools can do to create an environment that stimulates students to succeed.[8,9] In this study, we examined whether the implementation of an academic dismissal (AD) policy enables medical schools to improve the study progress of their students.

Over recent decades, many studies have identified factors that affect study progress. Most of these studies used the interaction approach, which assumes that study progress is the result of a complex interaction between a student and the academic and social environments.[10-12] Examples of student-related factors that may hamper progress are initial aptitude, academic procrastination, lack of motivation and inability to adapt to the academic environment.[3,5-7,13-16] More recent studies have reported that characteristics of the academic environment, such as teaching methods and styles, examination rules and the presence of remedial support, also affect study progress.[8,9,13,17-19] Apparently, there are measures medical schools can take to improve study progress, the decisive factors of which seem to be their effects on the study efforts of students.[8,19,20]

The challenge for medical schools is to create an academic environment that stimulates students to maintain satisfactory progress. A first step is to encourage efficient use of individual study time and to prevent students from postponing individual study.[9,13,19] One way of doing this involves intensifying the educational process, such as by introducing a more student-centred curriculum.[19] Other measures that appear to positively influence study progress are instigating regularly programmed examinations, fewer parallel modules and fair, but strict, examination rules.[8,18]

A second step is to identify students who are experiencing academic difficulties and to provide them with timely intervention through access to support programmes or, when appropriate, to refer them to another degree programme. Although the importance of early identification and intervention is well recognised, less is known about successful strategies for identifying and supporting under-performing students.[1,21,22]

A strategy that combines both steps involves the implementation of an AD policy that requires students to make satisfactory study progress. Failure to meet set standards leads first to an academic warning or academic probation and, if the substandard progress continues, will subsequently result in academic dismissal. Students who receive an academic warning or who are on probation are offered academic support to assist them to overcome their academic difficulty. Although AD policies are common at universities in the USA, and lately also at Dutch universities, to our knowledge, little has been published about their effect on study progress.

A pilot study with business administration students showed that an AD policy which dismissed students who achieved < 40 out of 60 credits by the end of their first year led to earlier dropout, higher Year 1 completion rates (from 48% to 55% after 2 years) and improved study progress in the first and subsequent years.[23] It should be noted that this study concerned a degree programme on which completion rates and study progress were relatively low before the implementation of the AD policy. It is not known whether similar positive effects on study progress can be found for degree programmes that already have high completion rates, such as those in medicine.[19]

Therefore, the main objective of the current study was to compare the study progress during the first 2 years at medical school of four consecutive student cohorts, of which two entered before and two entered after the implementation of the AD policy. In addition, we evaluated the extent to which the AD policy helped us to identify and support students with academic difficulties. We investigated whether struggling students in the AD cohorts accessed the support offered more often than struggling students in the non-AD cohorts, and whether accessing the support was related to improved study progress.

METHODS

Context

The present study was carried out at the Erasmus MC Medical School in the Netherlands. The integrated and theme-oriented curriculum of this school was implemented in 2001 and comprises 4 years of pre-clinical study and 2 years of clinical training consisting mainly of clerkships. The first year of the pre-clinical phase serves for student selection and orientation and is composed of three thematic blocks of 7-19 weeks and includes 10 examinations. Each examination qualifies the candidate for a fixed number of credits under the European Credit Transfer System (ECTS). One credit equals 28 hours of study; 60 credits represent the maximum number achievable in 1 year.

Academic dismissal policy

In 2005, Erasmus MC Medical School implemented an AD policy (Table 1). Year 1 students were informed of their academic progress at 4, 7, 12 and 24 months after enrolment. Progress

Table 1 Academic dismissal policy

Time from enrolment, months	Type of action	Substandard (maximum)	Support offered
4	Academic warning	< 10 credits (20.5)	Voluntary meeting with student counsellor
7	Academic warning	< 23 credits (37.5)	Compulsory meeting with student counsellor
12	Academic probation	< 40 credits (60)	Compulsory meeting with student counsellor every 3 months during the second year
24	Academic dismissal	< 60* credits (120)	Possible dispensation for 1 year

* All 60 credits of Year 1 curriculum should be completed

status depended upon the number of credits earned so far and was defined as substandard, average (above standard, but below maximum) or optimal (maximum number of credits). The standard was set at half (at 4 months) and two-thirds (at 7 and 12 months) of the maximum number of credits that could be obtained by that time-point. Substandard progress resulted in an academic warning (at 4 and 7 months), academic probation (at 12 months) or academic dismissal (at 24 months).

The AD policy also included the provision of additional support for students who received an academic warning or were put on probation. At 4 months, these students were invited to a voluntary meeting with a student counsellor to develop a plan for academic improvement. At 7 months, they were invited to a compulsory meeting which focused on planning for the re-examination period. Students whose progress was substandard at 12 months were allowed to repeat Year 1 (probation) only if they had attended the compulsory meeting at 7 months and agreed to discuss their study progress with a student counsellor every 3 months during their second year.

Students with an 'average' status at 12 months were allowed to engage in Year 2 modules alongside their remaining Year 1 module(s). Dispensation from AD was granted to students affected by temporary personal circumstances, such as illness or the death of a close relative. These students were allowed to continue for a further year.

Before the implementation of the AD policy, students whose progress was substandard received an invitation to attend a voluntary meeting with a student counsellor at 4 months and again at 10 months after enrolment. There were no compulsory meetings and students could not be academically dismissed at any time.

Participants

Four consecutive cohorts of Erasmus MC Medical School students were entered into the study; these included two non-AD cohorts (entering in 2003 and 2004, respectively) and two AD cohorts (entering in 2005 and 2006, respectively). These cohorts comprised 406, 403, 407 and 402 students, respectively. Data were derived from the university student administration system and anonymity was guaranteed. As data were collected as part of regular academic activities and only aggregate data are reported, individual consent was not necessary.

Pre-admission variables and outcome measures

Pre-admission variables

To enable valid comparisons, the AD and non-AD cohorts were contrasted on the pre-admission variables of gender, age and pre-university education grade point average (pu-GPA). The latter represented a student's mean grade obtained during the final year of pre-university education. Final grades were based half on school examinations and half on the national examination.

Study progress

We compared the study progress of two AD cohorts and two non-AD cohorts over the first 2 years in medical school. Three outcome measures were used to compare the effect of the AD policy on study progress: (i) dropout rate; (ii) Year 1 curriculum completion rate, and (iii) study rate. Dropout was defined as the proportion of students from the initial cohorts who left medical school voluntarily or were dismissed. Dropout was measured at 5 months, which was considered as 'early dropout', and at 2 years after enrolment. The period of 5 months was chosen because students in the Netherlands who withdraw within this period retain their full entitlement to government grants. The Year 1 curriculum completion rate was defined as the proportion of students from the initial cohorts who earned all 60 credits in the Year 1 curriculum and was measured at 2 years after enrolment. The study rate was defined as the proportion of students who completed all the required modules at 1 and 2 years after enrolment. This proportion was calculated by dividing the number of students who obtained the maximum of 60 credits each year by the number of students who did not drop out during the first 2 years. Students who were given dispensation and students in the non-AD cohorts who did not complete the Year 1 curriculum within 2 years but remained enrolled were also considered as dropouts because a very low proportion of these students can be expected to eventually complete medical school.

Attendance at support meetings

We compared attendance rates at the voluntary support offered at 4 months in the AD and non-AD cohorts. We also investigated whether attending the support options was related to improved study progress for students whose performance was substandard at 4 and 7 months after enrolment. As no data were available on student level for the non-AD cohorts, these analyses were restricted to the AD cohorts. The outcome measure was the number of students who completed the Year 1 curriculum within 2 years of enrolment.

Statistical analysis

Categorical variables were expressed as percentages and continuous variables as mean ± standard deviation (SD). Differences in percentages were tested using chi-squared tests, and differences in means using Student's *t*-test. A p-value of < 0.05 was considered statistically significant. Effect sizes (ESs) were calculated directly from chi-squared tests with ES ≈ 0.10 indicating a small effect, ES ≈ 0.30 a medium effect, and ES ≈ 0.50 a large effect.[24]

RESULTS

Pre-admission variables

There were no significant differences between the AD and non-AD cohorts with respect to gender (61.6% female versus 61.1% female), mean age (19.45 years versus 19.44 years) and pu-GPA (7.03 versus 6.98).

Study progress

The difference between the AD and non-AD cohorts in the proportion of early dropouts was not statistically significant, but the cumulative proportion of students who dropped out – both voluntarily and after being dismissed – at 2 years after enrolment was significantly higher in the AD cohorts than in the non-AD cohorts (Table 2). No significant difference was found between the AD cohorts and non-AD cohorts in Year 1 curriculum completion rate at 2 years after enrolment. As a consequence, significantly more students in the non-AD cohorts (8.5%) than in the AD cohorts (3.0%) who did not complete the Year 1 curriculum on time remained enrolled ($\chi^2_{(1)} = 23.10$, $p < 0.001$, ES = 0.12). Significantly more students in the non-AD cohorts had an optimal study rate at 2 years after enrolment, whereas the difference between the AD and non-AD cohorts in the proportion of students with an optimal study rate at 1 year after enrolment was not statistically significant (Table 2).

Attendance at support

The voluntary meeting offered at 4 months was attended by 104 (39.8%) of the students invited in the non-AD cohorts and by 177 (68.9%) of the students invited in the AD cohorts. This difference was statistically significant ($\chi^2_{(1)} = 43.95$, $p < 0.001$, ES = 0.29). Students in the AD cohorts who accepted the invitation had a higher chance of completing the Year 1 curriculum within 2 years of enrolment than students who refused the invitation (Table 3).

Table 2 Study progress in non-academic dismissal (AD) and AD cohorts during first 2 years at medical school

	Cohort				Statistics		
	Non-AD		AD				
	n	%	*n*	%	X^2	p	ES
Completion of Year 1 curriculum*							
≤2 years of enrolment	686	84.8	705	87.1	1.85	NS	
Dropout*							
≤5 months of enrolment	4	0.5	10	1.2	2.59	NS	
≤2 years of enrolment	57†	7.0	88‡	10.9	7.28	< 0.01	0.07
Optimal performance§							
At 1 year (60 credits)	487	71.3	470	67.4	2.43	NS	
At 2 years (120 credits)	384	56.2	311	44.6	18.58	< 0.001	0.12

* Percentage of all students from initial cohort.
† Three students withdrew despite having completed the Year 1 curriculum; 69 students did not withdraw, bit did not complete the Year 1 curriculum
‡ Eight students withdrew despite having completed the Year 1 curriculum; 24 students were given dispensation
§ Excluding dropout in Years 1 and 2
ES = effect size; NS = not significant

Table 3 Attendance at support meetings and rate of completion of Year 1 curriculum within 2 years in academic dismissal (AD) cohorts

		Completion of Year 1 curriculum ≤ 2 years				
		AD students		Statistics		
		n	%	X^2	p	ES
At 4 months (voluntary)	Present	130	73.4	10.92	< 0.001	0.20
	Absent	42	52.5			
At 7 months (compulsory)	Present	167	70.5	13.60	< 0.001	0.23
	Absent	8	33.3			

ES = effect size

In all, 237 (90.8%) of the 261 invited students in the AD cohorts attended the compulsory meeting offered at 7 months. These students completed the Year 1 curriculum within 2 years of enrolment more often than students who did not use the support (Table 3).

DISCUSSION

This study indicates that instigating an AD policy for medical students does not lead to earlier dropout, or to an increased Year 1 completion rate or an improved study rate during the first 2 years at medical school. Although we report several statistically significant differences, the impact of an AD policy on dropout rates and optimal performance is modest. However, there are some practically relevant implications for the help-seeking behaviour of struggling students: the possibility of AD increased participation in the study support offered from 40% to almost 70%, and participants more often completed their Year 1 programme on time.

A possible explanation for our failure to find a positive influence of the AD policy on the study progress of medical students is that the setting of standards also influenced the study behaviour of students whose study progress was satisfactory. As a result, these students may have reduced their study effort as soon as they had obtained the minimum number of credits required. If failing no longer has any clear consequences, other student activities may take precedence over test preparation.[8] In order to improve the study progress of this group, a better option may be to stress the benefits of an optimal study rate, rather than focusing on the minimum standards required.

An additional explanation for the small negative effect on study rates in Year 2 is that, rather than causing students to increase their overall study effort, the new policy caused them to change their study priority and to focus primarily on completing the Year 1 modules. As a result of this change in priority, AD students made less progress in Year 2 modules than did non-AD students. It thus appears that the AD policy induced a greater focus on the Year 1 curriculum and encouraged greater use of study time for this purpose. This behaviour is in line with findings from other reports which suggest that, because study time is limited, parallel examinations compete with one another for study time.[9,18,19,25]

As well as academic dismissal, the policy comprises two warnings and a probation measure for those students who continue to under-perform in the first year after enrolment. The first warning, provided to students who show substandard progress at 4 months, included an invitation to a voluntary meeting with a student counsellor. On the basis of our results, we conclude that students who accepted this invitation had a much higher chance of succeeding than those who refused it. Although this effect of early warning may be explained by the design of the support system provided by the student counsellors, we cannot exclude the possibility that a self-selection mechanism is at work and that students who are more committed accept the invitation to visit the student counsellor. As the Year 1 completion rate did not increase, the latter explanation appears more plausible. For a subgroup of students, self-reflective behaviour was thus stimulated by AD policy. Nevertheless, this did not always lead to the desired outcome: not all students who needed the support accepted the offer. This reluctance to seek help has been confirmed by other authors.[22,26] For example, Malik reported that 50% of failing students at Dundee Medical School did not seek help from any source.[26]

In addition, other types of support may have been more appropriate for improving the study progress of those who accepted the offer. As the quality rather than the quantity of study hours seems to be the problem for these students, measures focused on improving academic or test competence may be more effective.[27,28] However, such study skills interventions should be content-specific, should focus on the specific problems of the students and should be delivered by the instructor(s) involved or by well-trained senior students.[17,22,26,29]

An obvious positive result of our AD policy is that fewer students without a real prospect of success continue at medical school. However, a disadvantage of the 2-year decision period in our AD policy is that these students still invest 2 years in training before they are dismissed. Apparently, the possibility of dismissal does not incite students to withdraw voluntarily at an earlier stage more often. Future efforts should therefore focus on distinguishing early in Year 1 between students who are willing and able to be remediated and students who will be better off transferring to another degree programme. Making this distinction requires data on factors additional to study progress, such as willingness to participate in support programmes, as suggested by our results. Other factors might include procrastination, motivation, self-efficacy, learning styles and passive learning behaviour.[5,13,15,28,30,31] As data on these factors are not readily available, we aim to collect these with questionnaires early in Year 1 for use in future studies.

The strength of this study refers to its inclusion of four complete cohorts and a prospective design, which allowed us to include dropouts. A possible limitation is the use of historical controls rather than a truly experimental design. However, the cohorts did not differ in age, sex and pu-GPA, and the curriculum did not change over the period of interest. In addition, the results of this study were based on the interaction of students at Erasmus MC Medical School with that school's curriculum. Although specific characteristics of our curriculum may have influenced the results, the cohorts were representative of all Dutch medical students with regard to entrance variables and Year 1 completion rates.[8]

A practical implication of this study for other medical schools is that it may give rise to questions about whether implementing an AD policy is worth the effort, given the already high completion rates. Setting minimum standards will probably not increase Year 1 completion rates any further nor improve the study progress of students, but it will increase demand for support. Possible positive outcomes are the prevention of some students from pursuing their study without a real prospect of success and the possible identification of a group of at-risk students who are willing to accept support. Some adaptations might be considered before the implementation of an AD policy. Firstly, the type of support offered to students with academic difficulties should be carefully considered. Future research should aim to demonstrate whether, for example, a short, integrated study skills programme might be more effective.

Secondly, any AD policy should focus on the earlier identification and subsequent referral of those students who might be better off elsewhere. Again, future studies will need to demonstrate which factors can be used to improve this identification. Thirdly, standards might be raised in order to examine whether this will improve study progress. Non-struggling students, in particular, might be expected to demonstrate the ability to improve their study progress if they are stimulated to do so. Finally, the policy might be designed to dismiss all students who fail to meet set standards at 1 year after enrolment. This strategy is used at several Dutch universities. However, before decisions about adaptations can be made, each medical school must resolve the issue of whether it is preferable to invest in students who may eventually fail to finish medical school or to dismiss students who may eventually become good doctors.

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Chapter 6

The effect of a short integrated study skills programme for first-year medical students at risk of failure: a randomised controlled trial

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ABSTRACT

Background: There is a need for outcomes-based studies on strategies for supporting at-risk medical students that use long-term follow-up and contemporaneous controls.
Aims: To measure the effect of a short integrated Study Skills Programme (SSP) on the study progress of at-risk medical students.
Method: First-year students identified as at-risk of academic failure at 7 months after enrolment were invited to participate in the randomised-controlled-trial. Participants were randomly assigned to the SSP group or to a control group receiving standard academic support. Effects of SSP were measured on the short (= passed first exam after intervention), medium (= obtained enough credits to proceed to second year) and long term (= completed first-year curriculum within two years).
Results: SSP participants (*n* = 43) more often passed the first exam after the intervention than controls (*n* = 41) (30% versus 12%; $\chi^2_{(1)} = 4.06$, $p < 0.005$, ES = 0.22), in particular those who had previously passed at least one exam. No medium or long-term effect was found. Participants who had attended 4 or 5 SSP sessions outperformed those who had attended fewer sessions on all outcome measures.
Conclusion: A short, integrated study skills programme benefitted some, but not all students. Our advice is to focus support efforts on at-risk students who have demonstrated commitment and academic potential.

INTRODUCTION

As not all students cope successfully with the demands of medical school, this may result in study delay or dropout. Medical schools that wish to reduce delay or dropout will need to provide timely support to students who are experiencing academic difficulties. Despite the fact that the importance of early intervention is well recognised, little is known about effective strategies for supporting at-risk medical students.[1-3] In this study, we explored the efficacy of a short study skills programme for first-year medical students who are at risk of failure.

Most medical schools provide some form of academic support,[4,5] but there appears to be no consensus on the best approach to help underperforming medical students. Moreover, the support provided does not always meet the needs of those seeking assistance.[6] Recently, several authors have tried to offer guidance on how to support underperforming medical students, based on surveys, literature or the learning sciences. The consensus seems to be that successful support programmes should be focused on both skills development and content boosting.[5,7] However, evidence of the effect of such programmes on medical school performance is scarce.[5,8,9] Winston *et al.* reported positive effects of a mandatory cognitive skills programme for students who had failed and subsequently repeated their first semester.[10] In a follow-up study they concluded that this programme was successful since it (i) challenged students' conceptions of learning, (ii) had a group-based approach with skilled facilitators and (iii) took into account a blend of motivational and cognitive factors and the complex interplay between the student and the learning environment.[11] Others suggested that study skills interventions should be content-specific and be focused on the specific problems of individual students.[1,12-14] According to Hauer *et al.*, we can learn from the learning sciences that remediation activities should offer opportunities for deliberate practice followed by feedback, in order to gain knowledge and to develop skills.[2]

Despite recent efforts described in the medical education literature, still little is known about the effectiveness of support.[2] A first reason is that studies evaluating support efforts often lack a long-term follow-up.[2,15] Hattie *et al.* distinguished between study skills interventions aimed at enhancing performances that were either closely related – near transfer – or distantly related to the training task – far transfer.[12] In other words, study skills interventions can be aimed at passing a specific (subsequent) exam, or at acquiring generic study skills in order to enhance performance at future exams. Especially the latter is difficult to achieve, as was recently shown by Pell *et al.*[16]

Another reason for the uncertain outcomes of support programmes is the often less than optimal study design used in intervention studies. Several studies revealed positive outcomes for support programmes; however, they either had small sample sizes,[14,17] had to rely on historical controls,[10] or were restricted by a retrospective design.[18] A recent review on remediation practices across the continuum from medical school to practice yielded surprisingly few studies evaluating remediation efforts and none of these included a contemporaneous control group of low performers who did not receive remediation.[2]

Therefore, the main objective of the current study was to measure the effect of a short integrated study skills programme on the study progress of 'students at risk'. This study adds to previous studies by utilising a randomised controlled design to study the short, medium and long-term benefits of an academic support programme for students who were considered most at risk of failure based on their first-semester results.

METHOD

Context

This study was performed at the Erasmus MC Medical School, Rotterdam, the Netherlands. The integrated and theme-oriented curriculum of this school comprises a 3-year bachelor degree course followed by a 3-year masters degree course. The first year of the Bachelor of Medicine is divided into three thematic blocks of 11–16 weeks and includes nine written examinations. One resit per examination is offered in the summer. Each examination qualifies the candidate for a fixed number of credits under the European Credit Transfer System (ECTS). One credit equals 28 hours of study; 60 credits represent the maximum number achievable in 1 year.

In 2005, Erasmus MC Medical School implemented an Academic Dismissal policy requiring students to make satisfactory study progress.[19] Failure to meet set standards leads first to an academic warning (at 4 and 7 months) or academic probation (at 12 months) and then, if the substandard progress continues, to academic dismissal (at 24 months). Students whose progress is substandard at 7 months – at-risk students – are informed that they have to attend an academic guidance interview with a student counsellor.

Study design

This study was a parallel-group randomised controlled trial (RCT), in which the standard academic support – the academic guidance interview – was compared to a combination of the standard support and a newly developed short integrated Study Skills Programme (SSP).

Participants and procedure

Students of the 2008 and 2009 cohorts who were identified as most at risk of academic dismissal at seven months after enrolment, were invited to participate in the RCT (n = 88 and 57). Students were defined as most at risk when they had failed at least one of the first three exams and also had failed both exams 4 and 5. We chose these two criteria on the basis of data of five preceding cohorts, which showed that students who met both criteria had a chance of 0.63 to fail to meet the standard set at 24 months.[20] Trial participants were allocated to the SSP group or a control group by stratified random sampling. Stratification was based on the number of exams passed at seven months after enrolment (either 0 or 1-2).

Data on academic progress were derived from the university student administration system. The study was carried out in accordance with the Declaration of Helsinki. Participation was voluntary, written informed consent was obtained from all participants, and anonymity was guaranteed. No plausible harm to participants could arise from our study. According to Dutch law, this study was exempt from ethical approval requirements.

Sample size calculation

Based on results from previous cohorts of first-year students at Erasmus MC Medical School the expected group size for eligible participants was about 60. In the past years, about 39% of this group of students passed the first-year programme within two years. To detect an increase in passing rate of 30% – which is in agreement with the study of Winston *et al.*[10] – with a two-sided 5% significance level and a power of 80%, a sample size of 57 students per group was necessary, given an anticipated dropout rate of 10%. To recruit this number of students we planned two runs of the trial (each with an expected number of 60 participants), in May/June 2009 and May/June 2010.

Standard academic support

Students in both the SSP and control groups received the standard academic support: they had to attend a 30-minute academic guidance interview with a student counsellor. The semi-structured interviews focused on issues such as causes for academic failure and plans for the re-examination period. Students were encouraged to reflect on their current study approaches and to generate a remedial action plan. Where appropriate, students were informed about generic study skills courses, such as dealing with test anxiety or tackling procrastination.

Study Skills Programme

In both runs, students in the SSP group were divided into two study groups, which met on five Fridays for 1.5 hours during the May/June course. Each session began with participants taking a multiple-choice quiz, which contained 10 pre-existing questions on the study material of the past week. In consultation with the teaching staff, the most relevant questions for each study week were selected from an existing item bank, containing items from previous exams. The results on the quizzes were used to structure further discussion: difficult test items were explained step-by-step to demonstrate good study strategies and to identify any fallacies. This first part of the sessions was mainly aimed at content boosting (i.e. near transfer). The second part of the group sessions was focused on awareness and diagnosis of the individual causes for academic failure and on practicing various study skills, including time management, previewing, creating study guides and test taking. Students were provided with a syllabus, including handouts on study skills and assignments to complete either during the group sessions or at home. This second part of the sessions was aimed more at developing skills (i.e. far transfer). Participants were expected to attend all five sessions; therefore attendance was registered.

Second- to fourth-year medical students were recruited as study group leaders. Eligibility criteria included a good grade in the relevant subject area and previous teaching experience. The study group leaders completed a half-day training session which covered relevant study skills and strategies, and programme logistics. They received standard compensation for teaching assistance.

The study skills programme was carefully designed taking educational experience and multidisciplinary theory and practice into account. Previous research has shown that a study skills programme should take place in the first year, be content-specific and tied to the current study subject, be delivered by the instructor(s) involved and focus on the specific problems of individual students.[12,13,21,22] The use of well-trained senior students as 'role models' can also have positive effects.[13] Moreover, a study skills programme should be of good educational quality, reflect on current study approaches, demonstrate the different steps of a good study strategy, involve practice in diverse contexts and provide adequate feedback.[22] Finally, awareness and diagnosis of the individual causes of academic failure can lead to changes in study behaviour.[22]

Our integrated study skills programme fitted these guidelines: it was scheduled during the first year, was linked to a specific subject of study (May/June course), supported students in identifying their specific study problem and offered them tips and training focused on this particular problem. A deviation of the guidelines was the use of senior students instead of instructors; nonetheless, the instructors played a crucial role in designing the training material. Moreover, as stated above, a positive effect was expected from the use of well-trained senior students as role models. The syllabus and handouts were partly based on those developed by Winston *et al*.[10]

Baseline characteristics and outcome measures

Baseline characteristics

To enable valid comparisons, the control and SSP groups were contrasted on the baseline characteristics of gender, age, pre-university education grade point average (pu-GPA), and the number of exams passed at 7 months. pu-GPA represented a student's mean grade obtained during the final year of pre-university education. Final grades were based half on school examinations and half on the national examination.

Study progress

The main outcome measure of the study was study progress at the short, medium and long-term. The short-term outcome measure was 'passed the first exam after the intervention', the medium-term outcome measure was 'obtained enough credits to proceed to the second year' and the long-term outcome measure was 'completed the first-year programme within 2 years'. To proceed to the second year a minimum of 40 credits is required; the complete first-year programme consists of 60 credits. We also explored the effects of the number of exams passed at baseline and of the number of sessions attended.

Statistical analysis

Categorical variables were expressed as percentages and continuous variables as mean ± standard deviation (SD). Differences in percentages were tested using chi-squared tests, and differences in means using Student's *t*-test. The Breslow-Day test for homogeneity of odds ratios was used to explore whether there was an interaction between the number of exams passed at baseline and the treatment effect. A p-value of < 0.05 was considered statistically significant. Effect sizes (ESs) were calculated directly from chi-squared tests with ES ≈ 0.10 indicating a small effect, ES ≈ 0.30 a medium effect, and ES ≈ 0.50 a large effect.[23]

RESULTS

Characteristics of the participants

In 2009, 57 at-risk students (65%) consented to participate in the study and were allocated to one of the two groups; in 2010, this number was 27 (47%) (Figure 1).

There were no significant differences between the SSP group and the control group with respect to gender, mean age at the start of medical school, pu-GPA and the number of exams passed at 7 months after enrolment (Table 1).

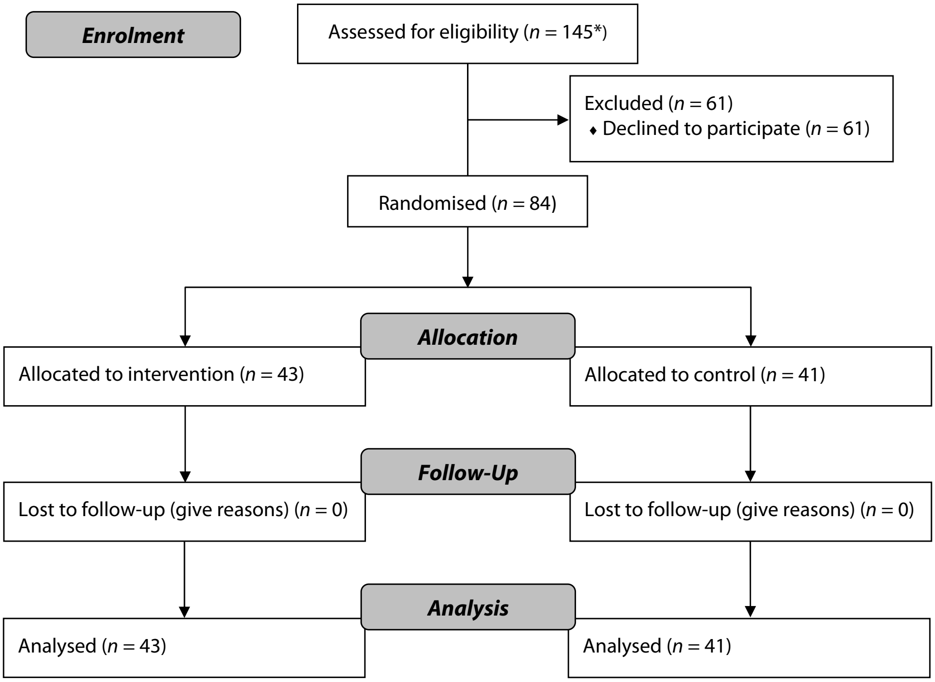

Figure 1 Participant flow. * Eighteen percent of all first-year students entering in 2008 (*n* = 408) and 2009 (*n* = 409)

Table 1 Characteristics of participants by study arm at baseline

	SSP group (*n* = 43)	Control group (*n* = 41)	Total	p-value
Mean age (SD), years	19.48 (1.00)	19.58 (1.79)	19.52 (1.45)	NS
Female sex, *n* (%)	26 (60.5)	23 (56.1)	49 (58.3)	NS
Mean Pre-university GPA (SD)	6.65 (0.44)	6.62 (0.39)	6.64 (0.42)	NS
Number of exams passed at 7 months, *n* (%)*				NS
0	23 (53.5)	19 (46.3)	42 (50.0)	
1-2	20 (46.5)	22 (53.7)	42 (50.0)	

* Maximum number of exams passed at 7 months is 5
SSP = study skills programme; SD = standard deviation; GPA = grade point average; NS = not significant

Study progress

Significantly more students in the SSP group than in the control group passed the first exam after the intervention (Table 2). Subgroup analysis revealed that there was an interaction between the number of exams passed at baseline and the effect of SSP: mainly students who had passed at least one exam before taking part in SSP benefitted on the short term (Breslow-Day test: $\chi^2_{(1)} = 10.32$; p = 0.001). For this particular group of students, significantly

Table 2 Academic progress of SSP participants, compared to controls

	Group				Statistics		
	SSP (*n* = 43)		Control (*n* = 41)				
	n	%	*n*	%	X^2	p-value	ES
Short term							
Passed first exam	13	30.2	5	12.2	4.06	< 0.05	0.22
Medium long term							
Proceeded to 2nd year	10	23.3	10	24.4	0.02	NS	
Long term							
1st year completion ≤ 2 yrs	21	48.8	20	48.8	0.00	NS	

SSP = study skills programme; ES = effect size

more students in the SSP group (12; 60.0%) than in the control group (2; 9.1%) passed the first exam after the intervention ($\chi^2_{(1)}$ = 12.22; p = 0.001; ES = 0.54). For students who had failed all exams before taking part in the intervention, the difference between the SSP and control groups was not significant. As to the medium and long-term outcomes, no statistically significant differences were found between the SSP and control groups on the number of students that were allowed to proceed to the second year, or the number of students that completed their first-year programme in time (Table 2).

Although students in the SSP group consented to attend all five sessions, only 22 (55%) of them actually attended at least 4 of the 5 sessions. Students who attended at least 4 sessions more often passed the first exam after the intervention than students who attended 1-3 sessions (Table 3). They were also more often allowed to proceed to the second year, and more often completed their first-year programme in time.

Table 3 Academic progress of SSP participants, by attendance

	Attendance SSP				Statistics		
	0-3 (*n* = 21)		4-5 (*n* = 22)				
	n	%	*n*	%	X^2	p-value	ES
Short term							
Passed first exam	2	9.5	11	50.0	8.35	< 0.01	0.44
Medium long term							
Proceeded to 2nd year	2	9.5	8	36.4	4.34	< 0.05	0.32
Long term							
1st year completion ≤ 2 yrs	6	28.6	15	68.2	6.75	< 0.01	0.39

SSP = study skills programme; ES = effect size

DISCUSSION

This randomised controlled trial indicates that the addition of a short integrated Study Skills Programme (SSP) to the standard academic support shows short-term gains for a subgroup of at-risk students. More specifically, SSP participants who had passed at least one exam before the intervention benefitted in the short term compared to controls. Participants who attended at least 80% of the SSP sessions outperformed those who attended fewer sessions on the short, medium and long term.

The short-term gains found for our study skills programme support the findings of previous studies that did not use a randomised and controlled design.[10,18,24] Despite the evidence for near transfer, our study skills programme failed to achieve far transfer. A possible explanation is that the participants were not able to use the knowledge and skills acquired during SSP in later subjects. Such transfer of knowledge and skills to new contexts is generally known to be difficult to achieve.[25] The challenge remains to find a good balance between teaching study skills in context, which is known to enhance performance, and enabling transfer of learned knowledge and skills to other contexts.

An additional explanation for the absence of medium and long-term effects – despite a positive short-term effect – might be that, rather than causing students to adopt new study skills, the intervention successfully restructured the learning environment by giving students frequent tasks and deadlines. Frequent tasks and deadlines make it easier for students to self-regulate their learning and increase their extrinsic motivation.[26] Especially weekly quizzes have been suggested to be successful in 'forcing' students to seriously study on a timely basis. As time management is one of the main problems for medical students,[6] future efforts should be aimed at exploring how this positive effect can be maintained beyond the duration of the intervention.

A final possible explanation for the lack of medium and long-term effects refers to the duration and the timing of the programme. It might be that our programme was too short to change study skills that students had previously acquired, usually over many years of education. Nevertheless, feedback from individual SSP participants revealed that in some cases the five sessions were sufficient. We deliberately offered the programme later in the year in order to be able to identify students who were most at risk of failure and ensure sufficient time for the need for help to become manifest. However, others have claimed that interventions should be offered as early as possible.[27,28] We agree with Winston *et al.*, that further research is needed into the duration and timing of study skills interventions.[10] As suggested by Saxena *et al.*, multiple types of support are probably required to effectively address the variety of at-risk students' needs.[29]

Our study revealed that SSP participants who had passed at least one exam before the intervention benefitted in the short term, while those who had not passed any exam did not. Possibly, a certain basic level of knowledge and skills is needed on which the programme can build. An implication of this finding is, that medical schools should consider carefully whom to invite for study skills interventions. Should the attention be focused on the most academically needy students – those who have failed all exams – or should it be shifted to students who have demonstrated academic potential – by passing at least one exam – who are more likely to benefit from limited support? The trend to shift the attention to more capable students – in the 1990s suggested by Muraskin[30] – appears to become more widespread in educational practice, since these students are likely to be able to use limited resources available to greatest advantage.

In line with the results of earlier studies,[10,30] increased attendance in the support programme was correlated with improved performance, both in the short and longer term. Although it might be tempting to enforce participation, or at least to strongly encourage participation, we are not totally convinced that this will yield the desired result. So far, mandatory study skills programmes have shown conflicting results.[10,28] It may be that, rather than the high attendance itself, student characteristics that lead to this high attendance cause the improved outcomes. As an example, it might be that students who succeed in attending all five sessions are better in time management or more committed to the medical course than those who fail to attend all sessions. Previous research has found strong relationships between participation in scheduled learning activities, motivational beliefs, learning strategies and first-year performance.[31] Future studies may want to investigate the relationship between attendance in support programmes and self-regulated learning skills.

The small sample size and the modest adherence to the intervention protocol may limit the conclusions on the utility of the intervention. The nature of the intervention also made it impossible to blind participants. Finally, there was an inevitable risk of contamination in this trial. Although control group students were not allowed to attend the SSP sessions, we do not know to what extent the SSP group students shared SSP material with their fellow students. On the other hand, in this study the previously reported methodological limitations were overcome by using a randomised and controlled protocol rather than historical controls, and by considering short, medium and long-term effects. Moreover, the trial was run twice in order to obtain an acceptable sample size.

CONCLUSION

We used a randomised controlled trial to determine the effect of a short integrated study skills programme on the study progress of 'students at risk'. The results of our study suggest that offering a short, integrated study skills programme to at-risk students benefits some, but not all students. The advice for medical schools is to focus support efforts on at-risk students who have demonstrated commitment and academic potential on the medical course.

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Chapter 7

Discussion

Medical schools worldwide seek measures to improve their students' progress. Lack of study progress can be seen as the result of a mismatch between the student and the academic environment.[1] To prevent study delay, medical schools need to identify students who are experiencing academic difficulties and to provide them with timely intervention through access to support programmes. Although the importance of early identification and intervention is well recognised, less is known about successful strategies for identifying and supporting struggling students.[2] The five studies reported in this thesis add to the existing literature by investigating student-related factors that could be used to identify at-risk students (Chapters 2-4) and by exploring the effectiveness of strategies to support them (Chapters 5-6).

METHODOLOGICAL CONSIDERATIONS

A first strength of this thesis is its relevance. Recent changes in Dutch higher education funding have further increased the importance of graduating within the designated time for both medical schools and students. From the 2012/2013 academic year three new measures will become effective: (i) students who exceed the official three-year programme with more than one year will be fined; they have to pay an additional tuition fee, (ii) students are only allowed to start their masters degree course after finishing their bachelors degree courses, (iii) master students receive student loans instead of grants. In addition, the Dutch government has recently decided to increase the number of admissions to medical schools and to abolish the national lottery system. Consequently, a well-informed selection of students who are most likely to complete the medical course - both before and after admission – becomes crucial. This thesis meets the current need of (Dutch) medical schools for guidance on encouraging satisfactory study progress and on identifying and supporting failing students.

A second strength of this thesis is its methodological rigour, which is reflected in the use of various quantitative methods and large datasets. We used several different quantitative research designs, including longitudinal prospective cohort studies (Chapters 3 and 4) and experimental designs with historical controls (Chapter 5) or contemporaneous controls (randomised controlled trial, Chapter 6). Using longitudinal designs is uncommon in studies on factors associated with academic performance in medical school.[3] Similarly, support interventions are rarely evaluated using randomised controlled trials.[4] In this thesis we also used several data analysis techniques, including the structural equation modelling technique. This powerful technique, which combines correlation, regression, factor analysis and analysis of variance, enabled us to test the significance of hypothesised relationships between motivational beliefs, learning strategies, participation and Year 1 performance (Chapter 4). An additional strength of the study in Chapter 4 was that the derived model was cross-validated using a second independent sample from the same population. This approach, which is used to reduce the risk of over-fitting, is rarely reported in medical education literature. In the studies reported in this thesis we used data from a large number of students, ranging from two nearly complete year cohorts (Chapter 4) to six entire year cohorts (Chapter 3). The only exception is the randomised controlled trial described in Chapter 6. The design of this study (randomised, voluntary and focused on a specific group) made a large number of participants infeasible. Nonetheless, the trial was run twice in order to obtain an acceptable sample size. The high response rates reported in Chapter 3 (86-95%) and Chapter 4 (77-91%) further add to the reliability of the thesis' outcomes.

To increase the general value of the findings described in this thesis and to exclude possible local effects of Erasmus MC Medical School, the studies need to be repeated at other medical schools. All studies reported in this thesis were grounded in theory, the findings were in line with those of other studies and the cohorts were representative of all Dutch medical students with regard to entrance variables (gender, age and pre-university GPA) and Year 1 completion rates.[5] Nevertheless, specific characteristics of the Erasmus MC curriculum may have influenced the results. Therefore, we would like to encourage investigators at other medical schools to replicate our studies, in particular in settings in which learning is more active, such as in problem-based learning (PBL) curricula.

TOWARDS A CONTINUUM OF ACADEMIC AND BEHAVIOURAL SUPPORT

The aim of this thesis was to early identify struggling students and to determine what medical schools can do to help them. Our findings suggest that it is not as simple as detecting the worst-performing students and offering them study skills training. As suggested in Chapter 6, the question is rather which students are most likely to benefit from support than which students are most in need of academic support. Based on the findings reported in this thesis, we propose an integrated school-wide approach for medical student success, comprising a continuum of academic and behavioural support (Figure 1). This continuum was inspired by the Positive Behavioural Interventions and Supports (PBIS),[6] a school-wide approach which has shown positive effects at primary and secondary schools in the USA and Norway, and which is increasingly being implemented in Dutch schools.

Two types of support

A first premise for such an integrated approach is that two types of support are required to prepare medical students for the next level of training: academic and behavioural support. Although the results of the studies in this thesis confirm the finding that early academic performance predicts later performance,[3,7,8] the results also suggest that data on students' behaviour might aid identifying at-risk students. We found that exam participation (Chapter

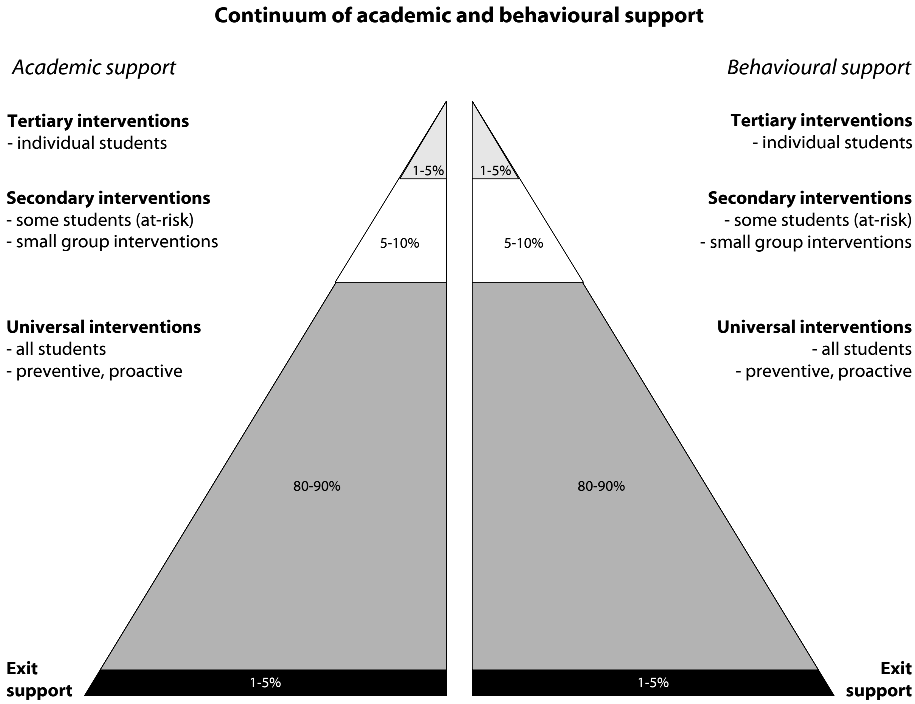

Figure 1 Continuum of academic and behavioural support

2), participation in scheduled learning activities (Chapter 4), and participation in support offered (Chapters 5 and 6) were associated with performance at medical school. Non-participation can be seen as a form of unprofessional behaviour. Professional behaviour, or professionalism, is increasingly considered important to both medical students and practising doctors.[9,10] Others have also reported that unprofessional behaviour as a student may be associated with poorer performance[11,12] and even with deficiencies in later professional life.[13] In addition to poor attendance, examples of students' unprofessional behaviours are inappropriate behaviours towards others, lack of commitment, or even very practical issues such as failure to complete Hepatitis B vaccination schedules on time.[14] Given the importance of professionalism, medical schools should focus their support on improving both student academic and behavioural outcomes.

Different levels of support

A second premise for this integrated approach is that support should be offered at different levels or tiers (see Figure 1). Tier 1 interventions are universal; they are provided to all students to prevent academic and behavioural problems. It is expected that 80-90% of the students respond to Tier 1 interventions. Tier 2 interventions are specially designed group interventions aimed at at-risk students. The estimation is that about 10-15 percent of students needs Tier 2 level interventions to be successful at medical school. Tier 3 interventions are individualised and tailored to meet the unique needs of individual students. This may be students with intensive academic and/or behavioural problems, but also students who combine medical school with a professional sports or musical career or students who are student board members (1-5% of the students). Following the findings in this thesis, we added a Tier 0 to the original PBIS continuum, consisting of exit support (e.g. exit interviews, careers counselling) for students who will be better off transferring to another degree programme.

Examples of Tier 1 academic interventions include the use of evidence-based educational practices. The results presented in Chapter 4 suggest that encouraging participation and strengthening self-efficacy comprise good educational practice, as higher levels of participation and self-efficacy are positively related to medical students' performance. The short integrated study skills programme described in Chapter 6 can be seen as an example of a Tier 2 academic intervention. A very different example is an honours class for excellent students as currently offered at several Dutch medical schools. An example of a Tier 3 intervention is offering additional individual skills lab sessions for students who are struggling with anatomy.

Tier 1 behavioural interventions establish and provide methods to teach all students how to display expected behaviours, proactively pre-correct students and acknowledge students for exhibiting expected behaviours.[6] Therefore, the first step for medical schools is to create uniform behavioural expectations for their students. In addition, there is a need for setting up sensitive methods for detecting unprofessional behaviour and clear strategies for dealing with it.[15,16] At Erasmus MC Medical School we have recently implemented a programme for longitudinal assessment of professional behaviour. This programme has two aims: (i) to provide students with feedback, so they can reflect on their professional behaviour and improve it where necessary, (ii) to early detect students who show unprofessional behaviour or attitudes. Tier 2 behavioural interventions include specially designed small-group counselling interventions such as communication skills training, assertiveness training, or training in tackling procrastination. Tier 3 behavioural interventions include individualised intervention plans to meet the unique needs of students who exhibit chronic problematic behaviours, which might include 'time out' and/or professional help.

Communicating expectations: academic dismissal policy

Communicating expectations to students, which has already been mentioned, is a third premise of the integrated approach. Communicating behavioural and academic expectations can be seen as a prerequisite for commitment. The implementation of an Academic Dismissal policy is an example of a Tier 1 intervention aimed at communicating academic expectations for all students. Unfortunately, this intuitively appealing policy failed to show anticipated positive effects on students' progress: it did not lead to earlier dropout, higher completion rates or an improved study rate during the first 2 years at medical school (Chapter 5). A possible explanation is that wrong expectations are communicated to students: an AD policy focuses on minimum standards rather than on the benefits of an optimal study rate. Therefore, as a first suggestion, medical schools might raise the standards in order to examine whether this will improve study progress. Non-struggling students, in particular, might be expected to demonstrate the ability to improve their study progress if they are encouraged to do so. The ultimate example is the introduction of a *jaarklassensysteem* – in which students who fail to complete the Year 1 course within one year are dismissed – which has recently been implemented at Erasmus University Rotterdam. A prerequisite for introducing such a system is that medical schools encourage and facilitate students to meet the standard by providing feasible study programmes, student-centred learning and timely feedback on examinations, and by introducing compensation between examinations. An alternative would be not to dismiss students who fail to meet the 60 credits standard, but to let them repeat the year, as is common in for example US medical schools[17-18] and Dutch pre-university education. In both cases there are clear consequences for students whose study progress is not optimal. Perhaps this is the incentive that encourages students to complete all Year 1 modules within one year.

A second suggestion is to optimise the standard for the first year rather than to add a standard for the second year of enrolment. In addition to a minimum standard for the first year of enrolment, several Dutch institutions apply a so-called 'p-in-2' rule requiring students to finish their Year 1 course ('p') within two years. It is questionable whether it makes sense to apply such an additional standard after two years of enrolment. The rationale behind this standard is that failed Year 1 modules might otherwise 'haunt' students during the remainder of pre-clinical course. However, most students are dismissed during their first year,[19] and the second-year standard appears to negatively affect progress in Year 2 modules (Chapter 5). Therefore, future research should focus on determining an optimal first-year standard. However, before decisions about an optimal standard can be made, medical schools must resolve the issue of whether it is preferable to invest in students who might eventually fail to finish medical school or to dismiss students who might eventually become good doctors.

Identification of at-risk students

A fourth premise for the integrated support approach is the timely identification of at-risk students who will benefit from the different types of support. A first step in the identification of at-risk students is to distinguish early in the first year between students who are willing and able to be remediated and students who will be better off transferrring to another degree course. Current Dutch legislation prescribes that students may only be dismissed at the end of their first year. However, it is questionable whether this is in the interest of both the medical school and the student. Perhaps 'not later than at the end of the first year' would be more in line with good educational practice. To determine for which students an early withdrawal (after the first semester) seems the most logical choice, medical schools should extend study progress data with data on pre-admission characteristics (Chapters 2 and 3), participation in exams and scheduled learning activities (Chapters 2 and 4), motivational beliefs and learning strategies (Chapter 4), acceptance of support (Chapters 5 and 6) and with remarks noted about poor attitude or behaviour. Future studies have to confirm whether a prediction model that integrates these factors aids identifying at-risk students and enables the distinction between those eligible for referral or for support.

A prerequisite for such an early distinction is that during the first months sufficient data must have been collected to assess a student's capability to finish medical school. Therefore, the recommendation for medical schools is to regularly assess students' performance during the first semester, preferably at least once a month. To give students the opportunity to improve their progress, it is necessary to provide them with timely feedback on their performance. Thus, a second recommendation for medical schools is to minimise the time scheduled for reviewing first-semester examinations.

A second step in the identification of at-risk students is structural monitoring of students' progress throughout the medical course. The studies reported in Chapters 2 and 3 revealed that risk factors for poor performance varied at different stages of the first year and of the medical course. Although there are students who struggle right from the start, the need for support sometimes becomes apparent later on in the first year (Chapter 2) or even in clinical training (Chapter 3). Therefore, the recommendation is to constantly monitor the progress of all students. In addition to constant monitoring, medical schools should aim to identify the reasons for underperformance, especially later on in the medical course. In particular, there is an urgent need for research into the causes of the lower clinical grades achieved by students from ethnic minority groups (Chapter 3). Firstly, research is required to determine whether non-Dutch students are less well prepared for clinical training, despite receiving the same pre-clinical training and, if so, why this is the case. Secondly, more detailed experimental studies might assist in understanding the processes underlying judgement and decision making in clinical assessments. Finally, interventions for improvement should be considered, designed, implemented and evaluated. Possible interventions are (i) attempts to make assessment in clinical training less subjective and (ii) to create awareness of cultural bias by both students and assessors and (iii) to develop a greater understanding of cultural differences through cultural competency training for all involved in clinical training.

It should be noted that the problems experienced by medical students are many and varied.[20] It can therefore not be expected to find a totally fail-safe means of early detection of at-risk students. Especially failure due to social or health-related problems may be difficult to predict. However, routine monitoring of a number of academic and behavioural criteria will enable medical schools to notice (sudden) drops in performance at an early stage. Student counsellors could play an important role in determining whether detected students would benefit from individual (Tier 3) or group (Tier 2) support.

Support for at-risk students

A fifth premise for the integrated approach is that support should be adapted to the needs of the different identified groups and that the interventions should be evidence-based. For the students who are eligible for referral, support should focus on assistance in deciding to withdraw and on provision of realistic alternatives (Exit support). The same applies for the group of students who are dismissed at one or two years after enrolment. Currently, too little attention is given to so-called exit interviews, while such interviews may be crucial to retain these students in higher education. For students identified as eligible for support various types of interventions are required. For some of these students an academic warning might be sufficient; others may need academic support (Chapter 5). Nowadays, the support offered mostly consists of an academic guidance interview with a student counsellor. However, other types of support may be more appropriate to improve these students' progress. As shown in Chapter 6, a short, integrated study skills programme benefitted at-risk students who had demonstrated commitment and academic potential. The findings from this thesis suggest that it is more effective to focus support efforts on students who almost meet the set standards (just below average) than on those who have very little chance of success. Future studies are required to test this assumption, preferably using robust study designs, such as RCTs.

In conclusion, an integrated approach for medical student success includes adequate instruction and clear expectations for all students, routine monitoring of a number of academic and behavioural criteria to identify students potentially at risk of struggling, multiple evidence-based types of support to address the variety of at-risk students' needs, and evaluation of intervention outcomes.

CONCLUSION

Not all students cope successfully with the demands of medical school, and this may result in study delay or dropout. In view of the large investment in a medical student's training made by both student and society, preventing delay and dropout is an important goal of medical schools. If medical schools wish to reduce delay or dropout, they will need to identify students who are experiencing academic difficulties at an early stage and to provide them with timely intervention through access to support programmes or, when appropriate, to refer them to another degree programme.

Ideally, medical schools are able to distinguish early in the first year between students who are willing and able to be remediated and students who will be better off switching to a non-medical career. An important factor in making this distinction, in addition to study progress, is their commitment to the medical course, which is reflected in their participation in scheduled learning activities and examinations, and in the willingness to participate in support programmes.

Further research has to prove whether setting high standards in combination with a continuum of academic and behavioural support (ranging from adequate instruction for all, via various targeted small-group interventions, to individualised support) enables medical schools to maximize academic commitment and performance for all students.

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Chapter 8

Summary

Not all students cope successfully with the demands of medical school, which may result in study delay or dropout. This thesis focuses on how to early identify students at risk of delay or dropout, and on what medical schools can do to help them.

In **Chapter 1**, it is argued that, despite relatively low dropout rates in medical education compared to other degree programmes, the large investment involved in a medical student's training for both the student and society combined with the severity of the selection process justifies efforts to reduce dropout and delay. A discussion of previous research reveals that, although the importance of early identification and intervention is well recognised, there is a need for more research into successful strategies for identifying and supporting at-risk medical students. The studies presented in this thesis address this need.

The studies reported in Chapters 2 to 4 focused on student-related factors that could be used to identify and characterise students who most likely benefit from support. To identify at-risk students, most medical schools use either pre-admission characteristics or early performance in medical school. However, the imperfect predictive value of the applied methods means there are unexpected student failures and successes. The retrospective study reported in **Chapter 2** aimed at learning from such unexpected failures and successes by examining at-risk medical students' pre-admission characteristics together with their participation and progress throughout the first two years. A main finding of this study was that there are differences between students who are correctly and incorrectly predicted as being at risk. Considering pre-admission characteristics, students who were incorrectly predicted to fail (unexpected successes; 11% of at-risk students) were less often older or admitted by national lottery than students who were correctly predicted to fail (expected failures; 19%). Meanwhile, students who were incorrectly predicted to succeed (unexpected failures; 9%) were more likely to be older, and had more often a lower-than-average pre-university grade point average (pu-GPA) or a non-Western pre-university diploma than students who were correctly predicted to succeed (expected successes; 61%). Considering exam participation and study progress, three types of at-risk students emerged: 1) students with low exam participation rate and low success rate (expected failures), 2) students with high exam participation rate and low success rate (unexpected failures), and 3) capable students who start slowly (unexpected and expected successes). Combining pre-admission characteristics and study progress with exam participation may be the best way to identify students most in need of help. Adding factors that affect exam participation – such as motivation and study skills – and constantly monitoring student progress may further improve the identification of at-risk students.

The study reported in **Chapter 3** focused on one of the pre-admission characteristics: ethnic minority status. Research from numerous medical schools has shown that students from ethnic minorities underperform compared with those from the ethnic majority. However, little is known about why this underperformance occurs and whether there are performance differences among ethnic minority groups. Therefore, we aimed at determining whether underperformance occurs across ethnic minority groups in undergraduate pre-clinical and clinical training and the extent to which this underperformance can be explained by age, gender, pu-GPA, and additional socio-demographic characteristics. A first finding of our study was that there are differences among ethnic minority groups in comparisons with majority students. Whereas Surinamese/Antillean and Asian students underperformed throughout medical school, Turkish/Moroccan and Western students only achieved lower grades in clinical training. The ethnicity-related disparities in performance, especially in clinical training, could not be explained by age, gender, pu-GPA, socio-demographic variables, including parental education and first language, and previous performance at medical school. A second finding was that the ethnicity-related disparities were greater in clinical performance: all minority groups achieved lower clinical grades. A more subjective grading cannot be ruled out as a cause of these lower clinical grades but other explanations, such as differences in communication styles or stereotype threat, require further investigation.

Building on the outcomes reported in Chapter 2, we examined the role of students' motivational beliefs, learning strategies and participation in scheduled learning activities in explaining medical school performance (**Chapter 4**). Using the statistical method 'structural equation modelling' we tested and cross-validated an integrated model of motivational beliefs (value and self-efficacy), learning strategies (deep learning and resource management), participation (lecture attendance, skills training attendance and completion of optional study assignments) and Year 1 medical students' performance. Year 1 medical students completed a questionnaire on motivational beliefs and learning strategies (sourced from the Motivated Strategies for Learning Questionnaire) and participation. The results showed that participation and self-efficacy beliefs were positively associated with Year 1 performance. Deep learning strategies were negatively associated with Year 1 performance, but positively related to resource management strategies, which in turn, were positively related to participation. Value beliefs were positively related to deep learning strategies only. The overall structural model for the 2008 cohort accounted for 47% of the variance in Year 1 grade point average, and was cross-validated in the 2009 cohort. These results suggest that participation mediates the relationships between motivation and learning strategies, and medical school performance, while participation and self-efficacy beliefs also make unique contributions to performance. Encouraging participation and strengthening self-efficacy may help to enhance medical student performance.

Chapters 5 and 6 report studies focusing on what medical schools can do to help more of their students succeed. In the study presented in **Chapter 5**, we explored the effectiveness of an academic dismissal (AD) policy as a strategy to enforce satisfactory study progress and to identify and help failing medical students. We compared two AD cohorts and two non-AD cohorts on dropout rates, Year 1 curriculum rates and the percentage of students with an optimal study rate (i.e. all modules completed) at 1 and 2 years after enrolment. We also measured the effect on study progress of attending the support meetings offered. The results showed that AD and non-AD cohorts did not differ significantly in dropout rate at 5 months, in Year 1 completion rate at 2 years and in the percentage of optimally performing students at 1 year after enrolment. At 2 years after enrolment, more students from the AD cohorts had left and more non-AD students demonstrated optimal performance, but effect sizes for these differences were small. Voluntary support at 4 months after enrolment was attended by AD students more often than by non-AD students. The AD students who attended the support meetings completed the Year 1 curriculum more often than those who did not. Attending the obligatory support meeting at 7 months after enrolment had a similar effect. We concluded that the presence of an AD policy did not lead to earlier dropout, higher completion rates or an improved study rate during the first 2 years at medical school. However, participation in support offered increased from 40% to almost 70%. Although support participants finished the Year 1 curriculum more often than non-participants, the current support system was not sufficient to improve overall study progress.

The main objective of the study described in **Chapter 6** was to measure the effect of adding a short integrated Study Skills Programme (SSP) to the standard academic support intervention on the study progress of 'students at risk'. This study adds to the existing literature by utilising a randomised controlled design to study the short, medium and long-term benefits of an academic support programme for students considered most at risk of failure based on their first-semester results. Year 1 students who were identified as at-risk of academic failure at 7 months after enrolment were invited to participate in the randomised-controlled-trial. Participants were randomly assigned to the SSP group or to a control group receiving standard academic support. Effects of SSP were measured on the short (= passed first exam after intervention), medium (= obtained enough credits to proceed to second year) and long term (= completed Year 1 curriculum within two years). The results showed that SSP participants more often passed the first exam after the intervention than controls, in particular those who had previously passed at least one exam. No medium or long-term effect was found. Participants who had attended 4 or 5 SSP sessions outperformed those who had attended fewer sessions on all outcome measures. The results of this study suggest that a short, integrated study skills programme benefits some, but not all students. The advice for medical schools is to focus support efforts on at-risk students who have demonstrated commitment and academic potential.

In **Chapter 7** a general discussion of the findings of this thesis is provided, starting with some methodological considerations. Subsequently, the findings of the different studies are compiled into a proposal for an integrated, school-wide approach for medical student success comprising a continuum of academic and behavioural support. Five premises for such an integrated approach are discussed: 1) support should focus on improving both academic and behavioural outcomes, 2) support should be offered at different levels, ranging from adequate instruction for all, via various targeted small-group interventions, to individualised support, and should also include exit support for students who might be better off at another degree programme, 3) behavioural and academic expectations should be communicated to students, 4) medical schools should facilitate timely identification of at-risk students who will benefit from the different types of support, and 5) support should be evidence-based and fit the needs of the different identified groups. We conclude that further research is required to prove whether a combination of setting high standards and a continuum of academic and behavioural support enables medical schools to maximise academic commitment and performance for all students.

Chapter 9

Samenvatting

Niet alle geneeskundestudenten zijn in even goed staat om te voldoen aan de eisen die de opleiding aan hen stelt, wat kan leiden tot studievertraging of zelfs uitval. In dit proefschrift staan de volgende twee vragen centraal: 1) hoe kunnen studenten die het risico lopen op uitval of vertraging vroegtijdig worden geïdentificeerd (hoofdstuk 2, 3 en 4) en 2) wat kunnen geneeskundeopleidingen doen om deze studenten te helpen (hoofdstuk 5 en 6).

In **Hoofdstuk 1** wordt beschreven waarom het, ondanks de relatief lage uitvalpercentages bij de opleiding geneeskunde, toch belangrijk is te proberen de uitval en vertraging onder geneeskundestudenten te verlagen: de geneeskundeopleiding vraagt een grote investering van zowel de student als van de maatschappij en toelating tot de opleiding is niet vanzelfsprekend. Vervolgens worden de resultaten van eerder onderzoek naar het identificeren en ondersteunen van zogenaamde 'risicostudenten' besproken. Duidelijk wordt dat, hoewel het belang van een vroege identificatie en interventie erkend wordt, meer onderzoek nodig is naar succesvolle strategieën voor het identificeren en ondersteunen van risicolopende geneeskundestudenten. Dit vormt de basis voor de studies in dit proefschrift.

In **Hoofdstuk 2, 3 en 4** worden studies besproken waarin we gekeken hebben naar studentkenmerken die gebruikt kunnen worden bij het identificeren en karakteriseren van studenten die de meeste baat hebben bij ondersteuning. Voor het identificeren van risicostudenten gebruiken de meeste opleidingen instroomkenmerken van de studenten (zoals geslacht, leeftijd, etniciteit en gemiddeld eindexamencijfer) of de eerste tentamenresultaten. Echter, de voorspellende waarde van deze methodes is niet perfect: er zijn altijd studenten die onverwacht toch zakken of slagen. De studie die beschreven wordt in **Hoofdstuk 2** had als doel om te leren van deze onverwachte zakkers en slagers door te kijken naar hun instroomkenmerken en hun participatie en voortgang tijdens de eerste twee jaar van de geneeskundeopleiding. Een belangrijke bevinding van dit onderzoek was dat er verschillen zijn tussen studenten voor wie de voorspelling klopt en studenten voor wie de voorspelling niet klopt. Kijkend naar instroomkenmerken, bleek dat studenten die onterecht voorspeld waren te zakken (onverwachte slagers; 11% van de risicostudenten) minder vaak boven de 21 waren en vaker waren toegelaten via decentrale selectie in plaats van via loting dan studenten die terecht voorspeld waren te zakken (verwachte zakkers; 19%). Tegelijkertijd bleek dat studenten die onterecht voorspeld waren te slagen (onverwachte zakkers; 9%) vaker boven de 21 waren en vaker een lager gemiddeld eindexamencijfer of een niet-westerse vooropleiding hadden dan de studenten die terecht voorspeld waren te slagen (verwachte slagers; 61%). Kijkend naar tentamenparticipatie en studievoortgang, kwamen drie typen risicostudenten naar voren: 1) redelijk succesvolle studenten met een trage start (verwachte en onverwachte slagers), 2) studenten die weinig pogingen doen en weinig succes hebben (verwachte zakkers) en 3) studenten die veel pogingen doen en toch weinig succes hebben (onverwachte zakkers). Op basis van deze resultaten lijkt het combineren van instroomkenmerken met gegevens over studievoortgang én tentamenparticipatie de beste manier om studenten te identificeren die de meeste behoefte hebben aan hulp. Het toevoegen van factoren die van invloed zijn op tentamenparticipatie – zoals motivatie en studievaardigheden - en het constant monitoren van de studievoortgang zou de identificatie van risicostudenten verder kunnen verbeteren.

In de studie die gerapporteerd wordt in **Hoofdstuk 3** zijn we nader ingegaan op één van de instroomkenmerken van studenten: etniciteit. Onderzoek bij geneeskundeopleidingen in diverse landen heeft aangetoond dat allochtone studenten slechter presteren dan autochtone studenten. Echter, er is weinig bekend over waarom dit zo is en of er verschillen zijn in prestaties tussen verschillende groepen allochtonen. Daarom hebben we in deze studie gekeken hoe subgroepen van allochtone studenten presteren in de preklinische fase (doctoraal) en klinische fase (coschappen) van de opleiding en in welke mate eventuele verschillen in prestaties verklaard kunnen worden door leeftijd, geslacht, gemiddeld eindexamencijfer en additionele sociaaldemografische factoren, zoals opleiding van de ouders en moedertaal. Een eerste bevinding van onze studie was dat er verschillen zijn tussen allochtone subgroepen in vergelijking met autochtone studenten. Terwijl Surinaamse/Antilliaanse en Aziatische studenten gedurende de gehele opleiding slechter presteerden, haalden de Turkse/Marokkaanse en Westerse studenten alleen lagere cijfers in de coschappen. De verschillen in prestaties, vooral die in de klinische fase, konden niet verklaard worden door verschillen in leeftijd, geslacht en gemiddeld eindexamencijfer en ook niet door verschillen in de additionele sociaaldemografische factoren of in eerdere prestaties tijdens de geneeskundeopleiding. Een tweede bevinding was dat de gevonden verschillen groter waren in de klinische fase: alle allochtone subgroepen haalden vaker lagere cijfers voor de coschappen dan de Nederlandse studenten. De subjectievere beoordeling kan niet worden uitgesloten als een oorzaak voor de lagere cijfers in de klinische fase. Er is echter behoefte aan nader onderzoek naar andere verklaringen, zoals verschillen in stijl van communiceren of de invloed van stereotypering.

Voortbordurend op de in Hoofdstuk 2 gerapporteerde bevindingen, wordt in **Hoofdstuk 4** een studie beschreven waarin we gekeken hebben naar de relatie tussen motivatie, leerstrategieën, onderwijsparticipatie en studieprestaties in het eerste jaar. Gebruikmakend van de statistische techniek 'structural equation modelling' hebben we een model getest en gevalideerd dat bestond uit motivatie (interesse in de studie en zelfvertrouwen), leerstrategieën (diep leren en resource management), onderwijsparticipatie (aanwezigheid bij hoorcolleges, vaardigheidsonderwijs en het maken van zelfstudieopdrachten) en het gemiddeld cijfer behaald in het eerste jaar. Er werd een online vragenlijst afgenomen bij eerstejaars studenten, die bestond uit de vragen van de MSLQ (Motivated Strategies for Learning Questionnaire) aangevuld met vragen over onderwijsparticipatie. Uit deze studie bleek dat onderwijsparticipatie en zelfvertrouwen een directe positieve relatie hadden met eerstejaarsprestaties. Diep leren had een negatieve directe relatie met eerstejaarsprestaties, maar een positieve directe relatie met resource management. Resource management (time management en regulatie van inzet) was weer positief gerelateerd aan onderwijsparticipatie. Interesse in de studie had alleen een positieve relatie met diep leren. De resultaten suggereren dat de relaties van motivatie en leerstrategieën met studieprestaties gemedieerd worden door onderwijsparticipatie. Het lijkt er dus op dat motivatie en leerstrategieën alleen een positief effect hebben op de studieprestaties wanneer ze gecombineerd worden met een hoge onderwijsparticipatie. Tegelijkertijd leveren onderwijsparticipatie en zelfvertrouwen ook een unieke bijdrage aan de studievoortgang. Het stimuleren van onderwijsparticipatie en het bevorderen van het zelfvertrouwen zou kunnen bijdragen aan het verbeteren van de prestaties van geneeskundestudenten.

In **Hoofdstuk 5 en 6** worden studies beschreven waarin we gekeken hebben naar wat geneeskundeopleidingen kunnen doen om meer van hun studenten te laten slagen. De in **Hoofdstuk 5** gepresenteerde studie onderzocht de effectiviteit van een Bindend Studieadvies (BSa) als strategie om de studievoortgang te verhogen en om slecht presterende studenten te identificeren en te helpen. De laatste twee cohorten voor invoering van het BSa in 2005 en de eerste twee BSa-cohorten zijn vergeleken op het aantal stakers, het propedeuserendement en het percentage nominaal studerenden na 1 en na 2 jaar. Daarnaast is gekeken naar het effect van het accepteren van begeleiding op het behalen van de propedeuse binnen 2 jaar. De resultaten lieten zien dat de BSa- en niet-BSa-cohorten niet significant van elkaar verschilden wat betreft het aantal vroege stakers (voor 1 februari), het propedeuserendement na 2 jaar en het percentage nominale studenten na 1 jaar. Na 2 jaar waren meer studenten uit de BSa-cohorten vertrokken en studeerden meer studenten uit de niet-BSa-cohorten nominaal. Studenten uit de BSa-cohorten accepteerden vaker de vrijwillige begeleiding na 4 maanden dan studenten uit de niet-BSa-cohorten. Studenten uit de BSa-cohorten die deze begeleiding accepteerden haalden significant vaker hun propedeuse dan degenen die dit niet deden. Deelname aan de verplichte begeleiding na 7 maanden had een vergelijkbaar effect. De conclusie was dat de invoering van een BSa niet leidt tot vroegere studiebeëindiging, een hoger propedeuserendement of een hogere studeersnelheid tijdens de eerste twee jaar van de geneeskundeopleiding. De dreiging van een negatief BSa verhoogt wel de deelname aan de aangeboden studiebegeleiding tot bijna 70%. Bovendien halen deelnemers vaker hun propedeuse dan niet-deelnemers.

De in **Hoofdstuk 6** beschreven studie had als doel het meten van het effect van het toevoegen van een korte geïntegreerde studievaardigheidstraining aan de standaard studiebegeleiding op de studievoortgang van studenten die risico lopen op uitval of vertraging. Uniek aan deze studie is het gebruik van een gerandomiseerd design om de korte, middellange en lange termijn effecten te meten van een begeleidingsprogramma voor risicostudenten. Degenen met de slechtste prestaties na 7 maanden werden uitgenodigd om deel te nemen aan de gerandomiseerde studie. Deelnemers werden willekeurig verdeeld over de trainingsgroep en een controlegroep, die de standaard studiebegeleiding kreeg. Het effect van de training werd gemeten op de korte (= behalen eerstvolgende tentamen na de training), middellange (= behalen van voldoende ECTS na 1 jaar om door te mogen naar het tweede jaar) en lange termijn (= behalen van de 60 ECTS van het eerste bachelorjaar binnen 2 jaar). De resultaten lieten zien dat deelnemers aan de studievaardigheidstraining vaker het eerstvolgende tentamen behaalden dan de studenten in de controlegroep, vooral die deelnemers die voor de training al minstens één tentamen hadden behaald. Er werden geen effecten gevonden op de middellange of lange termijn. Deelnemers die 4 of 5 trainingssessies hadden bijgewoond presteerden beter dan deelnemers die minder sessies hadden bijgewoond op de korte, middellange en lange termijn. De uitkomsten van deze studie suggereren dat sommige, maar niet alle risicostudenten baat hebben bij een korte, geïntegreerde studievaardigheidstraining. Op basis van onze uitkomsten is het advies voor geneeskundeopleidingen om hun inspanningen voor het ondersteunen van risicostudenten te richten op diegenen die inzet en academisch potentieel hebben getoond.

In **Hoofdstuk 7** worden de onderzoeksresultaten uit dit proefschrift bediscussieerd, startend met enkele methodologische overwegingen. Vervolgens worden de bevindingen uit de verschillende studies samengevoegd tot een voorstel voor een geïntegreerde, opleidingsbrede aanpak voor succes in de opleiding geneeskunde bestaande uit een continuüm van academische en gedragsgerichte ondersteuning. Vijf uitgangspunten voor een dergelijke geïntegreerde aanpak worden besproken: 1) ondersteuning moet zich richten op het verbeteren van studieprestaties en van gedrag, 2) ondersteuning moet aangeboden worden op verschillende niveaus, lopend van adequaat onderwijs voor allen, via verscheidene doelgerichte interventies voor kleine groepen risicostudenten, tot individuele interventies en moet daarnaast 'exit' begeleiding bevatten voor studenten die wellicht beter kunnen stoppen, 3) verwachtingen wat betreft gedrag en academische prestaties dienen duidelijk gecommuniceerd te worden naar studenten, 4) geneeskundeopleidingen dienen het tijdig identificeren van risicostudenten die baat kunnen hebben bij de verschillende vormen van ondersteuning te faciliteren, 5) de aangeboden ondersteuning moet beproefd zijn en worden aangepast aan de behoeften van de verschillende geïdentificeerde groepen. Verder onderzoek moet uitwijzen of het stellen van hoge eisen in combinatie met een continuüm van academische en gedragsgerichte ondersteuning, geneeskundeopleidingen in staat stelt om de inzet en de studieprestaties van alle studenten te optimaliseren.

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Publications and presentations

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Stegers-Jager KM, Splinter TAW (2007, August). *Questionnaires in medical education: is there a need to hunt for the last respondent?* Poster presented at AMEE 2007 Conference, Trondheim, Norway.

WORKSHOPS AND SYMPOSIA

Koole S, **Stegers-Jager K**, Van Lohuizen M (2012, March). *Promoveren of toch maar niet?* KNMG Carrièrebeurs, Utrecht, the Netherlands

Kerdijk W, Bakker N, **Stegers-Jager K**, Aper L, Koole S, Pelgrim E (2011, November). *Kansen en valkuilen in een promotietraject*. NVMO 2011 Conference, Egmond aan Zee, the Netherlands.

Koole S, **Stegers-Jager K**, Van Lohuizen M (2010, November). *SOS promotie: eerste hulp bij het doorlopen van een promotietraject*. NVMO 2010 Conference, Egmond aan Zee, the Netherlands.

Urlings-Strop LC, **Stegers-Jager KM**, Baars GJA, Splinter TAW (2008, November). *Selectie en interactie: de juiste student EN de juiste plaats*. NVMO 2008 Conference, Egmond aan Zee, the Netherlands

Curriculum Vitae

CURRICULUM VITAE

Karen Stegers-Jager was born in Haarlem, The Netherlands on 6 April 1976. In 1994 she obtained her *Gymnasium* Diploma at *'t Wagenings Lyceum* in Wageningen. In the same year she started her studies in Educational Science and Technology at the University of Twente. After graduating *cum laude* in 1999, she spent a year at the University of British Columbia in Vancouver, Canada. Here she combined a post-graduate course on Technology-Based Distributed Learning with research on the same topic. In October 2000, she started a job as an instructional designer at Cirquest in Amsterdam. As project leader and designer, she was involved in producing several multimedia tools, for clients such as the *Politieacademie* and the ICRC. From April 2003 until September 2006 she worked as an educational consultant at Risbo, Erasmus University Rotterdam, where she focused on the design, development and implementation of ICT tools - in particular multimedia and serious games - within higher education. In October 2006, she started her PhD research on the early identification and support of medical students at-risk of failure at the Erasmus MC Desiderius School (formerly known as *Opleidingsinstituut Geneeskunde*). This research has resulted in various national and international presentations and publications. As of April 2012 she has started working as a senior educational researcher and consultant at the Erasmus MC Desiderius School.

Karen is married to Marc Stegers and they have two two sons: Quirijn (2007) and Yorick (2009).

PhD Portfolio

PHD PORTFOLIO

Summary of PhD training and teaching activities

Name PhD student: K.M. Stegers-Jager
Erasmus MC Department: Desiderius School

PhD period: October 2006 – March 2012
Promotor(s): Prof. dr. ir. A.P.N. Themmen
Prof. dr. J. Cohen-Schotanus

	Year	Workload (Hours/ECTS)
1. PhD training		
General courses		
- Repeated Measurements in Clinical Studies	2007-2011	16.7 ECTS
- Regression Analysis		
- Study design		
- SPSS AMOS		
- Integrity in Research		
- Survival analysis		
- Biomedical English Writing and Communication		
- Diagnostic research		
- Advanced Analysis of Prognosis Studies		
Specific courses		
- Onderzoek van Medisch Onderwijs (Research in Medical Education), UMCG	2010	4 ECTS
Presentations		
- Oral (10x)	2008-2012	10 ECTS
- Poster (2x)	2007	1 ECTS
- Workshops/symposia (4x)	2008-2012	4 ECTS
(Inter)national conferences		
- 8 international conferences	2007-2012	8 ECTS
- 10 national conferences/ seminars	2006-2012	5 ECTS
2. Teaching activities		
Supervising Master's theses		
- 2 students (2x 20 weeks)	2008-2009	3 ECTS
3. Other activities		
- General board member and president of Promeras (Association for PhD students at Erasmus MC)	2007-2009	
- General board member and president of NVMO-promovendinetwerk (Network for PhD students in Medical Education in the Netherlands and Flanders)	2009-2012	