General discussion

GENERAL DISCUSSION

Selecting the doctors of the future – those possessing the capabilities and motivation to flourish both as a student and as a physician later on – is a continuous challenge. A variety of selection procedures have been applied ranging from (weighted) lottery to interviews to admission tests and other assessments of personal competencies (Kreiter & Axelson, 2013). Evidence that these procedures do indeed deliver better achieving students (Salvatori, 2001; Siu & Reiter, 2009), let alone better professional doctors (Papadakis, Teherani, et al., 2005) is limited. The introduction of medical school-specific procedures in addition to the national lottery system in the Netherlands created opportunities for experiments providing evidence-based conclusions and recommendations; a strategy also recommended by Cook, Bordage, et al. (2008). This thesis describes an experiment regarding selection of students hypothesizing that selection would identify students that will perform better than those who are randomly admitted. A two-step selection procedure was developed and used to select students, consisting of a non-academic (i.e. extracurricular activities) and an academic step (i.e. curriculum sample test and cognitive ability tests). Academic performance of selected students was compared with that of students admitted by lottery. The four studies in this thesis add to the existing literature by 1) comparing pre-clinical and clinical performance of selected versus lottery-admitted students (chapters 2 and 3), 2) determining the relative contribution of the non-academic and academic steps (chapter 4) and 3) exploring the relation between extracurricular activities assessed during selection and during medical school and performance (chapter 5).

MAIN FINDINGS

Our main findings are that students selected by the two-step selection procedure had a significantly lower risk for dropping out of medical school compared to controls admitted by lottery. Additionally, those selected obtained a higher mean grade than the lottery admitted students in their clinical years. Noticeable is the absence of difference in pre-university Grade Point Average between both groups. Thus, the observed difference in clinical achievement between the selected and lottery admitted groups seems not to be related to achievement during pre-university education. Instead the selection procedure seems to sort out those that have the capability to perform better during the important clinical stage of medical school. The study on the relative contribution of each of the two steps to the differences observed in student performance revealed that the significantly higher clinical grades were

attributable to participation in extracurricular activities before admission to medical school. The observed difference in dropout rate partly already existed before the start of the selection procedure, probably due to some kind of self-selection by those who, after they requested it, not returned the application form. And partly could be attributed to selection of participants based on academic criteria that made up the second selection step. The fourth study suggested that persistent activities during medical school of students selected on extracurricular activities explain their better achievements in the clinical phase.

In this chapter, these main findings will be evaluated by discussing the two conceptual frameworks underpinning the two-step selection experiment, i.e. extracurricular activities and the curriculum sample test. Because several years have passed since we initially developed our selection procedure, some thoughts about the changing medical school selection environment over the years are also appropriate.

EXTRACURRICULAR ACTIVITIES

The selection procedure we developed assessed extracurricular activities performed in the last three years of pre-university education. Assessing extracurricular activities is neither new nor specific for the medical field. Job application forms used in personnel selection use at least partly activities undertaken out of context of the job but relevant to the skills needed for the job. By assessing both the quality and the quantity of extracurricular activities performed over the preceding three years before application, we aimed to increase the authenticity of the admission procedure. Unlike the personal statement and single tests, which are more of a snapshot, long-term extracurricular activities reflect the applicant's development over several years. These activities were self-reported and guided by supporting documents by the applicants using a highly structured application form and thoroughly assessed using predefined guidelines.

Our hypothesis was that students, by participating in extracurricular activities, display greater ability, motivation or ambition to achieve than their peers, and subsequently perform better at medical school, and will continue to do so afterwards. One of the most remarkable results presented in this thesis (chapter 3) is that our selected students obtained higher grades in the clinical curriculum compared to their lottery admitted counterparts. Remarkable because the predictive value of selection tools decreases over time (Patterson, Knight, et al., 2016). This almost completely turned out to be an effect of the selection based on non-academic criteria and selected

students' persistent extra-curricular activities in the years thereafter during medical school (chapter 5).

The use of extracurricular activities performed during pre-university education for selecting students for medical school showed encouraging results in preventing dropout (O'Neill, Hartvigsen, et al., 2011), and predicting pre-clinical (Schripsema, van Trigt, et al., 2014) and clinical achievement (chapter 3). Explaining why students selected on their participation in extracurricular activities during pre-university education receive higher clinical grades is challenging in view of the years that have elapsed between the pre-university extracurricular activities and the grades obtained in the clinical phase of medical school. Moreover, at first sight the content of both parameters appears to be quite different.

The answer lies perhaps in the fact that performing extracurricular activities in addition to regular schoolwork reveals character traits that students also need when dealing with the requirements of medical school. More specifically, when performing these activities, students probably learn the skills and enhance their non-academic qualities that have been shown to be necessary for clinical performance (chapter 2, 3, Wright & Tanner 2002). Schripsema, van Trigt, et al. (2014) also included pre-university extracurricular activities in their selection procedure and concluded that selected students had better skills in terms of collaboration, communication, reflection, ethical decision making and professional behaviour during the first three years of medical school. These competencies in particular were also rated important for the clerkship program by clerkship directors (Windish, Paulman, et al., 2004). Selection based on these, non-academic, competencies have been shown to predict performance outcomes during clerkships and on licensing examinations, for example by using the Multiple Mini Interview instrument, (Eva, Reiter, et al., 2009; Reiter, Eva, et al., 2007). It would, therefore, be of interest to further study the relationship between participation in extracurricular activities and the characteristics determined by MMIs.

The overlap between skills associated with extracurricular involvement and skills associated with higher clinical grades might be explained by the involvement theory from Astin (1999 (originally published 1984)). In this theory, involvement was defined as active participation in all kinds of (extra)curricular and social activities to which a highly involved student devotes considerable energy. The greater the student's involvement, the greater the students learning capacity and personal development will be. Pike (2000) reported that involvement in a variety of curricular and co-curricular activities was directly related to growth in general abilities such

as communication skills, interpersonal skills and critical thinking. Also, conversely, improvements of academic, communication and interpersonal skills were associated with intra- and extracurricular involvement (Huang & Chang, 2004). Again, these interpersonal and communication skills were shown to correlate with success in the clinical setting (Haight, Chibnall, et al., 2012; Hojat, Erdmann, et al., 2013).

Remarkably, participation in extracurricular activities during medical school was associated with a higher pre-university GPA for lottery-admitted students only, whereas this was associated with higher clerkship grades for selected students only (chapter 5). These results indicate that persistent participation in extracurricular activities of selected students favours better clinical achievement. Ferguson, James, et al. (2003) also demonstrated that the amount of information given in a personal statement, mostly covering motivation and hobbies, was positively related to clinical performance. The observation that lottery-admitted students do not improve their clinical achievement after participating in extracurricular activities during medical school suggests that early or long-term, persistent participation is required to acquire competencies that are multi-usable in other settings (Huang & Chang, 2004). Alternatively, selected students and lottery-admitted students who participate in extracurricular activities during medical school may be different types of students: selected students always (both before and after admission) look for additional activities, irrespective of their pu-GPA, whereas only the lottery-admitted students with higher pu-GPA – with probably also better pre-clinical achievement – participate in extracurricular activities at medical school. Apparently, the personality types represented by the selected students are rated more favourably in the subjective grading in clinical training (Kasselbaum & Eaglen, 1999). Further research could be directed at which non-academic qualities and skills clerkship assessors consider important for clerkship grading and use in the evaluation of students. Once established, the challenge is then to translate these qualities and skills to more generalized traits that could be used in selection procedures.

In conclusion, the use of extracurricular activities in the selection for medical school as an operationalization of non-academic skills is at least profitable in terms of clinical performance, although the underlying comprehensive traits still need to be elucidated. The next step is to examine whether those selected are indeed better doctors. In addition, according to the involvement theory, it may be interesting to investigate whether tempting those students that would otherwise not benefit (i.e. those with lower grades and not used to participate in this kind of activities) to participate in extracurricular activities would also lead to better performance in clinical skills.

CURRICULUM SAMPLE TEST

Those students selected in the first selection step – appraised on quality and quantity of the extracurricular activities performed – were allowed to join a three-day class at the university including tests. This second selection step was designed as a curriculum sample in a medical school context. To prepare for this curriculum sample, applicants were provided with a reader about the medical topic chosen for that sample (e.g., HIV or diabetes). Over three consecutive days they attended lectures and took five tests on subjects related to the topic. The tests were developed by 1st year medical school faculty and focused on logical reasoning, scientific thinking, epidemiology and pathology, anatomy and philosophy – all subjects that are frequently addressed in the medical curriculum. We showed that, using the above described curriculum sample (or 'work sample'), the lower dropout rate of selected students was clearly associated with passing this step of the selection procedure, irrespective of pre-university GPA (chapter 5).

Studies in the personnel selection domain have also shown that selection based on the candidates' prior accomplishments and achievements is positively correlated to job performance. To illustrate, Hough (1984) reported that government attorneys wanted to be selected and promoted on the basis of their record, their prior accomplishments, and achievements. The author found that the accomplishment record was not related to the traditional psychological measures but did correlate with job performance. Thus, these findings suggest what psychologists have long advocated, i.e. the best indicator of future performance is past performance, thereby backing the behavioural-consistency model described by Wernimont & Campbell (1968). This model has in later years been translated into a work sample tests (e.g. (Callinan & Robertson, 2000; Hunter & Hunter, 1984; Schmidt & Hunter, 1998). A work sample test is used to assess an applicant's ability and skills required for a specific job and is often used as a tool in employee selection. The content of a work sample should be closely related to the content of the required work-related competencies. This can be achieved by focusing on behavioural indicators that are identified with and required for a successful overall job performance (Callinan & Robertson, 2000; Ployhart, 2006). These kinds of tests are traditionally thought to be among the most valid predictors of job performance (Schmidt & Hunter, 1998). Roth, Bobko, et al. (2005) in their review and meta-analysis tempered this conclusion a little bit. They found the correlation of work sample testing and later measures of job performance to be .32, which is lower than the value of .54 found in an earlier, often cited, meta-analysis by Hunter & Hunter (1984). This is due mainly to the exclusion of studies with small

sample sizes, adding studies from later years – since earlier studies found higher correlations – and leaving out studies with methodological problems.

Recently, De Visser, Fluit, et al. (2017) employed a curriculum sample in their selection of medical school students. They set up an online course and exam, both mimicking the course and examinations of the medical school curriculum as closely as possible. Selected students both significantly dropped out less often and more often obtained the obligatory credits necessary to start the second year (De Visser, Fluit, et al., 2017). These results were irrespective of pre-university GPA, similarly to the results concerning dropout reported in this thesis. The curriculum sample test is not solely used for selection by medical schools. For example, Visser, Van der Maas, et al. (2012) used a curriculum sample for selecting first year psychology students. Applicants followed a one-week course and studied a chapter of a first-year psychology course book. At the end of the week applicants took a test on the course. In line with the findings in this thesis, the authors concluded that selected students dropped out less often after correction for pre-university GPA. In addition, students selected using this curriculum sample test obtained higher grades in the first year and more often completed their bachelor's degree within four years. These results were attributed purely to this selection test (Visser, Van der Maas, et al., 2012). Lucieer, Stegers-Jager, et al. (2015) conducted an experiment using an adapted form, a sham procedure, of the selection procedure described in this thesis. Selecting all applicants of one cohort solely on the first, non-academic, step followed by the selection of the subsequent years' cohort exclusively on the second, academic, step allowed the comparison of the relative contribution of both phases. Their results show that indeed, the curriculum sample selection step contributed primarily to first year study success of selected students. After analysis of six consecutive cohorts Stegers-Jager, Themmen, et al. (2015) found that the most recent past performance – either before or during medical school – is the main predictor of future performance during pre-clinical training.

When designing a work sample as a selection tool, an important issue to consider is that it should be relevant to the specific role it is designed for (Meijer & Niessen, 2015; Patterson, Zibarras, et al., 2016). Or, more dedicated to medicine: select those students that fit the medical curriculum a specific school offers. Medical schools have different profiles, in the Netherlands some schools emphasize their specific educational principles (such as Maastricht University with its problem-based learning), others accentuate their research profile (Erasmus MC) or offer multiple (research) masters thereby widening the possibilities of medical students beyond the basic curriculum (Erasmus MC, Groningen University). If a medical school has designed

the work sample to fit its specific profile, it is also necessary that the school publicly shares this specific profile to allow the selection of the 'the best performing' student, in the context of its specific curriculum. If the profile is not publicized the risk exists that 'right' candidates, i.e. those fitting the profile, do not even apply. A recent study on student approaches to medical school choice of Wouters, Croiset, Schripsema, et al. (2017) underlines the necessity of transparency of the medical school selection aims. They found that only 10% of the students choose a medical school based on its curriculum. Indeed, most candidates apply for a specific medical school because of the attractiveness of the city where it is located and the selection procedure it runs. The authors appeal to medical schools to provide proper information about their program in order to achieve the desired student-curriculum fit.

Summarizing, a selection procedure based on a curriculum sample test should create conformity between selection, curriculum and assessment (Meijer & Niessen, 2015; Ployhart, 2006) and should be perfectly aligned with the curriculum that is selected for as recommended by Prideaux, Roberts, et al. (2011). A point of debate and subject for further research on curriculum sample tests as selection tools for medical school is that social skills, integrity and ethics are not taken into account, whereas these are perceived as important traits for medical doctors (Patterson, Ferguson, et al., 2008). It can be concluded from this thesis as well as from the literature that a curriculum sample test has proven its value in selecting students with lower chances to drop out of medical school. Nonetheless, it should be stressed that these benefits depend on alignment of the curriculum sample to the medical school curriculum and on transparent communication about the goals of the selection procedure, allowing applicants to make an informed choice to which medical school to apply to.

CHANGING ENVIRONMENT

Several years have passed since we initially developed our selection procedure. During these years, we selected for intrinsic motivation, operationalized through motivated behaviour, i.e. extracurricular activities. Our choice to use these extracurricular activities has worked well since both a decrease in dropout and an increase in higher clinical grades was noted (chapter 3). There is a potential drawback by continuing the use of extracurricular activities. In the early years, the selection procedure and its requirements to take part were not yet widely known among applicants, although adequate need to know information was provided. Thus, applicants had not undertaken their extracurricular activities considering a possible future selection procedure, but because such activities were attractive to them. Over

the years, this could have changed. Nowadays, applicants may choose a strategic approach and cherry pick only those activities that would help them to get into medical school. Because they feel they should, not because they want to, and this strategy potentially influences their motivation to perform (Lucieer, Stegers-Jager, et al., 2015). It may be that having and demonstrating this kind of extrinsic motivation instead of an intrinsic motivation, does not necessarily translate into having and demonstrating the capacity or the ability to develop the required qualities that are critical for higher performance in the clinical phase. This is elaborated in chapter 5 in which we considered it likely that this persistence or determination in pursuing these extracurricular activities - the intrinsic motivation - correlates positively with better clinical achievement for selected students.

Furthermore, it is not clear that an extrinsic motivation for extracurricular activities will lead to persistent activities during medical school. It might be that this behaviour is only exhibited for the explicit purpose of qualifying for entry into medical school. Further research to appropriately assess the influence of extrinsic motivation would be needed.

Additionally, commercial coaching agencies increasingly offer guidance to applicants in the form of preparation programs for the selection procedures. This recent development introduces a socio-economic dimension since these often quite expensive services are more available to those applicants who can afford it. These commercial coaching services are a new phenomenon in the Netherlands but are much more common in Anglo-Saxon countries such as Australia. In that country over half of the applicants was reported to use these commercial coaching services. However, this has not translated into a better performance in the selection tests, except for the non-verbal reasoning elements. (Griffin, Carless, et al., 2013; Griffin, Harding, et al., 2008). Thus, coaching does not have the intended effect because it cannot compensate for the absence of sustained practice, but non-verbal reasoning appears to be coachable and learnable through pattern recognitions (Griffin, Carless, et al., 2013). It also means that it is necessary to adapt the selection procedure in such a way to ensure that these kind of preparation programs pose as little unwanted influences as possible.

Coaching should not be confused with providing applicants with adequate information about the selection procedure, since the procedure also depends on applicants who know how they are selected and what they are selected for. It also provides applicants the opportunity to make a fair assessment if they qualify for the criteria, and finally it provides the selecting institution with selectable applicants – after all,

you cannot select volleyball players for a game of basketball. Giving representative information to students about the selection procedure intents to improve the composition of the group of applicants (Benbassat & Baumal, 2007).

Currently, Erasmus MC is the only medical school in the Netherlands that organizes a dedicated instruction day for applicants. During this day applicants are all given the same information and details of the procedure. This results in a level playing field, for both the applicants as well as Erasmus MC, because applicants who realize at the end of the day that they do not qualify for the selection criteria are able to withdraw their application. This seems even more meaningful knowing that high school students know very little about how the selection procedure for medical school works (Wouters, Croiset, Isik, et al., 2017).

Another recent development is increased scrutiny of professional behaviour demonstrated by medical professionals. There have been various media reports of misconduct or unprofessional behaviour by doctors, and this has influenced the debate about selection in that it should not be limited to including the best performing students but also excluding those future doctors that, despite good academic performance, do not qualify when it comes to the high standards for non-academic personal qualities (Niessen & Meijer, 2016; Powis, 2015). The selection procedure should focus on both academic grades and personal qualities (Norman, 2004) but cannot be expected to, or guarantee, that applicants are excluded who would become doctors who will be mentioned in the headlines when it comes to misconduct or unprofessional behaviour. They can successfully complete a selection procedure and subsequent medical school while behaving unprofessionally at the same time, but most students that showed unprofessional behaviour did not have a disciplinary action throughout their career (Papadakis, Teherani, et al., 2005).

It remains challenging to definitively link the admission procedure to good clinical performance or at least to what patients perceive as good clinicians – the latter measured through patients' satisfaction surveys (Basco, Gilbert, et al., 2000). Even more challenging is objectively sorting out applicants who do not meet the personal qualities essential for good clinicians. Adding an element of professional integrity to the selection procedure can help, for example with an integrity-based Situational Judgment Test, for detecting these unwanted behavioural qualities (De Leng, Stegers-Jager, et al., 2017; Husbands, Rodgerson, et al., 2015). This could be subject of further research. As a way of last resort, Dutch law (Wet Versterking Besturing, 2010) provides the possibility of an iudicium abeundi; the examination committee can prevent a registration based on behaviour or statements of a student

that makes him or her unsuitable for medical practice (Bonke & Van Luijk, 2010). Although theoretically promising, practically this procedure has proven to be rather problematic for example in having to establish an evidentiary file that is able to withstand judicial scrutiny – an applicant who has his or her registration ended has the right to appeal this decision.

LIMITATIONS OF SELECTION PROCEDURES

An often-heard critique when it comes to selection is the suggestion that it limits diversity at medical school (Cleland, Dowell, et al., 2012; Wouters, Croiset, Isik, et al., 2017). This is an important issue since (minority) patients feel best at ease with someone who shares the same background (Perloff, Bonder, et al., 2016). Additionally, when students have to deal with a more diverse student population during their studies, it is assumed to increase their understanding for these (minority) groups and later on for their patients (Cleland, Dowell, et al., 2012; Cohen-Schotanus, Muijtjens, et al., 2006). In an attempt to widen access to medical school for e.g. ethnic minorities and those from lower social economic status, various initiatives have been launched (Abbasi, 1998; James, Ferguson, et al., 2008; Johnsons, 1971). In the Netherlands this striving to equal access to all eligible for medical school was one of the reasons for introducing a lottery system for entrance to medical school (chapter 1). The lottery was anonymous and based on grades only, so it was assumed to be fair and to lead to equal access for all these under-represented groups unless they were already underrepresented during pre-university education. It was feared that selection based on extracurricular activities would induce or exacerbate inequality since minority students were believed to be less inclined to work on 'CV-building'. However, this fear is unwarranted. Stegers-Jager, Themmen, et al. (2015) showed, using a slightly adapted selection procedure as described in this thesis (applicants run through both steps), that minority subgroups were not disadvantaged although self-selection in terms of the decision not to return the application form cannot be ruled out. This is in line with a Danish study in which also no effect was found on diversity of the student population using a selection procedure that included extracurricular activities (O'Neill, Vonsild, et al., 2013).

Another limitation is the possibility of self-selection applied by the candidates since participation in the selection procedure offers candidates an additional chance in addition to the lottery. Joining the lottery is far less demanding than the effort asked for taking part in the selection procedure. As a result, only highly motivated students take part in the selection procedure. Nonis & Wright (2003) found that just this

high-performance level in combination with only moderate grades leads to better performance than vice versa. This degree of motivation at least protects them from dropout (chapter 4; (O'Neill, Hartvigsen, et al., 2011)). So, this kind of self-selection turned out to be desirable by making the applicant pool more dedicated. Another, rather positive, effect of self-selection turned out to be the selection of those having the personality traits that seems profitable for future doctors. Schripsema, van Trigt, et al. (2016) found that their selected students had higher scores on conscientiousness which in turn in other studies proved to affect results in medical school (Ferguson, Sanders, et al., 2000; Lievens, Coetsier, et al., 2002). Another example of a self-selection for selection procedures is the perception among minority groups that they have a (substantially) lower chance of successfully completing the selection procedure. Whereas most applicants consider the usage of a selection procedure and the specific city where the university of their choice is located to be the most important drivers in their decision to enroll or apply, this is slightly less important for (non-)Western minority groups (Wouters, Croiset, Schripsema, et al., 2017). It is conceivable that applicants from minority groups do not even bother to apply at a medical school that uses a selection procedure because they perceive to have no chance at admission. To what extent this plays a role in deciding or determining where to apply for medical school should be a subject of further research.

CLOSING REMARKS

Although the studies in this thesis show that a successful selection procedure for medical school has been developed, there remain some important medical school student skills that are not addressed in the current procedure, such as socials skills and integrity. The introduction of other methods such as the multiple mini interview (MMI) and situational judgment testing (SJT) to medical school selection widens the selection instruments to include these skills in the selection procedure. Both methods present applicants with work-related situations and subsequently assess their responses to these situations. The work-related situations reflect the roles that applicants are likely to encounter in training and practice during medical education (Eva, Rosenfeld, et al., 2004; Patterson, Zibarras, et al., 2016; Ployhart, 2006) and include social skills and integrity. Both methods proved to be reliable and valid for selecting medical students, even though the development of these tests is complex (Patterson, Knight, et al., 2016; Reiter, Eva, et al., 2007).

The challenge for the future lies in optimizing, further calibrating and ultimately strengthening selection procedures. Preferably this augmentation should be pre-

ceded by an answer to the question which set of skills a medical school wants to add to a medical doctor and allocated on the demands from society and the specific curriculum designed to achieve this. This specific profile and subsequent curriculum should be clear for each school as well as its future students. On the one hand this creates an opening to develop an optimal selection procedure fitted to the schools' profile. On the other hand, it gives future students the opportunity to make an informed choice which medical profile suits them best. For example, when offering a problem-based learning curriculum; some feel attracted to it and others do not. Also, for the university offering such a program, it is beneficial to select those who have the greatest chance to succeed.

Although the 2009 Framework for Undergraduate Medical Education in the Netherlands (Van Herwaarden, Laan, et al., 2009) offers the medical school an educational outline and end terms, the challenge for medical schools is to choose a profile and publicize this profile. This will result in more variety between medical schools that leads to future doctors that are not only skilled to practice medicine but also have other, additional, abilities valuable for their job and patient care. Results presented in this thesis showed that a selection procedure uniquely designed for a medical school with a marked research profile, reflected in the provision of additional extracurricular activities in the form of a research master's program, indeed endorsed these activities. A tailored selection procedure for this specific profile, using motivated behaviour by means of extracurricular activities followed by a curriculum sample test reduces the dropping out rate of the selected students and in the end, favours a better clinical performance.

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