

# Influence of Preadmission (Matriculation) Scores on the Progress of and Years taken to Graduate by Pharmacy Students at the University of the North, South Africa

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**Admission to the University of the North (UNIN) pharmacy programme is largely based on performance in the matriculation examinations, with a few students admitted through the UNIN foundation year (UNIFY) programme. We examined the relationship between matriculation scores and student's performance at first year and the time taken to graduate. High matriculation scores were predictive of good performance in the first year. The English scores had no influence on first year performance. Students with mathematics at higher grade (HG) fared better than those with standard grade (SG) mathematics. However, the same did not apply to biology and physical science. The matriculation scores did not influence the time taken to graduate. Students from the UNIFY programme had higher four year graduation rates than those admitted directly from high school (52.5% against 26%,  $P = 0.012$ ). These findings will influence the ongoing review of our selection procedures.**

*Keywords:* Admission criteria; Graduation rates; Preadmission programmes; Pharmacy education; Student performance

## INTRODUCTION

The selection of students for admission to university courses is often a contentious issue, and the preparedness of students, especially those from poor backgrounds, for university education is often questionable (Payne *et al.*, 1986; Lee, 1992; Kassebaum and Szenas, 1994; Glasser *et al.*, 1996; Pretorius, 2003; Keeton, 2004). Whereas some schools and programmes use a variety of methods and instruments, others rely entirely on end of secondary or high school results. There is no agreement on the predictive value of such scores on student success at

university (Brink *et al.*, 1988; Allen and Bond, 2001). Preadmission programmes have been used successfully to prepare students for future university studies in target courses like medical school and other health professions courses (Lewis, 1996; Strayhorn, 1999). In the South African context, issues of student suitability, selection and preparedness for university education take on even more importance given the apartheid legacy of inequalities in the education system between the poor (predominantly black) and rich (predominantly white) parts of the country.

The University of the North (UNIN) is one of the historically black universities (HBUs) in South Africa, having begun as University College of the North in 1959, under the Extension of University Education Act of 1959 that excluded "blacks" from "white" universities and proposed special tribal and racial colleges. Training of pharmacists (Bachelor of Pharmacy BPharm) started in 1966 with one student. The programme grew steadily through the turbulent 1970 and 1980s, and at the time of political change in the early 1990s admissions were 40–50 students per year, and the number continued to grow to more than 100 admissions for the 2002 academic year.

Hitherto, admission to the four year BPharm programme at UNIN has been largely based on performance in the matriculation (end of high school) examinations. South African schools offer subjects at standard grade (SG) or higher grade (HG)—the HG looks at a subject in more detail and covers a wider scope than the SG. Matriculated students are admitted to the BPharm programme if they have a rating of 30 or more in the best 6 subjects

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in the matriculation examination, with at least an E (SG) or F (HG) mathematics, a D in English (HG), and at least a D (SG) or E (HG) in physical science and biology. Students who do not qualify for direct admission to the BPharm programme may be admitted after a year in the remedial UNIN Foundation Year (UNIFY) programme. The UNIFY programme is a bridging programme in mathematics, physics, chemistry, biology and English, designed for those students who do not qualify for science-related courses (including pharmacy) on the basis of the matriculation results in the core subjects (UNIFY, 2003). Subsequently, the students may be admitted to the science courses on the basis of the UNIFY results.

At its inception, the UNIN pharmacy programme was primarily meant to supply black pharmacists, mainly for the homelands in the apartheid era. The programme is now focussed not only on offsetting the paucity of pharmacists in the public health sector, but also aims to produce graduates who are "seven-star pharmacists"—equally well prepared for academia, drug research and development (WHO, 1997). One of the ideas under consideration is a revision of the admission requirements by increasing the cut-off scores, and hopefully improving the quality of students admitted to the programme. The purpose of the present study was to:

1. relate the matriculation grades to the performance in the first year BPharm;
2. compare the performance in first year between students admitted via the UNIFY programme and those admitted directly from high school;
3. establish the time taken to graduate, and whether it is related or not to the matriculation grades;
4. determine any association between the route of admission (direct from high school or from UNIFY) and time taken to graduate.

## METHOD

We analysed the admission records for all students admitted to the BPharm programme at UNIN for the years 1994–2002, inclusive. This period was chosen because the period prior to 1994 was characterised by turmoil in the South African education system, with the apartheid regime prepared to keep (black) students at school forever, while many students did not apply themselves adequately, as part of the liberation-before-education struggle. Secondly, 1994 was the first year in which students were admitted via the UNIFY programme (which started in 1992). The matriculation scores in the four pre-requisite subjects for BPharm, namely English, mathematics, biology and physical science (a combination of chemistry and physics) were noted, as it was the level

at which the subject was done, HG or SG. These scores were then converted to aggregates using the South African matriculation board points weightage: for HG subjects  $A = 9$ ,  $B = 8$ ,  $C = 7$ ,  $D = 6$ ,  $E = 5$ ,  $F = 4$ ,  $G = 3$ , and  $H = 2$ ; and for SG subjects  $A = 8$ ,  $B = 7$ ,  $C = 6$ ,  $D = 5$ ,  $E = 4$ ,  $F = 3$ ,  $G = 2$ , and  $H = 1$ . The combined aggregate in the four subjects is hereinafter referred to as the matriculation aggregate.

The results from the first year BPharm subjects— anatomy, biology, chemistry, computer science/ skills, mathematics, pharmaceuticals, pharmacy practice and physics—were noted as pass or fail, and the student's fate in first year coded as 1 = passed all subjects; 2 = passed four (half) or more subjects; 3 = passed lesser than four subjects and 4 = failed all subjects. These results were analysed for relationships between the matriculation aggregate and fate in 1<sup>st</sup> year and between specific matriculation subject score and fate in first year. English was compared only with the overall result in the first year (since English is not a subject in first year BPharm), while for the other 3 subjects a comparison was also made between the matriculation score and the result in the corresponding first year subject (matriculation biology and performance in first year biology), except that the physical science score was matched separately against first year chemistry and physics. The graduation lists for the years 1997 (when the 1994 entrants should have graduated) to 2002 (the latest available one) were used to calculate the number of years between admission and graduation.

Cross-tabulation and  $\chi^2$  test were used to test the association between the matriculation scores in a particular subject and the fate of the student in first year, between the results in individual first year subjects and the corresponding matriculation subject scores, and between the course duration to the matriculation aggregate or route of admission. The matriculation aggregate in the four prerequisite subjects was stratified as follows: 30+, 25–29, 20–24, 15–19 and 10–14. In all analyses a probability level of 0.05 was adopted as the cut-off point for statistical significance.

## RESULTS

There were 568 complete records with matriculation scores and first year results of students admitted to the BPharm course in the years under review. Of those, five had a matriculation aggregate of 30 or more; 97 scored 25–29; 355 scored 20–24; 96 scored 15–19; while 15 were admitted with a matriculation aggregate of 10–14. The relationship between the matriculation aggregate in the four prerequisite subjects and student performance in the first year is shown in Table I. Relatively more students with

TABLE I Matriculation aggregate vs. performance in first year BPharm

| Aggregate* | n   | Subjects passed      |                        |                         |                       |
|------------|-----|----------------------|------------------------|-------------------------|-----------------------|
|            |     | All (%) <sup>†</sup> | ≥Half (%) <sup>†</sup> | < Half (%) <sup>†</sup> | None (%) <sup>†</sup> |
| 30+        | 5   | 3 (60)               | 0 (0)                  | 2 (40)                  | 0 (0)                 |
| 25–29      | 97  | 55 (56.7)            | 27 (27.8)              | 13 (13.4)               | 2 (2.1)               |
| 20–24      | 355 | 109 (30.7)           | 134 (37.7)             | 101 (28.5)              | 11 (3.1)              |
| 15–19      | 96  | 29 (20.2)            | 35 (36.5)              | 29 (30.2)               | 3 (3.1)               |
| 0–14       | 15  | 4 (26.7)             | 6 (40)                 | 5 (33.3)                | 0 (0)                 |

\*Combined aggregates from mathematics, English, biology and physical science. <sup>†</sup>Percentage of students in the category. Chi-square test:  $\chi^2 = 29.437$ , 12 degrees of freedom,  $P = 0.003$ .

an aggregate of 25 or higher passed all their first year subjects than those with a lower aggregate.

### Performance in the First Year

The matriculation score in English had no apparent influence on whether the students passed all, passed some or failed all first year subjects ( $P = 0.493$ ). On the other hand, performance was apparently related to matriculation mathematics of students admitted with HG mathematics, 46.5% passed all subjects, 38.4% passed more than half the first year subjects, 15.1% passed less than half of the first year subjects, and none failed all the subjects. The respective frequencies for those admitted with

SG mathematics were: 30.3, 34.7, 30.9 and 4.1%, and this difference was statistically significant ( $\chi^2 = 27.368$ , 3 degrees of freedom,  $P < 0.0001$ ). For both those with HG mathematics and those with SG mathematics, there were no intra-group differences based on the score in mathematics. For biology and physical science, the fate of the student was not related to whether the student was admitted with the subject at HG or SG ( $\chi^2 = 5.881$ , 3 degrees of freedom,  $P = 0.155$  for biology, and  $\chi^2 = 5.562$ , 3 degrees of freedom,  $P = 0.179$ ), but students with very good grades (A or B) in HG/SG biology did better than the rest overall. Students from the UNIFY programme did slightly better in the first year (with relatively more of them passing all their courses—52.8% against 44.9%) than those admitted to the BPharm directly from high school, but the difference was not statistically significant ( $\chi^2 = 4.722$ , 3 degrees of freedom,  $P = 0.258$ ).

Performance in first year mathematics, chemistry, physical science and biology were associated with performance in the corresponding subjects at matriculation. As shown in Fig. 1, those admitted with HG in respective subjects performed significantly better than those admitted with SG in the subjects, except for biology scores, where this difference was not significant. The respective  $\chi^2$  and  $P$  values (with 1 degree of freedom) were: 28.822 and  $< 0.0001$  for mathematics, 2.061 and 0.151 for

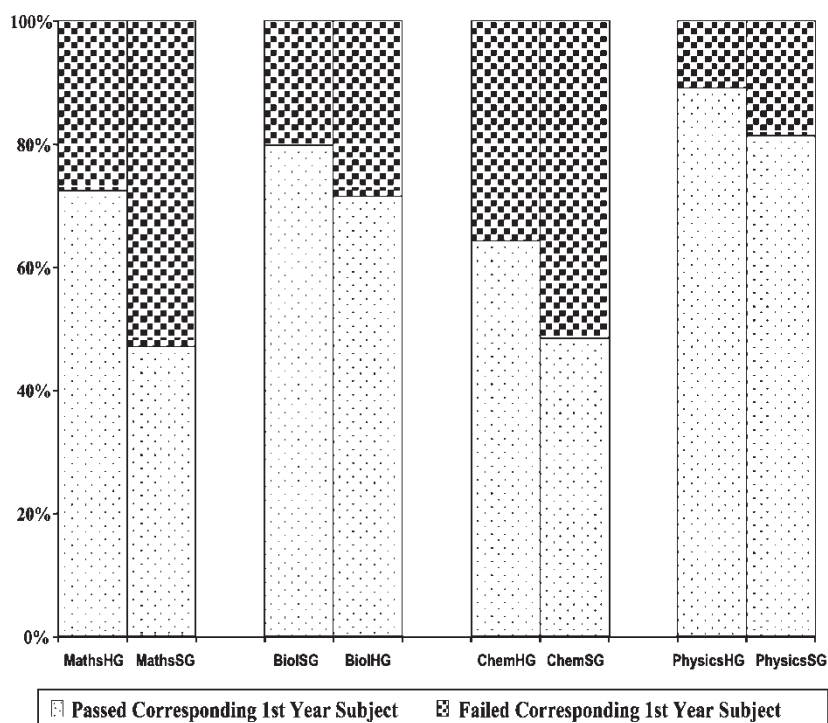


FIGURE 1 Matriculation subject level and fate in 1st year subject; *MathsHG*: fate in 1st year mathematics for students with HG mathematics; *MathsSG*: fate in 1st year mathematics for students with SG mathematics; *BiolHG*: fate in 1st year biology for students with HG biology; *BiolSG*: fate in 1st year biology for students with SG biology; *ChemHG*: fate in 1st year chemistry for students with HG physical science; *ChemSG*: fate in 1st year chemistry for students with SG physical science; *PhysicsHG*: Fate in 1st year physics for students with HG physical science; *PhysicsSG*: fate in 1st year physics for students with SG physical science.

biology, 11.104 and  $<0.0001$  for physical science and chemistry, and 6.027 and 0.014 for physical science and physics.

### Course Duration

There were 184 BPharm graduates from 1997 to 2002, 12 of whom registered for the programme in 1993, and hence their admission grades were not included in the study. The time taken to graduate varied from four to nine years, with a median of five years and a mean  $\pm$  S.E.M. of  $5.04 \pm 0.07$  years. Of the 184 graduates, 57 (31%) took 4 years, 80 (43.5%) took 5 years, 35 (19%) took 6 years, 9 (4.9%) took 7 years, 1 (0.5%) took 8 years, and 2 (1.1%) took 9 years. The relationship between the matriculation aggregate and the time taken to graduate is shown in Table II (a). There was no apparent association between the matriculation aggregate and the time taken to graduate ( $\chi^2 = 9.873$ , 20 degrees of freedom,  $P = 0.970$ ).

Comparison of the course duration for students from the UNIFY programme and for those admitted directly from high school was based on 159 graduates (59 UNIFY, 100 direct-entrants) whose entry route was clearly known. As shown in Table II (b), students from the UNIFY programme had significantly better graduation times ( $\chi^2 = 11.483$ , 3 degrees of freedom,  $P = 0.012$ ) with a median of four years (mean 4.67; 52.5% graduating in four years, 32.2% in five years, 11.9% in six years and 3.4% in seven years), compared to those admitted directly from high school who had a median graduation time of five years (mean 5.06; 26% in four years, 49% in five years, 18% in six years and 7% in seven years).

## DISCUSSION

The present study suggests that students admitted with high scores in the school leaving examination have an advantage over their colleagues with poorer

scores in the first year of the BPharm course, that this advantage is not evident by graduation time, and that otherwise poorly prepared students benefit from the remedial UNIFY programme and have better graduation times than students admitted directly from high school on the strength of their matriculation grades. It has been shown by others that the preadmission scores are important indicators of students' academic performance, the advantage of such high scores does not persist beyond the early parts of the course (Jones and Thomae-Forgues, 1984; Hojat *et al.*, 1985; Campos-Outcalt *et al.*, 1994).

Some of the first year subjects are done at high school too, but at a level that varies from school to school. Good schools with adequate resources (teachers, laboratories and books) tend to cover the science subjects to a greater depth (HG) than the poorer schools, most of which tend to offer the subjects at SG. Students from the good schools may have an edge over their colleagues during the first year when essentially the same subject material is covered, which may partly explain the initial advantage of those with higher scores or HG subjects over the others. It is noteworthy that those students who complete the remedial UNIFY programme do better than those admitted directly from high school, in spite of the fact that the latter have better matriculation grades. Anecdotal reports suggest that the same applies to the UNIFY students that undertake other science courses. It is one of the benefits of academic enrichment or remedial programmes that they narrow the gap between the well-prepared and poorly-prepared-students (Lee, 1992; Glasser *et al.*, 1996). The UNIFY programme which was born out of the need to correct the effect of unequal and inadequate funding of public schools on the quality of education among the poor black students (UNIFY, 2003) seems to be fulfilling its purpose.

The average course duration for the four year BPharm course was  $5.04 \pm 0.07$  years, with mean  $5.06 \pm 0.10$  for those students admitted directly from high school, and a mean of  $4.63 \pm 0.09$  years for those admitted via the one year UNIFY programme. Thus, even factoring in the additional year spent in the UNIFY programme, most students complete their BPharm course within four to six years of registering at the University. These figures compare favourably with those reported for medical students at one of the South African medical schools who overall take an additional two years to complete the six year degree (Price and Smuts, 2002). Various reasons are often advanced for the extra time students who need to complete University courses, including remediation of academic difficulties and slowing pace of education to overcome handicaps in academic preparedness and learning skills (Kassebaum and Szenas, 1994).

Given the nature of the present study, we were unable to establish the factors responsible for some

TABLE II Relationship between matriculation aggregate, route of admission and graduation times

| (a) Matriculation aggregates vs. graduation time |          |  |
|--|----------|--|
| Aggregate  | <i>n</i> | Course duration (years)<br>(mean $\pm$ S.E.M.) |
| 30+  | 3        | 4.67 $\pm$ 0.33                                |
| 25-29  | 41       | 4.95 $\pm$ 0.13                                |
| 20-24  | 111      | 5.11 $\pm$ 0.10                                |
| 15-19  | 14       | 5.14 $\pm$ 0.27                                |
| 11-14  | 3        | 5.00 $\pm$ 0.0                                 |
| (b) Route of admission vs. graduation times      |          |  |
| Course duration                                  | UNIFY*   | Matriculation entrants*                        |
| 4 years  | 52.5     | 26   |
| 5 years  | 32.2     | 49   |
| 6 years  | 11.9     | 18   |
| 7 years  | 3.4      | 7  |

\*% of graduates.  $\chi^2 = 11.483$ , 3 degrees of freedom,  $P = 0.012$

students staying longer than four years in the BPharm programme. It is also a limitation of the present study that it was not possible to track the progress of the students beyond the first year until graduation. It is only in the first year that all students take the same subjects, after that there is a mix, as some students carry-over subjects they did not complete the year before. Secondly, success at university courses is often assessed in terms of graduation rates and timeliness of graduation (Kassebaum and Szenas, 1994), we were unable to establish the drop-out rates from the available records.

We intend to conduct a prospective study of the present BPharm students, with a view to track them across the entire course and interpret their progress not only in terms of preadmission grades, but also by taking into account their background for factors such as family structure, type of school attended, financial resources and parents' education that are often implicated in student's success at university (Bogges, 1998; Veloski *et al.*, 2000). Secondly, as we embark on the task of improving the "quality of students" we admit to the programme, we shall need to take stock of the findings of the present study. From our data, the need for higher entry requirements seems questionable, if the advantage of high matriculation scores does not last throughout the course or affects the timeliness of graduation, how do we justify the call for higher entry requirements? The other issue relates to the value attached to a good pass in English language. Whereas the need for facility in English is self-evident given the fact that English is medium of instruction, our findings suggest that those with weak English passes are not disadvantaged on that account alone. Should we, nevertheless, insist on the higher English grades? Such questions ought to help us consider other criteria for admission to the BPharm course, such as interviews and written admission tests that have been successfully used elsewhere (Allen and Bond, 2001).

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