

Throughput rates and time to completion of health science students of rural origin in South Africa

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Background. There is a shortage of qualified healthcare workers in South Africa (SA), as well as a maldistribution between urban and rural areas. Research has shown that health professionals of rural origin are more likely to live and work in rural areas than their urban colleagues. It has been recommended that student selection policies of higher education institutions should prioritise applicants from rural and remote areas to address the urban-rural maldistribution of graduates and to redress historical equity issues. However, university students in SA have high attrition and low graduation rates. The Umthombo Youth Development Foundation (UYDF) recruits and supports rural-origin health science students, who completed Grade 12 at a rural school, to address staff shortages in rural areas.

Objectives. To report on the throughput rates (percentage of cohort who graduate) and time to completion (number of years taken to graduate) of eight cohorts of UYDF-supported rural-origin health science students.

Methods. A total of 388 student records from the 2008 - 2015 cohorts, covering 17 different health science disciplines, were analysed, and throughput rates and time to completion for the different cohorts and health science disciplines were calculated. Throughput rates and time to completion were also calculated for 3-year, 4-year and 6-year qualifications.

Results. Throughput for the 2008 - 2015 cohorts ranged between 82% (2010 cohort) and 100% (2009 cohort). For 3-year qualifications, five cohorts had 100% throughput and one cohort 50% throughput. For 4-year qualifications, throughput ranged from 75% (2010 cohort) to 100% (2009 cohort). For medical students (6-year qualification), throughput ranged from a low of 81% (2014 cohort) to 100% in two cohorts (2008 and 2009). More female students ($n=29$) were excluded than male students ($n=14$). With regard to time to completion, over the eight cohorts 68% of students completed in the minimum time, 23% needed 1 additional year, 6% an additional 2 years, 2% an additional 3 years, and 1% an additional 4 years. For 4-year qualifications, 58% of students completed in the minimum time, 28% needed 1 additional year, 9% needed 2 additional years, 4% needed 3 additional years, and 1% needed an additional 4 years. Of medical students, 76% completed in the minimum time, 19% needed 1 additional year, and 98% had completed after 2 additional years.

Discussion. The UYDF students studying for 3-year and 4-year qualifications exceeded the national throughput rates in seven of eight cohorts. UYDF medical students exceeded the national statistics in four cohorts, had similar throughputs in two cohorts, and had lower throughputs than the national statistics in two cohorts. Overall, 91% of UYDF students across the eight cohorts completed in the minimum time plus 1 additional year, exceeding the national statistics.

Conclusion. The relatively high throughput rates compared with the national statistics highlight the academic ability of rural-origin health science students and provide hope that national shortages of healthcare workers may be addressed if there is an investment in such students..

Afr J Health Professions Educ 2024;16(2):e1140. <https://doi.org/10.7196/AJHPE.2024.v16i2.1140>

There is a shortage of qualified healthcare workers (HCWs) in South Africa (SA),^[1,2] as well as a maldistribution between urban and rural areas.^[3-5] Research has shown that health professionals of rural origin are more likely to live and work in rural areas than their urban colleagues.^[3,6-9] It has therefore been recommended that student selection policies of higher education institutions should prioritise applicants from rural and remote areas who meet the minimum academic criteria, to address the urban-rural maldistribution of graduates and to redress historical equity issues.^[10] In SA, in an attempt to address historical inequities with regard to access, medical schools attempt to select candidates reflecting the demographic profile of the country, and therefore aim to increase the number of black African and coloured students selected for medical training.^[11]

However, despite massive investments in education, the legacy of low-quality basic education in historically disadvantaged parts of the school system persists.^[12] Furthermore, high attrition and low graduation rates of

university students have largely neutralised important gains in access by previously disadvantaged students,^[13] with a range of factors contributing to low throughput and graduation rates, including poor schooling and resulting under-preparedness of students to pursue higher education, lack of fluency in the language of instruction, inadequate access to financial support and student support services,^[13,14] being first-generation university students with a lack of appropriate family support,^[15] and lack of computer and technology literacy.^[16] Within the SA higher education system, university access, success and completion rates continue to be racially skewed, with white completion rates being on average 50% higher than black African rates. The net result of the disparities in access and success is that fewer than 5% of black African and coloured youth are succeeding in any form of higher education.^[12,14] Furthermore, the time to complete a qualification has consequences for students who are dependent on National Student Financial Aid Scheme (NSFAS) financial support,

which is capped at the minimum qualification time plus 1 year,^[17] or plus 2 years for students registered before 2018.

The Council on Higher Education (CHE)^[18] reported that 73% of the 2011 cohort of students studying for a 4-year health science degree in SA completed after 6 years ($n+2$), while the Department of Higher Education and Training (DHET)^[19] reported that 42.2% of the 2008 cohort and 47.6% of the 2014 cohort of first-time entering undergraduate students studying for 4-year qualifications through contact mode in SA completed in the minimum time, with 78.2% of the 2008 cohort having completed after 10 years, with an overall dropout of 17.2%. The values for the other cohorts ranged between these two values. With regard to medical students, the DHET^[19] reported that 63.9 - 71.6% of the 2008 - 2015 cohorts had completed in the minimum time, 79.5 - 85.4% after 1 additional year, and 86.1 - 90.1% after 2 additional years. After 10 years, 90.9% of the 2008 cohort had completed, with an overall dropout of 6.4%.

To address HCW staff shortages at rural district hospitals in KwaZulu-Natal (KZN) Province, the Umthombo Youth Development Foundation (UYDF), established in 1999, recruits and supports rural-origin health science students, with the intention that graduates will work in rural areas upon completion of their studies.^[8] Criteria for students to receive the UYDF financial and mentoring support are: (i) must come from the uMkhanyakude, Zululand or King Cetshwayo districts of KZN, or areas around two hospitals in Eastern Cape Province; (ii) must have obtained a place to study a health science degree at a public university in SA; (iii) must have done 1 week's voluntary work at their local hospital in the discipline they are interested in; (iv) must be in financial need; and (v) must be willing on graduation to work at a rural hospital in one of the three districts listed above, or at one of the two Eastern Cape hospitals, for the same number of years they were supported for. The majority of students recruited completed Grade 12 at non-fee-paying, quintile 1 - 3 rural schools in the uMkhanyakude, Zululand or King Cetshwayo districts of KZN - schools where the factors highlighted above tend to be more extreme,^[12] especially in terms of under-preparedness to pursue higher education and lack of fluency in the language of instruction, in addition to an array of social factors related to generational poverty.^[12] In an attempt to address these deficiencies, the UYDF provides academic and social mentoring support, as well as comprehensive financial support to all its students in partnership with NSFAS for a maximum of $n+2$.^[8] The mentoring support is compulsory and entails students having an individual face-to-face meeting with their mentor on campus every month to discuss any academic and social challenges they face. With the assistance of the mentor, they develop a plan of action, which the mentor holds them accountable to implement.^[8] As part of the mentoring support, all students are required to complete 4 weeks per annum of work exposure at their local rural hospital, which enables them to complement theory with practice and orientates them towards rural practice. A final component of the mentoring support is attendance by students at a Lifeskills Imbizo (gathering), held at the end of each year, where a range of non-academic issues, such as managing oneself well, financial literacy and professionalism, among others, are workshopped.

Limited information exists regarding the throughput rates and time to completion of rural-origin health science students, and therefore the viability of investing in them to address HCW shortages in SA. This study therefore reports on the throughput rates and time to completion of eight cohorts of UYDF-supported rural-origin health science students.

Methods

This was a retrospective, longitudinal, comparative study based on the records of the 2008 - 2015 student cohorts. The UYDF started by supporting four students in 1999 and currently supports between 180 and 200 rural-origin health science students a year at various stages of training. In 2008, full-time staff were employed to manage and develop the scholarship scheme, which included the development of a structured mentoring support programme. Comprehensive student records covering student demographic details, date and hospital of selection, annual academic progress, graduation date and employment history have been kept by the UYDF since initiation of the scholarship scheme. For the purposes of the present study, records from 2008 were used, as this is when the formal mentoring support was implemented, and because the numbers of students selected for UYDF support from 1999 to 2007 were very small, ranging between two and seven per year. In 2016, only two students were selected, while 36 from the 2017 cohort were still studying at the time of the study. Data were extracted into Excel version 2403 (Microsoft, USA), and throughput rates and time to completion were calculated for each cohort of students, as well as qualification length (3, 4 and 6 years). 'Cohort' in this study refers to the year that students joined the UYDF, which was not necessarily the first year they enrolled at university, and therefore differs from the DHET and CHE definition of being the first year of enrolment at university. This study used the DHET^[19] definition of 'throughput', defined as 'Cohort studies are the study of first-time entering undergraduate students, who are tracked over a 10-year period to determine the percentage of students that have dropped out from their studies or who have completed their studies', as opposed to the CHE^[8] definition, which calculates throughput up to 2 years beyond the minimum time ($n+2$). Time to completion was also calculated owing to its relevance related to financial support as highlighted above, and is defined as the number of years a student takes to complete their degree, i.e. minimum time (n), or $n+1$, $n+2$, etc.^[17]

A total of 388 student records were eligible for analysis over the 2008 - 2015 cohorts (Table 1). Students studied one of 17 health science disciplines (Table 1) at one of 16 public universities in SA. When the data were analysed by health science discipline (Table 2), the following disciplines were excluded because there were fewer than five students supported in each discipline: clinical associate ($n=1$), dentistry ($n=3$), orthotics and prosthetics ($n=1$), psychology ($n=5$; 4 were supported for 1 year only), and speech therapy ($n=3$). Regarding academic and social mentoring support, all first- and second-year students, as well as struggling senior students, had a monthly face-to-face meeting with a mentor, while the UYDF Student Manager mentored all senior students across all campuses and oversaw the entire mentoring programme. The mentor (a volunteer, and not necessarily a health professional, having little to no subject knowledge) was identified and trained by the UYDF, and after the monthly student meeting submitted a standardised report to the Student Manager, enabling the manager to assess the performance of all the students. The Student Manager visited all students at least once a year on campus, but often two visits a year were conducted, with the purpose of getting to know the students and understand their challenges, as well as reinforcing the reason why the UYDF was supporting them (to address staff shortages at rural hospitals). Students were excluded from UYDF support mainly owing to poor academic progress (failure), and in three cases because of non-compliance with UYDF policies, such as

Table 1. Health science discipline of students by cohort year and gender

| | Cohort, <i>n</i> | | | | | | | | Female, <i>n</i> | Male, <i>n</i> | Total, <i>n</i> |
|-------------------------|------------------|-------------|------------|------------|------------|------------|------------|------------|------------------|----------------|-----------------|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | | | |
| Total students | 26 | 26 | 45 | 54 | 58 | 45 | 82 | 52 | 228 | 160 | 388 |
| Discipline | | | | | | | | | | | |
| Audiology | - | 1 | - | 1 | - | 2 | 3 | 3 | 8 | 2 | 10 |
| Biomedical technology | 2 | 1 | 1 | 2 | 1 | - | 1 | - | 4 | 4 | 8 |
| Clinical associate | - | 1 | - | - | - | - | - | - | 0 | 1 | 1 |
| Dental therapy | 1 | - | 1 | 1 | 3 | 2 | - | - | 5 | 3 | 8 |
| Dentistry | - | 1 | - | - | - | 2 | - | - | 1 | 2 | 3 |
| Dietetics | 3 | 2 | 2 | 2 | 2 | | 2 | 2 | 11 | 4 | 15 |
| Medicine | 10 | 6 | 22 | 21 | 28 | 22 | 43 | 20 | 95 | 77 | 172 |
| Nursing | 5 | 3 | 3 | 7 | 5 | 2 | 1 | 10 | 21 | 15 | 36 |
| Occupational therapy | 1 | - | - | 2 | 2 | 3 | 3 | 2 | 9 | 4 | 13 |
| Optometry | - | - | 2 | 5 | 3 | - | 1 | - | 5 | 6 | 11 |
| Orthotics & prosthetics | - | - | - | - | - | - | 1 | - | 0 | 1 | 1 |
| Pharmacy | 1 | 4 | 3 | 4 | 3 | 3 | 10 | 9 | 24 | 13 | 37 |
| Physiotherapy | 1 | - | 6 | 6 | 5 | 2 | 9 | 1 | 19 | 11 | 30 |
| Psychology | 1 | 1 | - | 2 | - | - | 1 | - | 4 | 1 | 5 |
| Radiography | 1 | 1 | 3 | 1 | 6 | 7 | 7 | 3 | 14 | 14 | 28 |
| Social work | 1 | 5 | 1 | - | - | - | - | - | 6 | 1 | 7 |
| Speech therapy | - | - | 1 | - | - | - | - | 2 | 2 | 1 | 3 |
| Female | 14 | 18 | 26 | 39 | 27 | 28 | 48 | 28 | 228 | | |
| Male | 12 | 8 | 19 | 15 | 31 | 17 | 34 | 24 | 160 | | |
| Throughput | 96% | 100% | 82% | 85% | 91% | 88% | 86% | 90% | | | |

not meeting their mentor, being unco-operative, and not implementing the advice given. It is important to note that students excluded from the UYDF were not necessarily excluded by their universities, and some may therefore have completed their qualification without UYDF support. At the time of analysis, it was found that of the excluded students, 4/8 in the 2010 cohort completed, 3/7 in the 2011 cohort completed, 4/5 in the 2012 cohort completed, and 3/6 in the 2013 cohort completed.

Ethics approval was obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee (ref. no. BREC/00002918/2021).

Results

Table 1 provides details of all UYDF students supported from 2008 to 2015, with the first 2 years having the smallest cohorts of fewer than 30 students each. Female students were in the majority in all cohorts (except in 2012) and in all health science disciplines (except optometry), and constituted 59% of student numbers.

Supplementary Table 1 (available online at <https://www.samedical.org/file/2193>) presents the number of new students selected each year, as well as those who graduated, were excluded, withdrew, or were still studying at the time of writing, giving the throughput rate for the particular cohort. The 'Students withdrew' column represents those who left the UYDF programme for other support, and as per the DHET^[19] cannot be considered as 'dropouts,' as well as those financially supported by the UYDF for 1 year only. Of the 43 students who were excluded, 40 were excluded due to poor academic performance, and three for having a bad attitude and being non-compliant in adhering to the UYDF policies. There was a sharp decrease in throughput in 2010, being the lowest of all the cohorts, with no obvious explanation, as the exclusions covered five different disciplines, three of the exclusions were physiotherapy students, and five were second-year students.

Of the 11 excluded in 2014, two students have subsequently completed, and four are still registered (June 2023).

To provide greater insight into the data, Table 2 presents the cohort by health science discipline for 3-year, 4-year and 6-year qualifications. Thirteen students were not included in the data owing to the small numbers per discipline, as mentioned under 'Methods'.

The breakdown of 3-year qualifications shows that the number of students selected annually was small, ranging from two to seven students per cohort, with the throughput across the eight cohorts ranging from 50% to 100%.

Four-year qualifications covered eight disciplines and comprised 159 students. Throughput ranged from 100% in the 2009 cohort to a low of 75% for the 2010 cohort. The pharmacy student throughput was the best, with 100% throughput achieved across seven of the eight cohorts.

A total of 172 medical students (6-year qualification) were supported over the 8 years, representing the largest discipline, with the smallest number of six students selected in 2009 and the largest number of 43 selected in 2014. Eight students in the 2014 cohort were excluded by UYDF – at the time of the study four were still registered, and one had completed, increasing the throughput to 84%. The 2014 cohort had the lowest throughput of 81%, while the 2008 and 2009 cohorts achieved 100% throughput from a total of 16 students. One student in the 2015 cohort is still studying after a break in her studies due to ill health.

Across all disciplines except dietetics, more female students ($n=29$) were excluded than male students ($n=14$), and across six disciplines only female students were excluded (Table 3). For five disciplines, clinical associate ($n=1$), dental therapy ($n=8$), orthotics and prosthetics ($n=1$), psychology ($n=5$) and social work ($n=7$), no students were excluded. Pharmacy had the lowest exclusion rate of 3%, followed by optometry (9%) and medicine (10%). Occupational therapy students had the highest exclusion rate of 31%.

Table 2. Throughput by cohort and discipline and for 3-year, 4-year and 6-year qualifications

| Discipline* | Cohort, <i>n</i> | | | | | | | | Total, <i>n</i> |
|---------------------------------|------------------|-------------|------------|------------|-------------|------------|-------------|-------------|-----------------|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | |
| 3-year degrees | | | | | | | | | |
| Biomedical technology | | | | | | | | | |
| Selected | 2 | 1 | 1 | 2 | 1 | - | 1 | - | 8 |
| Graduated | 2 | 1 | 1 | 1 | 1 | - | 1 | - | 7 |
| Excluded | 0 | 0 | 0 | 1 | 0 | - | 0 | - | 1 |
| Withdrew | 0 | 0 | 0 | 0 | 0 | - | 0 | - | 0 |
| Throughput | 100% | 100% | 100% | 50% | 100% | - | 100% | - | |
| Dental therapy | | | | | | | | | |
| Selected | 1 | - | 1 | 1 | 3 | 2 | - | - | 8 |
| Graduated | 1 | - | 1 | 1 | 3 | 2 | - | - | 8 |
| Excluded | 0 | - | 0 | 0 | 0 | 0 | - | - | 0 |
| Withdrew | 0 | - | 0 | 0 | 0 | 0 | - | - | 0 |
| Throughput | 100% | - | 100% | 100% | 100% | 100% | - | - | |
| Radiography | | | | | | | | | |
| Selected | - | 1 | 3 | 1 | 6 | 7 | 7 | 3 | 28 |
| Graduated | - | 1 | 2 | 0 | 6 | 6 | 7 | 3 | 25 |
| Excluded | - | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 3 |
| Withdrew | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Throughput | - | 100% | 67% | 0% | 100% | 86% | 100% | 100% | |
| 3-year degree throughput | 100% | 100% | 89% | 50% | 100% | 93% | 100% | 100% | |
| 4-year degrees | | | | | | | | | |
| Audiology | | | | | | | | | |
| Selected | - | 1 | - | 1 | - | 2 | 3 | 3 | 10 |
| Graduated | - | 1 | - | 1 | - | 1 | 2 | 3 | 8 |
| Excluded | - | 0 | - | 0 | - | 1 | 1 | 0 | 2 |
| Withdrew | - | 0 | - | 0 | - | 0 | 0 | 0 | 0 |
| Throughput | - | 100% | - | 100% | - | 50% | 67% | 100% | |
| Dietetics | | | | | | | | | |
| Selected | 3 | 2 | 2 | 2 | 2 | - | 2 | 2 | 15 |
| Graduated | 3 | 2 | 1 | 1 | 2 | - | 2 | 1 | 12 |
| Excluded | 0 | 0 | 1 | 1 | 0 | - | 0 | 1 | 3 |
| Withdrew | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 |
| Throughput | 100% | 100% | 50% | 50% | 100% | - | 100% | 50% | |
| Nursing | | | | | | | | | |
| Selected | 5 | 3 | 3 | 7 | 5 | 2 | 1 | 10 | 36 |
| Graduated | 5 | 3 | 3 | 6 | 5 | 2 | 1 | 8 | 33 |
| Excluded | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 3 |
| Withdrew | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Throughput | 100% | 100% | 100% | 86% | 100% | 100% | 100% | 80% | |
| Occupational therapy | | | | | | | | | |
| Selected | 1 | - | - | 2 | 2 | 3 | 3 | 2 | 13 |
| Graduated | 0 | - | - | 2 | 0 | 3 | 3 | 1 | 9 |
| Excluded | 1 | - | - | 0 | 2 | 0 | 0 | 1 | 4 |
| Withdrew | 0 | - | - | 0 | 0 | 0 | 0 | 0 | 0 |
| Throughput | 0% | - | - | 100% | 0% | 100% | 100% | 50% | |
| Optometry | | | | | | | | | |
| Selected | - | - | 2 | 5 | 3 | - | 1 | - | 11 |
| Graduated | - | - | 1 | 5 | 3 | - | 1 | - | 10 |
| Excluded | - | - | 1 | 0 | 0 | - | 0 | - | 1 |
| Withdrew | - | - | 0 | 0 | 0 | - | 0 | - | 0 |
| Throughput | - | - | 50% | 100% | 100% | - | 100% | - | |

... continued

Table 2. (continued) Throughput by cohort and discipline and for 3-year, 4-year and 6-year qualifications

| Discipline* | Cohort, <i>n</i> | | | | | | | | Total, <i>n</i> |
|---------------------------------|------------------|-------------|------------|------------|------------|------------|------------|------------|-----------------|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | |
| Pharmacy | | | | | | | | | |
| Selected | 1 | 4 | 3 | 4 | 3 | 3 | 10 | 9 | 37 |
| Graduated | 1 | 4 | 3 | 4 | 3 | 3 | 9 | 9 | 36 |
| Excluded | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Withdrew | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Throughput | 100% | 100% | 100% | 100% | 100% | 100% | 90% | 100% | |
| Physiotherapy | | | | | | | | | |
| Selected | 1 | - | 6 | 6 | 5 | 2 | 9 | 1 | 30 |
| Graduated | 1 | - | 3 | 5 | 4 | 1 | 8 | 1 | 23 |
| Excluded | 0 | - | 3 | 1 | 1 | 0 | 1 | 0 | 6 |
| Withdrew | 0 | - | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Throughput | 100% | - | 50% | 83% | 80% | 100% | 89% | 100% | |
| Social work | | | | | | | | | |
| Selected | 1 | 5 | 1 | - | - | - | - | - | 7 |
| Graduated | 1 | 5 | 1 | - | - | - | - | - | 7 |
| Excluded | 0 | 0 | 0 | - | - | - | - | - | 0 |
| Withdrew | 0 | 0 | 0 | - | - | - | - | - | 0 |
| Throughput | 100% | 100% | 100% | - | - | - | - | - | |
| 4-year degree throughput | 83% | 100% | 75% | 88% | 80% | 90% | 92% | 80% | |
| 6-year degree | | | | | | | | | |
| Selected | 10 | 6 | 22 | 21 | 28 | 22 | 43 | 20 | 172 |
| Graduated | 10 | 6 | 19 | 18 | 26 | 17 | 34 | 19 | 149 |
| Excluded | 0 | 0 | 2 | 2 | 2 | 3 | 8 | 0 | 17 |
| Withdrew | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 5 |
| Still studying | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 6-year degree throughput | 100% | 100% | 90% | 90% | 93% | 85% | 81% | 95% | |

*Clinical associate, dentistry, orthotics & prosthetics, psychology and speech therapy are not included in the table because their numbers are <5.

Supplementary Table 1. Throughput of all UYDF students by cohort, 2008 - 2015

| Cohort year | No. selected | Graduates | Excluded | Students withdrew | Still studying |
|--------------------|--------------|------------|-----------|-------------------|----------------|
| 2008 | 26 | 25 | 1 | 0 | 0 |
| 2009 | 26 | 26 | 0 | 0 | 0 |
| 2010 | 45 | 36 | 8 | 1 | 0 |
| 2011 | 54 | 46 | 7 | 1 | 0 |
| 2012 | 58 | 53 | 5 | 0 | 0 |
| 2013 | 45 | 36 | 6 | 3 | 0 |
| 2014 | 82 | 70 | 11 | 1 | 0 |
| 2015 | 52 | 46 | 5 | 0 | 1 |
| All cohorts | 388 | 338 | 43 | 6 | 1 |

Time to completion

Time to completion per cohort is presented in Supplementary Table 2 (<https://www.samedical.org/file/2193>), with 'n' being the minimum regulation time required to complete the relevant qualification, and n+1, 2, 3 and 4 being 1, 2, 3 or 4 additional years required to complete.

Slightly fewer than 70% of students across the eight cohorts completed in the minimum time, with 23% needing 1 additional year (n+1), resulting in 91% of students having completed after 1 additional year, and 97% after 2 additional years. The performance of the students in the 2010 cohort was the best, with 83% completing in the minimum time and the balance needing only 1 additional year. The two students requiring 4 additional

years were both from the 2011 cohort, while those needing 3 additional years were spread over four different cohorts.

Time to completion by health discipline is presented in Table 4. Four dietetics students, two medical students, one nursing student and one optometry student needed an additional 3 years to complete, while one dietetics student and one medical student required an additional 4 years. Medical student time to completion was better than the average, with 76% of medical students completing in the minimum time and 19% after 1 additional year, which accounted for 95% of students. All six social work students completed in the minimum time.

Seventy-five percent of students studying for a 3-year degree completed

Table 3. Exclusion by discipline and gender of students

| Discipline* | All students, <i>n</i> | | | Excluded | | |
|-----------------------|------------------------|------------|------------|------------------|----------------|---------------------|
| | Total | Female | Male | Female, <i>n</i> | Male, <i>n</i> | Total, <i>n</i> (%) |
| Audiology | 10 | 8 | 2 | 2 | 0 | 2 (20) |
| Biomedical technology | 8 | 4 | 4 | 1 | 0 | 1 (12) |
| Dentistry | 3 | 1 | 2 | 1 | 0 | 1 (12) |
| Dietetics | 15 | 11 | 4 | 1 | 2 | 3 (20) |
| Medicine | 172 | 95 | 77 | 10 | 7 | 17 (10) |
| Nursing | 36 | 21 | 15 | 3 | 0 | 3 (8) |
| Occupational therapy | 13 | 9 | 4 | 3 | 1 | 4 (31) |
| Optometry | 11 | 5 | 6 | 0 | 1 | 1 (9) |
| Pharmacy | 37 | 24 | 13 | 1 | 0 | 1 (3) |
| Physiotherapy | 30 | 19 | 11 | 4 | 2 | 6 (20) |
| Radiography | 28 | 14 | 14 | 3 | 0 | 3 (11) |
| Speech therapy | 3 | 2 | 1 | 0 | 1 | 1 (33) |
| Total | 366 | 213 | 153 | 29 | 14 | 43/388 (11) |

*Excludes disciplines where no students were excluded: clinical associate (*n*=1); dental therapy (*n*=8); orthotics & prosthetics (*n*=1); psychology (*n*=5); social work (*n*=7).

Table 4. Time to completion of students by discipline

| Discipline* | Time to completion, <i>n</i> | | | | | Total, <i>n</i> |
|-----------------------------------|------------------------------|-------------|--------------------------|-------------|-------------|-----------------|
| | <i>n</i> | <i>n</i> +1 | <i>n</i> +2 [†] | <i>n</i> +3 | <i>n</i> +4 | |
| Audiology [‡] | 4 | 3 | 1 | 0 | 0 | 8 |
| Biomedical technology | 6 | 1 | 0 | 0 | 0 | 7 |
| Dental therapy | 4 | 3 | 1 | 0 | 0 | 8 |
| Dietetics [‡] | 1 | 3 | 3 | 4 | 1 | 12 |
| Medicine | 114 | 28 | 4 | 2 | 1 | 149 |
| Nursing [‡] | 27 | 4 | 1 | 1 | 0 | 33 |
| Occupational therapy [‡] | 5 | 3 | 1 | 0 | 0 | 9 |
| Optometry [‡] | 4 | 4 | 1 | 1 | 0 | 10 |
| Pharmacy [‡] | 26 | 8 | 2 | 0 | 0 | 36 |
| Physiotherapy [‡] | 6 | 13 | 4 | 0 | 0 | 23 |
| Radiography | 20 | 4 | 1 | 0 | 0 | 25 |
| Social work [‡] | 6 | 0 | 0 | 0 | 0 | 6 |
| Total | 224 | 74 | 19 | 8 | 2 | 327 |
| Percentage | 68% | 23% | 6% | 2% | 1% | |
| All 4-year degrees | 58% | 28% | 9% | 4% | 1% | |

n=minimum time, *n*+1, 2, 3 and 4 = 1, 2, 3 or 4 additional years required to complete.

*Clinical associate, dentistry, orthotics & prosthetics, psychology and speech therapy are not included in the table because their numbers are <5.

[†]*n*+2 is the Council on Higher Education measure of throughput.

[‡]Four-year degree.

in the minimum time, 20% needed 1 additional year, and two (5%) required an additional 2 years (Table 4). Fifty-eight percent of students studying for a 4-year degree completed in the minimum time, 28% needed 1 additional year, 9% needed 2 additional years, and 4% required 3 additional years (4 dietetics, 1 nursing, 1 optometry), while one dietetics student needed 4 additional years (Table 4).

Discussion

The aim of the present study was to report on the throughput rates and time to completion of rural-origin UYDF-supported students, all of whom were black African and the majority of whom completed secondary schooling at a quintile 1 - 3 rural school. Although this is a unique group, to which the UYDF provided some measure of academic and social mentoring support as well as comprehensive financial support, we believe that the data may be compared generally with national statistics, as the Committee of Medical

Deans stated that all eight medical schools offered structured support programmes to their students.^[11]

The support that the UYDF provides, in addition to comprehensive financial support, is essentially to hold students accountable to find the assistance they need by accessing university resources early in the academic year. The UYDF did not provide tutoring or subject specialist knowledge, so all registered students would be able to access the same support. The 2008 and 2009 cohorts were the smallest, both with 26 students, while the 2014 cohort was the largest with 82 students, and 59% of the students were female. The DHET^[19] 2000 - 2016 cohort report states that female students outperformed their male counterparts in virtually all cohort studies, which is in contrast to the results of the present study, in which 29 of the 43 students excluded (67%) were female, and for six disciplines only female students were excluded (Table 3). No obvious explanation exists for this anomaly. Five disciplines (clinical associate (*n*=1), dental therapy

Supplementary Table 2. Time to completion by cohort: all UYDF graduates and disciplines

| Year | Graduates | n | n+1 | n+2 | n+3 | n+4 |
|--------------------|------------|------------|------------|------------|------------|-------------|
| 2008 | 25 | 14 | 5 | 4 | 2 | 0 |
| 2009 | 25* | 18 | 5 | 2 | 0 | 0 |
| 2010 | 36 | 30 | 6 | 0 | 0 | 0 |
| 2011 | 44† | 25 | 13 | 3 | 1 | 2 |
| 2012 | 53 | 37 | 12 | 2 | 2 | 0 |
| 2013 | 35‡ | 27 | 7 | 1 | 0 | 0 |
| 2014 | 70 | 41 | 20 | 6 | 3 | 0 |
| 2015 | 46 | 35 | 8 | 3 | 0 | 0 |
| All cohorts | 332 | 226 | 75 | 21 | 8 | 2 |
| Percentage | | 68% | 23% | 6% | 2% | 1% |
| Total | | | 91% | 97% | 99% | 100% |

*1 student Master's studies.

†2 students Master's studies.

‡1 dental graduate not included owing to university exclusion and readmission a number of years later.

Note: n+2 is the Council on Higher Education measure of throughput.

($n=8$), orthotics and prosthetics ($n=1$), psychology ($n=5$) and social work ($n=7$) had no students excluded, while pharmacy had the lowest exclusion rate across eight cohorts of 3% ($n=1/37$) and occupational therapy had the highest exclusion rate of 31% ($n=4/13$) (Table 3).

The number of UYDF students studying for 3-year qualifications was small ($n=44$) in comparison with those studying for 4-year qualifications ($n=159$) and the 172 studying for a 6-year medical qualification. The 44 UYDF students studying for 3-year qualifications exceeded the national throughput rates for contact students reported by the DHET^[19] in seven of its eight cohorts (Table 2), as the best-performing national cohorts were 2011 and 2012, where 76.4% of students had completed after 10 years, whereas over seven cohorts 89 - 100% of UYDF students completed (the UYDF 2011 cohort throughput was 50%, lower than the national statistics). Of the UYDF dental therapy students, all eight completed (100% throughput) (Table 2), compared with 81% of Sefako Makgatho Health Sciences University (SMU) students across 10 cohorts (2004 - 2014).^[20] Fifty percent of UYDF dental therapy students completed in the minimum time, compared with 45% of SMU students^[20] across 10 cohorts. Masetla and Mthethwa^[20] also reported that more female students graduated (61%) compared with male students (39%).

The throughput rates of students studying for 4-year qualifications ranged from a low of 75% for the 2010 cohort to 100% achieved by the 2009 cohort (Table 2). The DHET^[19] national data for 4-year degrees over the same period range between 76.2% for the 2009 cohort to 80% for the 2013 cohort, meaning that the UYDF students outperformed the national statistics in six of the eight cohorts (Table 2). Regarding time to completion, 58% of UYDF students completed in the minimum time (Table 4), v. the national statistics which ranged from 40.7% (2009 cohort) to 47.9% (2015 cohort);^[19] 85% of UYDF students had completed after 1 additional year, compared with 57.8 - 63.6%.^[19] The CHE^[18] VitalStats data report throughput and time to completion specifically for 4-year health science qualifications as opposed to the DHET general data. In the 2011 cohort reported by the CHE,^[18] 44% of students completed in the minimum time, 15% needed 1 additional year (59% complete) and 6% needed an additional 2 years, accounting for 65% of students. Black health science students performed marginally better (64% had completed after 2 additional years) than coloured students (59% had

completed after 2 additional years), but slightly worse than Indian (66%) and white (70%) students. Mabope and Meyer,^[21] using a problem-based pharmacy curriculum at a previously disadvantaged university, reported a throughput rate for 458 students of 88.2% between 1999 and 2008, although 12 students were still studying, with 74% of students completing in the minimum time of 4 years and 13.7% needing an additional 1 or 2 years. In comparison, the UYDF pharmacy students achieved 100% throughput in seven of the eight cohorts and 90% throughput for the 2014 cohort, with slightly fewer completing in the minimum time (72% v. 74%), while 22% ($n=8$) needed 1 additional year and 5% ($n=2$) needed 2 additional years. The throughput rate of occupational therapy students in this study was the lowest of all disciplines at 69% (Table 2), with no obvious explanation, as all students were enrolled at the same institution and received the same mentoring support from the UYDF. Fifty-five percent ($n=5/9$) completed in the minimum time, which is lower than the 65% reported by Naidoo *et al.*^[22] in their study of 103 occupational therapy graduates at the same institution over the period 2005 - 2010. Unfortunately, their study did not provide the throughput rates of the students. The time to completion of dietetics students in the present study was found to be consistently longer than for other disciplines because students are not allowed to progress to the next year of study if they failed a module (they cannot 'carry' the failed module) - they have to repeat the module the next year before progressing.

Medical students ($n=172$) constituted the largest number of UYDF students, and of these 17 were excluded from the UYDF for various reasons (Table 3); however, some may subsequently have graduated (we are aware of at least three who did graduate), meaning that the actual throughput rate was better than reported. The throughput rate for the 2008 and 2009 UYDF medical student cohorts of 100% was higher than the DHET^[19] 2008 and 2009 cohort rates of 90.9% and 91.7% achieved after 10 years, as were the 2012 (93%) and 2015 (95%) UYDF cohorts. The DHET^[19] 2010 and 2011 throughput rates of 91.2% and 91.7% were slightly higher than the 90% UYDF rates for the same cohorts, while the throughput rates of the UYDF 2013 (85%) and 2014 (81%) cohorts were lower than the national statistics. With regard to time to completion, 76% of UYDF medical students completed in the minimum time (Table 4), v. the national statistics, which ranged from 63.9% (2010) to 71.6% (2015);^[19] 95% of UYDF students

completed in the minimum time or after 1 additional year (Table 4), v. 79.5% (2008) to 85.4% (2015);^[19] and 98% had completed after an additional 2 years (Table 4), v. 86.1% (2010) to 90.1% (2013).^[19] The five medical students who were categorised as 'withdrew' (Table 2) were assisted by the UYDF to settle outstanding university debt and were funded for 1 year only. Since they were 'out of area' students, who were not selected through the normal channels, they were not included in the study.

In the present study, across all disciplines, 91% of UYDF students had completed after 1 additional year (Table 4). If the students had been solely dependent on NSFAS financial support, 9% of UYDF students would have been left without funding in the new NSFAS dispensation of providing support for 1 additional year (n+1). Of greater concern is that according to CHE data,^[18] only 59% of students studying for 4-year health science degrees had completed in the minimum time plus 1 year, meaning that significant numbers of students would have lost their NSFAS funding before completing their degrees, which may result in their never completing, owing to financial challenges.^[12]

The DHET report^[19] notes the poor performance of black African students compared with the other racial groups, which again is in contrast to the present study, in which all the UYDF students were black Africans, and they exceeded the national throughput rates and time to completion in the majority of cohorts and health science disciplines. This finding highlights the fact that such students do have the academic potential to succeed if they are provided with comprehensive financial support and are held accountable to access support early in the academic year, and provides hope that the shortages of healthcare professionals in SA, in rural and under-served areas in particular, could be addressed by investing in such students.

Study limitations

The cohort numbers are small compared with the DHET and CHE VitalStats databases, and small changes in numbers reflected as percentages can therefore seem very large or small. It would have been ideal to compare this group with their peers, but unfortunately, that was not possible, hence the use of national statistics. Students reported as 'excluded' in this study cannot be regarded as 'dropouts', as some were not excluded by their university and may since have graduated. Unfortunately, we were unable to track their progress after leaving our programme.

Conclusion

This study has shown that health science students of rural origin have the academic ability to succeed in qualifying as healthcare professionals given moderate support, since in the majority of cohorts and health science disciplines they exceeded the national throughput rates and time to completion. Investment in them can therefore be justified.

Declaration. None.

Acknowledgements. None.

Author contributions. Conception, data collection, analysis, interpretation, report write-up: RGM. Article development, revision and submission: RGM, AJR.

Funding. None.

Conflicts of interest. The views expressed in this article are those of the authors and not an official position of any institution or funder.

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Accepted 5 March 2024.