

Cracking the Code: What Drives Dental Students to Specialize? Unveiling the Impact of Final Year Performance, Gender, and Geography

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Abstract

Purpose/Objectives: This study investigates how final year performance at dental school, gender, and geographic factors influence the likelihood of pursuing dental specialization in Sri Lanka.

Methods: We analyzed a 33-year retrospective cohort, using final year performance data from the country's sole dental school. Data on dental specialization were obtained from the Postgraduate Institute of Medicine (PGIM), University of Colombo, covering 1990 to 2023. Data were compiled in Excel and analyzed with SPSS-26.

Results: Graduates who achieved a 'class' in their Final BDS had 4.53 times higher odds (95% CI 3.15-6.53; $p=0.001$) of becoming dental specialists compared to those who did not. The mean time from graduation to specialization was 9.48 years (95% CI 8.78-10.18) for 'class' graduates, compared to 12.57 years (95% CI 11.25-15.89) for 'pass' and 12.88 years (95% CI 11.12-14.63) for 'referred' graduates, with these differences being statistically significant ($p=0.0001$). Females constituted 60% of dental specialists, with notable representation in Restorative Dentistry, Orthodontics, and Oral Pathology. Most specialists came from Colombo district, the country's most affluent area.

Conclusions: High performance in Final BDS correlates strongly with pursuing dental specialization. There is a significant female dominance among specialists and notable geographic disparities in dental school entry. These insights are valuable for dental education and workforce planning.

Key Words: Dental education, Final year performance, Dental specialization, Gender disparities, Geographic disparities, Feminization of dental specialists

Introduction

Dentistry is second only to medicine as a priority stream in biological sciences for being chosen for university education in Sri Lanka.

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The first Sri Lankan dental school was established in Colombo as the Department of Dental Surgery in the Faculty of Medicine of the University of Ceylon in 1943. Subsequently, it was moved to Augusta Hill, Peradeniya, in 1954. The Faculty of Dental Sciences, University of Peradeniya, was the sole dental school for the whole country and has produced over three thousand dental surgeons in its eighty yearlong illustrious history (Jayasuriya *et al.*, 2021). The second dental school was established in 2021 at the University of Sri Jayewardenepura which is yet to produce dental surgeons for the country.



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General Certificate of Education (GCE) Advanced Level examination is a highly competitive examination which selects students for Government Universities in Sri Lanka. Students are selected based on the all-island merit and district basis. 40% of the students are selected based on the Z score arranged, according to all-island merit and 55% out of the remaining 60% according to district basis. Accordingly for each course, 55% of students are selected proportional to the population of each district. The remainder of the students (5%) are selected from the sixteen underprivileged districts according to the population in those districts.

Colombo is the most educationally developed and populous district in the country. Thus the highest cut off mark for medical faculty selection is from the Colombo district. As dentistry is normally the second choice of almost all candidates in the biological sciences domain, the entire merit intake for dentistry (40% of the total intake) comes from the Colombo district. The rationale is that if these students were from any other district, they should have been selected for their 1st choice which is often medicine. In addition to this, the Colombo district has its own district quota as any other district has, based on its population. Therefore due to the existing university selection criteria nearly a half of annual dental faculty intake consists of students from the Colombo district.

The successive cohorts of dental undergraduates trained and qualified to become dental surgeons, progress themselves to become dental specialists. These specialties include Oral and Maxillofacial Surgery (OMF), Restorative Dentistry, Orthodontics, Community Dentistry, and Oral Pathology. Compared to the number of medical specialists (around 2500) in the country, dental specialists comprise of a small group (around 125). Nevertheless they contribute to the provision of island-wide specialized oral health services (Wijewardena *et al.*, 2018). The popular notion is that there is a higher probability of best performing dental undergraduates who secure classes and rank highly in their respective batches of becoming dental specialists,

compared to their ordinarily performing counterparts. Nevertheless, there is a counterargument for the possibility of ordinary performers at dental schools, becoming dental specialists over and above extraordinary performers. Such a possibility cannot be ruled out, as there is no hard and fast rule that all dental specialists would perform exceptionally well at an undergraduate level, as there could be many late bloomers. Hence, there is no agreement as such pertaining to the actual relationship between undergraduate performance and becoming a dental specialist.

Exploring the relationship between performances in dental school and acquiring subsequent postgraduate qualifications in the dental career remains an arena of limited research. There is literature on related areas such as academic performance in dental school and "first attempt" performance on a state dental licensure examination, relationship between performance at medical school and postgraduate competence and association between performance during medical school and residency or postgraduate training (Gonnella & Hojart, 1983; Hojart *et al.*, 1993; Steward *et al.*, 2004; Steward *et al.*, 2005). There have also been studies exploring the relationship between board certification and demographics of physicians and their performance at medical school and residency (Xu *et al.*, 1990; Kim *et al.*, 2016).

Strategies and pathways for professional development for dental graduates may vary across countries and regions (Jiang *et al.*, 2022). In general, dental graduates can choose to be a general dentist working in either private sector, public sector or both, as in the case of Sri Lanka (de Silva, 2007). Alternatively they could pursue further training to become a specialist, or work as a researcher-cum-teaching staff in academia. Joining dental insurance and dental product manufacturing companies, military dentistry and migration overseas are other options for dental graduates (Jiang *et al.*, 2022). Becoming a dental specialist is one mainstream career option for dental graduates in many countries and regions including Sri Lanka.

Nevertheless, barring few studies that assessed performance in dental school and performance later in their careers, no study to this date assessed the relationship between dental school performance and the probability of specialization in dentistry (De Ball *et al.*, 2002; Stewart *et al.*, 2004; Stewart *et al.*, 2005; Bergman *et al.*, 2016; Ali *et al.*, 2017). Against this backdrop, the present study was undertaken to identify whether there was a relationship between performance at the final undergraduate examination (Final BDS) and qualifying as a dental specialist in Sri Lanka. Furthermore it was aimed at exploring gender and geographic inequalities in becoming a dental specialist as well as compare mean and median durations taken by different specialties in dentistry to be board certified as a specialist. The findings would provide new insights into linking undergraduate final year performance with subsequent specialization that has implications on both undergraduate and postgraduate training in dentistry.

Materials and Methods

The ethics approval for the study was obtained from the Ethics Review Committee, Faculty of Dental Sciences, University of Peradeniya (ERC/FDS/UOP/2022/24) on 17/01/2023. A thirty three year retrospective cohort study was conducted from January 1990 to March 2023. All dental surgeons who had graduated from the country's only dental school; namely the Faculty of Dental Sciences, University of Peradeniya, between January 1990 to March 2023 were identified from the academic records at the dental school. Another dental school was established in the year 2021. However it has not produced dental graduates till date. The Final BDS results of all graduates which had been published at respective years in the dental school noticeboard were obtained by writing to the Dean of the Faculty. Thus, Final BDS results and dates of graduation of all dental surgeons between 1990 and 2023 were recorded into a data extraction form. Final BDS performance of each dental undergraduate was categorized as 'class', 'pass'

and 'fail' (repeat/referred). All dental specialists produced by the country's only post graduate institute for medicine and dentistry, namely the Post Graduate Institute of Medicine (PGIM), University of Colombo, were identified from PGIM's official website. The name of the specialist, his/her specialty and the date of board certification were recorded in to a data extraction form. Specialists' names, specialty and the date of board certification were triangulated with dental surgeons' names and the Final BDS results; obtained as described above. By subtracting the date of Final BDS results from the date of board certification, the time duration taken to become a specialist was calculated. All board certified specialists in Sri Lanka who had passed out as dental graduates from 1990 to 2023, were considered for the study.

Exploring the mean duration (the number of years) to become a specialist from graduation and comparison of the duration taken to become a specialist between different dental specialties were among the specific objectives. In addition, the gender inequalities in becoming a dental specialist and the relationship between the district of university entrance and becoming a specialist were also analysed. The data were extracted into Excel spread sheets and analysed using SPSS-26 Statistical Software Package. Frequency distributions were used to present data and Chi-square test of statistical significance was used to compare groups. Kruskal-Wallis test was used to compare means of quantitative data after assessing the variables for normality distribution by Kolmogorov-Smirnov and Shapiro-Wilk tests of statistical significance.

Results

The thirty three year old cohort comprised of 132 dental specialists and 1597 dental surgeons who did not specialize. Of the dental specialists, 56.8% had obtained a 'class' at Final BDS whilst 22.5% of dental surgeons who did not become dental specialists also passed their Final BDS with a 'class' (Table 01).

Table 01: Final BDS Performance and becoming a Dental Specialist

Performance at Final BDS Examination	Consultants		Non consultants	
	N	(%)	N	(%)
Class at Final BDS Examination	75	(56.8)	359	(22.5)
No Class at Final BDS Examination	57	(43.2)	1238	(77.5)
Total	132	(100.0)	1597	(100.0)

The odds of a dental students who secured a 'class' at the Final BDS examination were 4 times more likely to become dental specialists compared to their colleagues who could not obtain a 'class' that included 'pass' and 'referred' categories (Odds Ratio =4.53748 (95% CI

3.153361-6.529072) $p=0.0001$). More than a half (55%) of the specialists under consideration had entered the Dental Faculty from Colombo district. Only 45% had entered the Dental Faculty from all other 23 districts of the country (Figure 01).

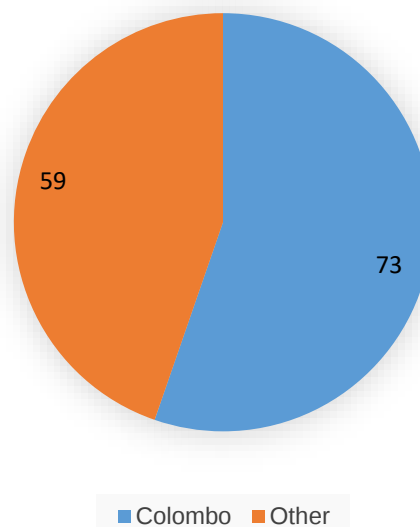


Figure 1 – District of undergraduate University entrance of Dental specialists (All Dental specialties combined 1990-2022): Colombo Vs. all other districts

Currently females dominated the dental specialties of Restorative Dentistry, Oral Pathology and Orthodontics accounting for

around 60% of specialists. Males outnumbered the females in disciplines of OMF Surgery and Community Dentistry (Figure 02).

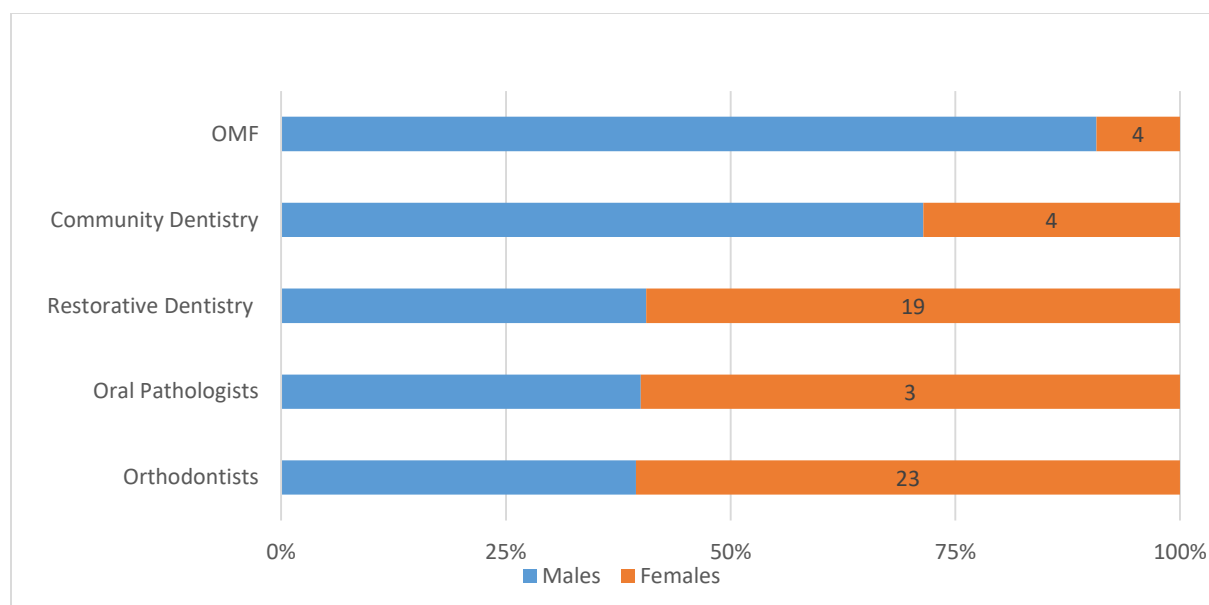


Figure 2- Gender distribution of dental specialists by specialties

As shown in Table 02, the mean (95% CI) duration from graduation to becoming a dental specialist for those who secured a 'class' was 9.48 (8.78-10.18) years. This was 12.57 (11.25-15.89) for those who obtained 'pass'. However,

for those who were referred, the mean (95% CI) was 12.88 (11.12-14.63) years. Those differences were statistically highly significant ($p=0.0001$).

Table 02: Time gap from graduation to becoming a dental specialist by final BDS performance

Results at the Final BDS Examination	Mean duration to become a specialist (years) with 95% CI
Class	9.48 (8.78-10.18)
Pass	12.57 (11.25-15.89)
Repeat/Referred	12.88 (11.12-14.63)

Kruskal-Wallis Test, $p=0.0001$

Discussion

Dental graduates have an array of career pathways after obtaining their basic degree. These include joining the public sector, private sector (full time or part time), academia, military services and gaining postgraduate qualifications (Kumari *et al.*, 2019; Jiang *et al.*, 2022). Moreover there are increasing opportunities for dentists to

pursue dental careers in other countries (Wilson *et al.*, 2010; Coleman & Finn, 2019). Concomitant to globalization, international knowledge and skill transfer augmented by economic crises in LMICs

(Low- or Middle-Income Country) including Sri Lanka, there is a significant trend of migration among dentists (Jiang *et al.*, 2022). However, there are wider geographical variations in dental education systems and job opportunities across different regions and countries. Further, diversity of accreditation in dental education, different licensure requirements, visa requirements and lack of global competencies in dental care often limit the globalization of dentistry (Kumari *et al.*, 2019; Jiang *et al.*, 2022).

Dental undergraduate and postgraduate training as well as recruitment criteria to the dental schools widely vary across countries and regions

(Jiang *et al.*, 2022). The Postgraduate Institute of Medicine of University of Colombo of Sri Lanka is the sole institution that trains medical and dental specialists within the country. Despite being a LMIC currently navigating through a major economic crisis, Sri Lanka stands among few countries around the world that offer undergraduate and postgraduate medical and dental education sponsored by the state (Perera *et al.*, 2012; de Silva *et al.*, 2014; de Silva *et al.*, 2023). Training of a dental undergraduate is the costliest to the tertiary education budget of Sri Lanka compared to other undergraduate training programmes in state universities (Jayasinghe *et al.*, 2023). It was estimated that it costs more than 8,100,000 Sri Lankan Rupees for the University to train a single dental surgeon. Therefore, it is important to reap the harvest of colossal sums of state money invested in training dental undergraduates as well as postgraduates. It is noteworthy that Sri Lankan dental students get more opportunities to provide satisfactory patient care services, under supervision, during their undergraduate training (Jayasuriya *et al.*, 2021). Accordingly, patients perceived high satisfaction for the services provided by the oral surgery student dental clinic (Jayasuriya *et al.*, 2021). Sri Lanka possesses a unique public health care delivery model which offers free health care services to people and dental services as well is integrated into the existing model (Perera *et al.*, 2012; de Silva *et al.*, 2023). It is estimated that 91-95% of newly passed out dental graduates will join the Ministry of Health, Sri Lanka. Another 2-3% will join universities or migrate abroad. Further 1-2% would join defense establishments or become full-time private dental practitioners (de Silva, 2007). As the country is going through an unprecedented economic crisis, its negative impact is evident in state sponsored dental academic education heavily dependent on costly dental material and equipment (Jayasinghe *et al.*, 2023).

As emerged from the findings, the odds of becoming a dental specialist by a dental undergraduate who obtained a 'class' at Final BDS was 4.53 (95% CI 3.15-6.53) ($p=0.001$) compared to an undergraduate who did not

obtain a 'class' at the Final BDS that included ordinary 'pass' and 'referred'. Therefore, our findings clearly indicated the strong association between Final BDS performance and subsequent dental specialization among a thirty three year cohort of dental graduates in Sri Lanka. This notion was supported by similar studies conducted in other countries. For example, a correlation between performance in dental school and performance on the Florida dental licensure exam for 1996-2003 was reported among University of Florida College of Dentistry graduates (Stewart *et al.*, 2005). Another retrospective analysis was conducted among "first-time" performance on the Florida Dental Licensure Exam for graduates from classes 1996 to 2003. Those performances were compared with performance on the senior mock board exam and clinical productivity, determined by numbers of procedures completed in each discipline. Significant relationships were identified between four of thirteen aspects of mock board performance and clinical productivity data and performance on the Florida Dental Licensure Exam (Stewart *et al.*, 2004). A similar study reported a significant association between Dental Admission Test (DAT) scores and National Board Dental Examinations (NBDE) for the 114 students matriculating in the University of Mississippi, School of Dentistry from 1992 to 1995 (de Ball *et al.*, 2002). The results demonstrated that DAT reading comprehension was a statistically significant predictor (p value less than or equal to 0.05) of all four subtests of Part I of the NBDE. Similar findings were reported by other studies even after adjusting confounding factors such as age, gender and ethnicity/race (Park *et al.*, 2006; Berman *et al.*, 2000; Lee *et al.*, 2011). Moreover, dental students who obtained classes at the Final BDS recorded the lowest mean time gap from graduation to specialization compared to other two categories and those differences were statistically highly significant ($p=0.0001$). It is prudent to argue that better performers at the Final BDS would be better equipped with knowledge to sit for the selection examinations for postgraduate specialization, making their journey faster. In view of this finding, better career guidance must be provided to encourage dental

graduates who received a 'class' at Final BDS to continue the momentum and pursue dental specialization.

There were significant differences in gender and geographic distribution of entry to dental school within and across specialties and the mean duration of becoming a specialist after graduation by specialties. The majority (60%) of dental specialists comprised of females with dominance in Restorative Dentistry, Orthodontics and Oral Pathology. Our findings therefore, supported the well-evident trend of feminisation of dentistry and dental specialties across the globe (Hunter *et al.*, 2010; McKay & Quiñonez, 2012; Amuchastegui, 2019; Fleming *et al.*, 2023). Given the unique needs and working patterns of a feminized dental workforce, there could be a significant impact on work performance and productivity confounded by career breaks and part-time working (Hunter *et al.*, 2010). Hence, feminization of the dental workforce raises many issues and challenges to human resource planners with regards to gender-sensitive human resource planning that embraces the country's economy and health care system (Jayasinhe *et al.*, 2023). However, a contrast notion was expressed by a study conducted among final year-dental undergraduates of a dental school in the United Kingdom which explored their attitudes on dental specialization. A significantly higher ($p=0.006$) proportion of females did not express their willingness to specialize (Puryer *et al.*, 2016). Additionally a study conducted among University of Birmingham dental students and dental core trainees (junior trainees within 4 years of graduation) reported that 23% of undergraduates wanted to specialize in the future, two-thirds of which were females. In contrast, 83% of the dental core trainees in that cohort wanted to specialize (60% of males and 100% of females) (Khan *et al.*, 2020). In a dental school situated in the United Arab Emirates, 92% of final-year-dental students aspired to specialize in the specialties of Orthodontics and Oral & Maxillofacial Surgery (Rashid *et al.*, 2013). Similar findings have been reported by another study conducted in Scotland (Lee *et al.*, 2018). Therefore, it is recommended that dental

schools and educators should enhance mentoring effects to assist career decisions of dental students based on their personal interest in the given specialty (Shin *et al.*, 2015; Cunningham *et al.*, 2023).

The selection criteria and processes for entry into dental schools could be governed by an array of factors such as geographic determinants. Geographic distribution of dental applicants could provide useful information on trends and patterns of geographic inequalities in dental school selection. Across all dental specialties, the majority entered from the Colombo district which is the most affluent district in the country. This was due to selection criteria to the state universities in Sri Lanka; where most of these dental specialists would have been selected for their 1st choice course of study at undergraduate level (Medicine) if selection was 100% on merit. On the other hand, it is reasonable to speculate that better educational opportunities and facilities in the most affluent district in the country provided a more conducive background for dental graduates to perform well and then to get specialized. This poses a unique challenge as most of the dentists and dental specialists would be concentrated in a single district. This is owing to the possibility that they would prefer to build a career in their home district. Thus reducing the access of the populations of other districts to general and specialist oral health care. The command of English is one such factor as the medium of instruction is English in undergraduate and postgraduate education. This provides room for improving the English literacy among the biological science students in rural districts. Supporting this notion, demographic disparities in medical and dental school selection demonstrating overrepresentation of females, ethnic minorities (especially Asians for dental schools) and socially advantaged groups were reported by studies conducted in the United Kingdom (Bedi & Gilthorpe, 2000; Gallagher *et al.*, 2009).

Further studies are warranted with methodological rigour and multivariate analyses on predictors of dental specialization in Sri Lanka.

Due to the heterogeneity of undergraduate and postgraduate dental education compounded by the economies and organization of dental services in different countries, one could argue the findings are confined to the Sri Lankan context. However, our findings corroborate the findings of other studies in global literature underpinned by the feminisation of dentists and dental specialists, geographic inequalities, and the higher probability of extraordinary performers at the undergraduate level following the same trend at the postgraduate level. On the other hand, ordinary performers at the undergraduate level could also end up as dental specialists. Therefore, those findings provide generalizable insights for dental educators and human resource planners across geographic, socio-cultural, and dental care system boundaries.

Conclusion

Dental students in Sri Lanka who performed well at the Final BDS examination had a significantly better probability of becoming specialists and did so in a shorter time duration compared to their colleagues who could not perform well at the Final BDS Examination. Clearly a majority of dental specialists had entered the University for the BDS program from the Colombo district.

Training a dental undergraduate is a costly business with the highest per capita recurrent expenditure. Therefore, besides imparting knowledge, inculcating skills and providing professional training, it is crucial for dental educators to provide appropriate career guidance for dental undergraduates. Dental students should be made knowledgeable to find their career paths weighing the pros and cons. Given the fact that specialization is a mainstream career path for dental graduates globally, the findings of the present study provides many novel insights. Moreover, incorporation of gender, geographic and specialty dimensions in dental specialization increases the translational value of this research for dental human resource planning and dental education planning. Our findings emphasize the need for gender and geographic inequalities

sensitive workforce planning conditional to health system and economic imperatives.

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