MODALIDADE ARTIGOS CIENTÍFICOS
Dissertação de Mestrado

UNIVERSIDADE FEDERAL DE GOIÁS
FACULDADE DE ODONTOLOGIA
PROGRAMA DE PÓS-GRADUAÇÃO EM ODONTOLOGIA

ERICA TATIANE DA SILVA

ANÁLISE DE SEGMENTAÇÃO DE ESTUDANTES DE GRADUAÇÃO EM ODONTOLOGIA: INFLUÊNCIA DO DESEMPENHO ACADÊMICO E PERFIL SOCIOECONÔMICO

Orientador: Prof. Dr. Cláudio Rodrigues Leles
Co-Orientadora: Profª. Drª. Maria Goretti Queiroz

UFG
2009

ERICA TATIANE DA SILVA

ANÁLISE DE SEGMENTAÇÃO DE ESTUDANTES DE GRADUAÇÃO EM ODONTOLOGIA: INFLUÊNCIA DO DESEMPENHO ACADÊMICO E PERFIL SOCIOECONÔMICO

Dissertação de Mestrado apresentada ao Programa de Pós-Graduação em Odontologia da Universidade Federal de Goiás para obtenção do Título de Mestre em Odontologia

Orientador: Prof. Dr. Cláudio Rodrigues Leles

Co-Orientadora: Profª. Drª. Maria Goretti Queiroz

UFG
2009

Programa de Pós-Graduação em Odontologia
da Universidade Federal de Goiás

BANCA EXAMINADORA DA DISSERTAÇÃO DE MESTRADO

Aluna: Erica Tatiane da Silva

Orientador: Prof. Dr. Cláudio Rodrigues Leles

Co-Orientadora: Profª. Drª. Maria Goretti Queiroz

Membros:

1. Prof. Dr. Cláudio Rodrigues Leles
2. Prof. Dr. Luiz Roberto Augusto Noro
3. Profª. Drª. Maria Goretti Queiroz
4. Profª. Drª. Vânia Cristina Marcelo

Suplente:

1. Profª. Drª. Rejane Faria Ribeiro-Rotta

Data: 02.03.09

Dedico este trabalho...

A Deus,

Que aponta caminhos e age através de cada pessoa que passa pela minha vida.

Aos meus pais, Eduardo e Maria Aparecida,

Exemplos de perseverança e dedicação à família e ao trabalho, pelo amor, carinho, incentivo e apoio constante, fundamentais para meu crescimento pessoal e profissional. Obrigado por tudo que representam e me deram nesta vida. Obrigada por viver meus sonhos e compartilhar comigo as realizações.

AGRADECIMENTOS

Ao meu orientador, Professor Cláudio R. Leles,

Exemplo de dedicação e competência profissional. Meus sinceros agradecimentos pelas oportunidades, aprendizados e desafios vivenciados ao longo destes anos, que contribuíram intensamente para o meu crescimento acadêmico, profissional e pessoal. Expresso aqui minha admiração, gratidão e respeito.

À minha co-orientadora, Professora Maria Goretti Queiroz,

Que, com seu olhar de "educadora", ampliou meus questionamentos, buscas e aprendizados na estruturação desta dissertação. Agradeço a receptividade, ensinamentos e valiosa colaboração na realização do trabalho.

À Universidade Federal de Goiás,

Especialmente às Professoras Valquíria e Luciana (diretoras do Departamento de Assuntos Acadêmico e Centro de Seleção, respectivamente), cuja receptividade e disponibilidade foram fundamentais para a coleta dos dados desta pesquisa.

Ao meu irmão, avós, tios e primos,

Pelo suporte e união familiar, compreensão nas horas de ausência, incentivo e momentos de alegria e amizade.

Ao meu noivo, Rommel,

Pelo intenso amor e companheirismo ao longo de nosso relacionamento. Pela compreensão e força nos momentos de ausência e apreensões. "Você surgiu e

juntos conseguimos ir mais longe/ Você dividiu comigo a sua história/ E me ajudou a construir a minha".

Aos professores da Faculdade de Odontologia da Universidade Federal de Goiás,

Em especial os que integram o Programa de Pós-graduação, pelos valiosos ensinamentos, profissionalismo e respeito com que conduzem suas atividades.

À doutoranda Maria de Fátima,

Pela contribuição no desenvolvimento do trabalho.

Ao mestrando Antônio Hélio,

Pelo companheirismo na convivência diária; pelos momentos de reflexão, distração e contribuições para meu engrandecimento profissional e pessoal.

Aos colegas do Mestrado,

Pelo convívio durante esse período de aprendizado e troca de experiências.

Aos funcionários do Centro Goiano de Doenças da Boca e do Programa de Pós-graduação,

Pela receptividade, atenção e dedicação com que desempenham o seu trabalho.

RESUMO

O objetivo deste trabalho foi analisar fatores influenciadores do desempenho acadêmico de estudantes de graduação da Faculdade de Odontologia da Universidade Federal de Goiás (FO/UFG). Foi delineado um estudo transversal retrospectivo, considerando todos os estudantes da FO/UFG que concluíram a graduação no período de 1988 a 2007 (n=1182). Os dados acadêmicos foram coletados a partir do questionário socioeconômico, nota do vestibular e histórico acadêmico, obtidos junto ao Departamento de Assuntos Acadêmicos e Centro de Seleção da Universidade Federal de Goiás. Foi realizada análise de *cluster*, seguida de análise bivariada (Teste do Qui-quadrado, Teste *t* pareado e ANOVA) e regresão linear múltipla. Análise de *cluster* (K-means) segmentou os estudantes em grupos de desempenho acadêmico alto (n=456; 38,6%), moderado (n=531; 44,9%) e baixo (n=195; 16,5%). O segmento de desempenho acadêmico baixo apresentou menor número de estudantes nos *clusters* de desempenho global e conforme grupos de disciplinas, variando entre 11,8% (disciplinas clínicas) e 19,2% (disciplinas do ciclo básico). Houve diferença no desempenho acadêmico entre as disciplinas dos ciclos básico e profissionalizante ($p<0,001$) e entre as disciplinas clínicas e não clínicas ($p<0,001$), sendo observadas maiores notas em disciplinas profissionalizantes e clínicas. Melhor desempenho acadêmico foi relacionado ao menor tempo entre ensino médio e ingresso na FO/UFG, gênero feminino, melhor classificação no vestibular, maior freqüência e carga horária cumprida pelo estudante ($R^2=0,491$). A segmentação de grupos de estudantes de acordo com o perfil socioeconômico (TwoStep Cluster) também identificou três *clusters* (compreendendo 26,6, 39,2 e 34,2% de uma amostra de 158 estudantes), os quais mostraram desempenho acadêmico satisfatório, com diferenças no

desempenho global ($p<0,05$) e por grupos de disciplinas ($0,01<p<0,05$), exceto em disciplinas clínicas. Os padrões de desempenho acadêmico conforme perfil socioeconômico evidenciou a necessidade de desenvolvimento de estratégias educacionais diferenciadas para cada *cluster*, bem como a importância do auxílio financeiro da Universidade para maximizar o sucesso de experiências educacionais de estudantes com menor nível socioeconômico. Conclui-se que a análise de fatores influenciadores do desempenho acadêmico configura-se como uma eficiente ferramenta auxiliar no planejamento de instituições de ensino, organizações profissionais e políticas públicas.

Descritores: Condições socioeconômicas; Currículo; Desempenho de Estudantes; Estudantes de Odontologia.

ABSTRACT

The aim of this study was the recognition of variables that influence academic performance in a retrospective sample including all undergraduate students who entered in a Brazilian dental school, in a 20-years period between 1984 and 2003 (n=1182). Data related to academic performance in dental school admission test and graduation, and to socioeconomic questionnaire completed by students at the time of enrollment in university entrance examination were retrieved by the University Registrar's Office. Cluster analysis, bivariate (Chi-square test, Paired-samples *t* test and One-way ANOVA) and multiple regression analysis were used for data analysis. In the first study, cluster analysis (K-means cluster) categorized students into groups of higher (n=456; 38.6%), moderate (n=531; 44.9%), or lower (n=195; 16.5%) academic performance. Lower performance groups had smallest number of students in overall performance and discipline groups clusters, ranging from 11.8% (clinical disciplines) to 19.2% (basic disciplines). Students' performance was higher in dental and clinical disciplines, compared with basic and non-clinical disciplines ($p<0.001$). Higher academic performance was predicted by lower time elapsed between completion of high school and dental school admission, female gender, better rank in admission test, frequency in course and student workload hours (R^2=0,491). In the second study, cluster analysis (TwoStep) categorized students (n=158) into three groups according socioeconomic variables, enclosing 26.6, 39.2 and 34.2% of the sample. Clusters showed satisfactory academic performance, with differences in overall performance ($p<0.05$) and by discipline groups ($0.01<p<0.05$), except for clinical disciplines. Patterns of academic performance according socio-economic characteristics revealed need for development of specific educational strategies

for each cluster and importance of university' financial support to maximize successful educational experience of socio-economically disadvantaged students. It was concluded that analysis of predictive variables that influence academic performance plays a strategic role in planning of educational institutes, professional organizations and public policies.

Key Words: Curriculum, Cluster Analysis, Dental education, Dental students, Socioeconomic status

LISTA DE ABREVIATURAS

CS	*Centro de Seleção*
DAA	*Departamento de Assuntos Acadêmicos*
FO/UFG	*Faculdade de Odontologia da Universidade Federal de Goiás*
IES	*Instituições de Ensino Superior*
IFES	*Instituições Federais de Ensino Superior*
REUNI	*Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais*
Sinaes	Sistema Nacional de Avaliação da Educação Superior
UFG	*Universidade Federal de Goiás*

SUMÁRIO

1 INTRODUÇÃO..... 13

2 OBJETIVOS 17

3 PROCEDIMENTOS METODOLÓGICOS 18

4 PUBLICAÇÕES 22

5 PARA NÃO CONCLUIR...MAS PARA DESAFIAR... 61

REFERÊNCIAS 64

APÊNDICES 73

ANEXO 76

1 INTRODUÇÃO

A formação de Recursos Humanos para a Saúde foi apontada pela Organização Pan-Americana da Saúde como uma prioridade para esta década[1]. Em contraposição ao modelo tradicional de formação profissional norteado pelos pressupostos dos relatórios Flexner e Gies[2,3]*, altamente valorizado no século XX, emerge na atualidade um novo paradigma educacional, visando à formação de um profissional generalista, crítico, tecnicamente competente, capaz de trabalhar em equipes multiprofissionais e de dar respostas às necessidades sociais no âmbito da profissão[3,4-9].

No cenário do ensino odontológico brasileiro, ao estabelecer o perfil do egresso e definir as competências e habilidades necessárias para a formação profissional, as Diretrizes Curriculares Nacionais do Curso de Graduação em Odontologia[10] representaram um grande avanço no sentido de alavancar mudanças visando o equilíbrio entre as dimensões técnico-científicas e ético-humanísticas na organização curricular[11].

Entretanto, o processo de planejamento, implementação e manutenção de medidas estratégicas voltadas à ressignificação da formação do cirurgião-dentista é complexo e dinâmico. Consequentemente, há um crescente interesse em pesquisas relacionadas à identificação de fatores que otimizem a experiência educacional de cada estudante e o sucesso do programa de graduação, de modo

* Os Relatórios Flexner e Gies foram publicados pela Fundação Carnegie, nos Estados Unidos, em 1910 e 1926, com o objetivo de normatizar o ensino médico e odontológico, respectivamente. No Relatório Gies foi proposta uma reorganização da prática odontológica, na qual se buscou uma maior autonomia da Odontologia frente à Medicina. Os princípios norteadores, entretanto, eram os mesmos do Relatório Flexner, ou seja, tinha como base o paradigma cartesiano, o qual era aplicado aos currículos e às disciplinas do meio biomédico, com ênfase na separação do todo em partes, no domínio cognitivo e na noção instrumental dos saberes.

a subsidiar as Instituições de Ensino Superior (IES) nessa reorientação[12-15].

Conforme evidenciado por trabalhos internacionais recentes que analisaram o impacto de variáveis multidimensionais – tais como a estruturação curricular[16-35], experiências educacionais prévias à universidade[12,14] e aspectos cognitivos[36-45], socioeconômicos[12-15,46,47] e culturais[48] – no desempenho acadêmico, este diagnóstico tem o potencial de nortear a melhoria da qualificação dos cursos e do desempenho acadêmico, identificando fatores relacionados ao desenvolvimento acadêmico e social dos estudantes, bem como dificuldades e desafios no processo ensino-aprendizagem. Nesses trabalhos, a expressão *desempenho* é utilizada para transmitir a idéia de *performance*, isto é, a ação de conquistar algo, ser bem sucedido, através de esforço e habilidade[49]. No caso do desempenho acadêmico, a avaliação é realizada por disciplina, incidindo sobre o rendimento acadêmico, tradicionalmente verificado por meio de provas, seminários, trabalhos de campo, exercícios teóricos e práticos, projetos, relatórios e demais atividades realizadas pelos estudantes, às quais são atribuídas notas[50].

Por outro lado, a literatura científica correspondente a pesquisas odontológicas brasileiras que têm como população de estudo o corpo discente é constituída por trabalhos centrados, fundamentalmente, em dados referentes à ocasião de ingresso no ensino superior – identificação do perfil socioeconômico[51-57], dos motivos de escolha do curso[51,52,58-62] e da perspectiva profissional de acadêmicos[51,52,57] – ou de conclusão do curso – identificação das expectativas de acadêmicos quanto ao exercício da profissão[51,52], e análise dos resultados do Exame Nacional de Cursos[63,64] e do Exame Nacional de Desempenho dos Estudantes[57], de modo a correlacioná-los com aspectos institucionais como o tipo e localização regional da IES.

Há, portanto, uma lacuna na investigação dos fatores relacionados ao desempenho acadêmico durante o processo de formação do cirurgião-dentista, evidenciada pela escassez de trabalhos nacionais e internacionais, especialmente no que se refere a pesquisas com amostras representativas de estudantes, compreendendo todo o período do curso de graduação em Odontologia.

Já no cenário das Instituições Federais de Ensino Superior (IFES) do Brasil, há a subutilização de dados acadêmicos potencialmente valiosos para a gestão institucional[65], especialmente frente à conjuntura atual caracterizada pelo repensar do papel do ensino superior, na qual é discutida a institucionalização da avaliação promovida pelo Sistema Nacional de Avaliação da Educação Superior (Sinaes)[66]**, a expansão universitária promovida pelo Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais (REUNI)[67]*** e, em âmbito local, o projeto de expansão universitária da Universidade Federal de Goiás (UFGInclui) - o qual instituiu o sistema de cotas e a implementação do REUNI.

Sendo assim, a análise do desempenho acadêmico apresenta-se como recurso auxiliar para tomada de decisão da instituição de ensino quanto à necessidade de reorientação curricular; além de fornecer indicadores sobre a

** Criado pela Lei n° 10.861, de 14 de abril de 2004, o Sinaes é formado por três componentes principais: a avaliação das instituições, dos cursos e do desempenho dos estudantes. O Sinaes avalia todos os aspectos que giram em torno desses três eixos: o ensino, a pesquisa, a extensão, a responsabilidade social, o desempenho dos estudantes, a gestão da instituição, o corpo docente, as instalações e vários outros aspectos. Possui uma série de instrumentos complementares: auto-avaliação, avaliação externa, Enade, Avaliação dos cursos de graduação e instrumentos de informação (censo e cadastro). Os resultados das avaliações possibilitam traçar um panorama da qualidade dos cursos e instituições de educação superior no País.

*** Programa instituído pelo Decreto nº 6.096, de 24 de abril de 2007, com o objetivo de propiciar a inclusão, democratização do acesso e permanência de estudantes que apresentam condições socioeconômicas desfavoráveis nos cursos de ensino superior. Suas diretrizes abordam a preocupação em garantir a qualidade da graduação da educação pública a partir de uma formação profissional mais abrangente, flexível e integradora. Para isto, faz-se necessária a reestruturação curricular valorizando a interdisciplinaridade e favorecendo a superação da formação estritamente profissionalizante e especialização precoce.

contribuição das IES para o alcance das metas nacionais em educação superior; e subsidiar a análise das alterações ocorridas no corpo discente ao longo dos anos de graduação[6,12-5]. É importante, portanto, para o acompanhamento da trajetória acadêmica, fornecendo diagnóstico e subsídios para a implantação ou manutenção de políticas educacionais que proporcionem melhor qualidade do ensino.

Nesse sentido, considerando o contexto atual da educação superior, especificamente do ensino odontológico, e frente à subutilização de uma vasta quantidade de dados acadêmicos gerados anualmente pela Universidade Federal de Goiás (UFG), o presente estudo propõe-se a analisar fatores influenciadores do desempenho acadêmico de estudantes da Faculdade de Odontologia da UFG (FO/UFG) que concluíram a graduação no período de 1988 a 2007. Considerando as diversas e importantes interfaces a serem abordadas na análise do desempenho do estudante, esse trabalho teve como enfoque a investigação de fatores multidimensionais relacionados ao desempenho acadêmico traduzido sob a forma de notas atribuídas aos estudantes nas disciplinas que compõem o respectivo curso.

A investigação do tema proposto para análise nesse estudo constitui um desafio e uma necessidade à FO/UFG, no sentido de fomentar discussões sobre o ensino odontológico e subsidiar a instituição, inserida no movimento nacional de reestruturação curricular desde 2004, em sua reorientação da formação profissional.

2 OBJETIVOS

2.1 OBJETIVO GERAL:

Analisar fatores influenciadores do desempenho acadêmico de estudantes de graduação da Faculdade de Odontologia da Universidade Federal de Goiás.

2.2 OBJETIVOS ESPECÍFICOS:

- Conhecer a segmentação dos estudantes de acordo com o desempenho acadêmico global e por grupos de disciplinas;
- Conhecer a segmentação dos estudantes de acordo com o perfil socioeconômico;
- Analisar o perfil do desempenho acadêmico considerando os resultados das análises de segmentação;
- Investigar o impacto de variáveis multidimensionais (dados socioeconômicos, classificação no vestibular e histórico acadêmico) no desempenho acadêmico global e por grupos de disciplinas.

3 PROCEDIMENTOS METODOLÓGICOS

3.1 TIPO DE ESTUDO

Estudo transversal retrospectivo.

3.2 POPULAÇÃO DE ESTUDO

A população de estudo consistiu de todos os estudantes da FO/UFG que concluíram a graduação no período de 1988 a 2007 (n=1182).

A FO/UFG é uma IFES da região central do Brasil, localizada em Goiânia, Capital do Estado de Goiás, fundada em 1945, tornando-se pública e unidade acadêmica da UFG em 1960. Os currículos existentes no período pesquisado eram anuais, integralizados no período de cinco anos e compostos de ciclo básico e profissionalizante, formando cerca de sessenta cirurgiões-dentistas anualmente.

3.3 PROCEDIMENTOS ÉTICO-LEGAIS

Seguindo as normas e preceitos éticos relativos a pesquisas que envolvam seres humanos, o presente trabalho foi submetido ao Comitê de Ética em Pesquisa da UFG, sendo aprovado sob o protocolo de número 081/2007 (Anexo 1). Além disso, a pesquisa foi autorizada pelo Departamento de Assuntos Acadêmicos (DAA) (Apêndice A) e pelo Centro de Seleção (CS) (Apêndice B) da UFG.

3.4 COLETA DE DADOS

Os dados foram coletados junto ao DAA e CS da UFG, no período de janeiro a julho de 2008.

O DAA é o órgão responsável pelo controle da vida acadêmica dos estudantes de graduação da UFG e pelos dados acadêmicos de egressos. Após autorização da presente pesquisa pela diretoria, os extratos acadêmicos da população de estudo foram identificados no sistema de gestão acadêmica e impressos por funcionários dessa seção.

A partir do extrato acadêmico, foram obtidos os dados demográficos e de identificação, além das notas, freqüência e situação do estudante (aprovado, aprovado por média, reprovado por falta, reprovado por média, aproveitamento de disciplina) em cada disciplina e carga horária cumprida ao final do curso. Para cadastros incompletos no sistema, os dados foram complementados a partir do histórico acadêmico arquivado em dossiês sob a guarda do DAA, mantidos no setor de Serviço Geral da UFG.

O CS é o órgão responsável pelos processos seletivos para ingresso aos cursos de graduação da UFG. Após aprovar a obtenção de dados dos processos seletivos de estudantes da FO/UFG, a diretoria deste setor disponibilizou planilhas eletrônicas em Excel referente às notas obtidas pelos ingressantes na FO/UFG no período de 1991 a 2003, além das respostas do questionário socioeconômico preenchido pelos candidatos inscritos no processo seletivo de 1999 a 2001. Os dados dos demais processos seletivos não fizeram parte da pesquisa, pois não estão disponíveis nos registros do CS ou encontram-se sumarizados em relatórios anuais (inviabilizando o acesso aos dados originais de cada estudante, uma vez que as informações referem-se ao grupo de ingressantes).

Em relação ao questionário socioeconômico (questionário elaborado pelo CS que investiga o perfil socioeconômico dos ingressantes na UFG), foram

selecionadas as questões consideradas de maior relevância para o desempenho acadêmico na graduação, conforme sugerido pela literatura científica[12-15,46,47]: estado civil, moradia, emprego, nível de escolaridade dos pais, renda mensal e tipo de auxílio que gostaria de receber da instituição, bem como informações referentes ao ensino médio, domínio de língua estrangeira e à participação em cursos pré-vestibulares e processos seletivos anteriores.

3.5 TRATAMENTO E INTERPRETAÇÃO DOS DADOS

A análise de *cluster* foi realizada para segmentação de grupos de estudantes de acordo com o desempenho acadêmico (K-Means Cluster, a partir do desempenho acadêmico global e por núcleos de disciplinas) e perfil socioeconômico (TwoStep Cluster, a partir dos dados do questionário socioeconômico).

Também conhecida como análise de segmentação, a análise de *cluster* é um conjunto de técnicas estatísticas cujo objetivo é agrupar objetos segundo suas características em grupos ou conglomerados homogêneos. Os conglomerados obtidos devem apresentar tanto uma homogeneidade interna (dentro de cada conglomerado), como uma forte heterogeneidade externa (entre conglomerados). Consiste em uma técnica do tipo de interdependência, pois não é possível determinar antecipadamente as variáveis dependentes e independentes. Ao contrário, examina relações de interdependência entre todo o conjunto de variáveis[68,69].

O algoritmo *K-Means Cluster* é utilizado quando os dados recaem em um número conhecido de agrupamentos a partir de variáveis contínuas[68,69]. Já o

algoritmo *TwoStep Cluster* encontra automaticamente o número apropriado de agrupamentos, a partir de um conjunto de variáveis contínuas e/ou categóricas[69].

Para verificação da validade externa, os *clusters* identificados foram comparados entre si por meio de análise bivarida (Teste do Qui-quadrado e ANOVA seguida do Teste de Tukey).

O desempenho acadêmico por grupo de disciplinas (média das notas do estudante considerando as disciplinas dos ciclos básico e profissionalizante e as disciplinas clínicas e não clínicas) foi analisado por meio do Teste *t* pareado e Teste do Qui-quadrado.

A análise de regressão linear múltipla stepwise foi utilizada para investigar a influência de variáveis independentes (classificação no vestibular e perfil do estudante quanto ao gênero, idade, tipo de escola de conclusão do ensino médio, tempo entre conclusão do ensino médio e ingresso na FO/UFG, tempo de conclusão do curso, freqüência e carga horária cumprida) no desempenho acadêmico global (média do desempenho do estudante considerando todas as disciplinas do curso).

O desempenho acadêmico conforme os *clusters* identificados pelo perfil socioeconômico dos estudantes foi investigado por meio de ANOVA seguida do Teste de Tukey.

Para o tratamento estatístico dos dados, foi utilizado o programa estatístico SPSS for Windows 16.0, considerando um nível de significância de 5% (α=0.05).

4 PUBLICAÇÕES

Artigo 1 - Factors influencing students' academic performance in a Brazilian undergraduate dental school

Artigo 2 - A cluster analysis of socioeconomic variables and their impact on academic performance in a Brazilian undergraduate student sample

Artigo 1 - Factors influencing students' academic performance in a Brazilian undergraduate dental school

ABSTRACT

Comprehensive assessment of students' academic performance plays an important role in educational planning. The aim of this study was the recognition of variables that influence academic performance in a retrospective sample including all undergraduate students who entered in a Brazilian dental school, in a 20-years period between 1984 and 2003 (n=1182). Age, gender and other educational variables were used to predict academic performance in the overall curriculum and course groups. Cluster analysis (K-means algorithm) categorized students into groups of higher, moderate, or lower academic performance. Clusters of overall academic performance showed external validity, as demonstrated by Chi-square test and One-way ANOVA. Lower performance groups had smallest number of students in overall performance and course groups clusters, ranging from 11.8% (clinical courses) to 19.2% (basic courses). Students' performance was more satisfactory in dental and clinical courses, rather than basic and non-clinical courses ($p < 0.001$). Better academic performance was predicted by lower time elapsed between completion of high school and dental school admission, female gender, better rank in admission test, rate of class attendance and student workload hours (R^2=0,491). Findings give evidence about predictors of undergraduate students' performance and reinforce the need for curricular reformulation focused on with improvement of the integration among courses.

Key Words: Dental education, Dental students, Curriculum, Cluster Analysis

INTRODUCTION

Recent efforts at a global level have focused on the discussion of professional competences and quality standards in dental education. Despite the differences in worldwide educational systems, there are convergent views toward curriculum reformulation and improvement of knowledge about learning process in dental education.

The American and the European Dental Education Association reinforce the need of reform in dental education aiming to qualify graduates with satisfactory scientific base for their professional practice and able to evaluate critically and integrate selectively new scientific findings that emerge during their professional lifetimes.[1,2] In addition, they are expected to be able to work effectively with other health professionals and to conduct their practices with a high level of sensitivity to the ethical and psychosocial dimensions of patient care.[3-5]

An ideal dental educational environment should enable students to acquire non-clinical, clinical and interpersonal competences, which must be supported by integration among knowledge of biomedical, behavioral, and dental courses, by cognitive and psychomotor skills, and by professional and ethical values.[3,6] However, process of planning, implementation and sustaining of these deep innovations is complex and dynamic.[5] Consequently, there has been increasing interest in researching factors to maximize success of educational experience for each student and outcome of undergraduate program.

Studies describing the educational experience of dental students traditionally have focused on characteristics of the learner, academic environment and curriculum

structure.[3-26] Few reports regarding academic performance in dental school are found in international literature.[27] Moreover, they were mainly cross-sectional studies conducted in a small sample, and that analyzed relation between school admission criteria and student performance in dental exams and basic or preclinical courses.

Additional studies are essential to elucidate trends and predictors for successful academic performance, plan and evaluate organizational development and curriculum structure, as well as develop priority goals for research in dental education. Thus, the aim of this study was to investigate the predictors of undergraduate academic performance in a Brazilian school of dentistry.

MATERIALS AND METHODS

A retrospective cross-sectional study was designed including all students who entered the School of Dentistry of Federal University of Goias, Brazil, during the years 1984 to 2003. After the research protocol was approved by local Institutional Review Board, data containing identification, demographic features and academic performance in dental school admission test and graduation were retrieved by the University Registrar's Office.

Academic performance in undergraduate courses was measured as the mean value of four bimonthly examinations, rated quantitatively in a 0-10 scale. Outcome variable was overall academic performance measured by grade average of all courses within the undergraduate program. Independent variables included gender, age, type of high school (private or public), elapsed time from completion

of high school until dental school admission, performance rank in admission test, time to degree, rate of class attendance and student workload hours.

Academic performance in course groups was also measured for basic and dental, and non-clinical and clinical courses. In this study, term ‘basic courses’ refers to biomedical and behavioral sciences, i.e. non-dental courses, while ‘non-clinical courses’ represents those that don’t involve clinical practice, including dental courses.

The whole sample was segmented into a pre-defined number of clusters according to academic performance measures. The pattern of academic performance was defined by cluster analysis with the K-means algorithm[28]. Cluster analysis aims to identify natural groupings of data from a large data-set to produce a concise representation of a system’s behaviour. This statistical tool partitions subjects into different groups on the basis of a minimal within-group and a maximal between-group variation, without prejudgment. The algorithm in K-means cluster analysis requires a priori definition of the number of clusters. The K-means algorithm assigns each point to the cluster whose center (also called centroid) is nearest. The center is the average of all the points in the cluster - that is, its coordinates are the arithmetic mean for each dimension separately over all the points in the cluster.

Classification procedure was performed based on overall academic performance and by course groups, so that students categorized into a 3-cluster solution: higher, moderate, or lower performance. Statistical differences among clusters were investigated using Chi-square test and One-way ANOVA followed by Tukey post hoc for nominal and continuous independent variables, respectively. Paired-

samples *t* test was used to compare student performance by different course groups.

Stepwise multiple regression analysis was used to test the influence of independent variables on the overall academic performance. Significance level was set at $p < 0.05$. SPSS 16.0 for Windows was used for statistical analysis.

RESULTS

Study population included 1182 students, 63.1% females. Mean age was 19.54 years (SD=2.05) at the time of dental school admission and 23.54 years (SD=2.07) at the time of graduate degree.

Table 1 includes descriptive analysis and comparison among clusters of overall academic performance. Only the variables type of high school and rank in dental school admission test were not statistically different among the clusters.

Taking into account the large data-set used in this research, cluster analysis was used to identify satisfactorily three groups of students with differing patterns of overall academic performance (lower, moderate or higher) and external validation, as demonstrated by the bivariate analysis. Lower performance cluster (n=195;16.5%) was characterized predominantly by males and older students, with higher elapsed time from completion of high school until dental school admission, as well lowest rate of class attendance, lowest student workload hours and higher time to graduate degree. Higher performance cluster (n=456; 38.6%) presents

opposite patterns to the lower performance group. Moderate performance cluster was the most prevalent (n=531; 44.9 %), with intermediary academic measures.

The analysis of academic performance by course groups (Table 2) revealed that the segments of lower performance comprised the smallest number of students, ranging from 11.8 (clinical courses) to 19.2% (basic courses). There were differences in student performance between the courses groups ($p < 0.001$), with higher scores in dental and clinical courses.Table 3 shows student distribution according academic performance by course groups.

Stepwise multiple regression analysis (Table 4) of the influence of independent variables on overall academic performance resulted in R^2 value that indicates that the final model accounts for 49% of the variance in outcome variable.

DISCUSSION

The effectiveness of educational principles and curriculum structure becomes known when student performance is assessed.[29] This study focused on identification of predictors variables of academic performance in a 5-year program of dental school.

As well as for overall performance, segments of lower performance also showed smallest number of students among academic performance clusters by course groups. However the significant number of students with lower academic performance reveals need for specific educational strategies for this segment.

Student performance was more satisfactory in dental and clinical courses, rather than basic and non-clinical courses, respectively. This finding corroborates those critical dichotomies in the curriculum: lack of integration between basic and clinical courses, and non-clinical and dental courses.[1,6,7,9,10,13-16,18,20,24] Dentistry is often criticized due to their technical nature and domination of biomedical model, emphasizing the mechanical versus the biological nature of dentistry.[7,10]

Fugill[30] found student dissatisfaction with lack of contextualization of knowledge they received. According to that author, this may be attributed to the fact that students do not have experience necessary to classify and bring together didactic information and practice. Boyd[8] reports that students recognize the experience of connecting what they learn in class with a “real” patient as being somewhat disorienting. In this context, Gick and Holyoak[31] demonstrate that learning is facilitated by contexts that demonstrate the usefulness of the knowledge in solving problems. Therefore, it should not be surprising that students have difficulty reorganizing information to make it useful for solving clinical problems.[10]

Henzi *et al*.[32] investigated which strengths and weaknesses of dental school curriculum, in point of view of students. Participants of this study were positive about their learning experiences in dental schools, but recognized several problematic areas, including large portions of the curriculum identified as being of questionable relevance, mainly in the biomedical and behavioral sciences. Their findings show that students desire a well-organized curriculum with the best possible clinical experience. Similar results were found in survey commissioned by American Dental Association Survey Center,[33] reinforcing that the desire of dental

students to condense non-clinical topics ought to be cause for deliberation among dental educators.

Most of dental schools were still organized along traditional course boundaries.[10,14,17,20] In the traditional 5-year Bachelor of Dental Surgery program, students take courses in biomedical sciences and general education during the first four semesters, while subsequent semesters focus on the clinical courses and, more directly, on clinical training.

Gradually, it became recognized that approaches which integrate basic and clinical courses provided a more meaningful, holistic preparation for dentistry.[1,7,14,20,21,29,34] Curriculum integration is essential in the preparation of the new general dentist able to solve patients' problems and incorporate new concepts and therapies into health care.[1,10,14,16,21,29]

This involves making a markedly significant cultural and attitudinal shift in dental schools, with recognition that basic and other sciences are important to form a competent dentist in 21st century.[7,35] Planning and implementing of these changes represent considerable risk of financial burdens on schools, need for training programs and workshops for faculty, increased training time for students, and re-structuring licensure procedures and curriculum.[7]

Findings of our study also revealed that overall academic performance was related to elapsed time from completion of high school until dental school admission, gender, dental school admission, rank in admission test, rate of class attendance and student workload hours.

Student selection and recruitment are considered as vital in the successful outcome of dental education.[11] Admission to graduate programs in the health professions is based on different factors, including undergraduate/pregraduate academic performance, extracurricular and research activities, interviews, and psychomotor assessments, varying the degree of emphasis placed on these factors according to the institutions.[11,27,36] In Brazil the dental school admission is focused on purely academic criteria (grades achieved in university entrance examination).

Admission information has historically been used as a predictor of academic success in dental school.[36] Previous studies reports relationship between admission criteria (college grade point average -GPA, subtest scores on the Dental Admission Test – DAT, interviews) and scores on the National Board Dental Examination (NBDE) or student performance on basic and predental courses.[26,27,36-40] Our findings reveal that admission criteria are related with academic performance during the formative years. According McManus and Richards,[34] this may be attributed to the three arguments: achievement, ability and motivation. This authors claim that successful performance in admission test is a reflection of the intelligence and motivation of the student, which will have a positive effect on their success in university performance. Others studies showed that admission level has limited value as a predictor of students' performance.[41-45]

Traditional studies of impact of gender on student performance found that men outperformance women, attributing possible reasons as: women's lowest sense of self-esteem, stereotype threat, differential speeds, aversion to risk taking, test bias, fear of success, test anxiety, and certain other personal characteristics.[25,46,47]

Recently, Fields *et al*.[38] investigated the impact of gender in academic performance among dental students and found that there were no significant differences. Authors related this to no presence of true differences or low power of the sample to detect small differences. On other hand, our results show that trend of feminization of dentistry[12,23,26] is accompanied by better performance of women in academic assessments.

The relationship between academic performance and rate of class attendance and student workload hours is possible related to higher student involvement in academic experiences of learning and research activities. Impact of elapsed time from completion of high school until dental school admission in academic performance reinforces importance of previous educational experiences for success in university entrance immediately after high school and academic performance at graduation.

Assessment of academic performance plays a strategic role in pedagogical planning of educational institutes. Our study gives evidence about predictors of undergraduate academic performance and reinforces the need for curricular changes with improvement of the integration among courses. This critical evaluation proves significant information for dental schools currently engaged in, or about to embark upon, the task of planning and implementing strategies for training of general dentist according new required competences.

Regional and cultural differences in educational principles may influence academic performance and suggest additional studies to corroborate our findings. Additional longitudinal studies are needed to evaluate influence of academic performance in professional behavior and involvement.

REFERENCES

1. ADEA Commission on Change and Innovation in Dental Education. Competencies for the new dentist: (as approved by the 1997 house of delegates these competencies are being revised in 2006-07). J Dent Educ 2007; 71:926-8.

2. Plasschaert AJ, Holbrook WP, Delap E, Martinez C, Walmsley AD. Association for Dental Education in Europe. Profile and competences for the European dentist. Eur J Dent Educ 2005; 9:98-107.

3. Divaris K, Barlow PJ, Chendea SA, Cheong WS, Dounis A, Dragan IF, Hamlin J,Hosseinzadeh L, Kuin D, Mitrirattanakul S, Mo'nes M, Molnar N, Perryer G, Pickup J, Raval N, Shanahan D, Songpaisan Y, Taneva E, Yaghoub-Zadeh S, West K, Vrazic D. The academic environment: the students' perspective. Eur J Dent Educ 2008; 12(Suppl 1):120-30, 2008.

4. Manogue M, Brown G. Managing the curriculum – for a change. Eur J Dent Educ 2007; 11:75-86.

5. Oliver R, Kersten H, Vinkka-Puhakka H, Alpasan G, Bearn D, Cema I, Delap E, Dummer P, Goulet JP, Gugushe T, Jeniati E, Jerolimov V, Kotsanos N, Krifka S,Levy G, Neway M, Ogawa T, Saag M, Sidlauskas A, Skaleric U, Vervoorn M, White D. Curriculum structure: principles and strategy. Eur J Dent Educ 2008; 12(Suppl 1):74-84.

6. Adams AB. The basic science curriculun problem in dental education: some causes and solutions. J Dent Educ 1976; 40:230-2.

7. Baum BJ. Can biomedical science be made relevant in dental education? A North American perspective. Eur J Dent Educ 2003; 7:49-55.

8. Boyd L. Reflections on clinical practice by first-year dental students: a qualitative study. J Dent Educ 2002; 66:710-20.

9. Chur-Hansen A, Carr JE, Bundy C, Sanchez-Sosa JJ, Tapanya S, Wahass SH. An international perspective on behavioral science education in medical schools. J Clin Psychol Med Settings 2008; 15:45-53.

10. Crawford JM, Adami G, Johnson BR, Knight GW, Knoernschild K, Obrez A, Patston PA, Punwani I, Zaki AM, Licari FW. Curriculum restructuring at a north american dental school: Rationale for change. J Dent Educ 2007; 71:524-31.

11. Gaengler P, De Vries J, Akota L, Balciuniene I, Berthold P, Gajewska M, Johnsen D, Urtâne I, Walsh L, Zijlstra A. Student selection and the influence of their clinical and academic environment on learning. J Dent Educ 2002; 3:8-26.

12. Gietzelt D. Social profile of first-year dentistry students at the University of Sydney. Aust Dent J 1997; 42:259-66.

13. Gotjamanos T. Integration of basic biological sciences and clinical dentistry in the dental curriculum. A clinically orientated approach to teaching oral and dental anatomy. Aust Dent J 1990; 35:290-3.

14. Huang C, Bian Z, Tai B, Fan M, Chiu-Yin K. Dental education in Wuhan, China: challenges and changes. J Dent Educ 2007; 71:304-11.

15. Humphrey S, Mathews R, Kaplan A, Beeman C. Undergraduate basic science preparation for dental school. J Dent Educ 2002; 66:1252-9.

16. Humphrey S, Skelton J, West K, MacPherson B. Toward better Integration of Biomedical Science and Clinical Dentistry. J Dent Educ 2004; 68:232-3.

17. Kassebaum DK, Hendricson WD, Taft T, Haden NK. The dental curriculum at North American dental institutions in 2002-03: a survey of current structure, recent innovations, and planned future changes. J Dent Educ 2004; 68:914-31.

18. Kerosuo E, Ruotoistenmäki J, Murtomaa H. Report on the development of a new dental curriculum at Helsinki. Eur J Dent Educ 2001; 5:23-30.

19. Kersten HW, Vervoorn JM, Zijlstra AE, Blok BS, Van Eijden TMGJ. Development and implementation of new educational concepts in a dental curriculum. Eur J Dent Educ 2007; 11:2-9.

20. Kingsley K, O'Malley S, Stewart T, Galbraith GM. The integration seminar: a first-year dental course integrating concepts from the biomedical, professional, and clinical sciences. J Dent Educ 2007; 71:1322-32.

21. Lantz MS, Chaves JF. What should biomedical sciences education in dental schools achieve? J Dent Educ 1997; 61:426-33.

22. Lindemann RA, Cabret ML. Assessment of dental student studying strategies. J Dent Educ 1995; 59:1020-6.

23. Orenuga OO, da Costa OO. Characteristics and study motivation of clinical dental students in Nigerian universities. J Dent Educ 2006; 70:996-1003.

24. Sessle BJ. Integration of basic sciences into the predoctoral curriculum to study temporomandibular disorders and orofacial pain. J Orofac Pain 2002; 16:181-4.

25. Shen L. Gender effects on student performance on the NBOME, Part I, Part II, and Part III. Acad Med 1994; 69 (issue 10 suppl):S75-7.

26. Smithers S, Catano VM, Cunningham DP. What Predicts Performance in Canadian Dental Schools? J Dent Educ 2004; 68:598-613.

27. Bergman AV, Susarla SM, Howell TH, Karimbux NY. Dental admission test scores and performance on NBDE Part I, revisited. J Dent Educ 2006; 70:258-62.

28. Wilkin GA, Huang X. A practical comparison of two K-Means clustering algorithms. BMC Bioinformatics 2008; 9 (Suppl 6):S19.

29. Haden NK, Andrieu SC, Chadwick DG, Chmar JE, Cole JR, George MC, Glickman GN, Glover JF, Goldberg JS, Hendricson WD, Meyerowitz C, Neumann L, Pyle M, Tedesco LA, Valachovic RW, Weaver RG, Winder RL, Young SK, Kalkwarf KL. The dental education environment. J Dent Educ 2006; 70:1265-70.

30. Fugill M. Teaching and learning in dental student clinical practice. Eur J Dent Educ 2005; 9:131-6.

31. Gick ML, Holyoak JK. Schema induction and analogical transfer. Cognit Psychol 1983; 15:1-38.

32. Henzi D, Davis E, Jasinevicius R, Hendricson W. North American dental students' perspectives about their clinical education. J Dent Educ 2006; 70:361-77.

33. American Dental Association Survey Center. 2003/2004 survey of predoctoral dental education: curriculum, volume 4. Chicago: American Dental Association, 2005.

34. McManus IC, Richards P. Audit of admissions to medical Schools, Br Med J 1998; 296:1520-1.

35. Baum BJ. The absence of a culture of science in dental education. Eur J Dent Educ 1997; 1:2-5.

36. Curtis DA, Lind SL, Brear S, Finzen FC. The correlation of student performance in preclinical and clinical prosthodontic assessments. J Dent Educ 2007; 71:365-72.

37. De Ball S, Kathleen S, Horine J, Duncan W, Repogle W. The relationship of performance on the dental admission test and performance on Part I of the National Board Dental Examinations. J Dent Educ 2002; 66:478-84.

38. Fields HW, Fields AM, Beck FM. The impact of gender on high-stakes dental evaluations. J Dent Educ 2003; 67:654-60.

39. Gray S, Deem L. Predicting student performance in preclinical technique courses using the theory of ability determinants of skilled performance. J Dent Educ 2002; 66:721-7.

40. Hoad-Reddick G, Macfarlane TV, Gibson VM. Relating personality to interview results and performance in the first year of the dental course. Br Dent J 1999; 10:348-52.

41. Gray S, Deem L, Straja S. Are traditional cognitive tests useful in predicting clinical success? J Dent Educ 2002; 66:1241-5.

42. Jacobsen N. Admission level and students' performance at a Norwegian dental school. Acta Odontol Scand 1987; 45:399-408.

43. Lynch CD, McConnell RJ, Hannigan A. Dental school admissions in Ireland: can current selection criteria predict success? Eur J Dent Educ 2006; 10:73-9.

44. Park SE, Susarla SM, Massey W. Do admissions data and NBDE Part I scores predict clinical performance among dental students? J Dent Educ 2006; 70: 518-24.

45. Potter RH, McDonald RE, Sagraves GD. A derived basic ability criterion for predicting dental students' performance. J Dent Educ 1982; 46:634-8.

46. Case SM, Becker DF, Swanson DB. Performances of men and women on NBME Part I and Part II: the more things change. Acad Med 1993; 68(issue 10 suppl):S25-S27.

47. Norcini JJ, Fletcher SW, Quimby BB, Shea JA. Performance of women candidates on the American Board of Internal Medicine Certifying Examination, 1973-1982. Ann Intern Med 1985; 102:115-8.

Table 1 – Clusters characteristics according to independent variables.

Variable	Clusters			*P**
	Lower performance (n=195)	Moderate performance (n=531)	Higher performance (n=456)	
Age at admission (years)**	20.48 (3.39)[A]	19.82 (2.06)[B]	19.04 (1.74)[C]	<0.001
Gender				
Female	34.4	63.5	75.0	<0.001
Male	65.6	36.5	25.0	
Type of high school				
Private	90.1	91.6	92.9	N.S.
Public	9.9	8.4	7.1	
Elapsed time from completion of high school until dental school admission (years)*	2.09 (2.76)[A]	1.55 (1.65)[A]	0.93 (1.11)[B]	<0.001
Rank in admission test**	28.70 (14.43)	28.12 (16.17)	27.31 (16.07)	N.S.
Time to degree (years)**	5.10 (0.49)[A]	4.99 (0.13)[B]	4.95 (0.20)[B]	<0.001
Rate of class attendance (%)**	89.61 (4.11)[A]	92.44 (2.06) [B]	93.92 (1.75)[C]	<0.001
Student workload hours**	4351.46 (223.83)[A]	4413.39 (311.20)[B]	4570.82 (444.84)[C]	<0.001

* Chi-square test and the One-way ANOVA followed by Tukey post hoc test
** Mean (s.d.)

Table 2 – Comparison of academic performance by discipline groups.

	n (%)	Mean (s.d.)	IC 95%	*P**
Overall disciplines				
High performance	456 (38.6)	8.13 (0.26)	8.10 – 8.15	
Moderate performance	531 (44.9)	7.41 (0.21)	7.39 – 7.43	
Low performance	195 (16.5)	6.60 (0.40)	6.54 – 6.66	
Basic disciplines				
High performance	466 (39.7)	7.95 (0.41)	7.91 – 7.98	
Moderate performance	482 (41.1)	6.85 (0.32)	6.82 – 6.88	
Low performance	225 (19.2)	5.63 (0.54)	5.55 – 5.69	<0.001
Dental disciplines				
High performance	501 (42.4)	8.18 (0.24)	8.15 – 8.20	
Moderate performance	552 (46.7)	7.52 (0.21)	7.50 – 7.53	
Low performance	129 (10.9)	6.70 (0.43)	6.63 – 6.78	
Non-clinical disciplines				
High performance	474 (40.1)	8.12 (0.32)	8.09 – 8.15	
Moderate performance	521 (44.1)	7.28 (0.25)	7.25 – 7.30	
Low performance	187 (15.8)	6.30 (0.49)	6.23 – 6.37	<0.001
Clinical disciplines				
High performance	500 (42.3)	8.13 (0.26)	8.11 – 8.16	
Moderate performance	543 (45.9)	7.40 (0.21)	7.38 – 7.42	
Low performance	139 (11.8)	6.59 (0.44)	6.51 – 6.66	

* Paired-samples *t* test

Table 3 - Student distribution according academic performance by discipline groups.

	Basic disciplines			
	Higher performance	Moderate performance	Lower performance	*P**
Dental disciplines				
Higher performance	382	84	0	
Moderate performance	117	339	26	<0.001
Lower performance	1	122	102	

	Non-clinical disciplines			
	Higher performance	Moderate performance	Lower performance	*P**
Clinical disciplines				
Higher performance	377	95	2	
Moderate performance	120	363	38	<0.001
Lower performance	3	85	99	

* Chi-square test

Table 4 - Stepwise multiple regression of the influence of independent variables in the overall student performance.

	β	Std error	Standardized Coefficients	95% CI β	*P* *
Frequency in course (%)	0.111	0.006	0.514	0.099 – 0.123	< 0.001
Student workload hours	0.001	0.000	0.221	0.000 – 0.001	< 0.001
Elapsed time from completion of high school until dental school admission (years)	-0.070	0.009	-0.195	-0.089 – -0.051	< 0.001
Gender: Female	-0.230	0.033	-0,189	-0.296 – -0.164	< 0.001
Rank in admission test	-0.003	0.001	-0.077	-0.005 – -0.001	< 0.01

* Stepwise multiple regression

R^2= 0,491

Artigo 2 - A cluster analysis of socioeconomic variables and their impact on academic performance in a Brazilian undergraduate student sample

ABSTRACT

The recognition of socioeconomic characteristics of dental students provides strategic information for planning educational policies in the university environment. The aims of this study were to identify natural segmentation of freshman undergraduate dental students based on socioeconomic variables, and to subsequently investigate their impact on academic performance in a sample of Brazilian undergraduate students. Cluster analysis (two-step algorithm) was used to segment students who entered dental school in the time period from 1999 to 2001 (n=158) into groups based on responses to a socioeconomic questionnaire completed by students at the time of the admission examination. Clustering analysis revealed three natural groups. Age, the parents' level of education, and performance on the first admission test were the most important variables for cluster segmentation. Cluster 1 (n=42; 26.6%) was characterized by female students with higher socioeconomic status and better previous educational indicators. Cluster 2 (n=62; 39.2%) represented disadvantaged socioeconomic profiles, with a predominance of females and older students. Cluster 3 (n=54; 34.2%) showed similar socioeconomic characteristics to cluster 1, except for male prevalence, higher age, and experiencing difficulty in the admission test. Betweengroups comparison showed significant differences (cluster 1> 2> 3) in overall performance and performance in course groups ($p<0.05$). The impact and significance of students' socioeconomic status on academic performance underlines

the need to develop individualized educational programs and reinforces the importance of financial support to maximize successful educational experiences of socioeconomically disadvantaged dental students.

Key Words: Cluster Analysis, Dental education, Dental students, Socioeconomic status

INTRODUCTION

Studies exploring socioeconomic characteristics of dental students provide valuable information for planning educational strategies and policies, and improve faculty expertise on learning issues. Numerous studies on dental student attributes have mainly focused on socio-demographic characteristics and analysis of changes over time, as well as investigating their reasons for choosing dentistry, academic involvement, and future professional plans.[1-7]

Recently, there has been increasing interest on inclusion policies and practices, such as attainment of equality in access to higher education and the relevance of cultural and social diversity in academic training of students and professionals in health care areas.[8-16] The American Dental Education Association also has reinforced the need for diversity in the workforce to achieve professional excellence and address iniquities in the oral health care services.[17,18]

Reports about the process of socialization and professionalization of medical students stressed that the matrix of social relationships in which a student internalizes attitudes and values will strongly determine his/her professional behavior.[19-24] Their findings support that minority students are more likely to practice in areas of physician shortage and treat disadvantaged and chronically ill patients.[19,23-24] Moreover, despite the hypothesis that increasing the number of students from underrepresented segments of the population would result in decreased quality standards for the general undergraduate population, evidence has suggested that there is no difference

in the academic performance of these “underrepresented” students when compared to other students.[19-22]

In dental education literature, there is little to no evidence regarding the impact of socioeconomic status on the academic performance of students. This is an especially relevant issue in developing countries, where major inequality in the distribution of wealth is a serious social concern. Improved knowledge of this relationship will provide a basis to guide the design of dental education programs, thus playing an important role in the current context of increasing demand for higher education and implementation of access and inclusion policies in Brazil. Thus, the aims of this study were to identify natural segmentation of freshman undergraduate dental students based on socioeconomic variables, and to subsequently investigate the impact of socioeconomic-based clusters on academic performance in a sample of Brazilian undergraduate students.

MATERIAL AND METHODS

A retrospective cohort study was designed to include all students who entered the School of Dentistry of Federal University of Goias, Brazil, from 1999 to 2001.

After the research protocol was approved by the local Institutional Review Board, data were gathered from the University Registrar’s Office, including student scores on the dental school admission test, performance in undergraduate courses, and answers to a socioeconomic questionnaire completed by students at the time of the university

admission test. Data retrieved from questionnaires provided the following socioeconomic variables: age, gender, marital status, living arrangement in the last two years, parental education, monthly family income, employment experience, the need for financial aid or support from the university, information about high school, language proficiency, participation in preparatory courses for university admission, and previous submissions to the admission test.

Two-step cluster analysis was used to segment samples into n number of clusters based on the socioeconomic variables, using an autoclustering algorithm. Cluster analysis was used as an exploratory data analysis technique designed to reveal natural grouping from latent patterns in a large dataset on the basis of a minimal within-group and a maximal between-group variation, without prejudgment. The two-step algorithm analysis allows subjects to be segmented in an optimal number of clusters according to continuous and categorical variables.[25]

The variable importance for cluster segmentation was ranked by Chi-square test (for nominal variables) or t-test (for continuous variables) in which each cluster group was tested against the overall group. Since multiple tests were performed, Bonferroni adjustments were applied to control the false-positive error rate. An alternative importance measure, which has the advantage of placing both types of variables on the same scale, is based on statistical significance values using $-\log_{10}$ of the statistical significance ($-\log_{10}$P-value). This transformation stretches the original scale to 0 to infinity (instead of a small band from 0 to 1), so that larger values of $\log_{10}$ of P-value equate to greater significance.[25]

Subsequently, the influence of the student's group classification on academic performance was tested. It was hypothesized that cluster analysis segmentation can be associated with distinct academic performance levels. In this study, academic performance in undergraduate courses was measured as the mean value of four bimonthly examinations, rated quantitatively on a 0-10 scale. Overall academic performance refers to the grade point average from all undergraduate courses. Academic performance in course groups relates to performance in basic and dental, and non-clinical and clinical courses. The term "basic courses" refers to biomedical and behavioral sciences, i.e. non-dental courses, while "non-clinical courses" represents those that don't involve clinical practice, including dental courses.

Bivariate analysis using Chi-square test and one-way ANOVA followed by Tukey post hoc test were used to compare socioeconomic status and academic performance among clusters with levels of significance defined as $p<0.05$. SPSS 16.0 for Windows was used for clustering and all descriptive and hypothesis testing analyses.

RESULTS

The study sample included 158 students, 58.2% females. Mean age was 19.58 years (SD=1.83) at the time of dental school admission and 23.55 years (SD=1.81) at the time of graduation. The average student was female, young, and single. In general, students from this study experienced comfortable lifestyles, possessed relatively little employment experience, had a great investment in their education, and came from parents with high levels of education and high monthly incomes.

The auto-clustering algorithm combined 100% of the cases in a three-cluster solution, enclosing 26.6, 39.2 and 34.2% of the sample. Table 1 includes descriptive analysis and comparison among clusters of socioeconomic status. Only the variables 'marital status', 'time that the subjects attended high school (daytime/night-time)', and 'rank in dental school admission test' were not statistically different among the clusters. Significant variables for segmentation of each cluster are shown in Table 2, where within-group rank of variable importance for cluster segmentation is depicted for each of the three clusters.

Cluster 1 (n=42; 26.6%) was characterized by a predominance of female and younger students without previous employment experience, living in Goiania with parents who have higher levels of education and monthly incomes. In these families, education costs have the biggest impact on finances, which is evidenced by larger investments in private schools and language courses. Students of this segment had significant success in the university entrance examination immediately after high school. Favorable socioeconomic status was related to a smaller need to receive financial aid or support from the university since these students are primarily supported by their families. In contrast, Cluster 2 (n=62; 39.2%) represented a more disadvantaged socioeconomic status, with a predominance of females and older students. Cluster 3 (n=54; 34.2%) showed similar characteristics to the first cluster, except for a prevalence toward males and older students, more participation in previous university entrance examinations, more participation in preparatory courses for admission, and fathers with higher levels of education.

Analysis of academic performance (Table 3) revealed that all clusters showed satisfactory performance. Differences in overall academic performance ($p < 0.05$) and by course groups ($0.01 < p < 0.05$) were found amongst clusters, except for clinical courses. In all cases, Cluster 3 demonstrated a significantly lower level of performance.

DISCUSSION

Socioeconomic characteristics play an important role in the development of students' intellectual and non-intellectual faculties, and may influence their commitment level to a profession.[22] Analysis of socioeconomic status of undergraduate students is important in understanding their background, priorities, and socialization and academic process.[4,7] The present study assessed socioeconomic status of Brazilian dental students and the impact of these characteristics on their academic performance.

Predominance of females among dental students is reported in Australia[1,3,6], Canada[19], Denmark[7], France[2], New Zealand[3], Nigerian[4], United Kingdom[16], and United States[10]. Besides a growing trend of feminization in the field of dentistry, previous studies have indicated that women follow a pattern different from their male counterparts in relation to working organization, time spent at work, and income.[2,3,5,7]

Brazilian universities accept dental school students directly from high school. Thus students of our research are young, with a mean age of 19.58 years (s.d.=1.83) at the

time of dental school admission. In educational systems where students must possess a previous degree prior to entering dental school, this age is obviously higher. In Sydney, for example, Hennequin *et al.*[3] found that first-year dental students have a mean age of 24.6 years (s.d.=3.9).

Most parents of dental students have high levels of education and income. Students are predominately single, without employment experience, reside with their parents, and are financially dependent.[1-7,19] Cluster 1 and 3 characteristics (n=96; 60.8%) corroborate previously published trends that most dental students came from more privileged socioeconomic groups.[1-7,19]

In our study, almost 40% of students (Cluster 2) had lower socioeconomic status than their collegues, which does not imply that this group corresponds to a representative sample of the overall disadvantaged population. On the contrary, the presence of economic, cultural, and social barriers to access higher education is still a major problem in Brazilian society and a primary reason for social inequity. Hung *et al.*[10] reinforced that a lack of diversity on campus and limited social, academic, and financial support are significant barriers for recruiting and retaining minority students.

The impact of students' socioeconomic status on academic performance was related to multidimensional factors, revealing the importance of development of specific educational strategies for each cluster. Cluster 1, characterized by female students with higher socioeconomic status and superior secondary formation, had significant success in university admissions immediately after high school and in the undergraduate program. Cluster 3 demonstrated similar socioeconomic

characteristics to the first cluster, except for the prevalence of male students who did not enter dental school directly from high school and lower academic performance. Surprisingly, Cluster 2 represented the second best academic performance. Despite disadvantaged socioeconomic status and a need for selfsupport during completion of their degree, this segment revealed significant ability to overcome personal and academic difficulties. This evidence reinforces the importance of financial support from the universities to maximize the successful educational experience of these students. Moreover, a better understanding of the reasons and associated factors for these differences in academic performance among students is needed in future studies.

In regards to the equality of access to education, our findings can guide dental schools in the planning and implementation of policies for recruiting, admitting, and retaining of minority students. Recently, universities have introduced academic support programs as well as lower academic criteria for admission of underrepresented segments.[8-16] On the other hand, in corroboration with previously reported studies, our results show that socioeconomically disadvantaged students have satisfactory academic performance, despite the need for financial support.[19-22] Bediako *et al.* [26] found that an academically rigorous high school program for minority and economically disadvantaged students led to higher rates of application and admission to medical school.

Assessment of the impact of today's societal and economic changes and expansion on dental care systems in characteristics of freshman undergraduate students is

important for the current context of expansion of higher education.[2,3,7] Progressive increases in the diversity of the student population will have an impact on undergraduate, continuing, and postgraduate education, professional retention, and practice location.[3,23]

Additional studies are needed to confirm the present results since regional and cultural differences may play a role in socioeconomic status and student performance. Longitudinal approaches are essential to elucidate the effectiveness of different strategies to attract, recruit, and retain minority students and assess their impact in professional practice.

CONCLUSION

Clustering analysis showed significant socioeconomic differences among students, which influenced overall performance and performance in course groups. The impact and significance of students' socioeconomic status on academic performance emphasizes the need of individualized educational programs and the importance of financial support to maximize successful educational experiences of socioeconomically disadvantaged Brazilian dental students.

REFERENCES

1 Gietzelt D. Social profile of first-year dentistry students at the University of Sydney. Aust Dent J, 42:259-66, 1997.

2 Hennequin M, Tubert S, Devillers A, Müller M, Michaïlesco P, Peli JF, Pouëzat J. Socio-economic and schooling status of dental undergraduates from six French universities. Eur J Dent Educ, 6:95-103, 2002.

3 Marino RJ, Morgan MV, Winning T, Thomson WM, Marshall RI, Gotjamanos T, Evans W. Sociodemographic backgrounds and career decisions of Australian and New Zealand dental students. J Dent Educ,70:169-78,2006.

4 Orenuga OO, da Costa OO. Characteristics and study motivation of clinical dental students in Nigerian universities. J Dent Educ, 70:996-1003, 2006.

5 Reeve PE, Watson CJ. An exploration of the attitudes, personality and performance of dental students. Med Educ, 19:226-37, 1985.

6 Sivaneswaran S, Barnard PD. Some social characteristics and background of first-year dental students, University of Sydney, 1976-85. Aust Dent J, 37:378-85, 1992.

7 Vigild M, Schwarz E. Characteristics and study motivation of Danish dental students in a longitudinal perspective. Eur J Dent Educ, 5:127-33, 2001.

8 Andersen RM, Carreon DC, Friedman JA, Baumeister SE, Afifi AA, Nakazono TT, Davidson PL. What enhances underrepresented minority recruitment to dental schools? J Dent Educ, 71:994-1008, 2007.

9 Formicola AJ, Klyvert M, McIntosh J, Thompson A, Davis M, Cangialosi T. Creating an environment for diversity in dental schools: one school's approach. J Dent Educ, 67:491-9, 2003.

10 Hung R, McClendon J, Henderson A, Evans Y, Colquitt R, Saha S. Student perspectives on diversity and the cultural climate at a U.S. medical school. Acad Med, 82:184-92, 2007.

11 Mahal AS, Shah N. Implications of the growth of dental education in India. J Dent Educ, 70:884-91, 2006.

12 Murray-García JL, Harrell S, García JA, Gizzi E, Simms-Mackey P. Self-reflection in multicultural training: be careful what you ask for. Acad Med,80:694-701, 2005.

13 Price SS, Brunson WD, Mitchell DA, Alexander CJ, Jackson DL. Increasing the enrollment of underrepresented minority dental students: experiences from the dental pipeline program. J Dent Educ,71:339-47,

2007.

14 Saha S, Guiton G, Wimmers PF, Wilkerson L. Student body racial and ethnic composition and diversity-related outcomes in US medical schools. JAMA, 300:1135-45, 2008

15 Veal K, Perry M, Stavisky J, Herbert KD. The pathway to dentistry for minority students: from their perspective. J Dent Educ, 68:938-46, 2004.

16 Bedi R, Gilthorpe MS. Social background of minority ethnic applicants to medicine and dentistry. Br Dent J, 189:152-4, 2000.

17 Sinkford JC, Valachovic RW, Harrison SG. Continued vigilance: enhancing diversity in dental education. J Dent Educ, 70:199-203, 2006.

18 Sinkford JC, Valachovic RW, Harrison SG. Underrepresented minority dental school enrollment: continued vigilance required. J Dent Educ, 68:1112-8, 2004.

19 Dhalla IA, Kwong JC, Streiner DL, Baddour RE, Waddell AE, Johnson IL. Characteristics of first-year students in Canadian medical schools. CMAJ, 166:1029-35, 2002.

20 Fredericks MA, Blanchet L, Mundy P. The relationship between social class academic achievement and National Board scores of students in a dental school. J Am Coll Dent, 40:174-81, 1973.

21 Fredericks M, Mundy P.The relationship between social class and national board scores of students in a medical school. Soc Sci Med. 3:104-10, 1969.

22 Fredericks M, Mundy P. The relationship between social class, stress-anxiety responses, professional attitudes, and National Board scores of students in a medical school. J Natl Med Assoc, 60: 271-8,1968.

23 Moy E, Boreman BA. Physician race and care of minority and medically indigent patients. JAMA, 273:1515-23, 1995.

24 Rabinowitz HK, Diamond JJ, Veloski JJ, Gayle JA. The impact of multiple predictors on generalist physicians' care of underserved populations. Am J Public Health,90:1225-8, 2000.

25 SPSS Inc. Market segmentation using SPSS. Chicago, Ill., 2006.

26 Bediako MR, McDermott BA, Bleich ME, Colliver JA. Ventures in education: a pipeline to medical education for minority and economically disadvantaged students. Acad Med,71:190-2, 1996.

Table 1 - Characterization of clusters according to socioeconomic variables.

Variables	Total	Clusters			$P^{\dagger}$
		1 (n=42)	2 (n=62)	3 (n=54)	
Age at admission (years)*	19.58 (1.83)	18.21 (0.56)[A]	20.30 (2.06)[B]	19.83 (1.64)[B]	<0.001
Gender – *Female*	58.2	78.57	66.13	33.33	<0.001
Marital status – *Single*	98.1	97.62	96.77	100	N.S.
Reside with parents	84.2	92.86	69.35	94.44	<0.001
Public high school	17.1	2.38	37.10	5.56	<0.001
Daytime high school	95.6	100	93.55	94.44	N.S.
Traditional high school (3 years)	95.6	100	90.32	98.15	<0.001
Participation in preparatory courses for admission	62.0	0	83.87	79.63	<0.001
Approved in first admission test – *Yes*	73.4	16.67	88.71	100	<0.001
Need for financial aid or support from university	75.9	66.67	98.39	57.41	<0.001
Need for own resources for support during undergraduate	34.2	11.90	51.61	31.48	<0.001
Employment experience at time of dental admission test	9.5	0	22.58	1.85	<0.001
Previous employment experience	17.1	4.76	32.26	9.26	<0.001
Family living in Goiania	71.5	78.57	56.45	83.33	<0.01
Father with high level of education	53.8	71.43	11.29	88.89	<0.001
Mother with high level of education	47.5	57.14	16.13	75.93	<0.001
Monthly family income greater than R$ 1.200,00**	67.1	92.86	33.87	85.19	<0.001
Education costs have high impact on family finances	67.7	78.57	56.45	72.22	<0.05
Foreign language proficiency	57.0	71.43	33.87	72.22	<0.01
Rank in admission test **	28.58 (16.59)	29.33 (18.71)	26.01 (14.72)	30.50 (16.08)	N.S.

* Mean (s.d.)

** Aproximately 4 times Brazilian minimum wage

† Chi-square test and the one-way ANOVA followed by Tukey post hoc test

Table 2- Within-group rank of variable importance for cluster segmentation

Clusters	Variables	Chi-square or t-test value*	*-Log$_{10}$ P-Value***	*P*
1	Age at admission (Younger)	-15.77	18.18	<0.001
	Approved in first admission test (Yes)	69.3	16.08	<0.001
	Participation in preparatory courses for admission (No)	68.6	15.92	<0.001
	Monthly income (Higher)	12.6	3.42	<0.001
	Need for own resources for support during undergraduate (No)	9.3	2.63	<0.01
2	Father with high level of education (No)	45.1	10.72	<0.001
	Monthly income (Lower)	31.0	7.58	<0.001
	Mother with high level of education (No)	24.4	6.11	<0.001
	Type of high school (Public)	17.5	4.55	<0.001
	Need for financial support from university (Yes)	17.1	4.45	<0.001
	Language proficiency (No)	13.5	3.62	<0.001
	Participation in preparatory courses for admission (Yes)	12.6	3.4	<0.001
	Employment experience at time of dental admission test (Yes)	12.4	3.36	<0.001
	Living arrangement in the last 2 years (Living without parents)	10.2	2.86	<0.01
	Previous employment experience (Yes)	10.1	2.82	<0.01
	Age at admission (Older)	2.1	2.74	<0.01
3	Father with high level of education (Yes)	26.8	6.64	<0.001
	Approved in first admission test (No)	19.6	5.01	<0.001
	Mother with high level of education (Yes)	17.5	4.55	<0.001
	Gender (Male)	13.8	3.68	<0.001
	Participation in preparatory courses for admission (Yes)	12.3	3.34	<0.001
	Need for financial support from university (No)	10.2	2.84	<0.01

* Chi-square or t-test was used for nominal or continuous variables, respectively

** *-Log$_{10}$ P-Value* : larger value is more significant

Table 3 - Comparison of academic performance among clusters.

	Mean (s.d.)	IC 95%	*P**
Overall courses			
1	8.13 (0.31)^{A}	8.03 – 8.23	<0.05
2	8.00 (0.43)^{AB}	7.89 – 8.11	
3	7.89 (0.44)^{B}	7.76 – 8.01	
Basic courses			
1	7.74 (0.45)^{A}	7.60 – 7.88	
2	7.59 (0.63)^{AB}	7.42 – 7.75	<0.01
3	7.37 (0.75)^{B}	7.16 – 7.57	
Dental courses			
1	8.26 (0.29)^{A}	8.17 – 8.36	
2	8.13 (0.39)^{AB}	8.03 – 8.23	<0.05
3	8.05 (0.38)^{B}	7.94 – 8.15	
Non-clinical courses			
1	7.92 (0.40)^{A}	7.79 – 8.04	
2	7.76 (0.55)^{AB}	7.62 – 7.90	<0.01
3	7.58 (0.60)^{B}	7.41 – 7.74	
Clinical courses			
1	8.31 (0.26)^{A}	8.23 – 8.39	
2	8.20 (0.37)^{AB}	8.10 – 8.29	N.S
3	8.14 (0.34)^{B}	8.05 – 8.23	

* One-way ANOVA followed by Tukey post hoc test

5 PARA NÃO CONCLUIR... MAS PARA DESAFIAR...

A análise de fatores influenciadores do desempenho acadêmico fornece subsídios para atuação de administradores, autoridades ligadas a políticas públicas e pesquisadores do ensino superior. Os resultados da presente pesquisa corroboram achados da literatura brasileira e internacional, evidenciando a necessidade de reestruturação curricular e reorientação da formação profissional nos cursos de graduação em Odontologia.

A diferença no desempenho acadêmico entre as disciplinas dos ciclos básico e profissionalizante e entre as disciplinas clínicas e não clínicas revela a importância da operacionalização de práticas integradoras no currículo de graduação, bem como da sensibilização e capacitação pedagógica do corpo docente para rompimento da ênfase dada às disciplinas clínicas e profissionalizantes, visando minimizar a tendência de especialização precoce entre os estudantes e favorecer a formação integral do futuro cirurgião-dentista.

Embora a maioria tenha apresentado desempenho acadêmico alto e médio, o número considerável de estudantes com baixo desempenho sugere a necessidade de estratégias educacionais diferenciadas para este segmento. A importância destas medidas é ressaltada frente à tendência de os estudantes permanecerem nos respectivos *clusters* de desempenho, independentemente do grupo de disciplina analisado.

A verificação de um melhor desempenho acadêmico entre os estudantes com menor tempo entre a conclusão do ensino médio e ingresso na faculdade

reforça a importância de dados de escolarização anteriores à graduação, revelando que estudantes com melhor formação apresentam melhor desempenho no vestibular e no curso de Odontologia. A relação entre desempenho acadêmico e frequência e carga horária cumprida evidencia que estudantes com melhor desempenho correspondem àqueles com maior envolvimento em atividades de ensino, pesquisa e extensão. Já as diferenças no desempenho acadêmico de acordo com o gênero, mostram que a tendência à feminilização da profissão odontológica é acompanhada pelo melhor desempenho acadêmico das mulheres.

O perfil socioeconômico da amostra de estudantes de Odontologia investigado nesse estudo corrobora evidências científicas prévias: a maioria dos estudantes caracterizou-se por indivíduos jovens, solteiros, do gênero feminino, sustentados por pais de alta escolaridade e renda mensal. A grande contribuição da presente pesquisa refere-se à análise de segmentação dos estudantes de acordo com o perfil socioeconômico, a qual identificou três *clusters* com características distintas e diferentes padrões de desempenho acadêmico.

Os achados de que estudantes com perfil socioeconômico desfavorável apresentam desempenho satisfatório sugerem que esse segmento possui significante capacidade de superação das dificuldades pessoais e acadêmicas. Além disso, a importância atribuída por esses estudantes ao auxílio da institucão para seu sustento durante a graduação ressalta a importância da implementação de políticas institucionais de assistência.

Faz-se necessário, portanto, o delineamento de políticas públicas e institucionais que permitam a permanência e a conclusão do curso pelos estudantes,

em uma perspectiva de inclusão social, formação integral, melhoria do desempenho acadêmico e de sua qualidade de vida.

Ressalta-se ainda que, apesar de seu uso recente em pesquisas odontológicas, a análise de segmentação apresenta-se como recurso estratégico em estudos voltados à análise de desempenho acadêmico. Como limitação do presente trabalho, deve-se considerar que o desempenho acadêmico revelado através de notas finais dos estudantes depende diretamente da competência dos professores para avaliar os estudantes, bem como dos métodos utilizados. Contudo, os dados coletados se apresentam abrangentes e confiáveis para alcance dos objetivos propostos.

Nesse contexto, os resultados desta pesquisa têm o potencial de fomentar discussões emergentes frente à conjuntura atual de reorientação da formação profissional em Odontologia e de ampliação da demanda e democratização do acesso ao ensino superior, além de fornecer diretrizes ao processo de institucionalização da avaliação. Este estudo destaca, ainda, algumas áreas de investigação relacionadas ao desempenho acadêmico, no âmbito das IES, de políticas públicas e da atuação profissional.

REFERÊNCIAS****

1 Brasil. Ministério da Saúde. Secretaria de Gestão do Trabalho e da Educação na Saúde. Organização Pan-Americana da Saúde. Chamado à ação de Toronto: 2006-2015: rumo a uma década de recursos humanos em saúde nas américas / Called to the Toronto action: 2006 to 2015: route to one decade of human resorts in health in americas. Brasília; Ministério da Saúde 2006. 12 p.

2 Medeiros AJ. Modelos assistenciais em saúde bucal. In: Ferreira MA; Roncalli A; Lima K. Saúde Bucal Coletiva: conhecer para atuar. Natal: EDUFRN, 2004. 304 p.

3 Moysés SJ. Políticas de saúde e formação de recursos humanos em Odontologia. Rev. ABENO, 4: 30-7, 2004.

4 ADEA Commission on Change and Innovation in Dental Education. Competencies for the new dentist: (as approved by the 1997 house of delegates these competencies are being revised in 2006-07). J Dent Educ, 71:926-8, 2007.

5 Divaris K, Barlow PJ, Chendea SA, Cheong WS, Dounis A, Dragan IF, Hamlin J,Hosseinzadeh L, Kuin D, Mitrirattanakul S, Mo'nes M, Molnar N, Perryer G, Pickup J, Raval N, Shanahan D, Songpaisan Y, Taneva E, Yaghoub-Zadeh S, West K, Vrazic D. The academic environment: the students' perspective. Eur J Dent Educ, 12:120-30, 2008.

**** As referências apresentadas neste capítulo referem-se àquelas citadas na Introdução e nos Procedimentos metodológicos

6 Manogue M, Brown G. Managing the curriculum – for a change. Eur J Dent Educ,11:75–86, 2007.

7 Oliver R, Kersten H, Vinkka-Puhakka H, Alpasan G, Bearn D, Cema I, Delap E, Dummer P, Goulet JP, Gugushe T, Jeniati E, Jerolimov V, Kotsanos N, Krifka S,Levy G, Neway M, Ogawa T, Saag M, Sidlauskas A, Skaleric U, Vervoorn M, White D. Curriculum structure: principles and strategy. Eur J Dent Educ, 12 (Suppl 1):74-84, 2008.

8 Plasschaert AJ, Holbrook WP, Delap E, Martinez C, Walmsley AD. Association for Dental Education in Europe. Profile and competences for the European dentist. Eur J Dent Educ, 9:98-107, 2005.

9 Kersten HW, Vervoorn JM, Zijlstra AE, Blok BS, Van Eijden TMGJ. Development and implementation of new educational concepts in a dental curriculum. Eur J Dent Educ, 11: 2-9, 2007.

10 Brasil. Resolução CNE/CES 3. Institui Diretrizes Curriculares Nacionais do Curso de Graduação de Odontologia. Diário Oficial da União, Brasília, 4 de março de 2002.Seção 1, p. 10.

11 Lemos CLS. A implantação das Diretrizes Curriculares dos cursos de graduação em Odontologia: algumas reflexões. Rev. ABENO,5:80-5, 2005.

12 Gietzelt D. Social profile of first-year dentistry students at the University of Sydney. Aust Dent J, 42:259-66, 1997.

13 Hennequin M, Tubert S, Devillers A, Müller M, Michaïlesco P, Peli JF, Pouëzat J. Socio-economic and schooling status of dental undergraduates from six French universities. Eur J Dent Educ, 6:95-103, 2002.

14 Marino RJ, Morgan MV, Winning T, Thomson WM, Marshall RI, Gotjamanos T, Evans W. Sociodemographic backgrounds and career decisions of Australian and New Zealand dental students. J Dent Educ,70:169-78,2006.

15 Orenuga OO, da Costa OO. Characteristics and study motivation of clinical dental students in Nigerian universities. J Dent Educ, 70:996-1003, 2006.

16 American Dental Association Survey Center. 2003/2004 survey of predoctoral dental education: curriculum, volume 4. Chicago: American Dental Association, 2005.

17 Baum BJ. Can biomedical science be made relevant in dental education? A North American perspective. Eur J Dent Educ, 7:49-55, 2003.

18 Boyd L. Reflections on clinical practice by first-year dental students: a qualitative study. J Dent Educ, 66:710-20, 2002.

19 Chur-Hansen A, Carr JE, Bundy C, Sanchez-Sosa JJ, Tapanya S, Wahass SH. An international perspective on behavioral science education in medical schools. J Clin Psychol Med Settings, 15:45-53, 2008.

20 Crawford JM, Adami G, Johnson BR, Knight GW, Knoernschild K, Obrez A, Patston PA, Punwani I, Zaki AM, Licari FW. Curriculum restructuring at a north american dental school: Rationale for change. J Dent Educ, 71:524-31, 2007.

21 Fugill M. Teaching and learning in dental student clinical practice. Eur J Dent Educ, 9:131-6, 2005.

22 Gaengler P, De Vries J, Akota L, Balciuniene I, Berthold P, Gajewska M, Johnsen D, Urtâne I, Walsh L, Zijlstra A. Student selection and the influence of their clinical and academic environment on learning. J Dent Educ, 3:8-26, 2002.

23 Gotjamanos T. Integration of basic biological sciences and clinical dentistry in the dental curriculum. A clinically orientated approach to teaching oral and dental anatomy. Aust Dent J, 35:290-3, 1990.

24 Haden NK, Andrieu SC, Chadwick DG, Chmar JE, Cole JR, George MC, Glickman GN, Glover JF, Goldberg JS, Hendricson WD, Meyerowitz C, Neumann L, Pyle M, Tedesco LA, Valachovic RW, Weaver RG, Winder RL, Young SK, Kalkwarf KL. The dental education environment. J Dent Educ, 70:1265-70, 2006.

25 Henzi D, Davis E, Jasinevicius R, Hendricson W. North American dental students' perspectives about their clinical education. J Dent Educ, 70:361-77, 2006.

26 Huang C, Bian Z, Tai B, Fan M, Chiu-Yin K. Dental education in Wuhan, China: challenges and changes. J Dent Educ, 71:304-11, 2007.

27 Humphrey S, Mathews R, Kaplan A, Beeman C. Undergraduate basic science preparation for dental school. J Dent Educ, 66:1252-9, 2002.

28 Humphrey S, Skelton J, West K, MacPherson B. Toward better Integration of Biomedical Science and Clinical Dentistry. J Dent Educ, 68:232-3, 2004.

29 Kassebaum DK, Hendricson WD, Taft T, Haden NK. The dental curriculum at North American dental institutions in 2002-03: a survey of current structure, recent innovations, and planned future changes. J Dent Educ, 68:914-31, 2004.

30 Kerosuo E, Ruotoistenmäki J, Murtomaa H. Report on the development of a new dental curriculum at Helsinki. Eur J Dent Educ, 5:23-30, 2001.

31 Kingsley K, O'Malley S, Stewart T, Galbraith GM. The integration seminar: a first-year dental course integrating concepts from the biomedical, professional, and clinical sciences. J Dent Educ, 71:1322-32, 2007.

32 Lantz MS, Chaves JF. What should biomedical sciences education in dental schools achieve? J Dent Educ, 61:426-33, 1997.

33 Lindemann RA, Cabret ML. Assessment of dental student studying strategies. J Dent Educ, 59:1020-6, 1995

34 Sessle BJ. Integration of basic sciences into the predoctoral curriculum to study temporomandibular disorders and orofacial pain. J Orofac Pain, 16:181-4, 2002.

35 Weaver RG, Haden NK, Valachovic RW. U.S. dental school applicants and enrollees: a ten-year perspective. J Dent Educ, 64:867-70, 2000.

36 Bergman AV, Susarla SM, Howell TH, Karimbux NY. Dental admission test scores and performance on NBDE Part I, revisited. J Dent Educ, 70:258-62, 2006.

37 Curtis DA, Lind SL, Brear S, Finzen FC. The correlation of student performance in preclinical and clinical prosthodontic assessments. J Dent Educ, 71:365-72, 2007.

38 Fields HW, Fields AM, Beck FM. The impact of gender on high-stakes dental evaluations. J Dent Educ, 67:654-60, 2003.

39 De Ball S, Kathleen S, Horine J, Duncan W, Repogle W. The relationship of performance on the dental admission test and performance on Part I of the National Board Dental Examinations. J Dent Educ, 66:478-84, 2002.

40 Gray S, Deem L. Predicting student performance in preclinical technique courses using the theory of ability determinants of skilled performance. J Dent Educ, 66:721-7, 2002.

41 Gray S, Deem L, Straja S. Are traditional cognitive tests useful in predicting clinical success? J Dent Educ, 66:1241-5, 2002.

42 Hoad-Reddick G, Macfarlane TV, Gibson VM. Relating personality to interview results and performance in the first year of the dental course. Br Dent J, 10:348-52, 1999.

43 Smithers S, Catano VM, Cunningham DP. What Predicts Performance in Canadian Dental Schools? J Dent Educ, 68:598-613, 2004

44 Lynch CD, McConnell RJ, Hannigan A. Dental school admissions in Ireland: can current selection criteria predict success? Eur J Dent Educ, 10:73-9, 2006.

45 Park SE, Susarla SM, Massey W. Do admissions data and NBDE Part I scores predict clinical performance among dental students? J Dent Educ, 70:518-24, 2006.

46 Dhalla IA, Kwong JC, Streiner DL, Baddour RE, Waddell AE, Johnson IL. Characteristics of first-year students in Canadian medical schools. CMAJ, 166: 1029-35, 2002.

47 Vigild M, Schwarz E. Characteristics and study motivation of Danish dental students in a longitudinal perspective. Eur J Dent Educ, 5:127-33, 2001.

48 Stacey DG, Whittaker JM. Predicting academic performance and clinical competency for international dental students: seeking the most efficient and effective measures. J Dent Educ, 69:270-80, 2005.

49 Hornby AS. Oxford Advanced Learner's Dictionary of Current English. Oxford, Oxford University Press, 2005.

50 Munhoz AMH. Uma análise multidimensional da relação entre inteligência e desempenho acadêmico em universitários ingressantes. 2004. Tese (Doutorado em Educação) - Universidade Estadual de Campinas.

51 Brustolin J, Brustolin J, Toassi RFC, Kuhnen M. Perfil do acadêmico de Odontologia da Universidade do Planalto Catarinense – Lages – SC, Brasil. Rev. ABENO, 6:66-9, 2006.

52 Freire MCM, Souza CS, Pereira HR. O perfil do acadêmico de Odontologia da Universidade Federal de Goiás. Divulgação em Saúde para Debate,10:15-20, 1995.

53 Freitas SFT, Nakayama MH. Um perfil do estudante de Odontologia no estado de São Paulo. Divulgação em Saúde para Debate, 10:29-37, 1995.

54 Junqueira JC, Colombo CED, Tavares PG, Rocha RF, Carvalho YR, Rodrigues JR. Quem é e o que pensa o graduando de odontologia. Rev Odontol UNESP.31: 269-84, 2002.

55 Nicodemo D, Naressi WG. O perfil do aluno de odontologia – do ingresso à sua graduação. Rev Odonto Ciência, 17:135-9, 2002.

56 Slavutzky SMB, Abbeg C, Gross RFE, Rosa MAC. Mercado de trabalho: perfil do acadêmico de Odontologia da Universidade Federal do Rio Grande do Sul. Rev Fac Odontol Porto Alegre, 43:3-6, 2002.

57 A trajetória dos cursos de graduação na área da saúde: 1991-2004 / Organizadores: Ana Estela Haddad *et al*. Brasília; Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira 2006. 533 p.

58 Almeida Jr E, Almeida RCA, Cabral OEJ. A escolha da profissão odontológica: motivação consciente. Odontol Mod, 11:21-6, 1984.

59 Arbenz GO, Abramowicz M, Abramowicz M, Silva M. Motivos conscientes na escolha da profissão odontológica. Rev Odontol Univ São Paulo, 11: 101-10, 1973.

60 Carvalho DR, Carvalho ACP, Sampaio, H. Motivações e expectativas para o curso e para o exercício da Odontologia. Revista da APCD, 51:345-9, 1997.

61 Costa ICC, Marcelino G, Saliba NA. Perspectivas de um grupo de alunos de odontologia sobre a profissão no terceiro milênio. Rev ABOPREV, 2:38-45,1999.

62 Freitas CHSM, Oliveira HB, Jardim MCAM,. D`Avila S, Félix SSS. Recursos humanos em odontologia: características do acadêmico em instituições públicas de ensino em três estados do Nordeste. Rev. Cons. Reg. Odontol, 2:7-11, 1999.

63 Carvalho ACP, Carvalho DR. Desempenho de graduandos de Odontologia no Exame Nacional de Cursos: Análise de grupos de cursos com resultados extremos (1977-2001). Rev. ABENO, 2: 57-62, 2002.

64 Panzarini SR, Carvalho ACP, Poi WR, Sonoda CK, Pedrini D, Castro JCM. Avaliaçäo do desempenho dos alunos da F.O. Araçatuba-UNESP nas questöes de clínica integrada do exame nacional de cursos (provão). ROBRAC, 10: 54-7, 2001.

65 Freire FS, Crisóstomo VL, Castro JEG. Análise do desempenho acadêmico e indicadores de gestão das IFES. Revista Produção Online, 7, 2007.

66 Instituto Nacional De Estudos E Pesquisas Educacionais Anísio Teixeira. Sistema Nacional de Avaliação da Educação Superior (Sinaes): da concepção à regulamentação. 2. ed. Brasília: 2004, 155 p.

67 Brasil. Decreto n° 6.096, de 24 de abril de 2007. Institui o Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais – REUNI. Diário Oficial da União, Brasília, de 25 de abril de 2007.

68 Wilkin GA, Huang X. A practical comparison of two K-Means clustering algorithms. BMC Bioinformatics. 9 (Suppl 6), 2008.

69 SPSS Inc. Market segmentation using SPSS. Chicago, Ill., 2006.

APÊNDICES

APÊNDICE A – Ofício de solicitação da autorização da diretoria do Departamento de Assuntos Acadêmicos da UFG para acesso aos dados acadêmicos requeridos para a presente pesquisa.

APÊNDICE B – Ofício de solicitação da autorização da diretoria do Centro de Seleção da UFG para acesso aos dados dos processos seletivos da população de estudo.

ANEXO

ANEXO 1 – Protocolo de aprovação do presente estudo pelo Comitê de Ética em Pesquisa da UFG (nº 081/2007).