HAL open science

Factor analysis of a motivation questionnaire adapted to predoctoral French dental students

Laurent Deumier, Brigitte Alliot-Licht, Ludivine Bouton-Kelly, Angelique Bonnaud-Antignac, Christophe Michaut, Florence Quilliot, Gilles Guihard

▶ **To cite this version:**

Laurent Deumier, Brigitte Alliot-Licht, Ludivine Bouton-Kelly, Angelique Bonnaud-Antignac, Christophe Michaut, et al.. Factor analysis of a motivation questionnaire adapted to predoctoral French dental students. Journal of Dental Sciences, 2016, 11 (2), pp.123-129. 10.1016/j.jds.2015.11.004 . hal-02082276

HAL Id: hal-02082276

https://nantes-universite.hal.science/hal-02082276v1

Submitted on 30 May 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Distributed under a Creative Commons Attribution - NoDerivatives 4.0 International License

Journal of Dental Sciences (2016) 11, 123—129

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-jds.com

ORIGINAL ARTICLE

Factor analysis of a motivation questionnaire adapted to predoctoral French dental students

Laurent Deumier [a], Brigitte Alliot-Licht [a], Ludivine Bouton-Kelly [b], Angélique Bonnaud-Antignac [c], Christophe Michaut [d], Florence Quilliot [e], Gilles Guihard [f*]

[a] *Faculté d'Odontologie, Université de Nantes, Nantes, France*
[b] *Faculté de Médecine, Université de Nantes, Nantes, France*
[c] *EA 4275 Biostatistique, Pharmacoépidémiologie et Mesures Subjectives en Santé, Université de Nantes, Nantes, France*
[d] *Centre de Recherche en Education de Nantes, Université de Nantes, Nantes, France*
[e] *Service de Production et d'Innovation Numérique, Université de Nantes, Nantes, France*
[f] *Laboratoire de Neurophysiologie Expérimentale, Faculté de Médecine, Université de Nantes, Nantes, France*

Received 5 June 2015; Final revision received 3 November 2015
Available online 9 April 2016

KEYWORDS
altruism;
career choice;
dental education;
incomes;
motivations;
socioeconomic status

Abstract *Background/purpose:* The motivations of dental students for their studies have largely been investigated in numerous countries using psychometric questionnaires. This is not the case in France since validated tools are still lacking. The aim of the present work was dedicated to the psychometric validation of a motivation questionnaire adapted for predoctoral French dental students.
Material and methods: The design corresponded to a monocentric study realized at the dental school of Nantes University, France. A 14-item questionnaire was translated into French and adapted for dental studies. It was autoadministered by the students between March 2014 and May 2014. Exploratory and confirmatory factorial analyses were used to investigate the psychometric properties of the French version.
Results: The rate of reply was 88.7% with a sex allocation consisting of 44.4% men and 55.6% women. The internal reliability and the item-sampling adequacy of the questionnaire reached acceptance thresholds. Exploratory and confirmatory factorial analyses established a four-factor structure with good internal reliability. The factors consisted in "altruism," "status and incomes," "scientific curiosity," and "educational advantages." Factors correlated well

* Corresponding author. Université de Nantes, Faculté de Médecine, 1 rue Gaston Veil, 44000 Nantes, France.
E-mail address: gilles.guihard@univ-nantes.fr (G. Guihard).

http://dx.doi.org/10.1016/j.jds.2015.11.004
1991-7902/Copyright © 2016, Association for Dental Sciences of the Republic of China. Published by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

with the overall questionnaire. The overall motivation score did not differ between male and female students, although "altruism" was best scored by female students while "status and incomes" obtained a higher score in the population of male students. Both male and female students displayed similar "scientific curiosity" and "educational advantages" scorings.
Conclusion: Our data establish that the French motivation questionnaire has good psychometric properties and that it is relevant for further studies.
Copyright © 2016, Association for Dental Sciences of the Republic of China. Published by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

Economically developed societies usually question the efficiency of their healthcare system.[1,2] Professionalism is a critical quality that is related to different environmental and personal factors including motivations.[3] Understanding the students' motivations and their career projects has being recognized to improve health formation programs.[4] In many reports, students committed into medicine, nursing, pharmacy, or physiotherapy curriculum are attracted by the high salary and economic security, prestigious social status, and desire to help.[5–8] Previous works have investigated the reasons for choosing dental studies, and have established that students from Asia,[9–11] Europe,[12–18] Middle East,[19–21] North Africa,[22] North and South America,[9,23–25] and Oceania[26] are attracted for economic, professional, vocational, altruistic, and personal reasons.

In France, the practice of dentistry requires being a PhD. French dental formation is provided in 16 dental schools. The selection of predoctoral students occurs during the 1st year of study common to medicine, dentistry, pharmacy, midwifery, and physiotherapy. Before 2010, 1st-year students were ranked on the basis of their academic results and were asked to choose between medical, dental, and midwifery studies. Jover et al[27] have reported that dental studies did not correspond to a deliberate choice for 41% of the students, although this has been contested for Nantes dental students (Alliot-Licht, unpublished results). Since 2010, the conditions of recruitment for French dental studies have been modified. The selection still occurs after the 1st year of health studies. A first ranking is carried out at the end of the first semester, after which up to 15% of the students are discarded. The students continuing on to the second semester register into one curriculum or combine several curricula (i.e., medical and/or dental and/or pharmaceutical and/or midwifery and/or physiotherapy studies). At the end of this second semester, each student undergoes academic tests and is ranked in the different chosen curricula. In 2013, 1200 students among 56,141 were recruited in one of the 16 dental schools of France.[28]

The understanding of the motivations of French dental students is noteworthy lacking. This prevents the improvement of educational strategies in dental studies. In the present work, we aimed to adapt and validate a French questionnaire in order to investigate the motivations of predoctoral students at the dental school of Nantes University, France.

Material and methods

The present work consists of an observational study. It has received an ethical accreditation from the Université de Nantes legal and ethics committee (reference number ST/BB 14-772).

Recruitment of the participants and questionnaire administration

Second year to 6th year students of Université de Nantes dental school ($n = 387$) were eligible. We contacted dental students by e-mail (3 times), and invited them to answer the electronic version of the questionnaire. The access (between March 2014 and May 2014) to the electronic version was made possible after an electronic validation of an informed consent, in which means and goals of the study were described. Answering the paper version of the questionnaire was also proposed at the end of course sessions to students who did not answer the electronic version (between March 2014 and May 2014). In these conditions, the informed consent was validated on paper. Data were only accessible to researchers and anonymity was ensured.

French translation of the motivation questionnaire

Socioeconomics and demographic information were collected for all students registered at the Université de Nantes dental school. Furthermore, we asked 2nd-year students whether their registration resulted from a 1st year curriculum exclusively devoted to dental studies, or to dental/medical, dental/pharmaceutical, and dental/midwifery curricula.

A French version of a motivation questionnaire[29] was elaborated according to the procedure described earlier.[30] The original version of the questionnaire was translated and back-translated by an English speaking team composed of a scientist, a psychologist, two dentists, and a French/English translator. The students were invited to answer the following question concerning each item: "To what extent do you agree with the following proposal?" Scoring was based on a 4-points Likert scale with 0 corresponding to "not at all" and 3 corresponding to "full agreement."

Data analysis

Data were collected at the end of the open session and were further analyzed with SPSS version 20 (IBM Inc., Armonk, NY, USA) and Sigma Plot (Jandel Scientific, San Rafael, CA, USA). Answers collected from dental students were randomly allocated into two subgroups (i.e., 1: $n = 172$ and 2: $n = 171$) through an Excel (Microsoft Inc., Redmond, WA, USA) procedure.

An exploratory factor analysis (EFA) was conducted on the answers of the first subgroup of dental students (maximum likelihood method with varimax rotation and Kaiser normalization). Well defined values[31] were used as acceptance thresholds. The appropriateness of the questionnaire was deduced from Kaiser—Meyer—Olkin and the Bartlett tests coefficients. The adequacy of item sampling was estimated by the anti-image correlation coefficient value for each item (threshold > 0.5). The determinant and residuals were deduced from correlation and reconstituted correlation matrices. Eigen values above 1.0 and communalities above 0.2 were considered for factorial structure determination. Item loading values above 0.3 was taken into consideration for factor allocation. The internal consistency was deduced from Cronbach α coefficient.

A confirmatory factor analysis (CFA) was conducted in order to validate the factorial model proposed after EFA, by using the answers obtained from Subgroup 2. Several indices were calculated to assess the goodness of fit of the model as described elsewhere.[32] These include: (1) the ratio between χ^2 and the degrees of freedom (χ^2/df, < 2 indicates a good fit); (2) the goodness-of-fit index (GFI), the adjusted GFI, and the comparative fit index (values above 0.9 correspond to an excellent fit); (3) the root mean square error of approximation (RMSEA, optimally below 0.05) and its relative $P_{(RMSEA < 0.05)}$ (above 0.05); (4) the standardized Root Mean Square Residual (the optimal value of which being equal to or below 0.05). The GFIs were also calculated for Subgroup 1, for the overall population, and for the female and male subpopulations.

Data are presented as mean $\pm$ standard deviation (sd). The statistical differences were analyzed using parametric or nonparametric tests after appropriate controls. Correlations were deduced from Pearson correlation coefficient. The level of significance was reached when the P value was < 0.05. The effect size of significant differences was deduced from Cohen coefficient calculation.

Results

Characteristics of the students registered at Université de Nantes dental school

Questionnaire feedback corresponded to 88.7%. The allocation of dental students in the different years and the sex repartition are indicated in Table 1. Mean age ($\pm$ sd) corresponded to 22.7 $\pm$ 2.3 years, with no significant difference between women and men (P = 0.229). The fathers of the respondents occupied a high intellectual and managerial profession (55.8%), acted as employees/workers (12.5%), farmers/artisans/traders (9.9%), or school teacher/health workers/technicians (7.6%). For 14.6% of the respondents, the father had no professional activity or was retired. The mothers of the respondents acted in a high intellectual and managerial profession (33.2%), as employees/workers (25.4%), school teacher/health workers/technicians (15.7%), or farmers/artisans/traders (5.0%). In the case of 20.7% of the respondents, the mother had no professional activity or was retired.

Because dental studies result from a selective 1st-year curriculum, we evaluated 2nd-year students' interest in dental studies during their 1st-year studies. Eight percent of the 2nd-year students reported a strong prioritization of the dental curriculum during their 1st year. Forty-two percent of them declared an exclusive dental curriculum, while 35% and 3% underwent dental/medical and dental/pharmaceutical curricula during their 1st year, respectively.

Table 1 Curriculum and sex allocation of Nantes dental students.

	No. of contacted students	No. of complete answers, *n* (%)	Women	Men
2nd y	82	76 (92.6)	42	34
3rd y	86	81 (94.2)	39	42
4th y	85	70 (82.3)	32	38
5th y	71	60 (84.5)	43	17
6th y	63	56 (88.8)	34	22
Total	387	343 (88.6)	190	153

Table 2 Score of the motivation items.

Item	Mean score $\pm$ sd	α
1. Opportunity for high income	1.7 $\pm$ 0.7	0.722
2. Social prestige/status	1.3 $\pm$ 0.8	0.727
3. Job security	2.3 $\pm$ 0.7	0.714
4. The education leads to a define profession	2.5 $\pm$ 0.7	0.711
5. Classroom-like study program	1.5 $\pm$ 0.8	0.694
6. Opportunity to take advantage of good grades	1.5 $\pm$ 0.8	0.697
7. Opportunity to work for social and humanitarian efforts	1.5 $\pm$ 0.9	0.725
8. Opportunity to work with people	2.2 $\pm$ 0.7	0.701
9. Opportunity to care for people	2.4 $\pm$ 0.6	0.700
10. Interest in relations between health, well-being, & society	2.3 $\pm$ 0.7	0.695
11. Desire for challenge	1.5 $\pm$ 0.8	0.707
12. Interest for human biology	2.0 $\pm$ 0.9	0.708
13. Opportunity to perform research	0.6 $\pm$ 0.7	0.730
14. General interest in natural science	2.0 $\pm$ 0.8	0.709

α = Cronbach α coefficient; sd = standard deviation.

Table 3 Exploratory factorial analysis.

Item	Factor loading values				h^2
	1	2	3	4	
9	0.870				0.795
8	0.724				0.535
10	0.506				0.428
1		0.986			0.789
2		0.533			0.330
3		0.452			0.360
12			0.796		0.652
14			0.756		0.614
5				0.762	0.687
6				0.669	0.549
4		0.545		0.515	0.338
7					0.197
11					0.158
13					0.159
Eigen values	3.420	2.410	1.688	1.043	

h^2 = communality value.

Item statistics and internal consistency of the French questionnaire

We determined the mean score for each item of the motivation questionnaire (Table 2). Items 4 ("The education leads to a define profession"), 9 ("Opportunity to care for people"), and 3 ("Job security") obtained the highest scores. Remarkably, Item 13 ("Opportunity to perform research") obtained the lowest value. The mean (± sd) item-score correlation was $r_{mean} = 0.341 \pm 0.108$, with $r_{min} = 0.154$ for Item 13, and $r_{max} = 0.599$ for Item 9. The overall internal consistency reached acceptance threshold (Cronbach $\alpha = 0.725$). We calculated Cronbach-α values if one of the 14 items was omitted (Table 2). The omission of Items 5 (Classroom-like study program), 6 (Opportunity to take advantage of good grades), or 10 (Interest in relations between health, well-being, and society) resulted in Cronbach-α values below 0.700 (Table 2). The anti-image correlation coefficient values were all above 0.5 (range, 0.656–0.856), indicating a good item sampling adequacy. From correlation matrix, we calculated a determinant value equal to 0.019. Eleven percent of the residuals displayed values above 0.05.

Factorial structure of the French version

Subgroups 1 and 2 were generated by a random allocation of dental students. Mean age and sex allocation did not differ significantly between Subgroup 1 ($n = 172$, 91 women, 81 men) and Subgroup 2 ($n = 171$, 95 women, 76 men).

The answers of Subgroup 1 were considered for EFA. In these conditions, the internal consistency of the French version slightly increased (Cronbach $\alpha = 0.735$). The appropriateness of the questionnaire was good, since the Kaiser–Meyer–Olkin value was 0.714 and Bartlett's sphericity test was significant ($\chi^2 = 708.73$, degree of freedom = 91, $P < 0.001$). EFA indicated a four-factor structure (Table 3), accounting for 61.1% of the observed variance. The goodness of fit of this solution was tested ($\chi^2 = 86.36$; degree of freedom 41, $P < 0.001$). Factor 1 accounted for 24.4% of the observed variance. Items composition (i.e., 7, 8, 9, and 10) argued for a relation to "altruism". The composition of Factor 2 (Items 1, 2, and 3, 17.2% of the variance) was related to "status and incomes". Factor 3 (Items 12 and 14, 12.1% of the variance) was considered as "scientific curiosity". Factor 4 gathered Items 4, 5, and 6 (7.4% of the observed variance) representing "educational advantages."

The communality values for Items 7, 11, and 13 were found to be below 0.2 (Table 3). Loading values of the other items were unambiguously above 0.4 with the exception of Item 4 (Table 3). It has been suggested to use the reciprocal of square root of the sample size as an approximated standard error for the factor loading.[33] Loading values for Item 4 (0.545 and 0.515 for Factor 2 and 4, respectively) differed by less than the standard error for the factor loading (0.076). Considering these observations, we excluded Items 4, 7, 11, and 13 from further calculations.

Goodness of fit

The four-factor structure was evaluated with CFA considering the answers of the second subgroup of dental students. The results are presented in Table 4. The model

Table 4 Confirmatory factor analysis of the four-factor model.

Indices	Population				
	Group 1 ($n = 172$)	Group 2 ($n = 171$)	Overall ($n = 343$)	Women ($n = 186$)	Men ($n = 157$)
χ^2/df	1.863	1.123	1.788	1.482	1.190
GFI	0.961	0.962	0.970	0.956	0.959
AGFI	0.887	0.929	0.944	0.916	0.921
CFI	0.948	0.993	0.976	0.975	0.986
RMSEA	0.072	0.027	0.049	0.051	0.036
$P_{(RMSEA < 0.05)}$	0.109	0.788	0.514	0.442	0.680
sRMR	0.067	0.045	0.044	0.049	0.056

AGFI = adjusted goodness of fit index; CFI = comparative fit index; GFI = goodness of fit index; P(RMSEA < 0.05) = P value for a close fit; RMSEA = root of mean square error of approximation; sRMR = standardized root mean square residual; χ^2/df = ration between χ^2 and the degree of freedom.

Table 5 Correlation analysis.

	Altruism	Status & incomes	Scientific curiosity	Educational advantages
Global score	0.680**	0.593**	0.539**	0.570**
Altruism		0.066 (ns)	0.324**	0.234**
Status and incomes			−0.077 (ns)	0.343**
Scientific curiosity				0.119*

*P < 0.05.
**P < 0.001.
ns = not significant.

satisfied all acceptance criteria, i.e., χ^2/df below 2, GFI, adjusted GFI, and comparative fit index above 0.9, standardized Root Mean Square Residual and RMSEA below 0.05. The GFI of our model remained valid when we used the answers of Subgroup 1 or those of the overall student population (Table 4). This was also the case when we examined the answers of female or male students (Table 4). By contrast, most of GFIs did not satisfy acceptance thresholds when the three-factor model described by Vaglum et al,[29] was evaluated (data not shown).

The internal reliability of each factor was established by calculating Cronbach-α values for "altruism" (0.798), "scientific curiosity" (0.781), and "educational advantages" (0.712). The factor "status and incomes" had a Cronbach-α value very close to 0.7 (i.e., 0.697). All factors correlated positively and significantly ($P < 0.001$) with the overall score, with medium-to-high correlation coefficient values (Table 5). Positive and significant correlation was found between "altruism," "scientific curiosity," and "educational advantages" (Table 5). The factor "status and incomes" correlated significantly with "educational advantages" but not with "altruism" nor with "scientific curiosity" (Table 5).

Considering that "altruism" and "status and incomes" were composed by an identical number of items, we compared their respective scores (Table 6). Dental students best scored "altruism" than "status and incomes" ($U = 29782$, $P < 0.001$). Similarly, we observed that "scientific curiosity" obtained a higher score than "educational advantages" ($U = 35762$, $P < 0.001$).

Table 6 Mean motivation scores obtained by female and male students.

	Overall population	Women	Men	P
Global score	19.3 ± 4.0	19.3 ± 4.0	19.4 ± 4.1	ns
Altruism	6.9 ± 1.7	7.2 ± 1.7	6.6 ± 1.7	**
Status and incomes	5.3 ± 1.8	5.1 ± 1.8	5.6 ± 1.7	*
Scientific curiosity	4.0 ± 1.6	3.9 ± 1.6	4.1 ± 1.5	ns
Educational advantages	3.1 ± 1.4	3.1 ± 1.4	3.0 ± 1.5	ns

*P < 0.01.
**P < 0.001.
ns = not significant.

Sex and motivations

The motivation scores were calculated for female and male subpopulations (Table 6). The global motivation scores did not differ in female and male populations ($U = 13425$, $P = 0.669$). However, "altruism" was best scored ($U = 11028$, $P = 0.001$) by female than by male students (Table 6). The effect size was moderate ($d = 0.352$). Male students obtained a higher score than female students for the factor "status and incomes" ($U = 11525$, $P = 0.008$, $d = 0.571$; Table 6). No difference related to sex could be highlighted for the factors "scientific curiosity" and "educational advantages" (Table 6).

Discussion

The aim of our work was devoted to the validation of a French questionnaire, allowing the investigation of French dental students' motivations for their studies. The rate of questionnaire return was high at Université de Nantes dental school. Although the sex allocation and the socio-professional origin of the students of Université de Nantes dental school are similar to those described for other French dental schools,[34] our data cannot be extrapolated to the other 15 dental schools of France.

The internal consistency of our French questionnaire was reasonably acceptable and its appropriateness was first-rate. Data and analysis support a factor structure with psychometric properties (i.e., overall reliability, item appropriateness, communalities, and loading values) of honorable quality. A four-factor structure is proposed after EFA and is accredited by CFA. The calculation of Cronbach α for each individual motivation factor demonstrates the good internal consistency of each one. Moreover, our data show positive and significant correlations between the overall score and those of the motivation factors. Consequently, we propose that Université de Nantes dental students are attracted by dental studies through a combination of four dimensions including "altruism," "status and incomes," "scientific curiosity," and "educational advantages."

Our observations suggest that the French version explores various motivational dimensions. In the original Vaglum et al's[29] questionnaire, motivations for medical studies resulted from a combination of three factors (i.e., "people oriented," "job/security," and "interest for natural sciences"). In our work, the factor "scientific curiosity" closely resembles Vaglum et al's[29] "interest for natural sciences" and to that described in a later study comparing the motivations of medical and dental students.[14] The factor "altruism" described here is similar to Vaglum et al's[29] "people oriented" and to that observed elsewhere.[14,35,36] It is tempting to compare our data with those obtained in a previous French study,[27] showing that altruism represented a minor component of French dental students motivation. Our data indicate that "altruism" is now a major contributor to the motivations of Université de

Nantes dental students. If a multicentric approach confirms our data, this could be a good indication of an improvement of the psychological characteristics of French dental students. It is noteworthy that the items composing Vaglum et al's[29] "job/security," are loaded in two separated factors in our study. Such a situation has also been described.[14] On the one hand, the factor "status and incomes," identified here, illustrates that dentistry is recognized by French students as a secure job (virtually no unemployment) with a well appreciated social status and high incomes (mean French salary in 2013: €92,137).[37] On the other hand, the factor "educational advantages" describes the student's requirement for a high-standard professionalizing formation. Thus, French dental teachers can find a useful tool to analyze the consequences of the pedagogical modifications regarding the motivational status of their students.

Doing research as an extension of dental training was reasonably considered by Norwegian and Portuguese medical students.[29,38] Surprisingly, our dental students are very poorly attracted by research programs. Indeed, the item "Opportunity to perform research" obtained a low score and was ranked in the last position. On the one hand, the poor consideration of dental students for research may result from an insufficient knowledge concerning the need for evidence-based dentistry. On the other hand, dental students may consider research as a time-consuming activity being in direct opposition with their future daily dental practice. This argues for a need of a reinforcement of the communication concerning research toward dental students.

We have observed that the overall motivation score does not differ between female and male students of Université de Nantes dental school. However, some sex-related differences can be observed in motivation factors. In particular, female students declare to be more motivated for altruistic than economic reasons. The opposite situation was observed with our male students. Similar observations have been done in USA, Peru, and Morocco.[22,23,39] However, such a scheme may depend on the country. Indeed, female and male students from Andhra Pradesh differed only in their altruistic motivations,[11] and Iranian female students declared to be essentially attracted for economic reasons and for high standard-associated professional status.[19]

It is now well accepted that the overall motivation results from autonomous (intrinsic) and controlled (extrinsic) processes.[40] This has been investigated in medical studies.[41] Our study was mainly focused on the contribution of intrinsic factors to motivation for dental studies. Further studies will be needed to: (1) generalize our results to other French dental schools; and (2) develop research programs devoted to both intrinsic and extrinsic motivational dimensions.

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

References

1. McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. *New Engl J Med* 2003; 348:2635—45.
2. Rowe AK, de Savigny D, Lanata CF, Victora CG. How can we achieve and maintain high-quality performance of health workers in low-resource settings? *Lancet* 2005;366:1026—35.
3. West CP, Shanafelt TD. The influence of personal and environmental factors on professionalism in medical education. *BMC Med Educ* 2007;7:29.
4. Kusurkar RA, Croiset G, Mann KV, Custers E, Ten Cate O. Have motivation theories guided the development and reform of medical education curricula? A review of the literature. *Acad Med* 2012;87:735—43.
5. Rascati KL. Career choice, plans, and commitment of pharmacy students. *Am J Pharm Educ* 1989;53:228—34.
6. Newton JM, Kelly CM, Kremser AK, Jolly B, Billett S. The motivations to nurse: an exploration of factors amongst undergraduate students, registered nurses and nurse managers. *J Nurs Manag* 2009;17:392—400.
7. Kusurkar RA, Ten Cate TJ, Van Asperen M, Croiset G. Motivation as an independent and a dependent variable in medical education: a review of the literature. *Med Teach* 2011;33:e242—62.
8. Edgar S. Identifying the influence of gender on motivation and engagement levels in student physiotherapists. *Med Teach* 2014;3:1—6.
9. Karibe H, Suzuki A, Sekimoto T, et al. Cross-cultural comparison of the attitudes of dental students in three countries. *J Dent Educ* 2007;71:1457—66.
10. Aggarwal A, Mehta S, Gupta D, et al. Dental students' motivations and perceptions of dental professional career in India. *J Dent Educ* 2012;76:1532—9.
11. Jaiswal AK, Pachava S, Sanikommu S. Why dentistry? A cross-sectional study of budding dentists in Andhra Pradesh. *IJSS* 2014;1:17—21.
12. Hallissey J, Hannigan A, Ray N. Reasons for choosing dentistry as a career—a survey of dental students attending a dental school in Ireland during 1998—99. *Eur J Dent Educ* 2000;4:77—81.
13. Vigild M, Schwarz E. Characteristics and study motivation of Danish dental students in a longitudinal perspective. *Eur J Dent Educ* 2001;5:127—33.
14. Crossley ML, Mubarik A. A comparative investigation of dental and medical student's motivation towards career choice. *Br Dent J* 2002;193:471—3.
15. Stewart FMJ, Drummond JR, Carson L, Reddick GH. The future of the profession—a survey of dental school applicants. *Br Dent J* 2004;197:569—73.
16. Gallagher JE, Patel R, Donaldson N, Wilson N. The emerging dental workforce: why dentistry? A quantitative study of final year dental students' views on their professional career. *BMC Oral Health* 2007;7:7.
17. Gallagher JE, Clarke W, Wilson N. Understanding the motivation: a qualitative study of dental students' choice of professional career. *Eur J Dent Educ* 2008;12:89—98.
18. Belsi A, Asimakopoulou K, Donaldson N, Gallagher J. Motivation to study dental professions in one London Dental Institute. *Eur J Dent Educ* 2014;18:24—30.
19. Khami MR, Murtomaa H, Jafarian M, Vehkalahti MM, Virtanen JI. Study motives and career choices of Iranian dental students. *Med Princ Pract* 2008;17:221—6.
20. Baharvand M, Moghaddam EJ, Pouretemad H, Alavi K. Attitudes of Iranian dental students toward their future careers: an exploratory study. *J Dent Educ* 2011;75:1489—95.
21. Halawany HS. Career motivations, perceptions of the future of dentistry and preferred dental specialties among Saudi dental students. *Open Dent J* 2014;8:129—35.
22. Bourzgui F, Abidine Z, Serhier Z, Diouny S, Bennani Othmani M. Motivational factors influencing career choices of Moroccan dental students. *Oral Health Dent Manag* 2014;13:390—4.
23. Bernabe E, Icaza JL, Delgado-Angulo EK. Reasons for choosing dentistry as a career: a study involving male and female first-year students in Peru. *Eur J Dent Educ* 2006;10:236—41.

24. Aguiar CM, Pessoa MA, Câmara AC, Perrier RA, de Figueiredo JA. Factors involved in the choice of dentistry as an occupation by Pernambuco dental students in Brazil. *J Dent Educ* 2009;73:1401—7.
25. Kfouri MG, Moyses SJ, Moyses ST. Women's motivation to become dentists in Brazil. *J Dent Educ* 2013;77:810—6.
26. Mariño RJ, Morgan MV, Winning T, et al. Sociodemographic backgrounds and career decisions of Australian and New Zealand dental students. *Int Dent Educ* 2006;70:169—78.
27. Jover M, Doudoux D, Deveaux E. Representations of the dental surgery profession and the motivations given by second-year French students for applying for dental surgery. *Eur J Dent Educ* 2006;10:2—9.
28. *Numerus Clausus Dental Surgery*. 2013. Available at: http://paces.remede.org/paces/numerus-clausus.html [Written in French. Data accessed: 01 September 2015].
29. Vaglum P, Viers-Jenssen J, Ekeberg Ø. Motivation for medical school: the relationship to gender and specialty preferences in a nationwide sample. *Med Educ* 1999;33:236—42.
30. Wild D, Grove A, Martin M, et al. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (pro) measures: report of the ISPOR task force for translation and cultural adaptation. *Value Health* 2005;8:94—104.
31. Field A. *Discovering Statistics Using SPSS*, 2nd ed. London: Sage Publications, 2005.
32. Byrne B. *Structural Equation Modeling with AMOS*, 2nd ed. New York: Taylor and Francis, 2009.
33. Cliff N, Hamburger CD. The study of sampling errors in factor analysis by means of artificial experiments. *Psychol Bull* 1967; 68:430—45.
34. Hennequin M, Tubert S, Devillers A, et al. Socio-economic and schooling status of dental undergraduates from six French universities. *Eur J Dent Educ* 2002;6:95—103.
35. Banks ZM, Bailey JH. Career motivation in newly licensed registered nurses: what makes them remain. *The Qual Rep* 2010;15:1489—503. Available at: http://www.nova.edu/ssss/QR/QR15-6/banks.pdf [Date accessed: 16 October 2014].
36. Keshishian F. Factors influencing pharmacy students' choice of major and its relationship to anticipatory socialization. *Am J Pharm Educ* 2010;74:1—6.
37. Ministère des affaires sociales, de la santé et du droit des femmes. Available at www.drees.sante.gouv.fr/. [Written in French. Data accessed: 01 September 2015].
38. Gonçalves-Pereira M, Trancas B, Loureiro J, Papoila A, Caldas de Almeida JM. Empathy as related to motivations for medicine in a sample of first-year medical students. *Psychol Rep* 2013; 112:73—88.
39. Scarbecz M, Ross JA. Gender differences in first-year dental students' motivation to attend dental school. *J Dent Educ* 2002;66:952—61.
40. Ryan RM, Deci EL. Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemp Educ Psychol* 2000;25: 54—67.
41. Ten Cate TJ, Kusurkar RA, Williams GC. How self-determination theory can assist our understanding of the teaching and learning processes in medical education. *Med Teach* 2011;33:961—73.