



Original article

Knowledge and attitude towards dentist-industry relationship and their association with own behavior among dentists working in Saudi Arabia

Abdulaziz M. Albaker^{a,*}, Fahad D. Alosaimi^b^a Department of Prosthetic Dental Science, College of Dentistry, King Saud University, PO Box 60169, Riyadh 11545, Saudi Arabia^b Department of Psychiatry, College of Medicine, King Saud University, PO Box 7805, Riyadh 11472, Saudi Arabia

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ABSTRACT

Objectives: To examine the knowledge and attitude towards dentist-industry relationship including accepting gifts, influence on decisions, and accuracy of given information among dentists working in Saudi Arabia. In addition, to examine the association of such knowledge and attitude of dentists' behavior with industry, including sorts of interaction and accepting industrial gifts.

Methods: A cross-sectional study was conducted among dental practitioners working in the private and governmental hospitals located in the various regions of Saudi Arabia. A self-administrated questionnaire was developed and distributed to all participants. Fourteen questions assessed the socio-demographic, economic, and occupational characteristics of the participants including age, gender, nationality, monthly revenue, income satisfaction, hospital setting, job rank, specialty, and patients' socio-economic status. Seventeen questions assessed the interaction with DSRs, acceptance and characteristics of gifts and opinion of dentists regarding gift acceptance in dental practice. One-Way ANOVA and *t*-test was used to examine differences in transformed scores by socio-demographic, occupations and outcome characteristics. All *P*-values were two-tailed. *P*-value < 0.05 was considered as significant.

Results: Total of 672 participants responded to general questions related to the knowledge and attitude. The mean of the overall knowledge and attitude score was 64.3 ± 7.2 , general questions score was 63.1 ± 8.6 and interaction questions score was 66.9 ± 8.0 . Approximately, 40% of participants disagreed that accepting industrial gifts can affect their own decisions but slightly lower proportion (25%) disagreed that accepting industrial gifts can affect decisions of other dentists. Only 25% of participants thought it is ethical to accept industrial gifts and even fewer proportions (20%) believed that dental supply representatives (DSRs) always provide accurate information about their new materials. Almost two-thirds of participants trusted information from other sources than from DSRs. On the other hand, 40% of the participants were against banning industrial gifts to dentists and approximately 50% were against informing the patients about the industrial gifts given to their dentist by dental companies.

Conclusions: There was insufficient knowledge and an overall positive attitude towards the dental industry among the sample of dentists in Saudi Arabia. Well-designed ethical education programs should be implemented to enhance knowledge and attitudes about the interactions with dental industry.

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1. Introduction

There are many studies worldwide that reported the dentists'/physicians' relationship with the dental materials and equipment manufacturing companies and with the drug companies (Moynihan, 2003; Tahir et al., 2013; Campbell et al., 2007; Saito et al., 2010; McNeill et al., 2006; Alssageer and Kowalski, 2012). This relationship is commonly considered as beneficial in terms of research and development of new dental materials, devices, and equipment resulting in a better environment for dental treatment and care (Hine, 1968; Shaughnessy and Slawson, 1996; Komisaroff, 2005). Although, these relationships appear to be

* Corresponding author.

E-mail address: aalbaker@ksu.edu.sa (A.M. Albaker).

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beneficial to the society, there are enough signs of negative effects that are obvious due to the conflict of interest between dentists and the dental equipment industry. The primary goal of dentists, by-en-large, is the patients' benefits whereas, that of the industry is increasing the profit for their business (Komesaroff and Kerridge, 2002; Brennan et al., 2006).

A continuing interaction between the dentists and the dental supply representatives (DSRs) is manifesting in a number of issues related to the ethics behind the relationship. A practice of gift giving is one of the issues that emerged between the dental practitioners and the dental supply companies (Daniel, 1988) but this routine, careless or inappropriate gift-giving practice could be detrimental to the overall patients treatment and care (Schwartz, 2005). Additionally, the practice of gift giving questions the transparency of disclosures that the dentists make about the options for treatment and its cost (Marco et al., 2006; Chimonas et al., 2010; Wazana, 2000; Cain and Detsky, 2008). It cannot also replace the caring attitude and behaviors of a professional dental practitioner. Basically, the practice of gift giving could break the trust between the dentist and patient, which is an important part in the dental profession (Green et al., 2012). Further to this, the validity of many of the company sponsored research agenda and its results are also found to be at stake many times (Chren et al., 1989).

There are very few studies especially in the Saudi setting that links the knowledge and attitude with dentists' behavior after their involvement with the dental equipment and materials industry. Therefore, the current study is making an attempt to examine the knowledge and attitude towards dentist-industry relationship including accepting gifts, influence on decisions, and accuracy of given information among dentists working in Saudi Arabia. In addition, to examine the association of such knowledge and attitude with dentists' own behavior with the industry, including any sort of interaction and accepting industrial gifts.

2. Methods

2.1. Subjects

The current study was conducted among dentists working in the private and governmental hospitals located in the various regions of Saudi Arabia. Only practicing dentists were included. Dental students, technicians, and other healthcare workers were excluded. The DSRs were defined as dental industry employees who regularly visit dentists to give information about their products.

2.2. Study design

A questionnaire based survey was conducted between March and July of 2013. The ethical approval of this study was obtained from the Ethical Committee of the College of Dentistry Research Center at King Saud University, Riyadh, Saudi Arabia under Research Project No. NF 2377.

2.3. Sample size

The calculation of sample size was done using OpenEpi software (version 2.2, Copyright (c) 2003, 2007 Andrew G. Dean and Kevin M. Sullivan, Atlanta, GA, USA). It was revealed that more than 600 participants are needed to detect a 20% difference of given characteristics between the two study groups, with 95% confidence level and 80% power. To allow possibility of about 10% missing data, the total number was adjusted accordingly.

2.4. Questionnaire

A self-administrated questionnaire was developed and distributed to all participants for their response with 31 questions in English arranged in two sections. The first section (14 questions) assessed the socio-demographic, economic, and occupational characteristics of the participants including age, gender, nationality, monthly revenue, income satisfaction, hospital setting, job rank, specialty, and patients' socio-economic status. The second section (17 questions) assessed the interaction with DSRs, acceptance and characteristics of gifts and the opinion of dentists regarding gift acceptance in dental practice. The scientific content of the questionnaire was validated by a multi-disciplinary committee covering psychiatry, ethics, dentistry, and epidemiology. Before widespread distribution, a pilot study was conducted on a small number of participants (N = 16). Based on the feedback from the pilot study, the phrasing and suggested responses were modified for some questions. The original version of this questionnaire was developed and validated by the second author in another study which targeted physicians' attitudes towards interaction with the pharmaceutical industry (Alosaimi et al., 2015).

The questionnaires were distributed by the authors of this study to a number of secondary and tertiary care hospitals in all five major regions of Saudi Arabia (Central, West, East, North and South regions). A written informed consent was obtained from all the participants after explaining the objectives of the study.

2.5. Statistical analysis

Data were presented using frequencies and percentages for categorical data and mean and standard deviation (SD) for continuous data. Knowledge and attitude questions were presented as frequency and percentage. Questions had five possibilities and measured on 5-point Likert scales. A score of 5 was assigned for "strongly agree/always" and score of 1 assigned for "strongly disagree/never". Significant differences in transformed scores by socio-demographic, occupations and outcome characteristics were examined using *t*-test or one-way analysis of variance (ANOVA). Mean scores by outcome variables adjusted for significant associations were created using general linear model (GLM) regression analysis. All *P*-values were two-tailed. *P*-value < 0.05 was considered as significant. SPSS software (release 20.0, SPSS Inc., Chicago, U.S.) was used for statistical analyses.

3. Results

A total 672 participants answered general questions related to the knowledge and attitude with 454 of them answered questions related to past interaction experience with DSRs. The answers for individual questions were presented in Table 1. There was a considerable degree of uncertainty among the study participants with 20–50% neutral answers for the majority of questions. Approximately 40% of the participants disagreed that accepting industrial gifts can affect their own decisions, however, a slightly lower proportion (25%) of the participants disagreed that accepting industrial gifts can affect decisions of other dentists. About 25% of the participants thought it is ethical to accept industrial gifts and even fewer proportions (20%) believed that DSRs always provide accurate information about their new materials. Moreover, almost two-thirds of the participants trusted information from other sources than from DSRs. On the other hand, 40% of the participants were against banning industrial gifts to dentists and approximately 50% were against informing the patients about the industrial gifts given to their dentist by dental companies. The majority (77%) of

Table 1
Response to knowledge and attitude questions among the study participants.

| General questions (N = 672) | Strongly agree | Agree | Neutral | Disagree | Strongly disagree | Total |
|----------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|-------------|-------------|-------------------|-------------|
| Accepting gifts from DCRs will affect my decision regarding the use of certain dental material or instruments | 140 (20.8%) | 134 (19.9%) | 156 (23.2%) | 162 (24.1%) | 80 (11.9%) | 140 (20.8%) |
| Dentists in my institution accept gifts from DSRs | 12 (1.8%) | 46 (6.8%) | 328 (48.8%) | 201 (29.9%) | 85 (12.6%) | 12 (1.8%) |
| In general, decision of other dentists, regarding use of certain material or instrument, is influenced after receiving gifts from DSRs | 60 (8.9%) | 110 (16.4%) | 284 (42.3%) | 163 (24.3%) | 55 (8.2%) | 60 (8.9%) |
| It is ethical to accept gifts from DSR* | 84 (12.5%) | 150 (22.3%) | 268 (39.9%) | 146 (21.7%) | 24 (3.6%) | 84 (12.5%) |
| Dental companies should be banned from giving gifts to dentists | 32 (4.8%) | 233 (34.7%) | 221 (32.9%) | 103 (15.3%) | 83 (12.4%) | 32 (4.8%) |
| Patients should be informed about the gifts given to their dentists by dental companies | 101 (15.0%) | 236 (35.1%) | 168 (25.0%) | 126 (18.8%) | 41 (6.1%) | 101 (15.0%) |
| DSRs always provide accurate information about their new materials* | 41 (6.1%) | 260 (38.7%) | 233 (34.7%) | 123 (18.3%) | 15 (2.2%) | 41 (6.1%) |
| Detailing by DSRs increases my preference for using the promoted materials | 9 (1.3%) | 147 (21.9%) | 251 (37.4%) | 228 (33.9%) | 37 (5.5%) | 9 (1.3%) |
| Materials information from DSRs influences my informed decision to use it | 34 (5.1%) | 150 (22.3%) | 226 (33.6%) | 238 (35.4%) | 24 (3.6%) | 34 (5.1%) |
| Materials information from other sources are more important and reliable than from DSRs | 8 (1.2%) | 53 (7.9%) | 179 (26.6%) | 256 (38.1%) | 176 (26.2%) | 8 (1.2%) |
| Interaction questions (N = 454) | Always | Usually | Sometimes | Rarely | Never | Total |
| DSRs use the word "safe" when they describe their products | 4 (0.9%) | 4 (0.9%) | 95 (20.9%) | 243 (53.5%) | 108 (23.8%) | 4 (0.9%) |
| Spontaneously, DSRs mention the materials disadvantages* | 87 (19.2%) | 250 (55.1%) | 74 (16.3%) | 39 (8.6%) | 4 (0.9%) | 87 (19.2%) |
| Spontaneously, DSRs mention the adverse effects* | 117 (25.8%) | 216 (47.6%) | 85 (18.7%) | 32 (7.0%) | 4 (0.9%) | 117 (25.8%) |
| Spontaneously, DSRs mention the price* | 28 (6.2%) | 147 (32.4%) | 153 (33.7%) | 83 (18.3%) | 43 (9.5%) | 28 (6.2%) |
| DSRs are ready to answer my questions* | 0 (0.0%) | 16 (3.5%) | 103 (22.7%) | 223 (49.1%) | 112 (24.7%) | 0 (0.0%) |
| DSRs are convincing | 8 (1.8%) | 28 (6.2%) | 233 (51.3%) | 158 (34.8%) | 27 (5.9%) | 8 (1.8%) |
| I receive encouragement from DSRs to try new materials on my patients | 52 (11.5%) | 45 (9.9%) | 169 (37.2%) | 133 (29.3%) | 55 (12.1%) | 52 (11.5%) |

* Questions were scored in the opposite direction.

the participants found DSR frequently (usually or always) use the word "safe" when they describe their products. On the other hand, the majority of the participants found DSR infrequently (never or rarely) mention the disadvantages (74%) and adverse effects (73%) of their materials. The majority of the participants frequently (41%) or at least sometimes (51%) found DSR convincing. The majority of the participants frequently (41%) or at least sometimes (37%) admitted they received encouragement from DSR to try new materials on their patients.

The mean of the overall knowledge and attitude score was 64.3 ± 7.2 . Similarly, the score for the general questions was 63.1 ± 8.6 and the score for the interaction questions was 66.9 ± 8.0 . The variability of the knowledge and attitude scores by socio-demographic and occupational characteristics was presented in Tables 2 and 3, respectively. For the score of general questions about knowledge, there were significant differences by age groups, monthly income, clinical specialty, and patients' socioeconomic status. For instance, there was an inverse association between score the general knowledge questions and participant age with younger age having higher score than older ages ($P = 0.027$). For the score of interaction questions, there were significant differences by age groups, gender, nationality, monthly income, type of hospital, clinical specialty, job rank, and working abroad. For instance, male and Saudi dentists had a higher score of interaction questions than females ($P < 0.001$) and non-Saudi dentists ($P = 0.043$), respectively. Additionally, certain specialties such as pediatric dentistry and orthodontics had a higher score of interaction questions than other specialties ($P = 0.006$). Moreover, lower job ranks had a higher score of interaction questions than higher ranks ($P < 0.001$). For the overall score, there was a smaller variability by age, job rank, and patients' socioeconomic status noted.

The associations of the scores of the general and interaction questions with the participant practices were depicted in Figs. 1 and 2, respectively. Higher scores of the general questions, were observed among the participants those had no interactions with DSRs (63.9 ± 9.0 versus 62.8 ± 8.4 , $P = 0.121$), who did not accept

Table 2
Knowledge and attitude scores (mean and standard deviation) by socio-demographic characteristics of the study participants using One-Way ANOVA.

| Characteristics | General questions (N = 672) | Interaction questions (N = 454) | All questions (N = 672) |
|----------------------------|-----------------------------|---------------------------------|-------------------------|
| Gender | | | |
| Male | 63.3 ± 9.0 | 68.1 ± 7.6 | 64.8 ± 7.5 |
| Female | 63.0 ± 8.2 | 65.2 ± 8.3 | 63.6 ± 6.8 |
| <i>P</i> -value | 0.653 | <0.001 | 0.034 |
| Age (years) | | | |
| 20–29 | 63.3 ± 8.4 | 66.5 ± 10.0 | 64.5 ± 7.2 |
| 30–39 | 62.5 ± 9.5 | 69.0 ± 6.4 | 64.5 ± 7.5 |
| 40–49 | 64.5 ± 8.3 | 64.2 ± 6.9 | 64.2 ± 7.5 |
| ≥ 50 | 60.9 ± 6.4 | 67.8 ± 7.1 | 63.1 ± 4.5 |
| <i>P</i> -value | 0.027 | <0.001 | 0.564 |
| Nationality | | | |
| Saudi | 63.2 ± 8.8 | 67.5 ± 8.5 | 64.5 ± 7.6 |
| Non-Saudi | 62.9 ± 8.2 | 65.8 ± 6.7 | 63.8 ± 6.1 |
| <i>P</i> -value | 0.709 | 0.043 | 0.248 |
| Monthly income (SR) | | | |
| <10,000 | 62.5 ± 7.4 | 68.1 ± 11.8 | 64.3 ± 6.4 |
| 10,000–19,000 | 64.5 ± 8.6 | 65.6 ± 6.4 | 65.0 ± 7.3 |
| 20,000–29,000 | 61.4 ± 8.6 | 66.0 ± 6.4 | 63.1 ± 6.8 |
| 30,000–39,000 | 63.1 ± 10.8 | 69.2 ± 7.3 | 64.2 ± 8.3 |
| $\geq 40,000$ | 62.5 ± 6.7 | 67.4 ± 8.6 | 64.1 ± 7.0 |
| <i>P</i> -value | 0.014 | 0.011 | 0.233 |
| Additional income | | | |
| Yes | 63.1 ± 7.2 | 66.9 ± 7.8 | 64.5 ± 6.8 |
| No | 63.1 ± 8.9 | 66.9 ± 8.1 | 64.2 ± 7.3 |
| <i>P</i> -value | 0.952 | 0.934 | 0.686 |
| Study abroad | | | |
| Yes | 63.1 ± 7.5 | 66.9 ± 7.1 | 64.4 ± 5.8 |
| No | 63.1 ± 9.4 | 67.0 ± 8.8 | 64.2 ± 8.1 |
| <i>P</i> -value | 0.965 | 0.921 | 0.649 |

industrial gifts (67.6 ± 8.2 versus 61.0 ± 7.4 , $P < 0.001$), and those who reported having some type of ethical education (64.4 ± 8.8 versus 62.1 ± 8.3 , $P = 0.001$). However, the difference did not reach statistical significance for the interactions with DSR. The results

Table 3
Knowledge and attitude scores (mean and standard deviation) by occupational characteristics of the study participants using One-Way ANOVA.

| Characteristics | General questions (N = 672) | Interaction questions (N = 454) | All questions (N = 672) |
|---------------------------------------|-----------------------------|---------------------------------|-------------------------|
| Type of hospital | | | |
| Public | 63.1 ± 8.8 | 66.9 ± 8.3 | 64.2 ± 7.4 |
| Private | 63.8 ± 7.6 | 65.4 ± 7.5 | 64.4 ± 5.6 |
| Both | 62.4 ± 9.3 | 69.5 ± 6.9 | 64.6 ± 8.0 |
| <i>P-value</i> | 0.499 | 0.007 | 0.880 |
| Main dentist assignment | | | |
| Clinical | 63.4 ± 9.0 | 66.5 ± 8.1 | 64.4 ± 7.4 |
| Academic | 62.4 ± 7.7 | 67.8 ± 7.7 | 64.0 ± 6.7 |
| <i>P-value</i> | 0.172 | 0.122 | 0.449 |
| Clinical specialty | | | |
| Oral and Maxillofacial Surgery | 64.4 ± 8.5 | 62.9 ± 7.5 | 63.5 ± 6.5 |
| Oral Medicine and Diagnostic Science | 62.8 ± 6.2 | 62.8 ± 10.5 | 62.9 ± 7.2 |
| Periodontics | 64.1 ± 8.9 | 67.8 ± 3.7 | 64.4 ± 6.6 |
| Pediatric Dentistry | 65.5 ± 10.2 | 69.9 ± 2.5 | 65.7 ± 8.7 |
| Orthodontics | 61.2 ± 3.7 | 69.0 ± 8.9 | 64.2 ± 3.4 |
| Prosthetic Dental Science | 60.8 ± 6.6 | 68.8 ± 5.8 | 63.2 ± 5.5 |
| Restorative Dental Science | 61.7 ± 9.5 | 66.5 ± 9.8 | 63.2 ± 7.5 |
| Endodontic | 64.3 ± 11.8 | 65.9 ± 5.3 | 64.8 ± 9.7 |
| Others | 67.5 ± 5.1 | 65.7 ± 3.6 | 66.8 ± 2.5 |
| Not specialized | 63.6 ± 8.3 | 67.1 ± 9.2 | 64.9 ± 7.1 |
| <i>P-value</i> | 0.010 | 0.006 | 0.236 |
| Job rank | | | |
| Consultant/prof/associate prof | 62.6 ± 8.5 | 66.7 ± 8.6 | 63.9 ± 7.5 |
| Specialist/assistant prof | 64.7 ± 10.0 | 67.4 ± 6.3 | 65.6 ± 7.4 |
| Resident/lecturer | 62.9 ± 7.7 | 65.1 ± 7.6 | 63.4 ± 6.6 |
| Intern/GP/demonstrator | 62.4 ± 8.3 | 70.0 ± 9.4 | 64.6 ± 7.4 |
| <i>P-value</i> | 0.072 | <0.001 | 0.020 |
| Working duration (years) | | | |
| 0–9 | 63.3 ± 8.3 | 67.2 ± 9.1 | 64.4 ± 7.1 |
| 10–19 | 63.4 ± 9.6 | 67.0 ± 6.9 | 64.7 ± 7.7 |
| ≥20 | 62.1 ± 7.9 | 65.9 ± 6.6 | 63.1 ± 6.6 |
| <i>P-value</i> | 0.361 | 0.498 | 0.147 |
| Work abroad | | | |
| Yes | 63.2 ± 7.9 | 65.3 ± 6.9 | 63.7 ± 6.1 |
| No | 63.1 ± 8.9 | 67.8 ± 8.4 | 64.6 ± 7.6 |
| <i>P-value</i> | 0.932 | 0.002 | 0.136 |
| Patients' socioeconomic status | | | |
| Not sure | 61.8 ± 7.8 | 67.9 ± 5.1 | 62.6 ± 6.4 |
| Lower class | 65.2 ± 9.3 | 67.2 ± 10.4 | 66.1 ± 8.4 |
| Middle class | 62.2 ± 8.1 | 66.7 ± 7.7 | 63.5 ± 6.5 |
| Upper class | 66.2 ± 9.8 | 67.0 ± 6.7 | 67.0 ± 7.3 |
| <i>P-value</i> | <0.001 | 0.831 | <0.001 |

were maintained after adjusting for the variables that were associated with score of the general questions in univariate analysis (Tables 2 and 3) including age, monthly income, clinical specialty, and patients' socioeconomic status (Fig. 1B). The unadjusted score of the interaction questions showed no significant differences by industrial gift acceptance ($P = 0.820$) nor having ethical education ($P = 0.329$). Surprisingly, adjusting for the variables that were associated with score of the interaction questions in univariate analysis (Tables 2 and 3) including age, gender, nationality, monthly income, type of hospital, clinical specialty, job rank, and working abroad (Fig. 2B) resulted in significant difference by having ethical education with higher score among those who had no ethical education (67.8 ± 0.8 versus 65.8 ± 0.8 , $P = 0.009$).

4. Discussion

The present study aimed to assess knowledge, attitude, and behavior towards gifts from the DSRs among dentists working

in Saudi Arabia. As per our knowledge, this study was the first to assess knowledge, attitude, and behavior towards gifts among dental practitioners in Saudi Arabia. The high response rate about the interaction between the dentists and DSRs indicated that the practice of dentist-DSR relationship is a reality in the Kingdom of Saudi Arabia. While observing it as a reality, most of the respondents were ambivalent while giving their view about their relationship with DSRs. Generally ambivalence is experienced as psychologically unpleasant when the positive and negative aspects of a subject are both present in a person's mind at the same time. This state of mind compel the individuals to avoid or postpone their response as a deliberate attempt to resolve the ambivalence within them (Newby-Clark et al, 2002; Priester and Petty, 1996).

When it comes to accepting gifts from DSRs, majority feels that the gifts can affect their own decisions and it was only a few who believes that it is ethical to accept industrial gifts. This view has been again underlined by a majority either neutral position or supporting the idea of banning industrial gifts. However, it has to be noted that a significant 40% were against the ban. A similar attitude was observed when asked about informing the patients about the industrial gifts; while half of the respondents are in agreement with it, another half did not agree. In contrast to the current study, the previous study found more than 50% of the participants did not agree that accepting gifts from pharmaceutical companies could affect their own decision (Alosaimi et al., 2015). However, similar to current findings, only a few (16.3%) participants agreed that it is ethical to accept pharmaceutical company gifts (Alosaimi et al., 2015). In contrast to the current study, about 44% of the participants agreed that pharmaceutical companies should be banned from giving gifts to physicians (Alosaimi et al., 2015). Similarly, in the previous study, more than half of the participants disagreed that patients should be informed about the gifts received by their physicians (Alosaimi et al., 2015).

Surprisingly, this study showed a significant difference by having ethical education with higher score among those who had no ethical education. These findings suggest that there is insufficient ethical education and limited awareness about local policies among the studied participants. Therefore, further studies should be done to look into these issues in detail and which would act as a guideline in determining the best strategies to reduce negative impacts.

Further analysis shows that the dentist attitude towards the DSRs varies with their age, income, nationality, specialty, socioeconomic status and gender. It is observed that male and dentists of Saudi nationality had a higher score of interaction questions than females. Similarly, higher scores of the general questions were observed among participants who had no interactions with DSR. In contrast, previous study reported no differences in the attitude and behavior of accepting gift between male and female participants (Siddiquie et al., 2014). However, a direct comparison could not be made as in the later study, the participants were medical students (Siddiquie et al., 2014). In the current study, Saudi dentists showed higher attitude of accepting gifts compared to non-Saudi dentists. However, this relationship was not studied previously.

In the current study, participant's job rank was associated with the knowledge, attitude, and behavior towards gifts acceptance and DSRs interaction. In contrast, previous study reported an insignificant association between attitude of accepting gifts and the job rank (Alosaimi et al., 2013). Furthermore, participant's specialty was also associated with the knowledge, attitude, and behavior towards gifts acceptance and DSRs interaction. Similarly,

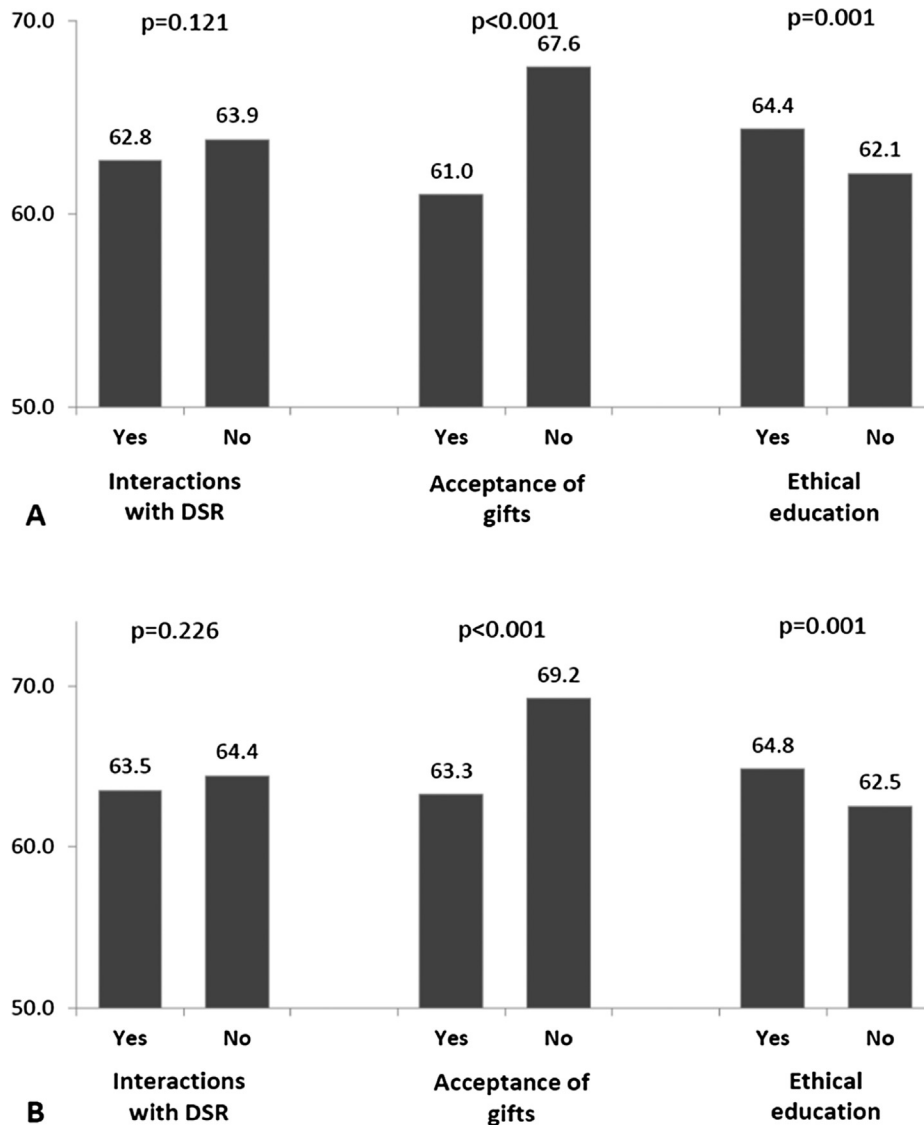


Fig. 1. Average score of the general questions; unadjusted (A) and adjusted* (B) by practices of study participants (*Adjusted for age, monthly income, clinical specialty, and patients' socioeconomic status).

a previous study among physicians reported a significant association between attitude of gift acceptance and the specialties (Campbell et al., 2010). In contrast, a previous study reported an insignificant association between attitude of accepting gifts and the specialties (Alosaimi et al., 2013). However, a direct comparison could not be made as in these studies the participants were physicians (Alosaimi et al., 2013; Campbell et al., 2010).

A study (Fadlallah et al., 2016) found that participants' awareness on physician's receipt of gifts was low. It also reported less concern, lower awareness and more acceptance of surgeon-device industry relative to physician-pharmaceutical industry interactions.

The present study had some advantages; bridging local knowledge gap on dental company gifts, surveying a relatively large number of dental practitioners across the country, and assessing the frequency of gift acceptance among dental practitioners of different job ranks and specialties. However, the current study acknowledged some potential limitations. Being a questionnaire-

based survey, the possibility of over- and under-estimation cannot be excluded particularly gift acceptance may involve conflicts of interests. In addition, the sample was collected conveniently; therefore, need some caution when generalizing the findings of the study. Furthermore, there were no patients included in the present study; hence patient's opinion on gift acceptance by their dental practitioners was not evaluated. Further studies are warranted to identify factors influencing gift acceptance among dental practitioners and their impact on the overall quality of dental practice in Saudi Arabia.

5. Conclusions

There was insufficient knowledge and an overall positive attitude towards the dental industry among the sample of dentists in Saudi Arabia. Well-designed ethical education programs should be implemented to enhance knowledge and attitudes about the interactions with dental industry.

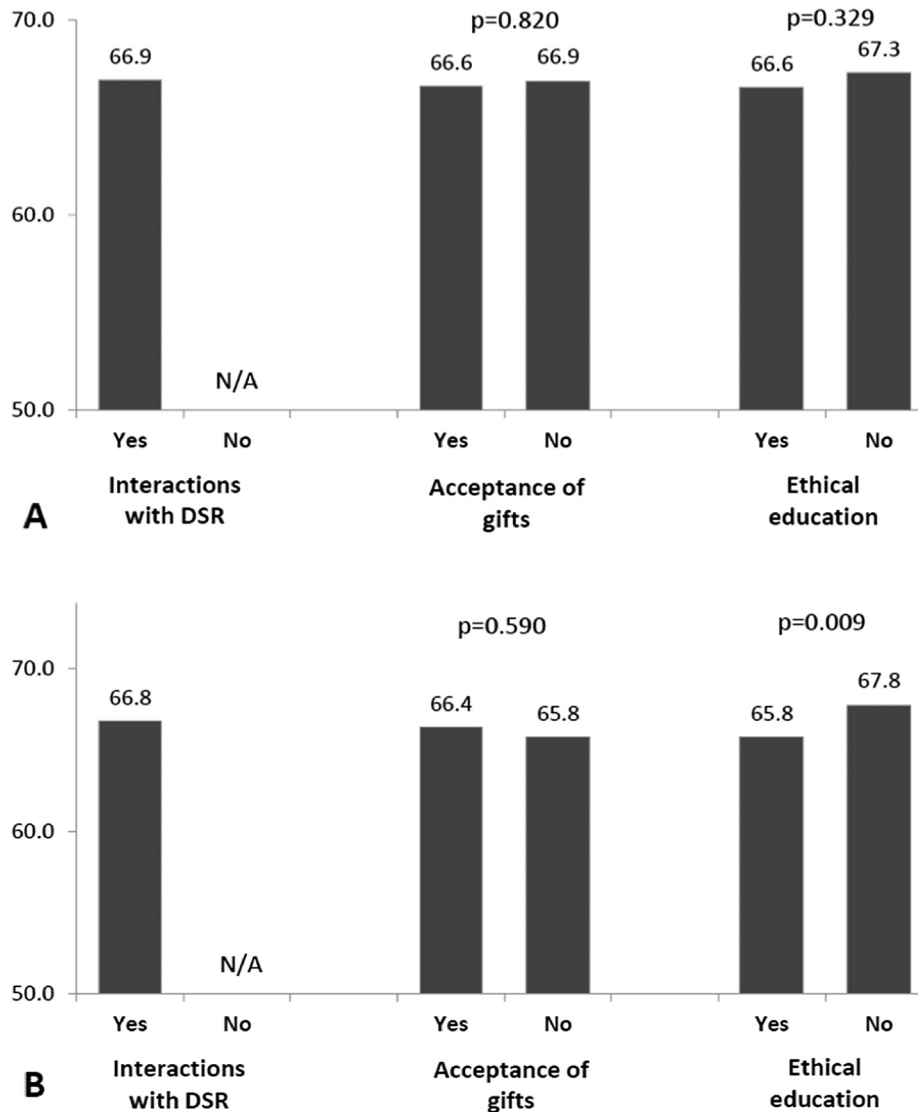


Fig. 2. Average score of the interaction questions; unadjusted (A) and adjusted* (B) by practices of study participants (*Adjusted for age, gender, nationality, monthly income, type of hospital, clinical specialty, job rank, and working abroad).

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Conflict of interest

The authors of this manuscript have no conflicts of interest to declare.

References

- Alosaimi, F.D., Al Kaabba, A., Qadi, M., Albahlal, A., Alabdulkarim, Y., Alabduljabbar, M., et al., 2015. Physicians' attitudes towards interaction with the pharmaceutical industry. *East Mediterr. Health J.* 20 (12), 812–819.
- Alosaimi, F.D., AlKaabba, A., Qadi, M., Albahlal, A., Alabdulkarim, Y., Alabduljabbar, M., et al., 2013. Acceptance of pharmaceutical gifts: variability by specialty and job rank in a Saudi healthcare setting. *Saudi Med. J.* 34 (8), 854–860.

- Allsageer, M.A., Kowalski, S.R., 2012. A survey of pharmaceutical company representative interactions with doctors in Libya. *Libyan J. Med.* 7 (Epub 2012 Sep 18).
- Brennan, T.A., Rothman, D.J., Blank, L., Blumenthal, D., Chimonas, S.C., Cohen, J.J., et al., 2006. Health industry practices that create conflicts of interest: a policy proposal for academic medical centers. *J.A.M.A.* 295 (4), 429–433.
- Cain, D.M., Detsky, A.S., 2008. Everyone's a little bit biased (even physicians). *J.A.M.A.* 299 (24), 2893–2895.
- Campbell, E.G., Gruen, R.L., Mountford, J., Miller, L.G., Cleary, P.D., Blumenthal, D., 2007. A national survey of physician - industry relationships. *N. Engl. J. Med.* 356 (17), 1742–1750.
- Campbell, E.G., Rao, S.R., DesRoches, C.M., Iezzoni, L.I., Vogeli, C., Bolcic-Jankovic, D., et al., 2010. Physician professionalism and changes in physician-industry relationships from 2004 to 2009. *Arch. Int. Med.* 170, 1820–1826.
- Chimonas, S., Rozario, N.M., Rothman, D.J., 2010. Show us the money: lessons in transparency from state pharmaceutical marketing disclosure laws. *Health Serv. Res.* 45 (1), 98–114.
- Chren, M.M., Landefeld, C.S., Murray, T.H., 1989. Doctors, drug companies, and gifts. *J.A.M.A.* 262 (24), 3448–3451.
- Daniel, M., 1988. Dental marketing: strategies for success. *J. Am. Dent. Assoc.* 117 (5), 563–567.
- Fadlallah, R., Nas, H., Naamani, D., El-Jardali, F., Hammoura, I., Al-Khaled, L., Brax, H., Kahale, L., Akl, E.A., 2016. Knowledge, beliefs and attitudes of patients and the general public towards the interactions of physicians with the pharmaceutical and the device industry: a systematic review. *PLoS One* 11 (80), e0160540.
- Green, M.J., Masters, R., James, B., Simmons, B., Lehman, E., 2012. Do gifts from the pharmaceutical industry affect trust in physicians? *Fam. Med.* 44 (5), 325–331.

- Hine, M.K., 1968. Professional - industrial relations for the promotion of oral health. *Ann. N.Y. Acad. Sci.* 153, 12–15.
- Komesaroff, P.A., Kerridge, I.H., 2002. Ethical issues concerning the relationships between medical practitioners and the pharmaceutical industry. *Med. J. Aust.* 176 (3), 118–121.
- Komesaroff, P.A., 2005. Ethical issues in the relationships with industry: an ongoing challenge. New guidelines open for public comment. *J. Paediatr. Child Health* 41 (11), 558–560.
- Marco, C.A., Moskop, J.C., Solomon, R.C., Geiderman, J.M., Larkin, G.L., 2006. Gifts to physicians from the pharmaceutical industry: an ethical analysis. *Ann. Emerg. Med.* 48 (5), 513–521.
- McNeill, P.M., Kerridge, I.H., Henry, D.A., Stokes, B., Hill, S.R., Newby, D., et al., 2006. Giving and receiving of gifts between pharmaceutical companies and medical specialists in Australia. *Int. Med. J.* 36 (9), 571–578.
- Moynihan, R., 2003. Who pays for the pizza? Redefining the relationships between doctors and drug companies. 1: entanglement. *Brit. Med. J.* 326 (7400), 1189–1192.
- Newby-Clark, N.I.R., McGregor, I., Zanna, M.P., 2002. Thinking and caring about cognitive inconsistency: when and for whom does attitudinal ambivalence feel uncomfortable? *J. Pers. Soc. Psychol.* 82 (2), 157–166.
- Priester, J.R., Petty, R.E., 1996. The gradual threshold model of ambivalence: relating the positive and negative bases of attitudes to subjective ambivalence. *J. Pers. Soc. Psychol.* 71 (3), 431–449.
- Saito, S., Mukohara, K., Bito, S., 2010. Japanese practicing physicians' relationship with pharmaceutical representatives: a national survey. *PLoS One* 5 (8), 12193.
- Schwartz, B., 2005. Receiving gifts: a conflict of interest discussion. *J. Can. Dent. Assoc.* 71 (8), 561–562.
- Shaughnessy, A.F., Slawson, D.C., 1996. Pharmaceutical representatives. *Brit. Med. J.* 312 (7045), 1494.
- Siddiquie, U.T., Shakoor, A., Kiani, S., Ali, F., Sharif, M., Kumar, A., et al., 2014. Attitudes of medical students towards incentives offered by pharmaceutical companies-perspective from a developing nation- a cross sectional study. *B.M.C. Med. Ethics.* 15, 36.
- Tahir, S., Rafique, A., Ghafoor, F., Saleem, A., Khan, A., 2013. Attitude and practice of dental surgeons towards pharmaceutical companies' marketing gifts. *J. Med. Ethics Hist. Med.* 6, 4 (eCollection 2013).
- Wazana, A., 2000. Physicians and pharmaceutical industry: is a gift ever just a gift? *J.A.M.A.* 283 (3), 373–380.