Changing Interactions Between Physician Trainees and the Pharmaceutical Industry: A National Survey

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BACKGROUND: Increasingly, medical school policies limit pharmaceutical representatives' access to students and gifts from drugmakers, but little is known about how these policies affect student attitudes toward industry.

OBJECTIVE: To assess interactions between trainees and the pharmaceutical industry, and to determine whether learning environment characteristics influence students' practices and attitudes.

DESIGN, PARTICIPANTS: We conducted a cross-sectional survey with a nationally-representative sample of first- and fourth-year medical students and third-year residents, stratified by medical school, including ≥ 14 randomly selected trainees at each level per school.

MAIN MEASURES: We measured frequency of industry interactions and attitudes regarding how such interactions affect medical training and the profession. Chi-squared tests assessed bivariate linear trend, and hierarchical logistic regression models were fitted to assess associations between trainees' attitudes and their schools' National Institutes of Health (NIH) funding levels and American Medical Student Association (AMSA) PharmFree Scorecard grades reflecting industry-related conflict of interest policies.

KEY RESULTS: Among 1,610 student (49.3 % response rate) and 739 resident (43.1 %) respondents, industry-sponsored gifts were common, rising from 33.0 % (first-year students) to 56.8 % (fourth-year students) and 54 % (residents) ($p < 0.001$). These gifts included meals outside the hospital (reported by 5 % first-year students, 13.4 % fourth-year students, 27.5 % residents ($p < 0.001$)) and free drug samples (reported by 7.4 % first-year students, 14.1 % fourth-year students, 14.3 % residents ($p < 0.001$)). The perception that industry interactions lead to bias was prevalent, but the belief that physicians receive valuable education through these interactions increased (64.1 % to 67.5 % to 79.8 %, $p < 0.001$). Students in schools receiving more NIH funding reported industry gifts less often (OR=0.51, 95 % CI: 0.38–0.68, $p < 0.001$), but the strength of institutional conflict of interest policies was not associated with this variable.

CONCLUSIONS: Despite recent policy changes, a substantial number of trainees continue to receive gifts from pharmaceutical representatives. We found no relation between these outcomes and a school's policies concerning interactions with industry.

KEY WORDS: pharmaceutical industry; undergraduate medical education; drug promotion; conflict of interest.

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The pharmaceutical industry is deeply involved with physician education at all levels.^{1,2} Its sponsorship of Continuing Medical Education (CME) events has been widely reported³; pharmaceutical manufacturers invested over \$850 million in CME in 2009,⁴ while a recent survey found that about two-thirds of clinical departments in medical schools and teaching hospitals in the US receive direct CME support from industry.⁵

The industry's role in education reaches back to trainees, including residents and medical students.⁶ Students' contact with industry representatives begins in the first year of medical school, in the form of gifts and meals, and increases in frequency during training.^{7–12} Supporters of unrestricted trainee–industry interactions argue that they can be a useful source of education about drug choices, particularly for newer products. However, promotional messages of pharmaceutical sales representatives or industry-sponsored educational events may present a perspective biased to favor use of the sponsor's product that is not compatible with the educational goal of evidence-based medicine.^{13–16}

In response to these concerns, numerous medical schools, academic medical centers, the Association of American Medical Colleges, and the Institute of Medicine have called for a reduction in the influence of such commercial sources of information on medical education at both the undergraduate and postgraduate levels.^{17–19} While the pharmaceutical industry developed industry guidelines on gift-giving to health care professionals,²⁰ many schools²¹ and residency

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training programs²² have enacted policies limiting industry access, including restrictions on meetings with sales representatives and a moratorium on industry-funded textbooks and other educational materials. While the impact of these policies has been studied in small numbers of institutions,²³ there has been no national study of their effect.

Given these recent developments, we conducted a large, nationally representative, cross-sectional survey of medical trainees at three different stages: first-year medical students, fourth-year students, and third-year residents. Our goal was to assess the extent of interactions between trainees and the pharmaceutical industry and their attitudes about the role of industry promotion in medical education and in shaping physician prescribing practices. Finally, we sought to determine whether variations in institutional policies and other learning environment characteristics influenced students' practices and attitudes.

METHODS

Survey Sample

Our sample frame was the American Medical Association's (AMA's) Physician Masterfile, a comprehensive information source containing all medical students and residents. We identified first-year students, fourth-year students, and third-year residents (all specialties) and excluded osteopathic trainees and residents who were graduates of these programs, trainees from non-US based medical schools, members of the armed services, and names without an address in the file.²⁴ These exclusions resulted in a universe of 16,299 first-year students, 14,804 fourth-year students, and 14,266 residents. Each list was stratified by medical school attended (120 schools available for first-year students and 121 schools for fourth-year students and residents). Next, we randomly selected 14 names per school from the first-year student population and 15 names per school from the fourth-year student and resident populations. The sample size was chosen to detect a binary outcome odds ratio of 1.4, assuming a survey response rate of 50 % for first-year students and 46.7 % for fourth-year students and residents, a baseline outcome rate of 30 %, a design effect at the school level of 0.05, and desired power of 90 %. This resulted in a total population of 5,310, including 3,495 medical students (1,680 first-year students and 1,815 fourth-year students) and 1,815 residents.

Survey Design

We collected information in three main topic areas related to trainee/industry interactions: behaviors, attitudes, and learning environments. First, we determined the frequency of students' and residents' recent interactions with industry.

We asked how often they use "pharmaceutical representative information" or "drug company sources, such as sponsored educational events" to learn about drugs (often/sometimes/rarely/never). We then asked them to report whether they had any interactions with "drug, device, or other medically related companies," including talking with representatives about companies' products or receiving gifts, during the last 6 months.

Next, we queried participants about their current attitudes regarding their interactions with representatives of the pharmaceutical industry. For example, we asked whether they believed that "Receiving gifts or food from pharmaceutical representatives increases the chance that I will eventually prescribe the drug company's product" and whether they believed the same regarding fellow trainees. For these questions, we used a 5-point Likert scale (strongly agree/agree/neutral/disagree/strongly disagree), as employed in prior studies.¹² We also asked about perceptions of how interactions with pharmaceutical representatives affect the profession, including whether "physicians receive useful education about new treatments," using a 4-point Likert scale (strongly agree/agree/disagree/strongly disagree).

Finally, we asked trainees for their views on the role of the pharmaceutical industry in medical schools. We asked first about their current attitudes about medical school access and disclosure policies. This section included whether they felt that "medical schools should not permit sales representatives from the pharmaceutical industry to have access" to pre-clinical or clinical students on campus, and whether "medical schools should require all faculty to disclose their financial conflicts of interest before their lectures." These questions offered the 4-point Likert scale as above.

We then asked trainees how well they understood their medical schools' policies regarding trainee-industry interactions and how well they thought their faculty and residents complied with these policies (very well/some-what/very little/not at all). For these questions only, we changed the tense in residents' surveys to direct them to evaluate the policies and compliance behaviors observed at the medical school they attended, not at their residency programs. See on-line [Appendix](#) for all questions.

The survey started by asking trainees about the educational sources they currently use to learn about drugs. Remaining questions about trainees' perceptions were randomly sorted to minimize question order bias and presented in the same order for all surveyed. Finally, we collected demographic information. The full-length survey was pilot-tested via cognitive interviews with a convenience sample of students. The project was approved by Institutional Review Boards at Brigham and Women's Hospital and Harvard Law School.

Survey Administration

The survey was administered by mail between February and May 2011. Participants received a pre-survey mailing explaining the purpose of the project. The next mailing contained a cover letter, survey, postage-paid return envelope, cash honorarium (\$2 for medical students and \$5 for residents), and the URL of an on-line version. Non-respondents were sent up to two further mailings to encourage participation; the final mailing included another \$1 cash honorarium. We excluded 231 medical students and 101 residents found to have incorrect addresses.

Statistical Analyses

Chi-squared tests for bivariate linear trend were used to determine significant differences in responses among first-year students, fourth-year students, and residents. Comparisons were made between positive responses (reported in Tables) and otherwise. Data were weighted for sampling probability (defined as the inverse probability of selection at each medical school).

To investigate the impact of medical school characteristics on responses, for each school we identified annual research funding from the National Institutes of Health (NIH), which aggregates funding received by both the medical school and its affiliated hospitals (missing for 15 schools).²⁵ We dichotomized schools at the median value of \$94.9 million. Next, we identified grades on the American Medical Student Association (AMSA) PharmFree Scorecard, which rates the strength of medical schools' conflict of interest policies on a scale of A to F. We used the 2010 scores and dichotomized schools based on whether they received an A/B (strong policy) or C/D/F (weak policy); three schools received incomplete grades and were excluded. To exclude the effect of recent policy changes on our outcomes, we performed a subgroup analysis comparing schools that scored A/B in both 2008 and 2010, compared to schools that scored C/D/F in both 2008 and 2010.

We then focused on three key questions assessing trainee behavior, attitudes, and learning environment (see Fig. 1), and fit a hierarchical logistic regression model for each question (SAS 9.2 (Cary, NC)) using the responses from medical students only. The model included random intercepts for medical schools to account for the correlation among responses from students within the same school, as well as fixed effects for AMSA score (A-B vs. C-F), NIH funding (above or below the median), and respondent year in training. We did not include information on medical school size in these models, because it was not associated with responses.

RESULTS

A total of 1,610 medical students (49.3 % response rate²⁶) and 739 residents (43.1 % response rate) completed the

survey (Table 1). Comparisons between respondents and non-respondents, respondents and other data sources, and early and late respondents²⁷ also confirmed the representativeness of the respondent population (see on-line Appendix).

Interactions with Pharmaceutical Industry

Trainees reported frequent contact with pharmaceutical industry representatives (Table 2). Approximately one in seven first-year students (16.7 %) attended an industry-sponsored lecture in the previous 6 months, as did larger fractions of fourth-year students (40.0 %) and residents (35.9 %) ($p < 0.001$). While meals outside of campus or the hospital were relatively rare among first-year students (5 %), the prevalence rose among fourth-year students (13.4 %) and residents (27.5 %) ($p < 0.001$). These interactions were sometimes encouraged by superiors: 4.7 % of first-year students acknowledged being asked or required by a more senior person to attend an industry-sponsored event, compared to 17.4 % for fourth-year students and 17.6 % for residents ($p < 0.001$). Despite limits imposed by many training programs on contact between residents and industry representatives, about one in five residents reported often using sales representatives (20.0 %) or industry-sponsored educational events (17.0 %) to learn about drugs. Residents were about twice as likely as first-year and fourth-year students to turn to sales representatives for drug information ($p < 0.001$).

A third of first-year students reported receiving industry-sponsored gifts, as did over half of fourth-year students (56.8 %) and residents (54.0 %). Pens, notepads, and T-shirts were the most common gifts among first-year students (19.4 %), while food or beverages in the workplace were most common for fourth-year students (47.0 %) and residents (35.1 %). Both first-year and fourth-year students (7.4 % and 14.1 %) reported receiving free drug samples, despite lacking authority to prescribe drugs themselves (see on-line Appendix).

Attitudes Toward Interactions with Industry

About a quarter of first-year (25.9 %) and fourth-year students (22.5 %) and about one-third (35.0 %) of residents saw no problem with medical students accepting gifts from sales representatives (Table 3). More students and residents felt that such gifts would affect others' behavior (range: 42.4–51.8 %) more than their own (range: 33.2–36.3 %). Similarly, students and residents found industry-sponsored grand rounds helpful and educational (range: 23.9–42.4 %), even as they overwhelmingly stated that such grand rounds were biased in favor of the company's products (range: 71.9–76.9 %).

Table 1. Personal and Professional Characteristics of Respondents

	First-year student respondents		Fourth-year student respondents		Resident respondents	
	No./Total No.	Weighted percentage*	No./Total No.	Weighted percentage	No./Total No.	Weighted percentage
Personal characteristic						
Sex						
Male	374/721	50.5	375/759	49.8	363/705	53.3
Female	346/721	49.4	384/759	50.3	339/705	46.4
Age (mean, SD)	25.2 (3.3)	—	28.3 (4.2)	—	31.8 (3.2)	—
Physician parent	169/725	23.1	182/761	24.8	167/708	23.8
Personal connection to pharmaceutical company	39/719	5.9	46/757	6.7	52/704	8.4
Professional characteristic						
Plan to enter primary care	142/712	18.4	196/739	24.9	90/324	27.9
Plan to conduct translational or bench research	229/723	34.1	204/759	28.2	148/702	21.0
Very concerned over level of debt	215/725	29.8	285/763	38.5	298/717	40.9
MCAT score (median, IQR)	33 (30–35)	—	32 (29–35)	—	—	—
United States Medical Licensing Examination Step One score (median, IQR)	—	—	—	—	234 (220–245)	—

*Weighted to adjust for sampling probability. The unweighted percentages (not shown) were closely similar

A majority of trainees in nearly all questions displayed a perception that bias may result from drug company interactions. However, we found a small but statistically significant reduction from first-year students to fourth-year students to residents in the perception that physician/industry interactions could lead to bias favoring the products being marketed (86.4 % to 78.9 %, $p<0.001$), as well as larger decline in the belief that such interactions threatened the public's trust in physicians (67.9 % to 46.2 %, $p<0.001$). Similarly, as training progressed, there was an increase in the belief that physicians receive useful education through these interactions (64.1 % of first-year students vs. 67.5 % of residents vs. 79.8 % of fourth-year students, $p<0.001$).

Perceptions of Learning Environment

About two-thirds of medical students and residents (range: 66.0–69.8 %) stated that industry representatives should be excluded from interactions with pre-clinical students, while a slightly smaller percentage (range: 53.0–60.3 %) felt the same about interactions at clinical sites. A small number of trainees reported understanding their medical school's conflict of interest policies (9.7 % of first-years, 20.1 % of fourth-years, 24.3 % of residents); only about half of fourth-year students (59.3 %) and residents (52.3 %) felt strongly that faculty and residents at their medical schools actually complied with those policies. By the end of medical school and residency, about two-thirds of trainees reported that they had been taught about professional relationships with industry. Only about a quarter of fourth-year students (21.6 %) and residents (27.6 %) felt "very prepared" to recognize conflicts of interest in their relations with industry, although by contrast extremely few medical students (1.3 %) or residents (1.5 %) reported feeling "very unprepared."

Effect of Training Environment on Medical Student Responses

After adjusting for year in training, current attendance at a medical school that received more NIH funding was associated with a decreased likelihood of medical students' reporting that they accepted a gift from a pharmaceutical company in the prior 6 months [odds ratio (OR): 0.51, 95 % confidence interval (CI): 0.38–0.68, $p<0.001$]. Medical students at institutions with higher NIH research funding were less likely to state that accepting such gifts would change their future prescribing behavior, a difference that approached but did not reach statistical significance (OR: 0.74, 95 % CI: 0.54–1.01, $p=0.05$). After adjusting for year in training, there was no association between an institution's AMSA conflict-of-interest policy score and the likelihood that its medical students would report accepting a gift from industry (OR: 1.21, 95 % CI: 0.89–1.65, $p=0.22$) or the likelihood that its trainees would agree that accepting gifts would change prescribing behavior (OR: 1.29, 95 % CI: 0.92–1.81, $p=0.14$) (Fig. 1). However, medical students at schools with higher AMSA scores were more than twice as likely to state that their institutions had adequate separation between faculty and industry, compared with schools with lower AMSA scores (OR: 2.31, 95 % CI: 1.09–4.88, $p=0.03$). Medical students at schools receiving more NIH funding were also more likely to see greater separation, although the difference was not statistically significant (OR: 2.06, 95 % CI: 0.97–4.36, $p=0.06$).

These results did not change in subgroup analyses focusing on schools that had consistent AMSA scores in 2008 and 2010, or with refined analyses using different AMSA score cutoffs.

Table 2. Respondents' Interactions with Pharmaceutical Industry in the Past 6 Months

Type of interaction:	First-year students	Fourth-year students	Residents
	Weighted % (95 % CI)	Weighted % (95 % CI)	Weighted % (95 % CI)
Talked with pharmaceutical representative	17.2 (16.7–17.6)	44.4 (43.8–44.9)	49.1 (48.5–49.7)
Attended a lecture sponsored by pharmaceutical company	16.7 (16.3–17.1)	40.0 (39.5–40.6)	35.9 (35.6–36.4)
Observed an attending physician or resident interact with a pharmaceutical sales representative	33.0 (32.5–33.6)	58.5 (57.9–59.1)	52.9 (52.3–53.5)
Been asked or required to attend industry-sponsored event	4.7 (4.5–5.0)	17.4 (17.0–17.9)	17.6 (17.1–18.1)
Often used a pharmaceutical sales representative to learn about drugs	7.9 (7.6–8.2)	9.7 (9.4–10.1)	20.0 (19.5–20.5)
Often used drug company sources, such as sponsored educational events, to learn about drugs	6.7 (6.4–6.9)	9.7 (9.3–10.0)	17.0 (16.6–17.5)
Received any gift*	33.0 (32.4–33.5)	56.8 (56.2–57.4)	54.0 (53.4–54.6)
1 gift	19.3 (18.9–19.8)	29.7 (29.2–30.3)	25.0 (24.5–25.5)
2 gifts	9.5 (9.1–9.8)	17.5 (17.0–17.9)	17.2 (16.7–17.6)
3 or more gifts	4.2 (4.0–4.5)	9.4 (9.1–9.8)	11.9 (11.5–12.2)

All results show a statistically significant change in trend ($p < 0.001$)
CI confidence interval

*Gifts include: (1) food or beverage in workplace, (2) meal outside of campus or hospital, (3) pens, notepads, T-shirts, (4) free drug samples, or (5) any other gift or financial support

DISCUSSION

This national survey of medical students and residents found that despite a majority of trainees' calling for increased separation from industry during medical education, interactions remain common between medical trainees and pharmaceutical company sales representatives. A substantial number of trainees at all levels reported accepting multiple gifts from drug companies and attending industry-sponsored educational conferences. The percentage of trainees using industry-sponsored information to learn about drugs more than doubled during training.

Our data support a shift in practices and attitudes among trainees in the past few years. A survey published in 2005 by Sierles et al. reported that over 90 % of students had accepted a small, noneducational gift from a drug company.¹¹ In January 2009, however, pharmaceutical manufacturers reportedly ended the practice of providing such gifts to health care professionals.²⁰ Consequently, we found gifts like pens, notepads and T-shirts to be less common, although nearly one in five current medical students still reported accepting such gifts in the past 6 months. These results may reflect some companies' persistence in gift-giving to trainees, and also suggest that voluntary, self-imposed guidelines may not be sufficient to end potentially problematic industry marketing practices.

Other results also suggest an evolution of trainee attitudes towards the pharmaceutical industry. While Sierles et al. found that only 17 % of third-year students favored preventing pharmaceutical manufacturers from meeting with students and residents,¹² we found that a majority of trainees at all levels favored excluding pharmaceutical representatives from clinical and non-clinical education sites. Evolution in attitudes on these points may reflect the

Table 3. Attitudes Toward Interactions with and Influence of Pharmaceutical Industry

"Strongly agree" or "Agree" with following statements about accepting gifts:	First-year students	Fourth-year students	Residents
	Weighted % (95 % CI)	Weighted % (95 % CI)	Weighted % (95 % CI)
It is appropriate for medical students/residents to accept gifts under \$50 from pharmaceutical companies	25.9 (25.4–26.5)	22.5 (22.0–23.0)	35.0 (34.4–35.5)
Receiving gifts or food from pharmaceutical representatives increases the chance that my fellow medical students/residents will eventually prescribe the drug company's products	51.8 (51.2–52.4)	45.6 (45.0–46.2)	42.4 (41.6–43.0)
Receiving gifts or food from pharmaceutical representatives increases the chance that I will eventually prescribe the drug company's products	33.2 (32.6–33.7)	36.3 (35.8–36.9)	33.5 (33.0–34.1)
Most grand rounds sponsored by drug companies are helpful and educational	23.9 (23.4–24.4)	36.6 (36.1–37.2)	42.4 (41.2–42.4)
Drug company-sponsored grand rounds are often biased in favor of the company's product	73.5 (73.0–74.0)	76.9 (76.4–77.4)	71.9 (71.4–72.4)
Drug company materials are a useful way for medical students/residents to learn about new drugs	40.6 (40.0–41.1)	30.1 (29.6–30.6)	45.5 (44.9–46.0)
As a result of physicians meeting with pharmaceutical representatives...			
• Physicians may prescribe a drug that is more expensive but no better than alternatives	65.3 (64.7–65.8)	71.0 (70.4–71.5)	67.0 (66.5–67.6)
• Physicians may become unconsciously biased toward a representative's product	86.4 (86.0–86.8)	82.7 (82.3–83.1)	78.9 (78.4–79.4)
• The trust that patients and the public have in physicians is threatened	67.9 (67.3–68.4)	55.1 (54.5–55.7)	46.2 (45.6–46.8)
• Physicians receive useful education about new treatments	64.1 (63.6–64.7)	67.5 (67.0–68.0)	79.8 (79.3–80.3)

All results show a statistically significant change in trend ($p < 0.001$)
CI confidence interval

Figure 1. Effect of medical school characteristics on students' receipt of gifts and attitudes about pharmaceutical industry interactions. The squares indicate odds ratio (OR), while the lines indicate 95 % confidence intervals (CI). * AMSA (American Medical Student Association) score is a rating of the strength of the school's conflict of interest policies. High AMSA score was an "A" or "B" (compared to schools receiving a C, D, or F). ** NIH (National Institutes of Health) funding is a measure of the amount of government-funded basic science research occurring at the medical school. High NIH funding was defined as above the median value (\$94.9 million) for all medical schools in 2010 (compared to schools below the median value).

Table 4. Respondents' Assessment of Learning About Physician/Industry Interactions

Statements assessing learning experiences:	First-year students	Fourth-year students	Residents
	Weighted % (95 % CI)	Weighted % (95 % CI)	Weighted % (95 % CI)
I "strongly agree" or "agree" that ...			
Medical schools should require all faculty to disclose their conflicts of interest before their lectures	87.2 (86.8–87.6)	90.9 (90.6–91.3)	94.0 (93.8–94.3)
Medical schools should not permit the pharmaceutical industry to have access to pre-clinical students on campus	69.3 (68.8–69.9)	69.8 (69.2–70.3)	66.0 (65.4–66.5)
Medical schools should not permit the pharmaceutical industry to have access to students in their training at clinical sites	60.3 (59.7–60.9)	53.0 (52.4–53.6)	56.3 (55.7–56.9)
It is appropriate for physicians who receive payment from a pharmaceutical company for speaking about a given drug to lecture to medical students on that same topic	42.6 (42.0–43.2)	46.1 (45.5–46.7)	56.8 (56.3–57.4)
There is adequate separation between the Faculty of Medicine at my university and the pharmaceutical industry	90.7 (90.4–91.0)	93.7 (93.4–94.0)	78.9 (78.4–79.3)
It is easy to find faculty role models who do not have financial relationships with industry	93.4 (93.1–93.7)	95.2 (95.0–95.5)	96.3 (96.1–96.5)
I was educated about professional relationships with industry	44.1 (43.6–44.7)	69.1 (68.5–69.6)	65.0 (64.5–65.6)
I know and understand my medical school's conflict of interest policy very well* †	9.7 (9.3–10.1)	20.1 (19.5–20.6)	24.3 (23.7–24.9)
I believe faculty and residents (at my medical school) comply with the conflict of interest policy very well* †	28.7 (28.1–29.3)	59.3 (58.6–60.0)	52.3 (51.6–53.0)
I feel very prepared to recognize conflicts of interest that arise in relation to the pharmaceutical industry ‡	10.2 (9.8–10.5)	21.6 (21.1–22.1)	27.6 (27.1–28.2)

All results show a statistically significant change in trend ($p < 0.001$)

CI confidence interval

* Only for those who answered affirmatively that the schools had a policy on industry interactions ($N = 1,086$). For residents, these questions were phrased in the past tense to direct respondents' attention to their medical schools

† Alternatives: somewhat well, very little, not at all

‡ Alternatives: somewhat prepared, somewhat unprepared, very unprepared

impact of recent events, such as the widespread reporting of illegal marketing practices by numerous pharmaceutical companies.²⁸

Policy changes at academic medical centers have recently been enacted to limit trainees' interactions with industry. We found that medical schools' conflict of interest policies, as reflected in their AMSA PharmFree Scorecard grade, may lead students to perceive greater separation between faculty and industry. However, such scores had little correlation with students' reports of accepting gifts or their attitudes about the impact of marketing on prescribing practices. The institutional policies that contribute to the AMSA score may have a limited effect on containing contact between students and pharmaceutical representatives. For example, interactions forbidden on campus may instead be conducted in restaurants and other settings off-campus, a practice that was commonly reported in our study.

By contrast, we did find that students at medical schools that receive less NIH research funding were more likely to accept gifts from drugmakers. Pharmaceutical industry representatives may preferentially develop relationships with students in less research-intensive institutions because they are more likely to become community practitioners.²⁹ However, students at less research-intensive settings were also more likely to believe that receiving gifts would not influence their prescribing practices.

Although this was a cross-sectional study, its findings suggest that trainees' attitudes about industry interactions may change during education. One explanation is that during medical education, trainees gain the impression that they can resist undue influence from industry interactions,³⁰ beliefs that run counter to substantial data that pharmaceutical marketing can change practices in non-evidence-based ways.^{31–33} One way to combat this shift—and to support the majority of trainees who considered themselves unprepared to deal with the ethical challenges presented by industry marketing—would be to provide formal instruction on managing conflicts of interest³⁴ and promote greater awareness of the issues throughout medical school and residency.³⁵

The survey has limitations that must be considered. Our results are subject to the traditional limitations of cross-sectional surveys, including recall and acquiescence bias. When residents were asked questions about their institutions (Table 4), they may have answered for their medical school or residency. We relied on self-reported behavior regarding interactions with pharmaceutical representatives, so some answers may have been affected by a bias toward providing more socially desirable responses. However, if true, this suggests that our results represent the lower bounds of interactions between trainees and the pharmaceutical industry. Our overall response rate of 43–49 % is comparable to the mean response rates reported in published surveys of physicians.³⁶ Nonetheless, the national

sampling methodology involved relatively few students being sampled from each school, limiting the precision of conclusions about effects of variations at the individual institution level. The lack of relationship we found between survey responses and the AMSA Scorecard may be spurious if inaccuracies exist in the Scorecard, although sensitivity analyses that accounted for potential variability in the Scorecard scores showed consistent results.

Interactions between medical trainees and the pharmaceutical industry are controversial, and our survey shows that many trainees now find these interactions unwarranted. However, gifts, meals outside campus, use of industry-sponsored educational materials, and even free drug samples persist among trainees. Though some academic medical centers have moved to restrict interactions between trainees and industry, it appears that further efforts will be needed to ensure that these restrictions effectively permit trainees to learn the fundamentals of their profession in the marketing-free environment that many of them crave.

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REFERENCES

1. Brody H. Pharmaceutical industry financial support for medical education: benefit, or undue influence? *J Law Med Ethics*. 2009;37(3):451–460.
2. Campbell EG, Regan S, Gruen RL, Ferris TG, Rao SR, Cleary PD, Blumenthal D. Professionalism in medicine: results of a national survey of physicians. *Ann Intern Med*. 2007;147(11):795–802.
3. Steinbrook R. Future directions in industry funding of continuing medical education. *Arch Intern Med*. 2011;171(3):257–258.
4. Avorn J, Choudhry NK. Funding for medical education: maintaining a healthy separation from industry. *Circulation*. 2010;121(20):2228–2234.
5. Campbell EG, Weissman JS, Ehringhaus S, Rao SR, Moy B, Feibelmann S, Goold SD. Institutional academic industry relationships. *JAMA*. 2007;298(15):1779–1786.
6. Zipkin DA, Steinman MA. Interactions between pharmaceutical representatives and doctors in training. A thematic review. *J Gen Intern Med*. 2005;20(8):777–786.
7. Fitz M, Homna D, Reddy S, Griffith C, Baker E, et al. The hidden curriculum: medical students' changing opinions toward the pharmaceutical industry. *Acad Med*. 2007;82:S1–S3.

8. **Bellin M, McCarthy S, Drevlow L, Pierach C.** Medical students' exposure to pharmaceutical industry marketing: a survey at one U.S. medical school. *Acad Med.* 2004;79:1041–1045.
9. **Hyman P, Hochman M, Shaw J, Steinman M.** Attitudes of preclinical and clinical medical students toward interactions with the pharmaceutical industry. *Acad Med.* 2007;82:94–99.
10. **Fein E, Vermillion M, Uijtdehaag S.** Pre-clinical medical students' exposure to and attitudes toward pharmaceutical industry marketing. *Med Educ.* Online 2007;12. Available at: <http://www.med-ed-online.net/index.php/meo/article/viewArticle/4465>.
11. **Sierles FS, Brodkey AC, Cleary LM, McCurdy FA, Mintz M, Frank J, Lynn DJ, Chao J, Morgenstern BZ, Shore W, Woodard JL.** Medical students' exposure to and attitudes about drug company interactions: a national survey. *JAMA.* 2005;294(9):1034–1042.
12. **Soyk C, Pfefferkorn B, McBride P, Rieselbach R.** Medical student exposure to and attitudes about pharmaceutical companies. *WMJ.* 2010;109(3):142–148.
13. **Austad KE, Avorn J, Kesselheim AS.** Medical students' exposure to and attitudes about the pharmaceutical industry: a systematic review. *PLoS Med.* 2011;8(5):e1001037.
14. **Wazana A.** Physicians and the pharmaceutical industry: is a gift ever just a gift? *JAMA.* 2000;283(3):373–380.
15. **Bowman MA, Pearle DL.** Changes in drug prescribing patterns related to commercial company funding of continuing medical education. *J Contin Educ Health Prof.* 1988;8:13–20.
16. **Sondergaard J, Vach K, Kragstrup J, Andersen M.** Impact of pharmaceutical representative visits on GPs' drug preferences. *Fam Pract.* 2009;26:204–209.
17. **Institute of Medicine.** Conflict of interest in medical research, education, and practice. Washington, D.C.: National Academies Press; 2009.
18. **Association of American Medical Colleges.** Industry funding of medical education: report of an AAMC task force. June 2008. Available at: <https://members.aamc.org/eweb/upload/Industry%20Funding%20of%20Medical%20Education.pdf>. Accessed 14 Jan 2013.
19. **Stanford School of Medicine.** New policy on continuing medical education. 19 Aug 2008. Available at: http://med.stanford.edu/oi/documents/deanpizzo_cmeletter.pdf. Accessed 14 Jan 2013.
20. **Pharmaceutical Research and Manufacturers of America.** PhRMA code on interactions with healthcare professionals. July 2008. Available at: http://www.phrma.org/sites/default/files/369/phrma_marketing_code_2008-1.pdf. Accessed 14 Jan 2013.
21. **University of Iowa health care conflict of interests and conflict of commitment policy regarding interactions with industry.** 20 January 2009. Available at: <http://www.healthcare.uiowa.edu/cme/planning/documents/FinalCOIPolicy.pdf>. Accessed 14 Jan 2013.
22. **Fugh-Berman A, Brown SR, Trippett R, Bell AM, Clark P, Fleg A, Siwek J.** Closing the door on pharma? A national survey of family medicine residencies regarding industry interactions. *Acad Med.* 2011;86(5):649–654.
23. **Kao AC, Braddock C 3rd, Clay M, Elliott D, Epstein SK, Filstead W, Hotze T, May W, Reenan J.** Effect of educational interventions and medical school policies on medical students' attitudes toward pharmaceutical marketing practices: a multi-institutional study. *Acad Med.* 2011;86(11):1454–1462.
24. **Weissman JS, Betancourt J, Campbell EG, Park ER, Kim M, Clarridge B, Blumenthal D, Lee KC, Maina AW.** Resident physicians' preparedness to provide cross-cultural care. *JAMA.* 2005;294(9):1058–1067.
25. **US News.** Best medical schools: research. 2011. Available at: <http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools/top-medical-schools/research-rankings>. Accessed 14 Jan 2013.
26. **American Association for Public Opinion Research.** Standard definitions: final dispositions of case codes and outcome rates for surveys. 2009. Available at: http://www.aapor.org/AM/Template.cfm?Section=Standard_Definitions1&Template=/CM/ContentDisplay.cfm&ContentID=1814. Accessed 14 Jan 2013.
27. **Johnson TP, Wislar JS.** Response rates and nonresponse errors in surveys. *JAMA.* 2012;307(17):1805–1806.
28. **Kesselheim AS, Mello MM, Studdert DM.** Strategies and practices in off-label marketing of pharmaceuticals: a retrospective analysis of whistleblower complaints. *PLoS Med.* 2011;8(4):e1000431.
29. **Mullan F, Chen C, Petterson S, Kolsky G, Spagnola M.** The social mission of medical education: ranking the schools. *Ann Intern Med.* 2010;152(12):804–811.
30. **Chimonas S, Brennan TA, Rothman DJ.** Physicians and drug representatives: exploring the dynamics of the relationship. *J Gen Intern Med.* 2007;22(2):184–190.
31. **Chren M-M, Landefeld CS.** Physicians' behavior and their interactions with drug companies: a controlled study of physicians who requested additions to a hospital drug formulary. *JAMA.* 1994;271:684–689.
32. **Manchanda P, Honka E.** The effects and role of direct-to-physician marketing in the pharmaceutical industry: an integrative review. *Yale J Health Policy Law Ethics.* 2005;5:785–812.
33. **Avorn J, Chen M, Hartley R.** Scientific versus commercial sources of influence on the prescribing behavior of physicians. *Am J Med.* 1982;73(1):4–8.
34. **Agrawal S, Saluja I, Kaczorowski J.** A prospective before-and-after trial of an educational intervention about pharmaceutical marketing. *Acad Med.* 2004;79:1046–1050.
35. **Austad KE, Kesselheim AS.** Conflict of interest disclosure in early medical education: should medical students stay in the dark? *JAMA.* 2011;306:991–992.
36. **Asch DA, Jedrzejewski MK, Christakis NA.** Response rates to mail surveys published in medical journals. *J Clin Epidemiol.* 1997;50(10):1129–1136.