Correlation Between Financial Relationships With Commercial Interests and Research Prominence at an Oncology Meeting

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ABSTRACT

Purpose

Little is known about the effects of financial relationships between biomedical researchers and industry (financial conflicts of interest [FCOIs]) on research prominence. We examined the prevalence of FCOIs in oncology and associations between FCOIs and research prominence among abstracts presented at American Society of Clinical Oncology (ASCO) annual meetings.

Methods

We analyzed 20,718 abstracts presented at ASCO meetings in 2006 and 2008 to 2011. Measures included the following: financial relationships, peer review score (PRS), and meeting placement prominence (descending order of prominence: plenary session, clinical science symposium, oral presentation, poster discussion, general posters, and publish only).

Results

Of 20,718 abstracts, 36% reported at least one author with an FCOI. The proportion of abstracts with any FCOI increased from 33% in 2006 to 38% in 2011 ($P < .001$). Abstracts with FCOIs had significantly higher meeting prominence compared with publish only and general poster abstracts. The odds ratios compared with general posters were 7.3 for plenary session, 2.2 for clinical science symposium, 1.9 for oral presentation, and 1.7 for poster discussion ($P < .001$). Abstracts with FCOIs had significantly better PRSs compared with those without FCOIs. For all abstracts, PRS was 2.76 (95% CI, 2.75 to 2.77) with FCOIs compared with 3.01 (95% CI, 3.001 to 3.02) without FCOIs ($P < .001$). Omitting publish-only abstracts, PRS was 2.62 (95% CI, 2.61 to 2.63) with FCOIs compared with 2.73 without FCOIs (95% CI, 2.71 to 2.73).

Conclusion

Abstracts with FCOIs had more prominent meeting placement and better PRSs. FCOIs were reported more frequently by year, suggesting an increasing influence of industry on cancer research, greater disclosure, or both.

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INTRODUCTION

The integrity of clinical research is based on rigorous scientific development, conduct, analysis, and presentation of clinical studies with minimization of bias from commercial interests. The proper management of financial conflicts of interest (FCOIs) is vital to the medical community because it justifies societal trust, promotes our integrity, and maintains our social contract with patients.¹ Although FCOIs do not necessarily lead to adverse influences on biomedical research, they may create a risk that researchers' professional judgments may be compromised.² Public scrutiny and awareness of financial relationships between clinical researchers and

for-profit commercial entities have increased in recent years within oncology and the health sector, in general.^{3,4} To date, management of FCOIs has been based on rules or policies mandating disclosure of industry relationships, with the goal of increasing transparency to engender public trust for the medical research community. As policies call for wider disclosure of potential FCOIs and, at times, prohibition of specific financial relationships, there is both a need and an opportunity to better understand the prevalence of investigator and research relationships with industry and the impact of these relationships on research and dissemination of results.^{5,6}

In 2005, the American Society of Clinical Oncology (ASCO) revised its FCOI policy.⁷ The new

ASCO policy established, for the first time, restrictions on certain types of financial relationships for principal investigators of clinical trials. Additionally, ASCO clarified its requirement for those submitting research for presentation at the ASCO annual meeting to disclose potential FCOIs with any entity having a commercial interest in the subject matter in question.

Despite the widespread implementation of conflicts of interest policies in academic centers, federal agencies, and professional medical societies, little is known about the impact and influence of FCOIs on research conduct, outcomes, and dissemination.⁸⁻¹⁰

In this study, we sought to examine both prevalence of FCOIs in oncology and associations between FCOIs and research prominence and peer review score (PRS), among abstracts presented at recent ASCO annual meetings. The abstract PRS is an available surrogate of scientific merit judged by peers. Meeting prominence, as selected by the ASCO Scientific Program Committee, reflects the research's significance and visibility to the oncology community at a national meeting. We aimed to determine the prevalence of specific types of FCOIs among cancer researchers, whether these relationships have changed over time, and whether their presence was associated with meeting placement prominence and better PRS.

METHODS

Using the ASCO database, we reviewed abstracts presented at the ASCO annual meetings in 2006 and 2008 to 2011. The ASCO database for 2007 was incomplete, and therefore, this period is excluded from analysis. Acceptance for presentation at the ASCO annual meeting was defined as placement in the plenary, clinical science symposium, oral presentation, poster discussion, or general poster sessions. FCOIs were classified as employment, stock, consultant, honoraria, research funding, and expert witness following the categories specified by the ASCO conflict of interest policy. We evaluated associations between FCOIs disclosed by any author and PRS and meeting placement prominence.

Order of meeting placement prominence was defined in descending order of prominence, as follows: plenary session, clinical science symposium, oral presentation, poster discussion, general posters, and publish only. Meeting placement was determined by the ASCO Scientific Review Committee, composed of regarded experts in the oncology field. The Scientific Review Committee took into account the PRS and thematic content of the annual meeting in determining meeting placement prominence.

PRS was determined by two individuals who each independently assigned a score of 1 to 5 (the lower the score, the more meritorious; Data Supplement). A mean PRS was calculated for each abstract using the reviewers' final actual rating scores. Peer reviewers were members of ASCO's Scientific Review Committee who were not co-investigators of their assigned abstracts. Peer reviewers were not blinded to abstract authorship, institutions, research sponsors, or disclosed FCOIs. All peer reviewers on the Scientific Review Committee disclosed all potential FCOIs before participation in review activities.

Logistic regression models were used to evaluate the association between FCOIs and acceptance at the annual meeting and change over time. *t* tests were used to compare PRS by any FCOI status. Odds ratio (OR) was calculated to determine the odds of a financial relationship as the PRS worsened.

RESULTS

Collectively, a total of 20,718 abstracts were accepted for presentation and/or publication at the ASCO annual meetings in 2006 and 2008 to 2011. Self-disclosed financial relationships by abstract are listed in Table 1. Thirty-six percent of all abstracts reported at least one author with a financial relationship. The proportion of all abstracts (accepted for presentation and publication only) in which authors disclosed any financial relationship increased from 33% in 2006 to 38% in 2011 ($P < .001$). Any financial relationship and all specific categories of relationships were significantly more prevalent among abstracts accepted for presentation compared with those accepted for publication only ($P < .001$). Also, there were significant increases over time in the proportion of abstracts reporting FCOIs of any relationship ($P < .011$) and research funding ($P = .011$). Among abstracts accepted for presentation ($n = 12,058$), those whose authors disclosed any financial relationship increased from 39% in 2006 to 47% in 2011 ($P < .001$).

Figure 1 graphically summarizes ASCO meeting placement prominence by financial relationships for all abstracts. Table 2 lists meeting placement prominence by FCOI using publication only as a benchmark for comparison. Abstracts in which at least one author disclosed any financial relationships had higher meeting placement prominence and were more often selected for plenary, clinical science symposium, oral abstract, poster discussion, and general poster sessions compared with publication only ($P < .001$). Ownership of stock,

Table 1. Financial Relationships (FCOIs) of Any Author Among Abstracts Submitted for the ASCO Annual Meeting

FCOI	% of Abstracts			OR* in 2006	95% CI	Multiplicative Increase in OR for Each Year After 2006	95% CI
	All Abstracts (N = 20,718)	Accepted for Presentation (n = 12,058)	Publication Only (n = 8,660)				
Any FCOI	36	44	25	2.0†	1.8 to 2.3	1.05‡	1.03 to 1.10
Employment	19	24	13	2.1†	1.8 to 2.5	1.0097	0.95 to 1.04
Stock	14	18	9	2.2†	1.9 to 2.7	1.01	0.96 to 1.07
Consultant	20	27	12	2.5†	2.2 to 2.9	1.03	0.98 to 1.09
Honoraria	17	23	10	2.4†	2.0 to 2.8	1.045	0.99 to 1.09
Research	22	29	13	2.2†	1.9 to 2.6	1.067‡	1.01 to 1.11
Expert witness	1.1	1.6	0.5	3.3†	1.7 to 5.8	1.00	0.82 to 1.21

Abbreviations: ASCO, American Society of Clinical Oncology; FCOI, financial conflict of interest; OR, odds ratio.

*OR for FCOIs among abstracts accepted for presentation versus abstracts accepted for publication only.

† $P \leq .001$ for increased odds of FCOI in accepted abstracts (compared with publication only).

‡ $P = .011$ for increased odds of FCOI in accepted abstracts (compared with publication only).

Fig 1. Presence of financial relationships by meeting placement prominence. FCOI, financial conflict of interest.

employment, consultancy, honoraria, and research funding relationships were more frequently associated with higher meeting placement prominence compared with publication only.

To account for potential differences between abstracts selected for presentation and publication only, we also explored abstract prominence using general posters as a benchmark for comparison in Table 3 (n = 12,058). ORs for these comparisons are listed in Table 4. Similarly, abstracts with FCOIs had higher meeting placement prominence compared with general posters ($P < .001$ for nearly all relationships). ORs compared with general posters were 7.3 (95% CI, 2.5 to 21.4) for plenary session, 2.2 (95% CI, 1.8 to 2.7) for clinical science symposium, 1.9 (95% CI, 1.6 to 2.1) for oral presentation, and 1.7 (95% CI, 1.5 to 1.8) for poster discussion ($P < .001$).

Abstracts in which authors disclosed financial relationships had significantly better PRSs compared with those without financial relationships. For all abstracts, PRS was 2.76 (95% CI, 2.75 to 2.77) with FCOIs versus 3.01 (95% CI, 3.001 to 3.02) without FCOIs ($P < .001$). Excluding publication only abstracts, significant differences in mean PRS remained; mean PRS for abstracts with FCOIs was 2.62 (95% CI, 2.61 to 2.63) versus 2.73 (95% CI, 2.71 to 2.73) without FCOIs ($P < .001$). Including all abstracts, the OR was 0.32 (95% CI, 0.30 to 0.35; $P < .001$), indicating that the odds of a financial relationship decreases by a multiplicative factor of 0.32 as the PRS worsens by 1 point. Excluding publish only abstracts, the OR was 0.41 (95% CI, 0.36 to 0.45; $P < .001$), indicating that the odds of a financial relationship

decreases by a multiplicative factor of 0.41 as the PRS worsens by 1 point.

DISCUSSION

Our analysis of the ASCO annual meeting over a recent 5-year period revealed that abstracts with authors who report financial relationships with commercial interests received better PRSs and achieved greater meeting placement prominence than abstracts whose authors did not disclose financial relationships. Our analysis also found that financial relationships with commercial interests were reported more frequently over time, suggesting an increase in relationships, greater disclosure, or both. It is important to note, however, that the significant yet modest increases in FCOIs annually might be difficult to detect without a large database such as this.

Prior work has shown that FCOIs among biomedical researchers are common.^{4,11} Specifically, within oncology, FCOIs are increasing over time.¹² A 2005 cross-sectional survey of cancer clinical trials and editorials revealed that 44% of clinical trials were entirely or partially funded by industry.¹³ Another study reported that 23% of all abstracts and 60% of plenary session abstracts from 2004 to 2005 at the ASCO meeting reported at least one author with an FCOI.¹¹ Before the years evaluated in our study, ASCO revised its policy for disclosure of

Table 2. ASCO Meeting Placement Prominence by Financial Relationships (FCOIs) of Any Author With Publication Only As Benchmark for Comparison

Placement Category	No. of Abstracts (N = 20,718)	Any FCOI (%)	Stock Relationship (%)	Employment Relationship (%)	Consultant Relationship (%)	Honoraria Relationship (%)	Research Funding (%)
Plenary session	23	82.6*	30.4*	39.1*	65.2*	52.2*	69.6*
Clinical science symposium	369	59.1*	29.8*	37.4*	39.8*	29.8*	43.9*
Oral presentation	1,066	54.9*	22.7*	27.8*	38.0*	33.3*	38.0*
Poster discussion	2,526	52.4*	21.9*	27.1*	34.5*	28.1*	35.6*
General posters	8,074	39.5*	15.8*	21.3*	22.1*	19*	24.7*
Publication only	8,660	25.3 (reference)	8.8 (reference)	12.7 (reference)	11.7 (reference)	10 (reference)	13.4 (reference)

Abbreviations: ASCO, American Society of Clinical Oncology; FCOI, financial conflict of interest.

* $P \leq .001$ (from logistic regression odds ratios).

Table 3. ASCO Meeting Placement Prominence by Financial Relationships (FCOIs) of Any Author With General Posters As Benchmark for Comparison

Placement Category	No. of Abstracts (N = 12,058)	Any FCOI (%)	Stock Relationship (%)	Employment Relationship (%)	Consultant Relationship (%)	Honoraria Relationship (%)	Research Funding (%)
Plenary session	23	82.6*	30.4†	39.1‡	65.2*	52.2*	69.6*
Clinical science symposium	369	59.1*	29.8*	37.4*	39.8*	29.8*	43.9*
Oral presentation	1,066	54.9*	22.7*	27.8*	38.0*	33.3*	38.0*
Poster discussion	2,526	52.4*	21.9*	27.1*	34.5*	28.1*	35.6*
General posters	8,074	39.5 (reference)	15.8 (reference)	21.3 (reference)	22.1 (reference)	19.0 (reference)	24.7 (reference)

Abbreviations: ASCO, American Society of Clinical Oncology; FCOI, financial conflict of interest.

* $P \leq .001$.

† $P = .062$.

‡ $P = .044$.

FCOIs, and increasing uptake and awareness of this policy may explain some of the continued increase in prevalence of FCOIs that we identified over time. Given continued reliance on self-reporting of FCOIs, it is likely that we will continue to underestimate the true prevalence of relationships.

FCOI does seem to correlate with potential design and reporting biases in clinical research. Phase III trials presented at the ASCO annual meeting were more likely to be published sooner if they had industry funding.¹⁴ An analysis of randomized trials in multiple myeloma showed both a trend toward higher quality scores and potential bias favoring positive results as demonstrated by violation of the equipoise principle among trials funded solely or in part by for-profit organizations compared with governmental or nonprofit organizations.¹⁵ Outside of oncology, a similar association between FCOI and publication bias (ie, reporting only positive studies) has been hypothesized.¹⁶⁻¹⁹ As others have noted, although the association between FCOI and positive results may reflect publication bias, it may also reflect differences in trial design, research questions, or pretrial evaluation that reflect other aspects of industry involvement.^{12,20} It is important to note that these retrospective studies did not specifically test for publication bias but hypothesized that publication bias might exist and explain an association between positive results and industry involvement in research.

To our knowledge, no study to date has examined the association between the research prominence of studies or abstract presentations and the FCOIs of those reporting the results in a scientific forum.

Close collaboration between biomedical researchers and industry has facilitated the development of many new medical therapies.²¹ This is an area in which key interests may be aligned: the public seeks effective new therapies, biomedical researchers wish to translate basic discoveries into treatments, and industry wishes to develop new products.²² Our findings provide evidence that these benefits may not be just theoretical; rather, they do exist.

Our study has several strengths, including the examination of a large number of abstracts submitted to the ASCO annual meeting in 2006 and 2008 to 2011. These data were prospectively collected, including comprehensive information regarding authorship, disclosures of relationships, PRSs, funding sources, and types of sessions. The data were extremely robust and included all abstracts submitted to the ASCO annual meeting during that time period (with the exception of 2007), minimizing bias from incomplete information. Furthermore, given the global scientific prominence of the ASCO meeting, this analysis should serve as a generalizable evaluation of contemporary clinical cancer research during the period of interest.

Nevertheless, our study should be interpreted in light of some limitations. Ascertainment of FCOIs relied on author self-disclosure, which may be an underestimate of the actual prevalence. It is possible that increases in reporting may account for a portion of the incremental increase in FCOIs seen annually. Prior research does show that self-disclosure does underestimate the presence of actual relationships.²³ However, with a shift in culture to greater self-disclosure, this may not be as underestimated as it has been previously. Whether underreporting of FCOIs is more or less likely among more prominent abstracts is unknown. Further, we excluded the year 2007 from our analysis because ascertainment of data was incomplete. Analysis of 6 consecutive years of the ASCO annual meeting would have been optimal. Although the absolute difference in mean PRS of 0.11 between abstracts with FCOIs versus those without seems small, this difference is actually 0.30 times the standard deviation of the scores. This falls in the range of a moderate effect size, defined as follows: 0.20 is small effect size, 0.50 is moderate effect size, and 0.80 is large effect size. Hence, the absolute difference of 0.11 is relevant because the scores did not have substantial variability.²⁴ Additionally, we consider only ASCO abstracts as a measure of research prominence, and we did not evaluate other potential measures such as impact factor of publication, media coverage, or citations in subsequent literature. However, given that the ASCO annual meeting is the largest international oncology meeting, there is value to understanding FCOIs among ASCO abstracts. There is evidence that abstract presentations have led to practice-changing behaviors even before full publication.^{25,26} With regard to mean PRS, an analysis of concordance between peer reviewers and their scores would have been optimal, but these details were not available in the de-identified data set. Finally, meeting placement prominence and PRS are derived from subjective assessment of the research by expert peer reviewers. There are multiple factors, in addition to PRS, that may influence meeting placement. The potential effects of these reviewers' FCOIs on their abstract scoring were not examined or accounted for in our study.

Nevertheless, our finding that FCOI correlates with better PRSs and greater prominence at an international scientific meeting has important implications for our understanding of cancer research and relationships with industry. Determining why this correlation exists is critical. Does this reflect commercial bias in the conduct, analysis, or

Table 4. ORs for ASCO Meeting Placement Prominence by Financial Relationships (FCOIs) of Any Author With General Posters As Benchmark for Comparison

Placement Category	No. of Abstracts (N = 12,058)	Any FCOI		Stock Relationship		Employment Relationship		Consultant Relationship		Honoraria Relationship		Research Funding	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Plenary session	23	7.3*	2.5 to 21.4	2.3†	1.0 to 5.7	2.4‡	1.0 to 5.5	6.6*	2.8 to 15.7	4.6*	2.0 to 10.5	7.0*	2.9 to 17.0
Clinical science symposium	369	2.2*	1.8 to 2.7	2.3*	1.8 to 2.9	2.2*	1.8 to 2.7	2.3*	1.9 to 2.9	1.8*	1.4 to 2.3	2.4*	1.9 to 2.9
Oral presentation	1,066	1.9*	1.6 to 2.1	1.6*	1.3 to 1.8	1.4*	1.2 to 1.6	2.2*	1.9 to 2.5	2.1*	1.8 to 2.4	1.9*	1.6 to 2.1
Poster discussion	2,526	1.7*	1.5 to 1.8	1.5*	1.3 to 1.7	1.4*	1.2 to 1.5	1.9*	1.7 to 2.1	1.7*	1.5 to 1.8	1.7*	1.5 to 1.8
General posters	8,074	1 (reference)		1 (reference)		1 (reference)		1 (reference)		1 (reference)		1 (reference)	

Abbreviations: ASCO, American Society of Clinical Oncology; FCOI, financial conflict of interest; OR, odds ratio.

* $P \leq .001$.† $P = .062$.‡ $P = .044$.

reporting of our most prominent cancer research, suggesting a scientific integrity problem? Alternatively, this may reflect bias in review and selection of research for presentation, with important science that is not supported by commercial interests receiving less attention, suggesting a need to address the integrity of our system of scientific education and communication to clinicians and the public. However, it is also possible that this correlation is found because collaboration and interaction between commercial interests and clinical researchers yield more important scientific results that merit the prominence found in our study.

One explanation for our findings is that industry may seek out and forge relationships with the most prominent academic cancer researchers who perform high-profile and high-quality work, thereby creating an association between FCOIs and prominent research. It is also possible that academic cancer researchers seek out relationships with industry with proprietary technology, in an effort to participate in more important and influential research. Thus, there may be significant benefits to these relationships. It may be within the public interest to foster, rather than discourage, some relationships, and there may be a need for greater scrutiny on the degree to which FCOIs are managed or prohibited and the impact of such policies over time.

The need for disclosure and FCOI policy arises from a concern that industry relationships will bias the conduct and interpretation of scientific data. Profit motives by the manufacturer, shared with the clinical researcher through FCOIs, could potentially lead to poor or inaccurate science and ultimately harm the public interest. Initial policies were intended to provide transparency into the system of FCOIs and, in many settings, have moved from disclosure to prohibition. For example, investigators with either stock in a company or who act as promotional speakers on behalf of a company (ie, honoraria) are categorized as comparable to employees of a company and are now prohibited from presenting study information at the ASCO annual meeting, based on both ASCO policy and Continuing Medical Education rules. Consulting for industry and receiving research funding are not currently viewed as presenting the same degree of conflict/influence or potential as promotional speaking, but one can imagine that this might shift over time. If FCOIs are purely adverse to the public interest, then there is a need to be concerned about their prevalence, their increase over time, the accuracy of reporting, and how they can best be managed and curtailed.

However, our finding that FCOIs correlate with better PRs and meeting prominence suggests that a note of caution is needed. Is this association artifactual or based on valid emergence of higher quality work when clinical science is performed by those with FCOIs? Can the associations with industry labeled FCOI contribute to higher quality work? Perhaps for FCOIs such as honoraria for promotional speaking, the association is artifactual (ie, derived from industry hiring researchers who are already doing prominent work to give talks on their behalf), whereas for others, such as consulting or research funding, the positive association is directly related to the work presented. There is

an urgent need to better understand that nature of the association documented in this study.

In conclusion, to our knowledge, this report provides the first primary evidence regarding the prominence of cancer research conducted by authors with self-disclosed financial relationships. Obtaining empiric evidence of the effects of FCOIs is important because these relationships are common in all of medicine and for maintenance of public trust in the medical research establishment.²⁷ In designing institutional and organizational conflict of interest policies, the potential benefits of these relationships should be considered. Much has been written about the perceived distinct benefits associated with industry support of medical research, but little evidence of these benefits has been demonstrated to date.^{3,21,28,29} Continued examination of the relationship between FCOIs and their impact on the quality of biomedical research is crucial to inform conflict of interest policies that truly foster public interest.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Although all authors completed the disclosure declaration, the following author(s) and/or an author's immediate family member(s) indicated a financial or other interest that is relevant to the subject matter under consideration in this article. Certain relationships marked with a "U" are those for which no compensation was received; those relationships marked with a "C" were compensated. For a detailed description of the disclosure categories, or for more information about ASCO's conflict of interest policy, please refer to the Author Disclosure Declaration and the Disclosures of Potential Conflicts of Interest section in Information for Contributors. Authors marked with an asterisk () are participants in ASCO's Disclosure Management System Pilot; their disclosure is not limited to subject matter under consideration in this article and includes payments to themselves, an immediate family member (I), and/or their institutions (INST). For information on the pilot program, or to provide feedback, please visit coipilot.asco.org.*

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