





BMJ Open Conflict of interest and funding in health communication on social media: a systematic review

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ABSTRACT

Objectives To synthesise the available evidence on the reporting of conflicts of interest (COI) by individuals posting health messages on social media, and on the reporting of funding sources of studies cited in health messages on social media.

Data sources MEDLINE (OVID) (2005–March 2022), Embase (2005–March 2022) and Google Scholar (2005–August 2022), supplemented with a review of reference lists and forward citation tracking.

Design Reviewers selected eligible studies and abstracted data in duplicate and independently. We appraised the quality of the included studies using the Mixed Methods Appraisal Tool. We summarised the results in both narrative and tabular formats. We followed the PRISMA 2020 checklist for reporting our study.

Results Of a total of 16 645 retrieved citations, we included 17 eligible studies. The frequency of reporting of conflicts of interest varied between 0% and 60%, but it was mostly low. In addition, a significant proportion, ranging between 15% and 80%, of healthcare professionals using social media have financial relationships with industry. However, three studies assessed the proportion of conflicts of interest of physicians identified through Open Payment Database but not reported by the authors. It was found that 98.7–100% of these relationships with industry are not reported when communicating health-related information. Also, two studies showed that there is evidence of a potential association between COI and the content of posting. No data was found on the reporting of funding sources of studies cited in health messages on social media.

Conclusions While a significant proportion of healthcare professionals using social media have financial relationships with industry, lack of reporting on COI and undisclosed COI are common. We did not find studies on the reporting of funding sources of studies cited in health messages on social media.

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INTRODUCTION

The traditional internet has expanded to a more dynamic and interactive entity referred to as ‘Web 2.0’.¹ Web 2.0 allows its users to create and share content as well as communicate and

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This is the first systematic review on the subject of reporting of conflicts of interest in social media.
- ⇒ The study applied standard methodology for conducting systematic reviews (including a comprehensive search, duplicate screening and data abstraction).
- ⇒ We found a relatively limited number of eligible studies.
- ⇒ Meta-analysis was not conducted due to heterogeneity of the included studies.

interact with other users.¹ It differs from Web 1.0 in that content and applications of the web are no longer necessarily created by specific individuals but by all internet users, and constantly modified by them.² It includes various social media platforms such as blogs, Twitter, Facebook, Instagram and YouTube.¹

Many individuals rely on the internet to answer their medical questions. While 90% of healthcare professionals use social media platforms for personal purposes, 65% use them for professional reasons such as promotion of health behaviours, discussions of healthcare policy, communicating with colleagues and education of patients, peers and students.³ Within recent years, the use of social media by healthcare professionals has increased significantly with some estimates reporting increases from 42% in 2010 to as high as 90% in 2011.⁴

However, professionals may have conflicts of interest (COI) that may bias their postings on their platforms.⁴ In general, conflicts of interest can be either individual or institutional, financial or non-financial.⁵ While financial COI entail receiving grants, personal fees, trips, honoraria or stock ownership, non-financial COI include career advancement, political or ideological beliefs, strong scientific opinions, fame, and social interests.

Reporting COIs allow their acknowledgement and incorporation in the public’s interpretation

of information posted on social media.⁴ That in turn should enhance public trust in the medical profession. Many medical associations have developed guidelines on physicians' use of social media, including reporting of COI.⁶⁻⁹ However, there are many unique challenges to reporting and managing COI on social media. These challenges arise from the characteristics of social media, such as the rapid spread of information, user-generated content and character limitation.⁴ Users may share products or services with which they may have financial or non-financial interest, without disclosing their conflicts. This blurring of boundaries between personal opinions, professional advice and undisclosed relationships can mislead the public and compromise the credibility of health communication.

Very limited research has been done on the topic of conflicts of interest and funding in social media. Previous studies considered COI reporting as part of measures of online professionalism,¹⁰ or as an indicator to assess credibility and quality of online information.¹¹⁻¹⁴ McCarthy *et al* discussed the urgent need for 'more research examining the prevalence, impact of physicians' COI on social media content, and appropriate management strategies'.⁴

The objective of this study is to synthesise the available evidence on the reporting of conflicts of interest by individuals posting health messages on social media, and on the reporting of funding sources of studies cited in health messages on social media.

METHODS

Design overview and definitions

We conducted a systematic review of the published peer-reviewed literature. We have followed Akl *et al*'s framework for defining, categorising and assessing conflicts of interest in health research.⁵ We referred to the following definition of COI: 'a COI exists when a past, current, or expected interest creates a significant risk of inappropriately influencing an individual's judgment, decision, or action when carrying out a specific duty'.⁵

We considered COI as a concept relevant to a social media account of an individual or an organisation (which would include the funding by a specific organisation). We considered funding as a concept relevant to a research study or project.

Table 1 Problems associated with scenarios varying by whether COI exists or not, and whether a COI reporting statement is available

	No COI exists	COI exists
No statement reporting on COI	Lack of reporting but no undisclosed COI	Lack of reporting with undisclosed COI
Statement reporting no COI	No problem	Undisclosed COI
Statement reporting COI	Over-reporting of COI	No problem
COI, conflicts of interest.		

Table 1 shows the terms used for different scenarios that vary by whether COI exists or not, and whether a COI reporting statement is available.

We used the following definition of social media: 'a group of applications which is based on ideological and technological foundations of Web 2.0 that allows the creation and exchange of user-generated content'.¹

We developed and published a detailed protocol for this review on protocols.io,¹⁵ (included in online supplemental file 1). We followed the Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) 2020 checklist to report our study.¹⁶

Eligibility criteria

We included articles that meet the following eligibility criteria:

- ▶ Topic: conflict of interest on social media or funding.
- ▶ Type of social media: all platforms that fit the Web 2.0 definition, including blogs, Facebook, Instagram, Twitter, LinkedIn and YouTube.
- ▶ Field: health field, including clinical, health systems and policy, public health and biomedical sciences.
- ▶ Study design: any primary study including surveys, research letters and qualitative studies. We excluded editorials, abstracts, letters to the editor, reviews and opinion pieces.
- ▶ Date of publication: 2005 to current (2005 being the year of the rise of Web 2.0).
- ▶ Language: any language.

Search strategy

We searched MEDLINE (OVID) (2005–March 2022), Embase (2005–March 2022) and Google Scholar (2005–August 2022). The search strategies included both keywords and medical subject headings (MeSH terms) relevant to the concepts of conflict of interest, funding, and social media. We developed the search strategies with the help of an experienced librarian and included them in the supplementary file (online supplemental file 2). We conducted our search in the databases with no restrictions on the language. We restricted the search by year (2005 and beyond). In addition, we screened the reference lists of included studies and forward searched for publications citing these included studies via Google Scholar.

Study selection

Teams of two reviewers screened in duplicate and independently the titles and abstracts of citations identified by the search using Rayyan screening tool. We retrieved the full texts of citations judged as potentially eligible by at least one reviewer. Reviewers subsequently screened the full texts in duplicate and independently. They resolved any disagreement by discussion or with the help of a third reviewer when consensus could not be reached. We used standardised and pilot-tested screening tools. We recorded the reasons for exclusion and summarised the results of the selection process

using the 2020 PRISMA flow diagram.¹⁶ The reviewers conducted calibration exercises before the screening process.

Data collection process

We developed a standardised and pilot-tested data extraction form with detailed instructions. Two teams of two reviewers abstracted the data from eligible studies independently and in duplicate using a standardised pilot tested form. The reviewers completed calibration exercises before starting the data collection process. They resolved any disagreements by discussion between the two reviewers or with the help of the principal investigator. We extracted the following variables into a Word document:

1. General characteristics of the study:
 - Type of healthcare professionals: physicians, nurses or other.
 - Year of conduct.
 - Study design.
 - Funding of the study.
 - COI of study authors.
 - Country of study authors.
2. Social media:
 - Type: eg, Facebook, Twitter, Instagram, YouTube, LinkedIn.
 - Number of posts, videos or blogs assessed.
 - Language of posts, videos or blogs.
 - Country of the subjects of study.
 - Topic focus of the study, if any.
3. Conflicts of interest:
 - Type of conflict of interest.
 - Subject of conflict of interest.
 - Source of conflict of interest.
 - Tools used to assess the presence of financial relationships.
 - Prevalence of conflict of interest, verified or suspected.
 - Frequency of reporting of conflict of interest.
 - Proportion of undisclosed conflict of interest.
 - Proportion of organisations reporting undisclosed conflict of interest.
 - Association between conflict of interest and post content.
4. Funding:
 - Source of funding.
 - Amount of funding.
 - Role of funder.

Quality assessment and data synthesis

A team of two reviewers assessed independently the quality assessment of included studies using the Mixed Methods Appraisal Tool. This tool is designed for the appraisal stage of systematic reviews that include qualitative, quantitative or mixed methods studies.¹⁷ Due to the nature of the data, we report the results in narrative and tabular formats.

Patient and public involvement

We did not involve patients or the public in the design, conduct, reporting or dissemination plans of our research.

RESULTS

Study selection

The PRISMA flowchart (online supplemental file 3) depicts the study selection process. We excluded 198 studies at the full-text screening stage for the following reasons: not about conflicts of interest or funding (n=116), not about social media (n=33) and not the study design of interest (n=66) (online supplemental file 4). We judged 17 studies to be eligible.

General characteristics

All 17 included studies were cross-sectional and reported quantitative data. [Table 2](#) shows the remaining general characteristics of these studies. The majority of studies were surveys of social media posts (88%), had the USA or Canada as the country of the study subjects (53%), focused on posts in English language (88%) and focused on a specific health specialty (71%). The median year of posts upload date was 2018. The social media most assessed were Twitter (29%), YouTube videos (29%) and blogs (29%).

[Table 3](#) shows the characteristics of COI in health communication on social media in the included studies. The majority of the studies had physicians as their study population (76%), specified industry as the source of COI (65%) and did not specify the type (whether financial or non-financial) of COI studied (59%).

Findings

We did not find evidence on the reporting of funding sources of studies cited in health messages on social media. With regards to COI reporting, the included studies assessed one or more of the following five outcomes: (1) prevalence of COI, verified or suspected (n=5); (2) frequency of reporting of COI (n=8); (3) proportion of undisclosed COI (n=3); (4) proportion of organisations reporting undisclosed COI (n=2); and (5) association between COI and post content (n=2). We provide the full details in online supplemental file 5 and summarise them narratively in the following paragraphs. Online supplemental file 6 includes the results of the quality assessment of the included studies. No major concerns were noted, except unclear appropriate measurements for 11 out of the 17 included studies.

Prevalence of COI, verified or suspected

[Table 4](#) presents the results from five studies on the prevalence of COI. The prevalence of verified COI (using Open Payment Database) ranged between 15% and 80%. The prevalence of suspected COI (based on authors' judgement) ranged between 0% and 80%.

Frequency of reporting COI

[Table 5](#) presents the results of eight studies on the frequency of COI reporting. The frequency ranged from

Table 2 General characteristics of included studies (N=17)

	n (%)
Study design	
Survey of posts	13 (76)
Median sample size (IQR)	159 (879)
Survey of individuals or accounts	4 (24)
Median sample size (IQR)	117 (205)
Funding of the study	
Funded	4 (24)
Not funded	6 (35)
Not reported	7 (41)
Conflict of interest of study authors	
Conflict of interest reported	5 (29)
No conflict of interest	11 (65)
Not reported	1 (6)
Study focused on a specific health specialty	12 (71)
Type of social media	
Twitter	5 (29)
Blogs	5 (29)
YouTube	5 (29)
Not specified	2 (12)
Language of posts*	
English	15 (88)
Other languages	4 (24)
No language restriction	1 (6)
Time period covered	
≤1 year	4 (24)
11–12 years	4 (24)
Not specified	9 (53)
Median year of post date (IQR)	2018 (3)
Country of the subjects of study*	
USA	7 (41)
Canada	2 (12)
Europe	2 (12)
Asia	2 (12)
UK	1 (6)
Australia	2 (12)
Not reported	6 (35)
No restrictions to countries	1 (6)
Outcome*	
Prevalence of COI	5 (29)
Frequency of reporting of COI	8 (47)
Proportion of undisclosed COI	3 (18)
Proportion of organisations reporting undisclosed COI	2 (12)
Association between COI and post content	2 (12)

*Some studies included more than one language, country or outcome. COI, conflicts of interest; IQR, Interquartile range; UK, United Kingdom; USA, United States of America.

Table 3 Characteristics of COI in health communication on social media assessed in the included studies (N=17)

	n (%)
Subjects of COI	
Physicians	13 (76)
Medical students	1 (6)
University	4 (24)
Healthcare entity (hospital, clinic)	4 (24)
Others*	9 (53)
Source of COI	
Industry	11 (65)
Others†	2 (12)
Not specified	6 (35)
Types of COI	
Financial	7 (41)
Not specified	10 (59)

*Others: non-physician health professionals (nurses, dietitians, nutritionists, pharmacists, chiropractors, acupuncturists), patients, societies/organisations (foundations, governmental institutions, academic journals), industry, news media and bloggers.
†Others: Volunteer donation, foundation, insurer, not-for-profit, webhost or corporation entity.
COI, conflicts of interest.

0% to 60%. It was not clear from any of the studies whether the percentage referred to the number of COI statements (whether reporting the existing or not of COI) or to the number of statements reporting a COI.

Proportion of undisclosed COI

We identified three studies reporting on the proportion of undisclosed COI. The proportion values were 99%, 100% and 100%.^{18–20} All three studies assessed the proportion of COI identified through Open Payment Database but not reported by the authors. It was not clear from any of the studies whether the proportion referred to those who reported no COI or those who had no COI statement.

Proportion of organisations reporting undisclosed COI

We identified two studies on the proportion of organisations reporting undisclosed COI. Chretien²¹ surveyed 130 deans of student affairs from institutions in the Association of American Medical Colleges. Out of the 78 deans who responded, 3% (2/78) reported unprofessional incidents related to product endorsement without reporting COI.

Greysen *et al*¹⁰ surveyed 48 executive directors of state medical boards about US-based physicians' violations of online professionalism. An estimated percentage of 56% indicated that they received reports of violations related to 'failure to reveal conflicts of interest online'.

Association between COI and content of posting

We identified two studies on the association between COI and the content of posting. Kaestner *et al*²⁰ analysed tweets

Table 4 Results from five studies on the prevalence of COI

Study	Social media	Health condition	Prevalence of COI (n of authors with COI / N total authors)
Verified			
Niforatos <i>et al</i> ¹⁸	Blogs	Emergency medicine	15.4% (45/292) of US-based healthcare providers
Tao <i>et al</i> ³¹	Twitter	Haematology-oncology	79.5% (504/634) of US-based haematologist-oncologists
Walradt <i>et al</i> ¹⁹	Twitter	Gastrointestinal endoscopy	37% (7/19) of tweets that mentioned the name of a medical device were posted by a US physician who had received a payment
Suspected			
Toth <i>et al</i> ¹³	Blogs	Detox diets industry	80% (4/5) of nutritionist blog posts had a 'potential' COI None of registered dietitians blog posts had a 'potential' COI
Chretien <i>et al</i> ³²	Twitter	General	0.2% (12/5156) of tweets involved 'possible' conflicts of interest

COI, conflicts of interest.

of 156 US-based haematologist-oncologists on oncology drugs; they also verified the physicians' financial conflicts of interest using Open Payments Database. The authors found that tweets were more likely to be positive ($p=0.02$) when they related to drugs from a company for which they had a financial COI compared with drugs from a company for which they did not have a financial COI.

Hessari *et al*²² assessed 1156 tweets of alcohol industry-funded organisations and 1649 tweets of non-alcohol industry-funded charities, with all entities aiming to raise alcohol awareness. While 10.1% ($n=166/1649$) of

the non-alcohol industry-funded organisations tweets mentioned alcohol marketing, advertising, sponsorship, issues related to alcohol pricing and physical health harms, none ($n=0/1156$) of the alcohol industry-funded organisations tweets mentioned those topics.

DISCUSSION

Summary of evidence

We systematically reviewed the literature for the reporting of COI by individuals posting health messages on social

Table 5 Results from eight studies on the frequency of reporting COI

Study	Social media	Health condition	Frequency (n of posts reporting COI / N total posts)
Betschart <i>et al</i> ³³	YouTube	Treatment options for lower urinary tract symptoms with benign prostatic hyperplasia	2% (2/159) (COI reporting)
Lagu ³⁴	Blogs	General	0% (0/271) (COI reporting)
Nishizaki <i>et al</i> ³⁵	Japanese YouTube videos	Paediatrics: nocturnal enuresis	0% (0/72) (COI reporting)
Pratsinis <i>et al</i> ³⁶	YouTube	Treatment options of urinary stones	9% (9/100) (COI reporting)
Pratsinis, <i>et al</i> ³⁷	YouTube	Benign prostatic hyperplasia, prostate cancer and urinary stone disease	'Majority' did not have COI disclosure Estimated: 46/240 (COI reporting)
Vu <i>et al</i> ³⁸	YouTube	Treatment of prostate cancer: surgical therapy vs radiotherapy	10% (surgery) and 5% (radiotherapy) (COI reporting)
Miller <i>et al</i> ¹²	Blogs	General	15.6% (148/951) of health blogs reported sponsorship
Shrank <i>et al</i> ³⁹	Social networking sites (93% featured blogs)	Diabetes information	1. Industry sponsorship: <ul style="list-style-type: none"> - Pharmaceutical manufacturers: 53.3% (8/15). - Diabetes device manufacturers: 60% (9/15). - Webhost sponsorship: 13.3% (2/15) 2. Foundation sponsorship: 20% (3/15). 3. Voluntary donations: 26.7% (4/15). 4. No industry sponsorship: 20% (3/15). 5. Insurers: 20% (3/15). 6. Not-for-profit: 26.7% (4/15).

COI, conflicts of interest.

media, and on the reporting of funding sources of studies cited in health messages on social media. The frequency of reporting of COI varied across studies but was mostly low (less than 15%). A significant proportion of healthcare professionals using social media have financial relationships with industry (up to 80%). However, most of these relationships are not reported when communicating health-related information. Also, there is evidence of a potential association between COI and the content of posting. We did not find studies on the reporting of funding sources of studies cited in health messages on social media.

Strengths and limitations

To the best of our knowledge, this is the first systematic review about conflicts of interest and funding in social media. We have applied standard methodology based on the principles of conducting systematic reviews (including a comprehensive search, duplicate screening, data abstraction and quality appraisal).

Unfortunately, a limited number of studies have addressed the topic of reporting of conflicts of interest in social media, and none has explored the reporting of funding of studies cited in health messages on social media. In addition, the included studies were heterogeneous in terms of study designs and outcomes reported, which prevented us from conducting a more advanced synthesis.

Two of the included studies found an association between COI and the content of social media posting. However, it is not clear whether the relationship is causal, that is, having it is the COI that leads to a specific point of view.

Implications for practice and research

Our findings are of high importance with the increasing reliance of patients and the public on social media as a source of information and medical advice. Furthermore, there is evidence that the use of social media increases significantly during natural hazards and crises.²³ This is particularly relevant to the COVID-19 information shared with the public on novel therapeutic agents which may have harmful side effects.²⁴

This is particularly important, considering our definition of COI. Indeed, the specific duty for individuals posting on social media (particularly professional figures with a high number of followers) is to provide accurate and reliable information. This is extremely important given the potential impact on both clinical and public health decisions. Having conflicts of interests, whether financial or non-financial, poses a significant risk of biasing the opinions of individuals sharing their opinions on social media, leading to either misinformation or disinformation.

Given the above, reporting conflict of interest and funding on social media is a basic requirement for the responsible use of social media, particularly during crises

(such as the COVID-19 pandemic) associated with infodemics, misinformation and disinformation.²⁵

Healthcare professionals should be encouraged to disclose their conflicts of interest when sharing health-related content by referring to existing guidelines on physicians' use of social media.⁶⁻⁹ When using social media platforms with character limits such as Twitter, it is recommended to include a disclosure of interests by incorporating an electronic hyperlink to a standardised disclosure form, such as the one provided by the International Committee of Medical Journal Editors (<https://www.icmje.org/disclosure-of-interest/>). Alternatively, healthcare professionals can include a link to public reporting tools such as Center for Medicare and Medicaid Open Payments.⁴

In addition, clear guidance and policies are needed for the reporting of COI and funding by healthcare professionals when using social media. Such policies can be developed through a collaboration between regulatory entities, professional organisations and social media platforms. Healthcare providers can refer to published guidance on the reporting of funding.²⁶ In addition, improving public media literacy is essential to help users identify potential conflicts in health information and make informed decisions.

Future research should explore the impact of COI in social media on the perceptions, beliefs and behaviours of their users. Despite the extent of misinformation, and disinformation on social media during the COVID-19 pandemic,²⁷ no study has assessed the prevalence of COI in that context. Interestingly, one study found a correlation between the amounts received by academic infectious diseases physicians from Gilead Sciences, producer of remdesivir and their public opposition to the use of hydroxychloroquine.²⁸ Therefore, it would be important to explore the prevalence of COI in that context and the relationship between COI, misinformation and disinformation. From a methodological point of view, future studies should clearly distinguish between the absence of a COI statement and a statement of absence of COI.

Two crucial aspects that were outside the scope of this study, but deserve further consideration are the reporting of funding by the media and scientific journals and the declaration of interests by their editors.²⁹ Funding by, and financial relationships with pharmaceutical companies and other for-profit entities, have the potential to bias the information shared through media and journal publications. Indeed, a recent survey found that an extremely low percentage of peer reviewers and journal editors addressed study funding and authors' COI.³⁰ Also, the study found that peer reviewers and journal editors rarely declared their COI, or commented on their own or on each other's COI.

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Contributors EAA conceived and designed the study. VH and FM coordinated various parts of the study. EAA has full access to all the data in the study and takes responsibility for the integrity and accuracy of the data analysis. LH, VH and FM designed the search strategy. FM and RE-K ran the search and VH later updated it. VH, FHM, JK, HAN, AM, RE-K, DAO and RH contributed to the study selection process. VH, FM, AM, HAN and JK extracted the data. VH and FHM analysed the data. VH, FM, JK and EAA interpreted the data. FM wrote the first draft of the manuscript with EAA. VH worked on subsequent drafts with JK and EAA. All authors critically revised the manuscript and approved the final manuscript. EAA is the guarantor of the work and accepts full responsibility for the presented content.

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