

## Original article

## Publication misconduct and plagiarism retractions: a systematic, retrospective study

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**Abstract****Objectives:**

To investigate whether plagiarism is more prevalent in publications retracted from the medical literature when first authors are affiliated with lower-income countries versus higher-income countries. Secondary objectives included investigating other factors associated with plagiarism (e.g., national language of the first author's country affiliation, publication type, journal ranking).

**Design:**

Systematic, controlled, retrospective, bibliometric study.

**Data source:**

Retracted publications dataset in MEDLINE (search filters: English, human, January 1966–February 2008).

**Data selection:**

Retracted misconduct publications were classified according to the first author's country affiliation, country income level, and country national language, publication type, and ranking of the publishing journal. Standardised definitions and data collection tools were used; data were analysed (odds ratio [OR], 95% confidence limits [CL], chi-squared tests) by an independent academic statistician.

**Results:**

Of the 213 retracted misconduct publications, 41.8% (89/213) were retracted for plagiarism, 52.1% (111/213) for falsification/fabrication, 2.3% (5/213) for author disputes, 2.3% (5/213) for ethical issues, and 1.4% (3/213) for unknown reasons. The OR (95% CL) of plagiarism retractions (other misconduct retractions as reference) were higher ( $P < 0.001$ ) for first authors affiliated with lower-income versus higher-income countries (15.4 [4.5, 52.9]) and with non-English versus English national language countries (3.2 [1.8, 5.7]), for non-original research versus original research publications (8.4 [3.3, 21.3]), for case reports and series versus other original research types (4.2 [1.4, 13.0]), and for publications in low-ranked versus high-ranked journals (4.9 [2.4, 9.9]). Up until 2012, there were significantly ( $P < 0.007$ ) fewer 'serial offenders' (first authors with  $>1$  retraction) with publications retracted for plagiarism (11.5%, 9/78) than other types of misconduct (28.9%, 24/83).

**Conclusions:**

This is the first study to demonstrate that publications retracted for plagiarism are significantly associated with first authors affiliated with lower-income countries. These findings have implications for developing appropriate evidence-based strategies and allocation of resources to help mitigate plagiarism misconduct.

**Introduction**

The globalisation of clinical research is contributing to a rapid increase in the number of publications by authors from lower-income countries or countries

where English is not a national language<sup>1,2</sup>. Authors from these countries, where there may be strong incentives to publish in English-language journals, where cultural differences may result in a lack of awareness of the seriousness of plagiarism, or where non-native English speakers may have difficulty paraphrasing English text, may be at greater risk of plagiarism than other forms of misconduct<sup>3-10</sup>.

Previous findings on the factors involved in publication misconduct retractions showed that retracted publications with first authors who were affiliated with lower-income countries were associated more with misconduct retractions than mistake retractions<sup>11</sup>. However, the type of misconduct retraction was not reported in this study and no published studies have examined whether the type of misconduct (plagiarism or falsification/fabrication) differs between authors affiliated with lower- or higher-income countries. This question is important; without such evidence, how can resources to prevent misconduct be directed to the areas of most need? The hypothesis for the current study was that retracted publications with first authors affiliated with lower-income countries may be associated more with plagiarism misconduct retractions than retracted publications with first authors affiliated with higher-income countries. Hence, the primary objective of this study was to investigate whether plagiarism is more prevalent in retracted publications when first authors are affiliated with a lower-income country than with a higher-income country.

## Methods

### Study design

A systematic, controlled, retrospective bibliometric design was used, which was approved by an independent academic research statistician.

### Search strategy

The current study is an extended analysis of an existing dataset; the search strategy for the dataset was reported previously<sup>11</sup>. Briefly, the PubMed<sup>12</sup> special queries function 'Retracted Publications' was used to search the MEDLINE database (search filters: human studies; English; 1 January 1966 to 18 February 2008). Retracted publications were included only if the full original publication and retraction notice were available, and if the publication had been retracted because of misconduct. As reported previously, 11% (57/520) of all retracted publications did not have the original publication or retraction notice available online<sup>11</sup>.

### Definition of misconduct

Classification of retracted publications was based on the wording of the retraction notice. Publications retracted because of misconduct were characterised as (1) plagiarism, defined as "appropriation of another person's ideas, processes, results, or words without giving appropriate credit" and included self-plagiarism, (2) falsification, defined as "manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record" or (3) fabrication, defined as "making up data or results and recording or reporting them"<sup>13</sup>. Self-plagiarism was defined as "substantial reuse of previously published text by the same author" and included duplicate or redundant publications<sup>14</sup>. Publications retracted because of breaches of ethical guidelines (e.g., no ethics approval) or authorship disputes were classified as misconduct retractions, but were not categorised further<sup>14,15</sup>.

### Data extraction

Data were extracted using a standardised data collection tool<sup>11</sup>. Each publication retracted for misconduct was then classified according to the income and national language of the country affiliation of the first author, the type of publication, and the type and ranking of the publishing journal. The income of the country affiliations of the first authors was classified as low, middle, or high according to the World Bank Country Classification, which is based on gross national income per capita<sup>16</sup>. The national language(s) of the country affiliation of first authors was determined using the Ethnologue Data database<sup>17</sup>. Countries were classified into regions using the World Health Organization criteria<sup>18</sup>. Publications were classified as original research or non-original research (e.g., reviews, letters, or commentaries). Original research publications were further classified as case reports, case series, or other original research publications. Publishing journals were classified as general medicine according to the Journal Citation Reports 2008 (Institute for Scientific Information [ISI] Web of Knowledge<sup>19</sup>) subject category 'medicine, general & internal' or other. The ISI journal rankings were based on the most relevant subject category associated with the publication. Journal rank for each publishing journal was expressed as a percentage where the rank of each journal within the subject category was the numerator and the total number of journals within the subject category was the denominator. For analyses, the journal rank percentage was classified as low (100% to 67%), medium (66% to 34%), or high (33% to <1%). First authors were considered to be 'serial offenders' if they had more than one publication retracted because of misconduct. Assessment of 'serial offenders' was conducted

from January 1966 to February 2008 and from January 1966 to August 2012. A gap of at least 4 years between publications and possible retraction notices was considered reasonable. Previous research has shown the median time from publication of an article to its retraction was 17 months<sup>20</sup>.

## Data analysis

Statistical analyses were conducted by an independent academic statistician using SAS Version 9.1.3 (SAS Institute Inc., Cary, NC, USA). Frequency counts were performed for each misconduct type and each subcategory. Low- and middle-income countries were combined into one category because of the small number of low-income countries. As the primary interest was plagiarism, the comparator group comprised all other reasons for retractions (e.g., falsification or fabrication). Misconduct publications that were retracted for unknown reasons ( $n=3$ ) were excluded from all analyses. Odds ratios (OR) with 95% confidence limits (CL) and chi-squared tests were used to determine which of the following prespecified categories were associated with plagiarism using other misconduct types as the reference: income status (lower, higher) and national language (English, non-English) of the country affiliation of the first author, type of publication (original research, non-original research, case reports and series, other original research), journal type (general medicine, other), and journal rank (low, middle, high). A two-tailed Fisher's exact test was used to compare the proportion of 'serial offenders' who had publications retracted for plagiarism or other types of misconduct.

The proportion of publications retracted because of misconduct per 100,000 MEDLINE publications over time was calculated by dividing the total number of misconduct retractions by the total number of publications in MEDLINE for each 5-year period from 1978 onwards (search filters: human, English, date range). The first year that a publication was retracted from MEDLINE was 1978. In the current dataset, the last year that a publication was retracted from MEDLINE was 2007.

## Results

Of the publications retracted because of misconduct, almost half (41.8%, 89/213) were retracted because of plagiarism. The remaining misconduct publications (58.2%, 124/213) were retracted because of falsification or fabrication (52.1%, 111/213), author disputes (2.3%, 5/213), ethical issues (2.3%, 5/213), or unknown reasons (1.4%, 3/213). Of the publications retracted because of plagiarism, almost half (48.3%, 43/89) had a first author who was also listed as an author on the original publication, which may be an indicator of self-plagiarism. Of the

potential self-plagiarism publications, 65.1% (28/43) were original research, 18.6% (8/43) were reviews or commentaries, and 16.3% (7/43) were case reports or case series.

Plagiarism misconduct retractions were significantly associated with the income level of the country affiliation of the first author (Table 1, Figure 1); indeed this factor had the highest OR among all factors examined. The OR for a publication being retracted because of plagiarism was significantly higher for first authors affiliated with lower-income than those affiliated with higher-income countries (OR [95% CL]: 15.4 [4.5, 52.9],  $P<0.001$ ). Overall, 89.3% (25/28) of first authors affiliated with a lower-income country had a publication retracted because of plagiarism compared with 35.2% (64/182) of first authors affiliated with a higher-income country. Most of the lower-income countries with plagiarism misconduct retractions were located in the South-East Asian (e.g., India, Thailand), Western Pacific (China, Taiwan), or Eastern Mediterranean (e.g., Iran, Lebanon, Egypt) regions (Table 2).

Plagiarism misconduct retractions were also associated with the national language of the country affiliated with the first author, although this relationship did not appear to be as strong as that for income level (Table 1, Figure 1). The OR of a publication being retracted because of plagiarism was significantly higher for first authors affiliated with countries where English was not a national language than those affiliated with countries where English was a national language (OR [95% CL]: 3.2 [1.8, 5.7],  $P<0.001$ ). Overall, 55.5% (61/110) of first authors affiliated with a country where English was not a national language had a publication retracted because of plagiarism compared with 28.0% (28/100) of first authors affiliated with a country where English was a national language. Of the nine lower-income countries with plagiarism misconduct retractions, only India has English as a national language (Table 2).

Plagiarism misconduct retractions were also associated with publication type and journal factors (Table 1, Figure 1). The OR for a publication being retracted because of plagiarism was significantly higher for (1) non-original research (e.g., reviews, letters, commentaries) than original research, (2) case reports and case series than other types of original research publications, and (3) low-ranked journals than high-ranked journals. The OR for a publication being retracted because of plagiarism was not significantly different for (1) general medicine journals than other journal types or for (2) medium-ranked journals than high-ranked journals.

The proportion of all MEDLINE publications that were retracted because of plagiarism has increased in the past 5 to 10 years (Figure 2). In contrast, the proportion of publications retracted because of falsification or fabrication has remained relatively consistent. Retracting publications because of ethical issues or

**Table 1.** Effect of first author country affiliation, publication type, and journal factors on the odds ratio of a publication being retracted because of plagiarism misconduct\*.

Factor	Reason for retraction, % (n/n)		Odds ratio (95% CL)	P
	Plagiarism	Other		
First author country affiliation				
Lower-income country (vs higher-income)†	89.3% (25/28)	10.7% (3/28)	15.4 (4.5, 52.9)	<0.001
Higher-income country	35.2% (64/182)	64.8% (118/182)		
National language: non-English (vs English)‡	55.5% (61/110)	44.5% (49/110)	3.2 (1.8, 5.7)	<0.001
National language: English	28.0% (28/100)	72.0% (72/100)		
Publication type				
Non-original research (vs original research)\$¶	81.8% (27/33)	18.2% (6/33)	8.4 (3.3, 21.3)	<0.001
Original research	35.0% (62/177)	65.0% (115/177)		
Case reports and series (vs other original research)	66.7% (10/15)	33.3% (5/15)	4.2 (1.4, 13.0)	<0.001
Other original research	32.1% (52/162)	67.9% (110/162)		
Publishing journal factors				
General medicine (vs other)**	37.5% (9/24)	62.5% (15/24)	0.8 (0.3, 1.9)	0.607
Other journal type	43.0% (80/186)	57.0% (106/186)		
Low-ranked journal (vs high-ranked)††	68.0% (34/50)	32.0% (16/50)	4.9 (2.4, 9.9)	<0.001
Medium-ranked journal (vs high-ranked)††	48.6% (17/35)	51.4% (18/35)	2.2 (1.0, 4.6)	<0.001
High-ranked journal	30.4% (38/125)	69.6% (87/125)		

\*Misconduct publications retracted for other reasons were used as the reference. Misconduct publications retracted for unknown reasons ( $n=3$ ) were not included in the analyses.

†Income was classified as lower (low and middle) or higher (high) according to the World Bank Country Classification<sup>15</sup>.

‡National language was determined using the Ethnologue Data database<sup>16</sup>.

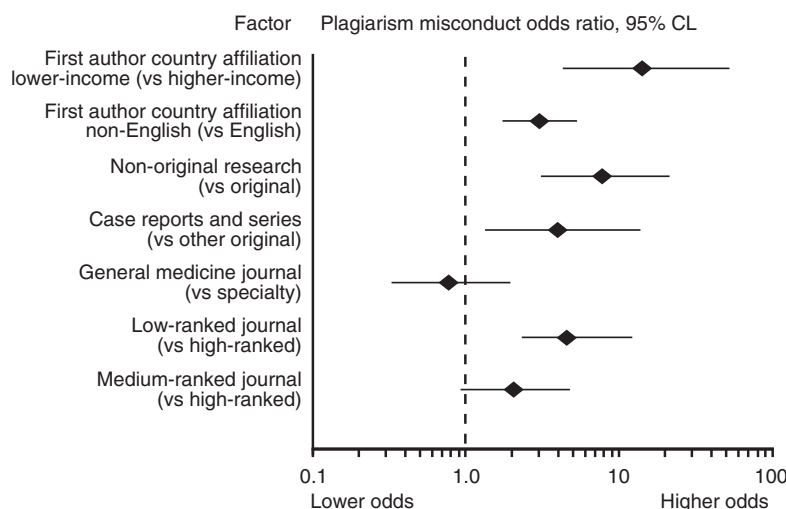
\$Non-original research publications were defined as reviews, letters, or commentaries.

¶Original research publications were defined as case reports, case series, or other.

\*\*General medicine journals were defined according to the Institute for Scientific Information (ISI) Journal Citation Reports subject category 'medicine, general & internal'.

††Journal rank for each publishing journal was expressed as a percentage where the rank of each journal within an ISI Journal Citation Reports subject category was the numerator and the total number of journals within the subject category was the denominator. Journal rank percentages were classified as low (100% to 67%), medium (66% to 34%), or high (33% to <1%).

CL, confidence limits; vs, versus.



**Figure 1.** Effect of first author affiliation, publication type, and the publishing journal factors on the odds ratio of a publication being retracted because of plagiarism. Publications were categorised according to (1) the income classification of the country affiliation of the first author according to the World Bank Country Classification<sup>16</sup>, (2) the national language of the country affiliation of the first author (English or non-English<sup>17</sup>), (3) the type of publication (original research or non-original research [reviews, letters, or commentaries]), (4) the type of original research publication (case reports and case series or other), (5) journal type (general medicine according to the Institute for Scientific Information [ISI] Journal Citation Reports subject category 'medicine, general & internal' or other), and (6) journal rank. Journal rank for each publishing journal was expressed as a percentage where the rank of each journal within an ISI Journal Citation Reports subject category was the numerator and the total number of journals within the subject category was the denominator. Journal rank percentages were classified as low (100% to 67%), medium (66% to 34%), or high (33% to <1%). Misconduct publications retracted for other reasons were used as the reference. Misconduct publications that were retracted for unknown reasons ( $n=3$ ) were not included in the analyses. CL, confidence limit; vs, versus.



Table 2. Total number of publications, plagiarism retractions, and other retractions for lower-income and higher-income countries (1966–2008)\*.

All publications				Plagiarism retractions			Other retractions		
Rank†	Country	National language English‡	N	Rank\$,**	Country	% (n)	Rank¶,**	Country	% (n)
<b>Lower-income</b>									
1	China	No	55,440	1	Iran	0.075 (5)	1	South Africa	0.007 (1)
2	Turkey	No	49,104	2	Lebanon	0.020 (1)	2	India	0.002 (1)
3	India	Yes	48,712	3	Croatia	0.018 (1)	3	Turkey	0.002 (1)
4	Taiwan	No	45,758	4	Egypt	0.016 (1)	4	China	0.000 (0)
5	South Africa	Yes	13,884	5	China	0.014 (8)	5	Croatia	0.000 (0)
6	Thailand	No	13,256	6	India	0.008 (4)	6	Egypt	0.000 (0)
7	Iran	No	6632	7	Thailand	0.008 (1)	7	Iran	0.000 (0)
8	Egypt	No	6223	8	Turkey	0.006 (3)	8	Lebanon	0.000 (0)
9	Croatia	No	5631	9	Taiwan	0.002 (1)	9	Taiwan	0.000 (0)
10	Lebanon	No	4980	10	South Africa	0.000 (0)	10	Thailand	0.000 (0)
<b>Higher-income</b>									
1	US	Yes	1,314,707	1	South Korea	0.124 (10)	1	South Korea	0.037 (3)
2	UK	Yes	290,451	2	Kuwait	0.072 (2)	2	Norway	0.034 (9)
3	Japan	No	289,891	3	Singapore	0.020 (3)	3	Germany	0.011 (23)
4	Germany	No	210,427	4	Portugal	0.015 (1)	4	Saudi Arabia	0.011 (1)
5	Italy	No	188,332	5	Czech Rep.	0.012 (1)	5	US	0.004 (54)
6	Canada	Yes	158,802	6	Saudi Arabia	0.011 (1)	6	UK	0.004 (12)
7	France	No	147,855	7	Italy	0.004 (7)	7	Israel	0.003 (2)
8	Australia	Yes	108,117	8	Greece	0.004 (1)	8	Japan	0.002 (7)
9	Spain	No	72,199	9	Israel	0.003 (2)	9	Canada	0.002 (3)
10	Israel	No	62,966	10	Austria	0.003 (1)	10	France	0.002 (3)
11	Switzerland	No	53,002	11	UK	0.002 (7)	11	Australia	0.001 (1)
12	Belgium	No	48,357	12	Germany	0.002 (5)	12	Austria	0.000 (0)
13	Finland	No	44,958	13	Belgium	0.002 (1)	13	Belgium	0.000 (0)
14	Austria	No	33,624	14	Finland	0.002 (1)	14	Czech Rep.	0.000 (0)
15	Greece	No	26,903	15	Switzerland	0.002 (1)	15	Italy	0.000 (0)
16	Norway	No	26,293	16	US	0.001 (11)	16	Finland	0.000 (0)
17	Singapore	Yes	14,658	17	Japan	0.001 (3)	17	Greece	0.000 (0)
18	Saudi Arabia	No	9148	18	Canada	0.001 (2)	18	Kuwait	0.000 (0)
19	Czech Rep.	No	8173	19	France	0.001 (2)	19	Portugal	0.000 (0)
20	South Korea	No	8042	20	Australia	0.001 (1)	20	Singapore	0.000 (0)
21	Portugal	No	6769	21	Spain	0.001 (1)	21	Spain	0.000 (0)
22	Kuwait	No	2778	22	Norway	0.000 (0)	22	Switzerland	0.000 (0)

\*Misconduct publications that were retracted for unknown reasons ( $n=3$ ) were not included in the analyses.

†Rank based on total number of publications.

‡The national language(s) of the country affiliation of first authors was determined using the Ethnologue Data database<sup>16</sup>.

\$Rank based on the percentage of plagiarism retractions.

¶Rank based on the percentage of other retractions (falsification/fabrication, ethics issues, author disputes).

\*\*Rank of countries with the same percentage of retracted publications was based on the number of retracted publications in each category, or if the number of retracted publications was the same, countries were listed alphabetically.

Rep., Republic; UK, United Kingdom; US, United States.

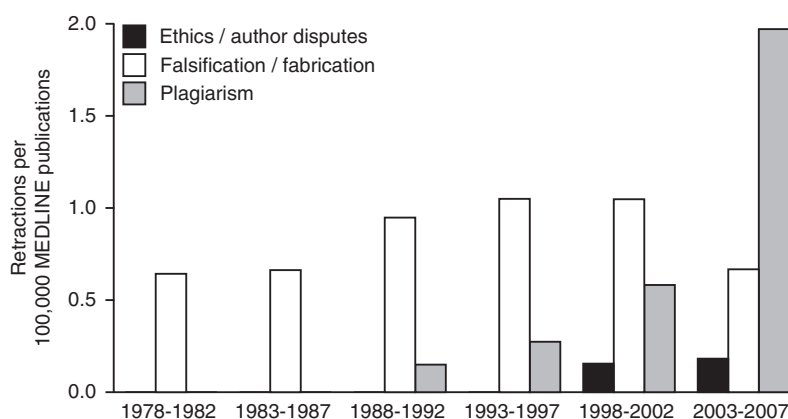


Figure 2. The proportion of misconduct retractions per 100,000 MEDLINE publications for each 5-year period from 1978 onwards (search filters: English, human, date range). The first year that a publication was retracted from MEDLINE was 1978. In the current dataset, the last year that a publication was retracted from MEDLINE was 2007.

**Table 3.** Assessment of 'serial offenders' (first authors with more than one publication retracted because of misconduct) up until 2012.

Factor	First authors with a misconduct retraction		P-value*
	Plagiarism	Other misconduct	
	(N = 78)	(N = 83)	
Authors with >1 retraction from 1966 to February 2008			
First author position	10.2% (8)	25.3% (21)	0.014
Any author order position	16.7% (13)	34.9% (29)	0.012
Authors with >1 retraction from 1966 to August 2012			
First author position	11.5% (9)†	28.9% (24)‡	0.007
Any author order position	19.2% (15)	38.6% (32)	0.001

\*Two-tailed Fisher's exact test.

†The country affiliations of first authors were Kuwait (1), Iran (1), Israel (1), Italy (2), Singapore (1), South Korea (2), and the United Kingdom (1).

‡The country affiliations of first authors were France (1), Germany (7), Japan (2), Norway (1), South Korea (1), the United Kingdom (3), and the United States (9).

author disputes has only been documented recently (Figure 2).

There were significantly fewer 'serial offenders' with publications retracted for plagiarism than other types of misconduct (Table 3). Of the 78 first authors with a publication retracted because of plagiarism, 10.2% had more than one first-author retraction between 1966 and 2008 and 11.5% had more than one first-author retraction between 1966 and 2012. Of the 83 first authors with a publication retracted because of other types of misconduct, 25.3% had more than one first-author retraction between 1966 and 2008 and 28.9% had more than one first-author retraction between 1966 and 2012. Up until 2012, the country affiliations of 'serial offenders' with publications retracted because of plagiarism or other types of misconduct have been predominantly from higher-income countries (Table 3). However, the country affiliations of 'serial offenders' with plagiarism retractions were predominantly from Western Pacific or Eastern Mediterranean countries, and country affiliations of 'serial offenders' with other misconduct retractions were predominantly from European countries, the United Kingdom, or the United States. In addition, only two first author names had publications that were retracted because of plagiarism and other types of misconduct. The country affiliations of these first authors were Japan (total of nine retracted publications as first author) and South Korea (total of three retracted publications as first author).

## Discussion

This is the first study to demonstrate that publications retracted for plagiarism are associated more with first authors who are affiliated with lower-income countries than those affiliated with higher-income countries. This finding is important because of the recent rapid increase in the number of clinical research publications from lower-income countries (e.g., China) and the increasing

collaboration among authors from lower- and higher-income countries<sup>21</sup>. Other factors associated with a publication being retracted because of plagiarism were the national language of the first author (non-English), publication type (reviews, letters, or commentaries; case series and case reports), and journal type (low-ranked). These results have implications for allocating and prioritising resources to address plagiarism misconduct.

This study was not designed to identify the specific reasons why a country's income level could be associated with plagiarism misconduct retractions. The significant association between income level of the first author's affiliated country and plagiarism is an interesting finding, but one that is yet to be fully explained. Although this is the first study to systematically examine plagiarism misconduct retractions among countries, high levels of plagiarism by researchers and students from lower-income countries have been reported<sup>7,22,23</sup>. Income level may have direct effects on the risk of plagiarism or it may be a surrogate marker for other factors that could influence plagiarism (e.g., cultural factors). Factors that may have a direct effect on plagiarism include a lack of resources dedicated to ethical writing skills, limited resources being focussed primarily on English writing skills (rather than ethical writing skills), or the inability to purchase plagiarism-detection software. Cultural differences regarding what might constitute plagiarism misconduct may also place authors from lower-income countries at a greater risk of publication misconduct<sup>6,23</sup>. For example, authors from countries such as China, where the notion of individual intellectual property might be difficult to conceptualise or where the re-use of a senior author's text is seen as a measure of respect<sup>4,6</sup>, may be unaware of the scope or seriousness of plagiarism. The other factors associated with plagiarism retractions were language, publication type, and journal rank. Given that English is the global language of scientific communication and that authors who are not proficient in English may have considerable difficulty paraphrasing English text<sup>8-10</sup>, they may, unwittingly,

have a greater risk of plagiarism misconduct. In addition, this finding may contribute in part, to the direct and indirect effects of income level of the first author's affiliated country on plagiarism misconduct retractions. Given the relatively wide confidence interval for the association between first authors affiliated with lower-income countries and plagiarism retractions, more precise estimates of this association will be possible as the number of plagiarism retractions in MEDLINE increases (i.e., larger sample sizes can be studied in future studies). In addition, larger sample sizes would allow further exploration of the association between country income, national language, and cultural factors through multivariate analyses.

Although the increased risk of plagiarism misconduct for non-original research publications may have been expected, this risk did not appear to result from self-plagiarism. Most of the retractions arising from possible self-plagiarism were original research publications. The finding that low-ranking journals were associated with a greater risk of plagiarism is consistent with that of other researchers<sup>24</sup>. Increased plagiarism in lower-ranked journals may reflect limited resources dedicated to plagiarism detection and the possibility that authors from lower-income countries may publish more in regional journals, which tend to be lower-ranked<sup>21</sup>. The finding regarding the relatively rapid increase in the proportion of plagiarism retractions, compared with the reasonably consistent proportion of falsification and fabrication misconduct retractions, is seemingly in contrast to other studies. Steen reported a sharp increase in the number of retractions since 2000, with similar numbers being retracted for falsification/fabrication and for scientific mistake<sup>25</sup>. However, Steen's finding is difficult to interpret as this study did not take into account the overall increase in publication output over time. Further, the definition of misconduct used in Steen's study excluded plagiarism, which contradicts the definitions used by the US Office of Research Integrity<sup>13</sup> and other researchers<sup>11,26</sup>. The current study attempted to overcome these limitations by reporting the findings as a proportion of total MEDLINE output and by using standardised definitions for misconduct. Using this approach, it is suggested that the reported increase in retractions as a proportion of total MEDLINE output<sup>11,27</sup> may be driven largely by a sharp increase in reports of plagiarism retractions. This increase may be a result of the introduction of electronic plagiarism detection tools<sup>28</sup> and, possibly, from an actual increase in plagiarism arising from an increased pressure on authors to publish and succeed.

Previous findings on the factors involved in publication misconduct retractions showed that first authors with at least one other retracted publication were associated more with misconduct retractions than mistake retractions<sup>11</sup>. The current study extends these findings and shows that among 'serial offenders', there may be fewer with

additional plagiarism misconduct retractions than other types of misconduct retractions. A limitation of this assessment of 'serial offenders' is that first author names are not unique. For example, a search (search filters: humans, from 1966 to August 2012) of PubMed retrieved 2783 publications and 7 retractions for the author name Kim SJ. Increased use of the Open Researcher and Contributor ID (ORCID)<sup>29</sup>, where a researcher is provided with a unique identifier, will make it possible to track the impact of 'serial offenders' on the integrity of the medical literature with more confidence.

A major strength of this study was that retracted publications were retrieved from the MEDLINE retracted publications database, a large, international database of retracted publications, which only retracts publications that have been formally identified as requiring retraction<sup>30,31</sup>. This means the plagiarism retractions that were studied are unlikely to have been trivial (e.g., the re-use of a few short phrases). Another strength of this study was its originality; no other studies have assessed the reasons for retracted publications in terms of the country affiliation of authors. However, it should be emphasised that the first author's affiliation may not always correspond to the country or organisation where the misconduct occurred, and other authors may contribute, actively or passively, to misconduct. Nevertheless, most affiliations reflect where the work was conducted<sup>32</sup> and first authors are the authors most often implicated in publication misconduct<sup>33</sup>. An additional strength of this study is that retractions were classified based on well-known criteria (i.e., those used by the US Office of Research Integrity<sup>13,14</sup>), which have been used by other researchers<sup>11,26</sup>. Doing so facilitates valid comparisons between the results of this study and those of others. Additional limitations of this study are that (1) not all misconduct retractions are recorded in MEDLINE and, in terms of sample size, it was only possible to study those that were, (2) the extent of plagiarism may be underestimated, given the increasing rate of plagiarism and the delay between publication and retraction, and (3) this study was limited to retrieve human rather than animal studies as publications of these studies are more likely to influence clinical practice.

The results of this study have implications for clinicians, policy makers, and educators. Clinicians from higher-income countries who co-author publications with first authors affiliated with lower-income countries should ensure all authors adhere to ethical writing practices; all authors have a duty to ensure their publications do not include plagiarised text. Clinicians who serve as peer reviewers or have editorial responsibilities should be aware of the recent and marked increase in plagiarism misconduct. In terms of risk-management strategies, they should pay particular attention to the risk factors that we found were significantly associated with plagiarism.

Perhaps somewhat paradoxically, policy makers and educators working with lower-income countries may find the current results on plagiarism encouraging. Although it may not be possible to prevent authors from falsification and fabrication, it may be possible to prevent inadvertent plagiarism. Education strategies need to incorporate unambiguous and standardised guidelines on what constitutes plagiarism misconduct and should address the varied ethical standards and beliefs in the countries in which they are conducted. The finding in this study regarding the relatively consistent rate of falsification and fabrication retractions over time and the relatively high percentage of 'serial offenders' among authors with publications retracted for this type of misconduct also raises questions that require further study and wider debate among all users of the medical literature. Are there always going to be authors who will commit misconduct, irrespective of the risks involved? Is this a risk that has to be accepted? Is this a risk that should be addressed through more auditing, rather than more education?

## Conclusion

In conclusion, this study showed that plagiarism accounted for almost half of all misconduct retractions and that there was a significant association between plagiarism misconduct and first authors affiliated with lower-income countries. Other factors significantly associated with plagiarism misconduct were first authors affiliated with countries where English is not a national language; reviews, letters, or commentaries; case reports and case series; and low-ranked journals. Given the increasing contributions from authors of lower-income countries to the medical literature and efforts to enhance collaborations between authors from higher- and lower-income countries, these results should help raise awareness of the extent of plagiarism and help develop evidence-based strategies that focus on the risk factors most associated with this type of publication misconduct.

## Transparency

### Declaration of funding

This study was funded, in part, by a research grant from ARCS Australia Ltd, an independent, not-for-profit organisation that provides professional development in therapeutics. ARCS Australia Ltd had no role in the development of the study design, collection, analysis, or interpretation of results, or in the writing of the report or in the decision to publish. All authors participated in the data collection, the interpretation of study results, and in the drafting, critical revision and approval of the final version of the manuscript. S.S. and K.L.W. developed the idea for the study, were involved in the study design, and are the guarantors.

### Declaration of financial/other relationships

All authors have completed the Unified Competing Interest form at [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) (available on request from the corresponding author) and declare that (1) all authors have support (e.g., reimbursement of expenses for conference travel; payment for independent academic statistical services for their research) from their employer, ProScribe Medical Communications, for the submitted work; (2) the authors have no relationships with any company that might have an interest in the submitted work in the previous 3 years; (3) their spouses, partners, or children have no financial relationships that may be relevant to the submitted work; and (4) the authors are actively involved in national and/or international not-for-profit organisations that encourage ethical medical writing practices. All authors provide ethical medical writing support and training courses to authors from low-, middle-, and high-income countries.

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