



# Misuse of co-authorship in Medical PhD Theses in Scandinavia: A Questionnaire Survey

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## Abstract

**Background** Several studies suggest that deviations from proper authorship practices are commonplace in medicine. The aim of this study was to explore experiences of and attitudes towards the handling of authorship in PhD theses at medical faculties in Denmark, Norway, and Sweden.

**Methods** Those who defended their PhD thesis at a medical faculty in Scandinavia during the second half of 2020 were offered, by e-mail, to participate in an online survey. Survey questions dealt with experiences of violations of the first three of the ICMJE authorship criteria and misuse of authorship order in the thesis articles, as well as respondents' attitudes to these matters. Both questions with fixed response alternatives and questions with free-text responses were used. Quantitative data were analysed statistically using the Table functions in SPSS 25 and Chi-2 tests. Free-text responses were analysed qualitatively using manifest content analysis.

**Results** 287 valid questionnaires were returned (response rate: 34.1%). Almost half (46.0%) of the respondents reported that the ICMJE authorship criteria were not fully respected in at least one of the papers in their thesis, while a vast majority (96.7%) found it important that authorship is handled according to the ICMJE authorship criteria. 24.4% reported inadequate handling of authorship order in at least one paper. The qualitative results provide a wide spectrum of examples of how the ICMJE authorship criteria are circumvented.

**Conclusion** Despite increasing educational efforts to reduce deviations from good research practice at Scandinavian universities, the handling of authorship in medical papers remains problematic.

**Keywords** Authorship · Authorship order · Publication ethics · Research ethics · Research ethical guidelines · Scientific misconduct

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Extended author information available on the last page of the article

## Background

Publication in scientific journals remains the dominant means of communicating research. Authorship of peer reviewed articles is still the main scientific merit, a fact that researchers tend to be well aware of (Génova & de la Vara, 2019). Misuse of co-authorship introduces unfairness between researchers. It can also be seen as a distortion of the scientific record since a transparent report on who did what arguably is part of proper documentation of research (ALLEA 2017). More seriously, co-authorship influences who gets resources, such as academic positions and research funding, hence influencing what research gets done and by whom. The more widespread misuse of co-authorship, the greater the risk of research resources being allocated to those less deserving and less equipped to contribute to valuable research.

While researchers tend to find adequate handling of authorship and authorship order to be important (Helgesson et al., 2018), it is quite common that researchers are added as co-authors without deserving it in terms of contribution to the research (Kornhaber, McLean, & Baber, 2015; Al-Herz et al., 2014). Unjust authorship may occur because of ignorance of normative authorship criteria or policies (e.g. Schroter et al., 2020), but also because of intentional misuse (Lövtrup, 2010; Helgesson et al., 2018).

Sometimes renowned researchers are added to increase the chances for the article to end up in a top journal (Greenland & Fontanarosa, 2012; Al-Herz et al., 2014; Bülow & Helgesson, 2018), sometimes influential local researchers make sure they are included (Helgesson et al., 2018) or invite others as part of a tit-for-tat exchange with equally positioned colleagues or as payment for services performed (Eriksson & Helgesson, 2013). So, while authorship should be based on research contributions only, power structures have a real-life impact on who end up as authors (Haeussler & Sauermaann, 2013; Jabbehdari & Walsh, 2017).

In two survey-based studies, from 2009 and 2016, PhDs from all medical faculties of Swedish universities who had recently defended their thesis were asked about the inclusion of undeserving co-authors in the papers of their theses. Almost all theses at these faculties consist of a number of published (or ready-to-publish) papers and a thesis summary. According to the 2009 survey (Lövtrup, 2010), 47% of the respondents reported undeserving co-authors on at least one paper in their thesis, according to the ICMJE authorship criteria, also known as the Vancouver rules (ICMJE, 2022<sup>1</sup>). When the survey was repeated in 2016, 53% responded that the authorship criteria were not fully respected in at least one of the papers in the thesis (Helgesson et al., 2018).

In the present study, we follow up on these previous surveys. This time the survey was extended to cover medical faculties in Denmark, Norway, and Sweden and was made electronic. We also made some modifications in the background questions and added two questions regarding the perceived reasonableness of the ICMJE authorship criteria. As in the 2009 and 2016 surveys, the focus was exclusively on scientific authorship.

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<sup>1</sup> The ICMJE authorship criteria are continuously updated. The three criteria at the core of both the present survey and the two predecessors have remained substantially the same over the relevant time period.

## Methods and Participants

### Aim

The aim of this study was to investigate experiences of and attitudes towards authorship handling in PhD theses at medical faculties in Denmark, Norway, and Sweden among those who had recently defended their thesis. This included to make comparisons between the countries and with results from the two previous studies to see whether approaches to co-authorship had changed.

### Participants and Recruitment

This survey targeted all those who had defended their doctoral thesis for a doctor's degree (PhD) at a medical faculty in Denmark, Norway, or Sweden during the second half of 2020. Research participants were invited by e-mail to participate in the electronic survey. The survey was distributed in mid-March. Two reminders were sent out, about one and two weeks after the first e-mail was distributed. There were slightly different approaches regarding recruitment and survey distribution in the three countries.

In Denmark, potential participants who had defended their PhD thesis during the second half of 2020 were approached through three of the four Danish universities with medical faculties. Two PhD schools forwarded the invitation directly to the concerned PhDs (one of them omitting reminders). From the third university, the authors received a list of names and e-mail addresses to potential respondents. One e-mail address was dysfunctional but could be replaced by a valid address after a short internet name search.

In Norway, official lists of persons who had defended their PhD thesis during the second half of 2020 were obtained. As many of the PhDs had changed their e-mail addresses, searches were performed to identify updated addresses. Google searches were combined with searches in more recent publications identified in PubMed and Google Scholar in order to identify e-mail addresses. When in doubt with respect to whether the e-mail address was valid, an e-mail was sent to the identified e-mail address. When these e-mails obtained a positive response, they were included. When negative, new searches were instigated.

In Sweden, official lists of persons who had defended their PhD thesis during the second half of 2020 were obtained. Some of these had updated e-mail addresses, others did not. One university declined to share with us other e-mail addresses than the e-mail address linked to the university. No additional searches were made to update addresses.

### Survey Characteristics

The questionnaire consisted of thirteen questions. The first five questions covered background information (gender, country of defence, type of content in the thesis, basic training, and years of experience from research – and a control question checking that the recipient of the survey fulfilled the inclusion criterion; Table 1). The following eight questions concerned authorship issues in medical papers. Questions 6 and 7 explored whether the respondents had received information about authorship guidelines when they were doctoral students (response options: Yes/No/Uncertain), and whether the respondents' departments had applied a clear policy regarding the handling of authorship (Yes, consistently/Yes,

**Table 1** Demographics

	Denmark* N=57	Norway N=106	Sweden N=124	Total N=287
Gender	21	38	56	115
Male	(36.8%)	(35.8%)	(45.2%)	(40.1%)
Female	35	68	66	169
Other	(61.4%)	(64.2%)	(53.2%)	(58.9%)
Prefer not to say	0	0	2 (1.6%)	2 (0.7%)
	1 (1.7%)	0	0	1 (0.3%)
How would you describe your PhD thesis?	12	22	27	61
Basic research	(21.1%)	(20.8%)	(21.8%)	(21.3%)
Clinical research	31	56	59	146
Other applied research	(54.4%)	(52.8%)	(47.6%)	(50.9%)
Mixed	6 (10.5%)	8 (7.5%)	12 (9.7%)	26
Other	8 (14.0%)	13	24	(9.1%)
	0	(12.3%)	(19.4%)	45
		7 (6.6%)	2 (1.6%)	(15.7%)
				9 (3.1%)
What is your basic training?	17	53	48	118
Medicine	(29.8%)	(50.0%)	(38.7%)	(41.1%)
Other health professions	17	28	29	74
Natural sciences / technology	(29.8%)	(26.4%)	(23.4%)	(25.8%)
Social sciences	12	19	36	67
Other	(21.1%)	(17.9%)	(29.0%)	(23.3%)
	4 (7.0%)	5 (4.7%)	9 (7.3%)	18
	7 (12.2%)	1 (0.9%)	2 (1.6%)	(6.3%)
				10
				(3.5%)
How many years of research experience do you have?	29	36	20	85
<5 years	(50.9%)	(34.0%)	(16.1%)	(29.6%)
5–10 years	24	57	85	166
>10 years	(42.1%)	(53.8%)	(68.5%)	(57.8%)
	4 (7.0%)	13	19	36
		(12.3%)	(15.3%)	(12.5%)

\* Within country percentages to enable easy comparison between countries. Percentages may not sum to 100% because of rounding.

partly/No/Uncertain). Question 8 concerned the perceived reasonableness of the ICMJE authorship criteria (very/quite/not particularly/not at all reasonable). Question 9 was an open-ended question directed to those not finding the ICMJE authorship criteria reasonable, asking what their main reasons for thinking so were. Question 10 focused on deviations from the ICMJE authorship criteria by asking whether researchers had been included as co-authors on papers in the thesis (a) without having made a substantial contribution to the conception or design of the work or to the acquisition, analysis, or interpretation of data for the work (first criterion); (b) without having drafted the first version of the paper or revised it critically for important intellectual content (second criterion); or (c) without having given approval of the final version of the paper (third criterion; Yes, No, or I don't know/Uncertain). Question 11 asked respondents to state how important they felt it was for co-authorship to be handled according to the ICMJE authorship criteria (Very important/Quite important/Not particularly important/Not at all important). Question 12 raised the issue of authorship order, by asking whether authorship order in any of the papers in the thesis did not correspond to the relative contributions of the authors (Yes/No/Uncertain). Finally, question 13 asked about the perceived importance of how authorship order is handled in biomedical papers (Very important/Quite important/Not particularly important/Not at all important). Respondents had the opportunity to provide comments to question 10. (For the complete questionnaire, see Appendix I.)

## Analysis

The quantitative data were analysed using the Table functions in SPSS 25 and Chi-2 tests. In the statistical analysis of potential differences relating to gender, the category 'Other' was amalgamated to the smallest category, i.e. 'Male', in order to avoid too many empty cells and thereby violations of the assumptions of the statistical tests. The results have been presented as proportions of those who answered "Yes" to having experienced various deviations from the ICMJE authorship criteria and to whether they found the various rules important.

Free-text responses were analysed in accordance with manifest qualitative content analysis, which aims to categorize manifest content into subcategories, categories, and themes (Graneheim & Lundman, 2004).

## Ethical and Regulatory Considerations

In the invitation e-mail, potential participants were informed that the survey concerned co-authorship in research, why they were selected (PhD defence in second half of 2020), that participation was anonymous, and that responses to the questionnaire would be handled confidentially. The e-mail also informed that participation was voluntary, and that one could abstain from participating simply by not responding to the survey. Further, to maintain anonymity, participants were encouraged in the opening window of the online survey to not write any information in free-text responses that could serve to identify specific persons or institutions.

In Denmark, the study was not subject for notification to the Danish Committee on Health Research Ethics, nor was it subject to any other oversight. The recruitment procedure was cleared at the participating institution in terms of GDPR. In Norway, this study was not subject to Research Ethics Committee (REC)/institutional review board (IRB) approval, nor was it subject to any other oversight. In Sweden, this study was not subject to ethical review according to the Swedish Ethical Review Act (2003:460), nor was it subject to any other oversight.

## Results

Our survey was distributed to 872 persons who had defended their PhD thesis at a Danish, Norwegian, or Swedish medical faculty during the second half of 2020. 20 questionnaires generated a message to the effect that the recipient could not be reached at the used e-mail address; of the remaining 852 questionnaires, 298 were filled in and returned. Of these, 11 were excluded from the analysis because the respondent answered 'No' to the control question concerning whether they had defended their thesis in the second half of 2020, leaving 287 valid questionnaires. This leaves an overall response rate of 34.1% of those eligible to participate (287/841). There is some attrition in response rates in the questionnaire, so the valid number of answers per question varies from 287 to 275 for the last questions.

## Main Results

Slightly less than half (46.0%) of the respondents reported that the ICMJE authorship criteria were not fully respected in at least one of the papers in their thesis; 34.4% reported that one or more authors had been included without having made a substantial contribution to the work (first criterion); 32.6% responded that researchers were included as authors even though they had not drafted or critically revised the manuscript (second criterion); and 10.5% claimed not to have received final approval from at least one of the co-authors (third criterion; see Table 2). And all this while 65.1% found it *very* important and 31.6% found it quite important that authorship is handled according to the ICMJE authorship criteria. 61.5% responded that they found these authorship criteria very reasonable, 37.1% saw them as quite reasonable, while 1.4% found them not particularly reasonable.<sup>2</sup>

Furthermore, 24.4% reported having experienced that authorship order was not determined based on the relative contributions of the authors in at least one paper in their thesis. In response to the question how important they think it is that the authorship order reflects the relative contributions of the authors, 49.5% answered “Very important” and 41.1% answered “Quite important” while 9.5% found it of minor importance (Table 2).

As regards having received information about the ICMJE authorship criteria, or other ethical guidelines dealing with co-authorship, while being doctoral students, 88.4% responded that they had received such information, while 11.6% responded either that they had not or that they were uncertain about it (see Table 2). On whether their department applied clear policies on co-authorship, 23.9% replied “Yes, consistently”, 37.7% “Yes, partly”, and 23.9% “No”, while 14.4% were uncertain.

When comparing the Swedish results with those from two previous Swedish surveys (Table 3), no statistically significant changes were found.

Due to variations in background factors, such as professional background and amount of research experience, in combination with the fact that the number of respondents from each country was small, we could not meaningfully disentangle country effects from effects of professional background and experience in multivariate analysis (for percentages separated per country, see Table 3).

## Results Related to Background Factors

The statistical analysis showed that women found it significantly more important than men that the ICMJE authorship criteria for authorship are followed ( $p < .05$ , data not shown (dns)) and that the order of authorship reflects contribution ( $p < .005$  dns). The analysis further showed that women were more likely than men to state that there was a paper in their thesis where the authorship order did not reflect contribution ( $p < .05$  dns).

We also found a statistically significant difference between different types of PhD projects in relation to whether the student had been informed about authorship rules during their doctoral studies ( $p < .05$  dns) with those doing clinical research being more likely to state that they had received such information than those doing other kinds of research.

<sup>2</sup> Only two free-text responses were obtained regarding why the criteria were not perceived as reasonable (question 9). They will not be reported.

**Table 2** Authorship results

Have you ever received information, while a PhD student, about the Vancouver rules* or any other ethical guidelines on co-authorship?	251 (88.4%)
Yes	33
No	(11.6%)
Were any clear policies on co-authorship applied at your department?	175 (61.6%)
Yes	109 (38.4%)
No	
According to you, has anyone been listed as co-author in any of the papers in your thesis	95
a. without having made a substantial contribution to any of the following: conception or design of the work; or the acquisition, analysis, or interpretation of data for the work?	(34.4%) 181
Yes	(65.6%)
No	90
b. without having drafted the first version of the paper or revised it critically for important intellectual content?	(32.6%) 186
Yes	(67.4%)
No	29
c. without having given a final approval of the version to be published?	(10.5%) 247
Yes	(89.5%)
No	
Any perceived violation of a or b or c? (calculated)	127
Yes	(46.0%)
No	149 (54.0%)
How reasonable do you think that the Vancouver rules are?	4 (1.4%)
Not particularly reasonable	105
Quite reasonable	(37.1%)
Very reasonable	174 (61.5%)
How important do you think it is that co-authorship is handled according to the Vancouver rules?	266 (96.7%)
Important	9 (3.3%)
Not important	
According to you, has it occurred in any of the papers in your thesis that the authorship order does not correspond to the relative contributions of the authors?	67 (24.4%)
Yes	208
No	(75.6%)
How important do you think it is how authorship order reflects the relative contributions of the authors?	249 (90.5%)
Important	26
Not important	(9.5%)

\* We used this term for the ICMJE authorship criteria

## Results from Qualitative Analysis of free-text Responses

The analysis of the free-text responses to question 10 – on deviations from the first three ICMJE authorship criteria – resulted in 25 subcategories and 12 categories, leading to the three overarching themes “Inadequate handling of co-authorship”, “Reasons and explanations for inadequate handling of co-authorship”, and “Avoiding misuse of co-authorship” (Table 4).

The free-text responses provide a wide spectrum of examples of how the Vancouver rules (i.e., the ICMJE authorship criteria) are circumvented: by supervisors and others making sure they end up on papers they have power over, or because departments have such

**Table 3** Swedish comparison with previous surveys and results per country

The Vancouver rules disrespected	Sweden 2009 (n=302)	Sweden 2016 (n=285)	Sweden 2021 (n=124)	Denmark 2021 (n=57)	Norway 2021 (n=106)
Coauthor did not make a substantial contribution	30% CI* [25–35]	39% CI [33–45]	34% CI [25–42]	29%	32%
Coauthor did not draft or critically revise the manuscript	41% CI [35–47]	40% CI [35–46]	37% CI [28–46]	35%	20%
Coauthor did not approve the final manuscript version	14% CI [10–18]	14% CI [10–18]	13% CI [7–20]	8%	8%
At least one of the above authorship criteria disrespected	47% CI [41–53]	53% CI [47–59]	45% CI [37–54]	44%	39%

\* 95% confidence interval

a policy; by influential researchers including friends or distributing benefits for pragmatic reasons, such as making sure PhD students get the final paper needed to defend their thesis. Sometimes deviations from following the rules are explained by eagerness to avoid conflicts. One respondent comments on a specific workplace: “Authorship is granted based on very little, as part of politics.” A few respondents explicitly suggest that misuse of co-authorship is characteristic of medicine, and perhaps in particular clinical research, with one of them commenting: “It seems to me that the medical ‘tradition’ expects co-authorship when doctors are involved in a study regardless of exact fulfilment of each of the three mentioned Vancouver rules. It can therefore be viewed as impolite or rude not to include a doctor as co-author.” Others point to potentially incorrect exclusions, for instance: “I feel that people involved in for example data collection could have been co-authors if the opportunity had been given to them.”

In the free-text responses, some suggestions can also be found regarding ways to avoid misuse of co-authorship. One practical recommendation we found is that one should clearly define roles in collaboration beforehand, including what is needed from each collaborator to qualify.

## Discussion

The main result from this survey among recent PhDs from medical faculties in Denmark, Norway, and Sweden is that 46.0% of the respondents reported having articles in their summary thesis in which handling of authorship did not satisfy all the ICMJE authorship criteria. This stands in sharp contrast both to how reasonable these authorship criteria are perceived to be (98.6% of the respondents in our survey find them very or quite reasonable) and to how important it is understood to be that they are acted in accordance with (96.7% say it is very or quite important).

These results correspond well with the previous studies in 2009 and 2016. Moreover, they are coherent with a systematic review estimating the proportion of articles with at least



**Table 4** Deviations from authorship criteria: qualitative analysis of free-text responses

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First theme: Inadequate handling of co-authorship

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Gift authorship

- Individuals who do not contribute to the research, nor to the writing or revision of the article, are nevertheless listed as co-authors.
- MDs tend to be included as co-authors without making a substantial contribution.

Undeserving supervisors

- There is a practice that all supervisors get included as co-authors on papers, although only some of them make important contributions to the papers.
- Co-authorship is sometimes looked upon as a “right” of the supervisor, no matter how little s/he contributes to a paper.

Failure to revise

- Sometimes one fails to get feedback from busy co-authors – there may be only an “ok” or silence during revision time.
- Persons from another institution failed to provide feedback on the paper.

Inclusion of those who in other ways do not fulfill all criteria

- Senior researchers do not always read the final version submitted (hence they are unable to properly approve that version).
- A collaborating unit required co-authorships to supply material for our study.
- Co-authors are included due to their previous work in gathering data for the dataset used in later publications, without contributing specifically to later publications.

Debatable exclusions

- Drug distribution to patients within a study or performing lab analyses may be important parts of data acquisition but are not recognized as such in my understanding of the Vancouver guidelines.
- People involved in for example data collection could have been coauthors if the opportunity had been given to them.

**Second theme: Reasons and explanations for inadequate handling of co-authorship**

Career-related, “political”, or other reasons for inclusion

- The main supervisor made a friend co-author because the friend needed the publication to fulfill professional requirements.
- The PI includes PhD candidates who probably don’t deserve authorship in order for them to get another publication needed for the thesis.
- Authorship granted based on very little (in terms of contributions), as part of politics.
- Department “policies” and unwritten rules requiring some people to be co-authors without fulfilling all authorship criteria, in order to avoid conflict.
- A colleague on long-term sick leave, originally meant to contribute in the writing part, was included as co-author “for humanistic reasons”.

Difficulties in reaching agreement on the interpretation of central terms

- Different conclusions regarding whom to include as co-author may rest on different interpretations of “substantial contribution”.
- There may be different interpretations of “revise critically” that leads to different conclusions about inclusion.

Difficulties for PhD students to stand up for authorship principles

- It can be hard for PhD students to defend that the ICMJE authorship criteria should be followed in front of senior supervisors and scholars.

**Third theme: Avoiding misuse of co-authorship**

Collaborators can abstain from requiring co-authorship

- A collaborator withdrew from claims of co-authorship as the person did not contribute enough according to the authorship criteria.
- The supervisor did not show any interest in being co-author.

Clearly defined roles in collaboration facilitate abidance

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**Table 4** (continued)**First theme: Inadequate handling of co-authorship**

· Participation in a well-defined PhD project, not part of a bigger whole, with clear roles for and contributions from everyone made it easy to follow the ICMJE authorship criteria.

**Discussion beforehand on what co-authorship would require facilitates abidance**

· A discussion was held beforehand with PhD student contributing to a paper outside his thesis on required contribution to qualify as author.

· Additional authors were proposed to all the PhD's papers, but they were excluded after critical evaluation of actual contributions.

**Absence of career-need reduces pressure to misuse power over co-authorship**

· The high-ranked, well-funded main supervisor didn't need to participate in career-promoting trade of favors with the PhD student's papers.

one author not satisfying the ICMJE authorship criteria to be 63% for medical research (Marušić, Bošnjak, & Jerončić, 2011), at least to the extent that they agree that deviations from the norms are not mere exceptions but common practice. More recent studies also reveal high levels of inappropriate authorship (Al-Herz et al., 2014; Das et al., 2016; Alsho-gran & Al-Delaimy, 2018; Bredahl Jensen et al., 2018; Uijtdehaage et al., 2018). Internal or external pressure and habits are reported to be the main reasons for the practice of including authors in a way not compatible with the ICMJE criteria. Moreover, studies also report that researchers accept inappropriate authorship (order) to avoid conflicts with collaborators (Rees et al., 2019). The extension and sustainability of authorship problems indicate basic structural and cultural problems in academia.

An interesting finding that needs to be further explored in future studies concerns differences in responses between men and women, where women to a greater extent respond that authorship order did not reflect contribution in their theses. A larger proportion of women also stress the importance of following the ICMJE authorship criteria and assuring that authorship order reflects relative contributions. This might be taken to suggest that women are treated more poorly than men in relation to authorship issues and therefore stress the importance of acting fairly more frequently. Subtle differences in the treatment of male and female PhD students have been identified in recent research (Heffron et al., 2021).

The results from the free-text responses regarding deviations from the ICMJE authorship criteria harmonize well with results of the two previous surveys (Lövtrup, 2010; Helgesson et al., 2018) as well as with what is found in the literature. For instance, Al-Herz and colleagues note that researchers who do not deserve authorship are added for all kinds of other reasons, such as to avoid conflict and to increase the likelihood that the paper gets accepted (Al-Herz et al., 2014).

While the attention to inappropriate authorship has increased significantly, and authorship norms are extensively taught at courses and discussed in journals, the problem prevails. One reason for this might be that courses completely dedicated to research ethics are mostly compulsory only for doctoral students. Considering that our results, and others', seem to suggest that more senior researchers than doctoral students are the ones transgressing the ethical boundaries when it comes to handling of academic authorship, one might argue that these educational efforts have been misdirected, or at least incomplete. However, a recent trend at medical faculties in Sweden is to make courses in research ethics compulsory for researchers who want to take on the role of supervisors for doctoral students.

Still, educational measures to address the problem may not be appropriate on their own. One reason for this might concern incentives, i.e., the role of authorship as academic currency. The risk is considerable that as long as authorship is the “money of research”, some people will try to cheat. While there have been various attempts to reduce the crediting role of authorship, for instance by the introduction of contributorship (see, e.g., Smith, 2012), no agreed solution has been established. Quite a few journals require contribution statements, but contributorship can be subject to the same pressure on young researchers as authorship. An additional complication is that the emergence of formalised research contribution standards such as the CRediT Contributor Roles Taxonomy (<https://credit.niso.org>), which includes more aspects than those held to be relevant for authorship according to the ICMJE criteria, may blur the importance of ICMJE-based authorship attribution. All in all, it seems that other kinds of changes are needed. Since one can hardly hope to remove the pressure to obtain academic credit in highly competitive research environments, change probably has to concern moving away from emphasizing publications so heavily to something more multifaceted. More work probably also needs to be put into improving research environments and research culture. What these solutions might be still needs to be explored. One of many questions to ask is: what can the universities do to steer or nudge their researchers into a more ethical behaviour, also regarding giving due credit for research contributions?

## Limitations

There are several limitations with this study. First, although the ambition was to reach all who had defended their thesis at a medical faculty in Denmark, Norway, and Sweden during the second half of 2020, an obvious obstacle was the lack of updated e-mail addresses. The problem varied between universities, where some provided new, valid e-mail addresses if the university address was no longer in use, while others did not. This problem was tackled in Norway by thorough searches for updated information on valid e-mail addresses, for instance through recently published papers. Resources to do such detective work were not available in Sweden. This specific problem was not an issue in Denmark. On the other hand, one medical faculty in Denmark declined to participate with reference to GDPR restrictions.

Another limitation is that the number of respondents from each of the three countries is small. This combined with the fact that respondents differ between countries in relation to professional background and amount of research experience makes it difficult to disentangle country effects from effects stemming from professional background and experience in multivariate analysis. No meaningful comparison between countries could therefore be made.

Scandinavian medical theses are typically article-based. In other countries, more theses take the form of a monograph, i.e., a single extensive research contribution that may only later be published, in suitable ‘chunks’, as research articles. Because of this difference in publication practices, it may well be that the perceived pressure to include undeserving authors in the work of doctoral students is considerably smaller in countries with monograph traditions, since the temptation to capitalize on co-authorship is mainly detached from the supervision task in such cases (Robin & Kanowski, 2008). In line with this, Urda-Cimpean and colleagues (2016) have found PhD theses based on article publications to attract more contributors than post-publication of articles from monograph PhD theses. For these reasons, results of our study are probably not directly transferable to countries with monograph traditions.

Since the survey deals with responses to questions about how authorship issues were handled, and we ask for respondents' judgments, it cannot be excluded that respondents at times are mistaken. Hence, they may judge that there was a breach in abidance to authorship criteria when it was not, or vice versa. In particular, respondents may underestimate contributions to the conception and design that were made before they entered the PhD project. Also, what a "substantial contribution" amounts to is a matter of judgment, and there may be disagreement. Hence, the frequencies reported in this survey should be read with some caution. As argued when the previous survey was reported (Helgesson et al., 2018), also an erratic perception that the ICMJE authorship criteria are not followed is problematic, since it might affect younger researchers to be less inclined to follow the rules themselves.

## Conclusion

Despite increasing educational efforts to reduce deviations from good research practice at Scandinavian universities, the handling of authorship in medical papers remains problematic. 46% of the respondents stated that authorship was not handled according to the ICMJE authorship criteria in at least one of the papers in their PhD thesis. This stands in sharp contrast both to how reasonable and important these authorship criteria are considered to be.

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