

Chiropractic students in Denmark and their adherence to chiropractic conservatism: A cross-sectional study

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Abstract

Background The chiropractic profession is split between those practicing evidence-informed and those whose practice is honed by vitalism. The latter has been coined 'chiropractic conservatism'. Concerningly, this behavior is also present in students, as a recent survey conducted on students from a European private chiropractic college showed that chiropractic conservatism was the norm. This was also present in two Australian university-based institutions not associated to a medical faculty. In Denmark, the chiropractic program is university-based and firmly embedded in a medical faculty. We were curious if the same levels of conservatism were present in this setup. The objectives of this study were to establish the level of conservatism in Danish chiropractic students, to investigate if this was linked to year of study, and to compare the results from previous studies on the university and non-university-based institutions. **Methods** A cross-sectional survey on 122 (73%) 3rd to 5th year chiropractic students attending the University of Southern Denmark was conducted. Information about the project was sent out on October 1st, 2019. Participants were provided with a questionnaire consisting of 10 items concerning chiropractic conservatism. All ten answers were dichotomized into appropriate/inappropriate and summed up. This score was used in a linear regression to determine the association with academic year of study. The level of conservatism was thereafter categorized into four groups (group 1 indicating low levels of conservatism and group 4 indicating high levels of conservatism). These results were compared systematically to those of the previous studies. **Results** In general, the Danish chiropractic students had low conservatism scores, and this decreased with increased year of study. Seventy percent of the students were placed in the two lowest conservative groups. The Danish students answered consistently, on 3 out of 5 items, with the other university-based programs, both agreeing that adjustments can make the body function at 100% and that they can improve the health of infants. An inverse relationship was observed with the private college, whose students were primarily placed in the highest conservatism group. **Conclusions** The Danish chiropractic students did not show the same level of conservatism as the private college, but were more comparable to the other university-based programs. Despite a favorable environment, some students were still linked with some conservative thinking, but this did decrease with increasing year of study.

Background

Since early in its history, two factions have existed in the chiropractic profession, which have disagreed on some basic but central principles (1). Somewhat oversimplified; one group regards the chiropractic scope of practice as primarily related to musculoskeletal disorders, whereas the other considers manual treatment of the spine (denoted '*adjustments*') as a panacea, which is purported to effect positive or curative changes in all health and disease, irrespective of the underlying disorder. Increasingly, the former can be identified as progressive and evidence-based and the latter as conservative and dogmatic (1).

The theoretical basis for the latter has taken slightly different guises over time, from outright vitalistic concepts of '*life-forces*' with religious undertones (2), to more scientific-sounding but fuzzy notions about perturbations of the autonomic nervous activity effecting specific organs or bodily functions (3) to - more recently - believing that '*adjustments*' have a positive effect on clusters of dormant neurons in the brain, with virtually unlimited possibilities for treatment, including neurodegenerative and neurodevelopmental disorders (4).

Common to these theories is the conviction that the human body is capable of maintaining optimal health, if the nervous system is allowed to regulate all tissues without interference. Furthermore, mechanical spinal dysfunctions (denoted '*subluxations*') are thought to be the primary cause of such interference and are amenable to spinal 'adjustments'.

Referring to these theories, some chiropractors promote a *chiropractic lifestyle*, offer manual treatment for conditions for which no supporting evidence exists, recommend regular manual treatment as a primary preventative measure in healthy individuals, and advise against other healthcare initiatives such as vaccination (5,6), for which evidence does exist.

It is disturbing how groups of chiropractors still stick to these conservative concepts that lack general contemporary acceptance in the scientific community. Remarkably, these unscientific concepts are apparent also in modern-day chiropractic students (7,8), which is especially troubling.

We speculate that there are three main types of chiropractic 'educational patterns': 1) private and independent chiropractic schools that a) might partially or wholly accept and encourage some degree of conservative and vitalistic approach to chiropractic, or b) do not have the resources to properly regulate conservative and vitalistic thoughts. 2) Chiropractic schools embedded in or affiliated with a university but independently of any medical course that, nevertheless, might have staff, who more or less overtly, include elements of chiropractic conservatism in their interactions with students, and 3) chiropractic degree courses that are embedded in a medical school. Medicine has the longest and most well-established tradition for scientific inquiry of the healthcare professions (9). Thus, such outdated concepts cannot easily establish themselves without ridicule in such an environment.

Studies have previously been published on this topic. One survey (7), in which chiropractic students from a private and independent institution in Europe responded to a questionnaire on chiropractic conservatism, revealed that a large majority of students held very conservative views on the nature of chiropractic, the implications of 'spinal subluxations', and the effects of spinal 'adjustments'. These findings were surprising, as the school officially adheres to an evidence-based approach. Further, it was shown that the students with the most conservative views had no apparent limitation to their scope of practice, apart from respecting obvious contra-indications to chiropractic treatment. For instance, they would not deter from treating preventively to help children avoiding the development of diseases later in life.

Another survey, in Australia (8), showed that many chiropractic students expressed very conservative views on spinal 'adjustments', for example believing that *spinal adjustments help the immune system* and *prevent spinal degeneration*. These students attended two chiropractic courses provided at state universities but unaffiliated with any medical faculty.

Danish chiropractors are licensed on the basis of a university-based five-year chiropractic degree program, which is closely integrated with the medical education. The national chiropractic organization, of which there is only one, is well-organized and professionally managed, and chiropractic services are included in the publicly funded health-insurance system (10). Furthermore, research-funding is available via The Foundation for Chiropractic Research and Postgraduate Training, which supports a relatively large and active research community. The Foundation is continuously and proportionally financed, as part of the agreement on public

reimbursements of chiropractic service fees, corresponding to approximately 4000 €/chiropractor/year (11). Chiropractors in Denmark can work in various clinical positions that extend beyond the primary care, for instance as diagnosticians at hospitals, and recently, a 5-year post-graduate in-hospital residency program for a chiropractic musculoskeletal specialty was initiated (12). Thus, the chiropractic program is placed in a lively clinical and research environment and taught by chiropractors and other academic staff who are active researchers.

We were curious as to whether Danish chiropractic students, nevertheless, share the same conservative views on chiropractic scope of practice as those revealed in the previous two studies. For this reason, we conducted a survey of chiropractic students attending the third, fourth- and fifth-year programs, at the Department of Clinical Biomechanics at the University of Southern Denmark.

The objectives of this study were to establish the level of conservatism in Danish chiropractic students, to investigate if this was linked to year of study, and to compare the results from previous studies on the university and non-university-based institutions.

Methods

Setting and study sample

This was a cross-sectional cohort study, using a subset of data from a survey conducted on all senior chiropractic students (3rd, 4th and 5th year) enrolled in the master degree program in Clinical Biomechanics at the University of Southern Denmark (SDU).

Information about the project (Supplementary file 1) was distributed beforehand by e-mail on October 1st, 2019 and two reminders followed on the 8th and 22nd of October using the student e-mail system. It took approximately 10 minutes to complete the survey.

In order to achieve as high a response rate as possible, a lecturer or one of the researchers (CGN) interrupted the students' regular class work, giving them the possibility to answer the survey directly or later.

All data were collected anonymously and online using SurveyExact (13). Data was extracted on November 4th, 2019. No ethics permission is necessary to conduct an anonymous voluntary survey in Denmark (14).

Survey

The survey consisted of a questionnaire with ten statements regarding beliefs about spinal 'adjustment'/manipulation (n=6) and spinal 'subluxations'/dysfunctions (n=4) designed to investigate the level of chiropractic conservatism, i.e. the degree to which the respondent agreed with historical, dogmatic ideas about chiropractic, using a five-point Likert scale. The survey also included a number of simulated clinical cases which were presented in order to gauge the different treatment strategies students would pursue (data to be presented elsewhere). Details about each questionnaire item are presented in the results section. Data on year of study, age and sex were also collected.

The full questionnaire has been used previously in a study on chiropractic students from a European private chiropractic institution (7), and a subset of questions has been used in a study conducted in two Australian state university schools not embedded in a medical faculty (8).

The survey was translated to Danish using a modified version of Beaton's cross-cultural adaptation technique (15). Two from the research team, fluent in English and Danish, translated the survey forward (SON) and backwards (HHL). A consensus meeting, where issues regarding content were discussed, was held between SON, HHL and CGN, and the final Danish version was agreed upon. Subsequently, we pilot tested the survey on four recently graduated Danish chiropractors, who were interviewed about their understanding of the phrasing and the appropriateness of the questions. This did not give rise to any changes to the survey.

Statistics

Data transformation

Each response to the 10 items concerning chiropractic conservatism was dichotomized into 'appropriate'/'inappropriate', as described in the Supplementary File 2. This definition of 'appropriate' and 'inappropriate' was the same as the one used in the original study (7), namely that a conservative view was considered 'inappropriate'. The degree of conservatism was calculated as the number of 'inappropriate' answers, yielding an individual score between 0 and 10. This score was further categorized into four conservatism groups: Group 1, a score between 0 – 2; group 2, a score between 3 – 5; group 3, a score of 6 or 7; and finally group 4, a score between 8 and 10, using the same scoring system as in the private college study (7).

Descriptive statistics

All descriptive statistics are presented as counts, frequencies and 95% confidence intervals. Sex and age are reported as proportions for the cohort.

Association statistics

Binary and multivariate linear regression analyses were performed using the conservatism score [0-10] as the dependent variable and the academic year of study as the independent variable. The analysis was then adjusted for sex. Confidence intervals where 0 was not included would indicate a statistical significance.

Comparison between surveys

The results from the present study were quantitatively compared to:

- i. Third to 5th year students attending the two university programs, using identical questions (item 1-5) previously reported elsewhere (8).
- ii. Third to 6th year students from the private chiropractic institution (7), using i) the number of 'inappropriate' answers per student (0-10/10) and ii) the distribution of individuals in the cumulated conservatism groups (groups 1 - 4)

Data analyses and data wrangling of the Danish study were performed using the tidyverse (16) in R (17) (Linux, v. 3.6.0 with R-studio v. 1.1.456). The *exactci* package (18) was used to calculate 95% confidence intervals (CI).

Results

The first part of the Result section refers to the Danish study and the latter part compares our results to the results from the studies of the other university-based courses and the private college.

Danish study

Descriptive student data

One-hundred-and-sixty-seven (167) students were invited to participate in the study, and 122 (73%) completed the survey. Of these, 66 (54%) were female and the mean age was 25.2 (SD = 2.1). Response rates were lowest in year 3 and highest in year 5. For further details, see Table 1.

Table 1. The response rates for each academic year by sex in a survey on chiropractic conservatism conducted on chiropractic students in a Danish university-based course

Academic year of study	Males N (% of students)	Females N (% of students)	% of respondents per year of study of all eligible students
5 th year	19 (79)	29 (97)	89
4 th year	15 (75)	20 (74)	74
3 rd year	19 (61)	17(57)	59
Missing data	3		

Conservative beliefs

Frequencies of 'inappropriate' answers in absolute numbers and percentages are presented in Table 2 (column 2). The 'inappropriate' answers per item ranged between < 1% and 65%, with 7 of the 10 items found to be below 33%. The distribution of 'inappropriate' answers per student is presented in Table 2. The mean and median number of 'inappropriate' answers per student were 3.0/10 and 2/10, respectively.

In general, the Danish students had more 'inappropriate' beliefs about 'spinal adjustments'/manipulation than about 'subluxations'/dysfunction. Two items concerning 'adjustments'/manipulation scored more than 50% of 'inappropriate' answers: 65% accepted that *spinal adjustments can help the body function at 100% of its capacity*, and 58% reported that they believe that *spinal adjustments have the ability to improve the health of infants*.

On questions regarding ‘subluxations’, 42% believe that it is possible to detect *subluxations before the onset of symptoms*, but only one student believed in the original chiropractic concept that *subluxations are the cause of all diseases*.

Table 2. The proportion of chiropractic students who gave ‘inappropriate’ answers relating to chiropractic conservatism in two different chiropractic undergraduate institutions. Percentages are in bold

Questions	Proportions of ‘inappropriate’ answers in the Danish study n (%) [95%CI]	Proportions of ‘inappropriate’ answers in the two other university-based courses n (%) [95%CI]
<i>Can spinal adjustments prevent disease in general?</i>	25 (25) [14-29]	79 (24) [20-29]
<i>Can spinal adjustments help the immune system?</i>	16 (13) [8-21]	150 (46) [41-52]
<i>Can spinal adjustments improve the health of infants?</i>	71 (59) [49-68]	178 (55) [49-60]
<i>Can adjustments help the body function at 100% of its capacity?</i>	79 (65) [56-74]	238 (73) [68-78]
<i>Can spinal adjustments prevent degeneration of the spine?</i>	36 (29.5) [22-39]	193 (59) [54-65]
<i>It is appropriate for every person to receive chiropractic adjustments for their entire life?</i>	29 (24) [17-33]	-
<i>Subluxations are the cause of all disease.</i>	1 (0<1) [0-5]	-
<i>Subluxations cause short-circuits of the nervous system.</i>	18 (15) [9-23]	-
<i>Subluxations can have a negative effect on the capacity of the nervous system to provide energy to tissues and organs.</i>	39 (32) [25-43]	-
<i>It is possible to detect subluxations before symptoms appear.</i>	49 (42) [33-51]	-

Changes in conservatism score by academic year of study

A clear association between the degree of conservatism (0–10) and academic year of study was observed for the Danish students. The conservatism score was found to decrease by each increasing academic year, reaching statistical significance at the 5th year, also after adjusting for sex and age. This means that the number of ‘inappropriate’ answers became smaller in the higher years of study. For example, a student in year 5 had a conservatism score which was 2.2 points lower compared to a student in year 3 when adjusting for differences in sex. See Table 3 for the complete results

Table 3. Association between chiropractic conservatism group and academic year of study in a survey conducted on chiropractic students from Denmark

	β Estimate [95% CI] Unadjusted	β Estimate [95% CI] adjusted for sex [index=female]
Year 3 - 4	-0.5 [-1.5 - 0.5]	-0.5 [-1.5 - 0.5]
Year 3 - 5	-2.1 [-3.0 - -1.2]	-2.2 [-3.1 - -1.3]

Sum of conservatism scores collapsed into four categories

When the total number of ‘inappropriate’ answers per student was collapsed into four groups, 58 (48%) were placed in conservative group 1, 39 (32%) in conservative group 2, 15 (12%) in group 3, and only 3 (2%) participants belonged to the extremely conservative group 4, i.e. most students were in the least conservative groups, 1 and 2.

Seven participants (6%) failed to complete one or more questions and could not be categorized. They reported a mean conservative score of 2.7 (0–10) and had an average of 3.7 unanswered items out of the 10 possible items.

Comparison to other studies

Comparison of the degree of conservatism in the Danish study and the university-based study

Five of the items regarding spinal ‘adjustments’/manipulation were also reported in the university-based study (8) – see Table 2 (column 3). Three of the five items had similar results, but the university-based institutions not embedded in a medical faculty scored considerably higher on *adjustments helping the immune system* (46% vs 13%) and on *adjustments preventing degeneration of the spine* (59% vs 30%).

Comparison of ‘inappropriate’ answers in the Danish study and the private college study

Presented in Table 4, the number of ‘inappropriate’ answers per student differed considerably between the Danish survey (column 2) and the private college survey (column 3). In the present Danish data, only 3 percent scored 8 or more (highly conservative). By contrast, only 3 percent in the private college study scored 1 or less (least conservative).

Table 4. The number of ‘inappropriate’ answers (0-10) per student in two different chiropractic undergraduate institutions. Percentages are in bold

Number of inappropriate answers per student	Danish study N (%) [95%]	Private college study N (%) [95%]
0	14 (12) [7-20]	3 (1) [0-2]
1	23 (19) [13-28]	7 (2) [1-4]
2	21 (17) [12-27]	5 (1) [0-3]
3	12 (10) [6-18]	16 (4) [3-7]
4	14 (12) [7-20]	25 (7) [4-10]
5	13 (11) [6-19]	29 (8) [6-11]
6	8 (7) [3-13]	42 (12) [8-16]
7	7 (6) [2-12]	76 (21) [17-26]
8	2 (2) [0-6]	81 (23) [19-28]
9	1 (<1) [0-5]	63 (18) [14-22]
10	0	7 (2) [1-4]
Missing	7 (6) [2-12]	5 (1) [0-3]

Comparison of collapsed categories of conservatism in the Danish survey and the survey of the private college

The distributions of conservatism categories are presented in Fig. 1. This figure illustrates clearly a 'stair-case' distribution in both data sets, but with opposite orientations. In the data from the private college, a high degree of conservatism is the norm and low levels of conservatism is the exception. In the present Danish data, the situation is reversed.

Discussion

This survey shows that chiropractic students at an undergraduate institution embedded in a medical faculty generally do not subscribe to the antiquated conservative chiropractic concepts, such as: *subluxations are the cause of all disease, spinal adjustments can help the immune system, and vertebral subluxations cause short-circuits of the nervous system*. To our surprise, however, they have picked up some other tenets that are not part of their curriculum. Approximately 20% answered 'inappropriately' about the connection between spinal manipulation and its ability to intervene with the nervous system in instances such as, *adjustments can; prevent*

diseases in general, help the immune system and prevent degeneration of the spine. Some also believe that adjustments can improve the health of infants.

The extent of such beliefs per student was limited, however, with only 3 students scoring 8 or 9 points and nobody reaching the 10 out of 10 possible. None-the-less, 3 is 3 too many!

The difference in chiropractic conservatism between the Danish students and the students from the other university-based study was smaller compared to the difference with the private college. The students in the latter institution appeared overwhelmingly conservative in approach with a remarkable inverse pattern for the four-group results, when compared to the Danish students.

These results indicate that collaborating with a medical school may have a protective effect with regards to antiquated unscientific and unacceptable concepts, and that education does indeed play a central role, as the conservatism score diminished in the fourth and, particularly, fifth year of study. On the contrary, in a previous report from Australia, a tendency was noted for final-year students to have a more non-evidence-based approach compared to the lower years (8). This indicates that the protection of education worked better in the medical faculty-embedded university than in the other two universities. Unfortunately, this relation was not reported in the study on the private college (7).

Whether this chiropractic conservatism among students is caused by forces within the institutions (19) or concepts picked up from outside, is difficult to say. The degree of conservatism in the surrounding chiropractic profession and the access to that type of courses may well play a role. Altruistic students with an acceptance of alternative treatment approaches may well become attracted to an alternative to the scientific approach in the information material, and they could become included into the pre-graduate course, particularly, if there is a need for a large student intake, as there is in private colleges. However, at the Danish university, a conscious effort is exerted in informing applicants on the musculoskeletal and scientific focus of the education (20). In addition, the selection process of students could be insufficient, although admittance procedures to enter the education at the Danish course have been tightened in recent years. Finally, external lecturers may also include non-evidence-based concepts and views when delivering clinical teaching to the students bypassing methods of "vetting" new lecturers.

Nevertheless, quite a few Danish chiropractic students still hold, at least, some unusual beliefs that would surprise this controlled university faculty and most likely the Danish health authorities. This is disappointing, when considering the educational setting for these students. The five-year course in Clinical Biomechanics at the University of Southern Denmark is highly academic at both the bachelor and master level. Classes are taught by academic specialists (anatomists teach anatomy, pathologists teach pathology, etc.), and there is considerable overlap in curriculum with the medical degree course. In fact, chiropractic and medical students sit in the same classes and attend the same examinations throughout the three years of bachelor studies and to a lesser extent in the master's studies. Clinical subjects like rheumatology and orthopedics are taught by medical specialists, as opposed to chiropractors with a *special interest*. Pre-graduate clinical training takes place primarily in a medical secondary care spine center, where the students attend to patients on referral from general medical practitioners, private practice chiropractors and other hospital departments. Students are supervised by medical specialists as well as senior chiropractors (21–23).

With this extensive academic program, it is concerning that outmoded conservative views are still relatively prevalent among chiropractic students. If not from within the University, this thought process could be provided to the students through social media or chiropractors practicing in Denmark, who also, surprisingly, tend to have unscientific viewpoints judging by their websites (24). Approximately 5% of the chiropractic program concerns spinal manipulation including both technique training and the theoretical framework. While not occupying much of the students' academic focus, spinal manipulation is unconditionally an essential aspect of being a "chiropractor". Thus, the students may not find 'relief' in the presented biomedical model, thus seeking other explanations as often given by charismatic representatives of alternative approaches.

Methodological Considerations

There are some potentially weak points to consider regarding this survey. It is possible that opinions of the non-responders could have altered the results, but as this was an anonymous survey it is not possible to conduct a responder/non-responder analysis. As the response rates ranged from acceptable to good, however, we have no reason to believe that the students who either were absent on the day of invitation or were uninterested in responding would have a remarkably different profile that could substantially change the results. However, 7 students chose to terminate their survey in the initial section for reasons unknown. We speculate if these students did not understand the questions or disliked responding to the questions. However, judging by their intermediate score, they did not appear to be highly chiropractically conservative.

It is also possible that the questionnaire used in the studies (7,8) had poor content validity (25) despite having gone through pilot tests. For instance, the question *adjustments can improve the health of infants* could have been interpreted to specifically refer to infantile colic, a condition commonly treated by chiropractors in Denmark (26). Thus, it is possible that answers reflect a conviction that 'adjustments' improve the health of infants in specific circumstances, and not as a general effect. This is speculative, however, and will require further research to clarify.

However, the fact that the score of conservatism (0–10), when tested in one of these studies (7) corresponded in such a logical manner with the inability to respect a number of chiropractic non-indications, indicates that the ten questions, on the whole, validly captures individuals who accept the chiropractic conservative concepts.

Lastly, and related to content validity, the terms 'subluxations' and 'adjustments' are not typically included in the Danish chiropractic curriculum. However, we assume that the students would have picked up these terms from their international reading material, and the pilot study did not reveal any such problems.

A strength of the study was that questionnaire we used had previously been used, which allowed us to compare our findings with those of other studies. Nevertheless, a full comparison of all questions was not possible, as the data reporting was not identical to ours in the two previous studies. Further, the Danish questionnaire was translated and piloted carefully before being applied, yet another strength of the study.

As our data were collected cross-sectionally, our suggestion of the differences between 3rd, 4th and 5th years students being indicative of a development over time may be false. Obviously, only a longitudinal study can establish whether students change over time.

Conclusions

While not excessively concerning, the Danish students still expressed some levels of chiropractic conservatism, most notably regarding the purported effects of spinal 'adjustments'/ manipulation.

We therefore suggest a qualitative follow-up study to investigate i) the validity of items and ii) what source of influence gave rise to the approximately 20% who answered 'inappropriately' on some undoubtedly antiquated viewpoints.

This must be followed by remedial action by the University. Clearly, continued monitoring would thereafter be necessary to verify whether the various remedial actions have an effect. Such information could potentially be helpful also for chiropractic programs in more challenged milieus.

Abbreviations

CI

Confidence interval

SDU

University of Southern Denmark

Declarations

Ethics approval and consent to participate

Not applicable as no ethical permission is necessary to conduct an anonymous survey in Denmark.

Consent for publication

Not applicable.

Availability of data and materials

The data are available in a fully anonymized format from the corresponding author upon reasonable request.

Competing interests

HHL, SON and RKJ are all lecturers at the Biomechanics course at the University of Southern Denmark and HHL is the head of the Chiropractic program, but did not have impact on the analyses or statistical outcomes. CLY is a senior editorial adviser to the journal Chiropractic & Manual Therapies but was not a part of the post submission progress.

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Authors' contributions

- CGN, GG, SON and CLY: Configured the study design.

- CGN, SON, and HHL: Completed the translation and validation of the questionnaire.
- CGN, SON, HHL: Organized and conducted the questionnaire sessions.
- CGN: Completed the analysis and interpreted the data.
- CGN and CLY: Wrote the initial draft
- HHL and RKJ: Provided valuable insight into the chiropractic program at the University of Southern Denmark
- All authors contributed to the Discussion section and agreed upon the final manuscript.

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Figures

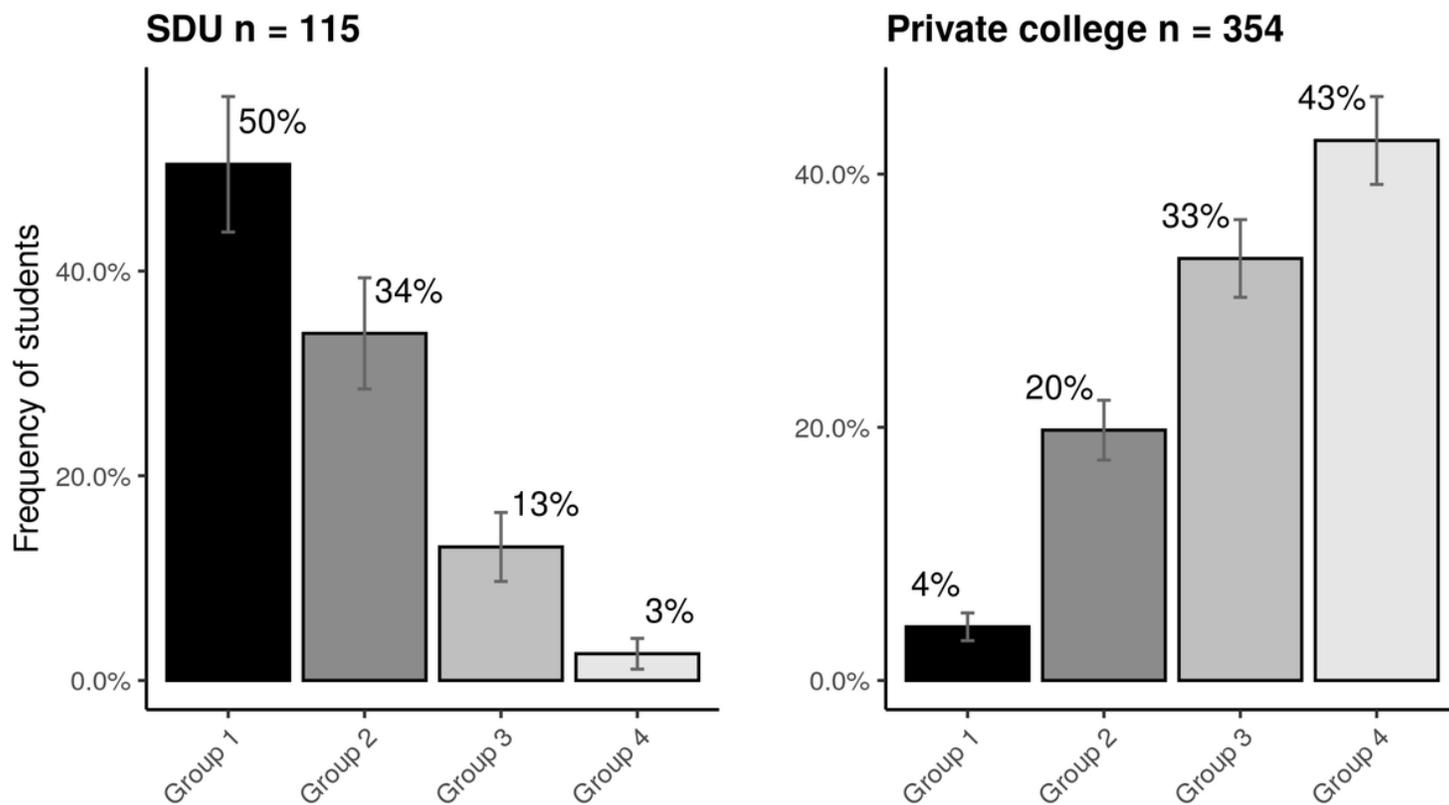


Figure 1

Comparing the chiropractic conservatism scores from all available students in the Danish survey (SDU) to the survey on the private college. Group 1 indicates low conservatism, whereas group 4 indicates highly conservative thinking

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