RESEARCH ARTICLE

Medical Students Meeting Pandemic Staff Needs: Duty, Drives and Dreads - a cross-sectional questionnaire survey at Aalborg University in Denmark

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Abstract:
Background: The covid-19 pandemic hit healthcare systems globally, and demands on healthcare worker resources rose dramatically. Medical students are a potential resource to meet these demands, but to what extent can they be expected to step up, and where can they fill in.
Aims: To evaluate medical students' contribution as healthcare workers during the pandemic and assess motivation and deterrence factors.
Methods: A cross-sectional survey questionnaire was distributed one year following the lockdown of the country and accessible from March 18th through April 14th 2021. All medical students enrolled at Aalborg University were asked about positions held, number of working hours, and factors of motivation and deterrence.
Results: The response rate was 69% (557 of 806), and 80.4% (448 of 557) of the respondents had performed paid work as healthcare workers during the pandemic. Students took up an array of jobs in the healthcare system, the most prevalent being Covid-19 test-personal (302, 54%), assistant nurse (149, 27%) and locum physician (115, 21%), with 42.2% (235 of 557) of medical students holding more than one position. The majority worked between 11 and 20 hours weekly, and the 448 medical students working in the pandemic reported filling in for 205 full-time jobs. Working students differed from non-working students by giving the most markedly higher scores to taking pride, participating in a historical event, receiving salary and improving job opportunities (all, $p<0.001$).
Conclusion: Medical students proved to be willing contributors and flexible resources. The 448 medical students worked an estimated 344,000 hours during the first year of the pandemic, and they supported several job types. Differences within domains for motivation and deterrence were identified.

1.1 Background

On 11th March 2020, the Director-General of the World Health Organization (WHO) declared SARS-CoV-2 a pandemic.[1] The world was shutting down, and the prime minister of Denmark closed down all non-critical society activities to dampen the spread of the virus. This was supported by the scenes from Northern Italy in early 2020 of a healthcare system pushed beyond capacity. The markedly raised need for healthcare staff encouraged new solutions.

The undergraduate medical curriculum at Aalborg University evolves around patient-centred learning in the clinical environment, with medical students learning through participation. [2] The majority of medical students at Aalborg University reported a willingness to meet the increased demand for healthcare staff. [3]

Aalborg University Hospital sought to employ medical students to meet the rising demands. Educational institutions facilitated their mobilisation by establishing fast-track training courses. [4]

The new solution to the critical situation stood on three legs, the educational institutions prioritizing hands-on training, hospitals seeking to employ staff qualified to meet demands, and the willingness of medical students to help.

A study of medical students' contributions can help future decision-makers in hospitals, universities, local governments, and policymakers prepare for future pandemics by enlightening what can be expected from medical students.

The willingness of medical students to contribute was, however, reported during the very early phase of the pandemic. One year into the pandemic, the second and third waves of Covid-19 took its toll on all healthcare worker resources. History has shown that this will not be the last pandemic. Therefore it is essential to establish what can be expected from this healthcare group during a pandemic. Medical students have been employed to alleviate healthcare staff needs. Still, we lack knowledge of their perspective during the pandemic.

This led us to survey how many medical students at the medical school at Aalborg University,

Denmark, participated in the healthcare workforce (HCW), which positions they took up, and the number of working hours they contributed during the first year of the Covid-19 pandemic. Additionally, we aimed to evaluate the differences in motivation and demotivation between working and non-working medical students to guide decision-makers on what areas of motivation could be supported among medical students.

2.1 Methods

The paper is written following the "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE) guideline. [5]

A cross-sectional study design was chosen with a survey questionnaire distributed at one point in time. The questionnaire was distributed on 18th March 2021 to all medical students enrolled at Aalborg University. An invitational e-mail was delivered through institutional e-mail addresses and was followed by two reminder e-mails. Data collection terminated on 14th April 2021.

All medical students at Aalborg University, Aalborg, Denmark, were invited (n=807). No exclusion criteria were applied. In Denmark, healthcare and education is free of charge, and admission to medical schools relies on grades. The medical curriculum comprises 12 semesters and thus spans six years, with years four and five doing clinical rotations. The primary teaching principle at Aalborg University is patient organised problem-based learning. [2]

All medical students can work as Covid-19 testing personal, assistant nurses, assistant ventilators, and phlebotomists after participation in qualifying courses. Medical students qualify as locum physicians in Denmark after completion of study year 4. Students working as locum physicians perform patient admissions and ward rounds supervised by qualified doctors.

The first admission at Aalborg University Medical School was in 2010, and the first graduation of medical doctors was in 2016. The number of medical students has increased gradually since.

Development of the research questionnaire

The questionnaire is an extended version of a survey developed for a previous study. [3] In brief, an expert panel was set up comprising a medical student (AWE), a junior doctor (MSA), and a senior consultant and educational decision-maker (SA). They performed a brainstorm on motivational domains. Essential domains were highlighted and further narrowed down to key questions. A survey questionnaire was constructed and sent out for review by two experts on education (JE, SR). The questionnaire then underwent an iteration with language revision to enhance quality for digital distribution (GVG, SA). The final iteration on February 2021 added demotivational points based upon feedback by students to our previous survey. [3]

Content of the questionnaire

The survey questionnaire is included in the appendix in an original Danish format and an English translation. The questionnaire included questions regarding demographics, contribution to the pandemic workforce, and motivational factors. Demographic factors were age, gender, and the number of completed semesters. Questions on contribution were: how many months of clinical experience do you have from extracurricular activities (a month being defined as full-time employment during that month, which is 37 hours/week in Denmark); what is this extracurricular experience based upon; did you do paid work related to public healthcare during the pandemic; what is your extracurricular clinical experience based upon. Students participating in paid work in relation to public healthcare were defined as having contributed as a healthcare worker. By this, we conclude that they have alleviated pressure directly or indirectly on the healthcare system by their participation.

We assessed the contribution by the question: counting from March 2020 to the time of this survey, how many hours have you spent on average per week performing paid work in the healthcare system. The respondents could choose pre-selected ranges of "working-hour-groups": 0

hours, 1-10 hours, 11-20 hours, 21-30 hours, 31-37 hours, and >37 hours.

We calculated the number of hours contributed by the medical students by multiplying the number of individuals in each working-hour group by the median number of hours in that group, and 40 hours were used in the calculations for the 37+ hours group. The total number of hours of all groups were divided by the number of hours of a full-time employment in Denmark in 2020.

The survey included 11 motivational statements following an overarching question: "To what degree are the following statements important for you to join/stay active in a national pandemic healthcare workforce?" and four demotivational statements following the overarching question: "To what degree are the following statement a limiting factor for you to join/stay active in a national pandemic healthcare workforce?"

Motivational statements concerned altruism, learning, pride, doctoral fellowship, being needed, safety, supervision, job opportunities, feeling of duty, salary, and taking part in a historical event. Demotivational statements concerned lack of study time, risk of getting barred from exams, risk of getting infected, and risk of infecting family and close relatives. Students were asked to score each statement on a scale ranging from 0 to 100, 0 being to a very low extent and 100 being to a very high extent. For motivational and demotivational statements, each section was terminated by the open-ended question in an empty text field, "Do you have further motivational points that have not been asked about?" with the student being able to reply in text freely.

One semester equals 21 weeks, and semesters were merged to report advancements in full study years completed. Age was grouped as: ≤20 years, 21-25 years, 26-30 years, and ≥31 years. Clinical experience was summed and categorised as: < 1 year, 1-2 years, 2-3 years, and 3+ years based on Danish standards, with full-time work equaling 37 hours a week.

To enhance interpretation and conveying of message we chose to categorise scores for motivation and demotivation into quintiles defining scores as: < 20 "very low", > 20-40 "low", >40-60 "average", >60-80 "high", and >80 as "very high".

2.2 Data management

The data were collected using Research Electronic Data Capture (REDCap) electronic data capture tools hosted at Region Nordjylland. [6,7] REDCap is a validated web-based software platform designed to support secure data capture for research studies. Data collection and management followed the permission from the data Danish Data Protection Agency, and ethical approval was waivered as ethical approval was not necessary for this kind of study. The study was registered for Danish Data Protection Agency with ID 2020-108.

2.3 Bias

The invitation of all medical students enrolled at Aalborg University, Denmark, at the time of the survey minimised the risk of selection bias. Non-response bias was prevented using neutral wording and sentences in the questionnaire by involving a medical student (AWE) in its development and providing incentives for participating in the survey by highlighting the potential for improved working environment and study conditions.

2.4 Statistical analysis

Data were summarised using descriptive statistics with medians and quartiles. Motivational scores were categorised by quintiles to enhance presentation and understanding while they were compared as continuous variables using Mann-Whitney Test for two groups and Kruskal-Wallis test for comparison of multiple groups. Chi-squared test was used for comparison of proportions ie. by sex or study year. Correlations were calculated using Spearman's rho. Missing data accounted for 0.2% (16/6,648) of demographic data and 1.0% (94/8,912) of motivational and demotivational data. We did not perform imputations, and observations with missing data were included in the analyses. Statistically significant findings were defined by

having a p< 0.05. The sample size was defined by the total number of enrolled medical students at Aalborg University, Denmark, by 15th February 2021. The Statistical Package for the Social Sciences was used (IBM Corp. IBM SPSS Statistics for Windows, Version 13.0. NY: IBM Corp.).

3.1 Results

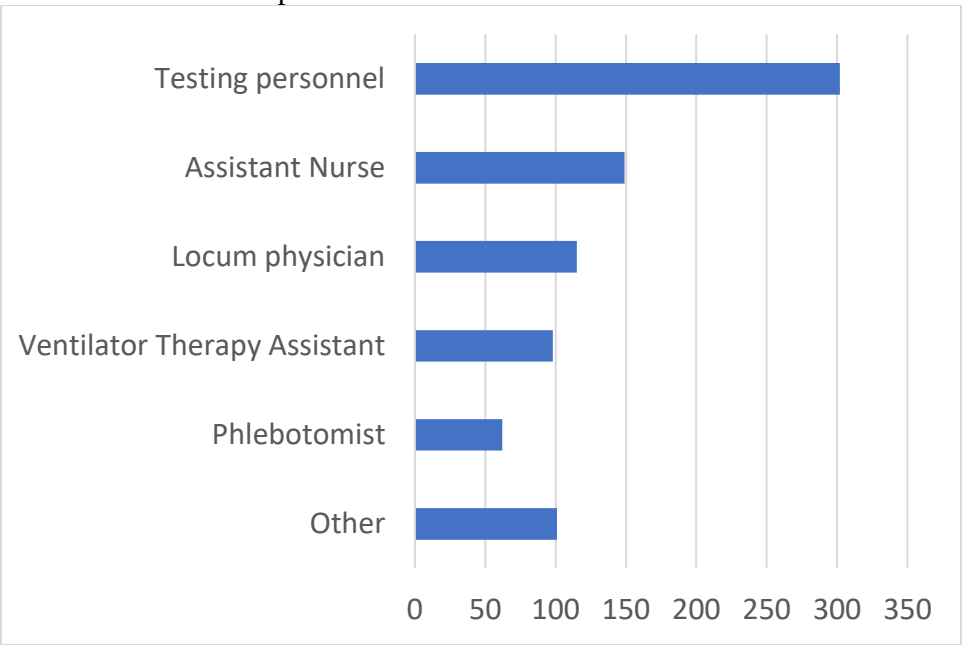
The response rate was 69.1%, with 557 of 806 medical students responding. The response rate was higher among students in the final three years (first three years, 60.5%; last three years, 81.3%; p<0.001) and among female students (male 60.8%, female 72.6%; p<0.001). The proportion of female students at our medical school is 67.4%. The number of responding medical students having "joined" as a healthcare worker during the pandemic was 56.0% of 1st-year medical students, 90.9% of 2nd year, 80.6% of 3rd year, 80.1% of 4th year, 94.2% of 5th year, and 90.6% of 6th year. Demographic data are presented in table 1. The median (quartiles) age was 23 (22;25) years, and clinical experience in full months was nine (4;21).

Table 1: Demographics of the medical students participating in the study (n=557)

			Not joined	Joined	Total	P
Age groups			N (%)	N (%)	N (%)	
	Up to 20 years		22 (20.2)	36 (8.0)	58 (10.4)	0.010
	21-25 years		66 (60.6)	310 (69.2)	376 (67.5)	
	26-30 years		12 (11.0)	84 (18.8)	96 (17.2)	
	31+ years		9 (8.3)	18 (4.0)	27 (4.8)	
		Total	109 (100)	448 (100)	557 (100)	
Gender						
	Male		29 (26.6)	131 (29.2)	160 (28,8)	0.680
	Female		79 (72.5)	315 (70.3)	394 (70,7)	
	Other		1 (0.9)	2 (0.4)	3 (0,5)	
		Total	109 (100)	448 (100)	557 (100)	
Study year						
	1		51 (46.8)	65 (14.5)	116 (20.8)	<0.001
	2		9 (8.3)	90 (20.1)	99 (17.8)	
	3		14 (12.8)	58 (12.9)	72 (12.9)	
	4		25 (22.9)	106 (23.7)	131 (23.5)	
	5		5 (4.6)	81 (18.1)	86 (15.4)	
	6		5 (4.6)	48 (10.7)	53 (9.5)	
		Total	109 (100)	448 (100)	557 (100)	
Clinical experience in full years						
	< 1 year		99 (89.9)	259 (57.8)	357 (64.1)	<0.001
	>1-2 years		7 (6.4)	77 (17.2)	84 (15.1)	
	>2 -3 years		3 (2.8)	58 (12.9)	61 (11.0)	
	>3 years		1 (0.9)	54 (12.1)	55 (9.9)	
		Total	109 (100)	448 (100)	557 (100)	

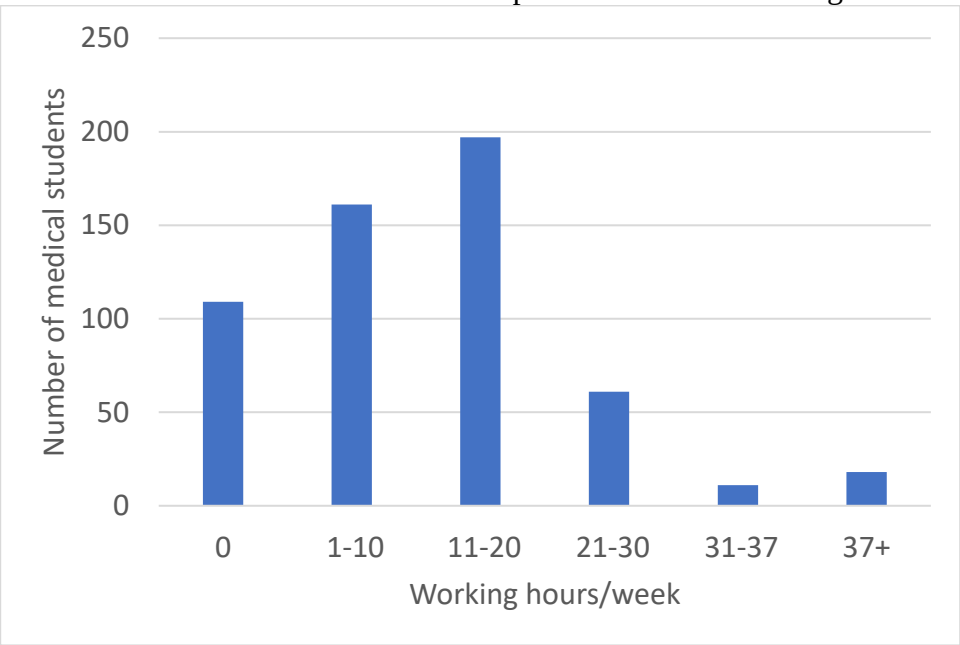
A total of 448 (80.4%) students had performed paid work and contributed to the healthcare services during the pandemic since early march 2020. The clinical work participation of students based on professions can be seen in figure 1, with the most prevalent being Covid-19 test-personal, assistant nurse and locum physician. Several students had participated in more than one job during the year and the number of HCW positions held by medical students was: 0 job: 109, 1 job: 213, 2 jobs: 132, 3 jobs: 71, 4 jobs 29, 5 jobs: 3, totalling 557 students.

Figure 1: The healthcare worker positions held by medical students at Aalborg University during the first twelve months of the Covid-19 pandemic.



The medical students contributed to the pandemic workforce with varying numbers of hours/week, as illustrated in figure 2. The number of working hours in the pandemic increased with advancing study year ($p<0.001$).

Figure 2: The number of self-reported hours of working weekly as pandemic health care staff during the first twelve months of the Covid-19 pandemic. A full working week in Denmark is 37 hours.



Motivational (figure 3) and demotivational (figure 4) scores were compared between the medical students working and those not working as pandemic healthcare staff. Differences were marked for taking pride in contributing with median (quartile) scores of 70 (54;84) / 52 (50;71) (P < 0.001) for those working/not working as pandemic healthcare staff. Similarly, differences were marked for "I become a part of the doctoral fellowship" (75 (60;88) / 65(50;82), P= 0.007), for "I am informed that I am needed" (65 (50;80) / 50 (50;71), P= 0.018), for "I develop my professional job profile" (75 (59;90) / 65 (50;81), P < 0.001), for "I get paid for my work" (89 (74;100) / 74 (50;91), P < 0.001), and for "I become part of a historic event" (50 (24;75) / 30 (10;50), P < 0.001). Demotivational statements differed by "I lose time to study" (working / not working students: 75 (62;88) / 84 (66;100), P=0.002), and for "I risk getting infected with Covid-19" (29 (11;50) / 34 (17;60), P= 0.025).

Figure 3: Priorities among medical students to spend time working in the pandemic health care workforce. (full/broken line: working/not working; median of scores). * P<0.05; ** P<0.01; *** P<0.001

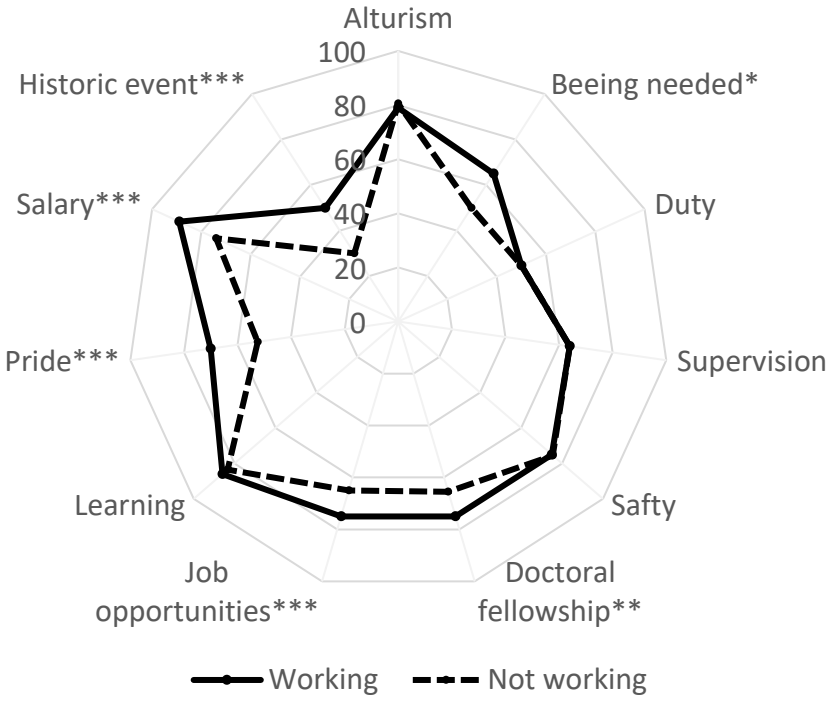
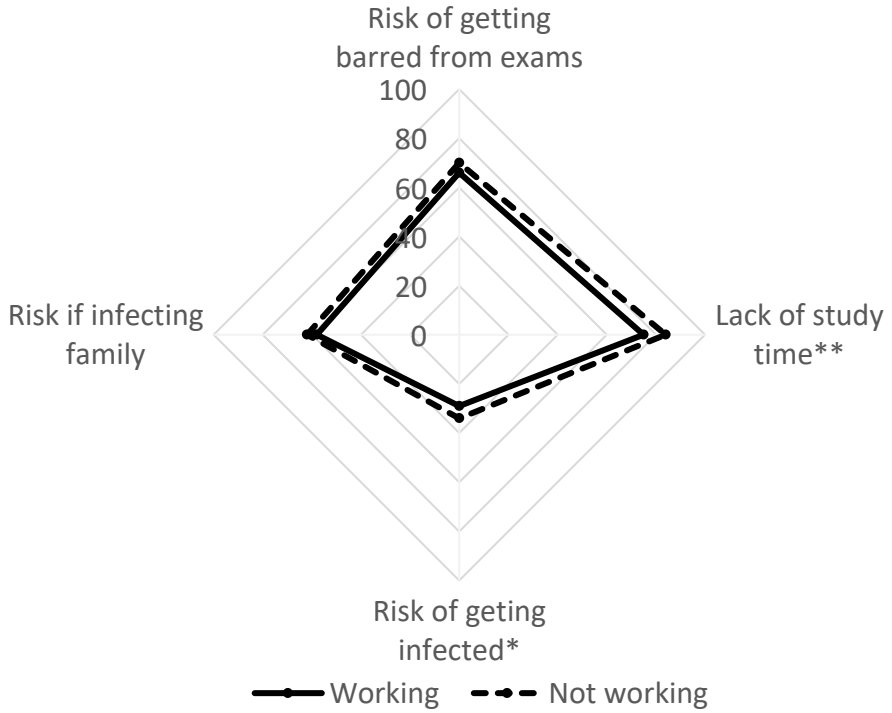


Figure 4: Factors worrying medical students and holding them back from joining the pandemic health care workforce. (full/broken line: working/not working; median of scores). * P<0.05; ** P<0.01; *** P<0.001



Additional comments by the medical students included the notion that they were motivated to join the pandemic workforce because of the possibility of socialising (4%, n=22). Gatherings in private were restricted to a maximum of 5 persons at the time of the survey. Moreover, students who had joined were demotivated by poor working conditions, with students mentioning poor planning, unflexible work time requirements, and unstructured workplace logistics with daily changes with short notice (6%, n=33).

4.1 Discussion

This study found that one year into the pandemic 80% (448) of medical students joined the HCW. They contributed to a range of positions and most frequently worked between 11 and 20 hours weekly, making an overall contribution equal to 205 full-time positions. Moreover, motivational factors differed markedly between those who worked in the HCW and those who did not.

Eighty percent of medical students responding to the survey had contributed to the HCW during the first year of the Covid-19 pandemic. This is in keeping with our previous finding in the early days of the pandemic that 80% of medical students intended to join the HCW [3] and with previous studies, having shown an inclination among medical students to join the HCW during the pandemic [8–10]. In contrast, a study from Brazil with 10,433 respondents from 257 medical schools reported that only 13.4% believed that all medical students should participate in response to the Covid-19 pandemic, 47.6% responded that only students in internship should participate, and 40% reported that medical students should not participate. [11] Such discrepancies can relate to different views of medical students and differences in the undergraduate curriculum and in the ways of learning. It may be speculated that the problem based learning with medical students embedded in the clinical environment facilitates the willingness to contribute to the HCW.

Teaching and learning focused on patients, and their problems are important for medical education, and learning in the clinical environment motivates learners by its relevance. [12] The medical education at Aalborg University is based on an integrated curriculum with clinical practice informing non-clinical material on patients and their problems used in problem-based learning (PBL) small group teaching sessions. [2] The PBL sessions are an intersection of these two interwoven paths to learning, and PBL is acknowledged to motivate student engagement. [13] The support by PBL to student engagement may carry through to the clinical environment and encourage experience-based learning by facilitating participation. Students may thus advance through the levels of participation and may make a difference to patients even before they are clinically experienced. [14] The motivation and increasing capability experienced by medical students when learning in the clinical environment may be speculated to both encourage their participation in the HCW and increase their self-confidence. Our finding that four out of five medical students voluntarily joined the HCW is in agreement with experienced-based learning facilitates participation also in a pandemic emergency.

Medical students contributed as a healthcare worker within several areas of the healthcare system, and 42% of the students at our university had more than one job role during the pandemic. A Polish study investigating the effort of healthcare students report similar findings, with 42% of students taking up more than one position. [15] It may be an important finding that medical students contributed within several job types as they thus prove a vital contributor to the health care workforce by being able to respond not only to needs throughout the healthcare system but also with the ability to respond to changing needs and fill-in where most needed.

The 448 medical students in our study reported working about 344,000 hours at our hospital during the first year of the pandemic. This finding

was corroborated by the respondents reporting an additional six months of clinical experience compared to the previous year. [3] This sums up to 205 full-time jobs, and it suggests that each student had added a half-time job on top of their studies. The university saw no delay in the progression of their studies, which suggests that their pandemic work either contributed to the learning or encouraged further reading to pass exams. A study from Switzerland reports a total of 936 shifts staffed by medical students doing 6,700 swabs for Covid-19 over approximately a month. [16] A Polish study report that 580 health students had participated in volunteer work during the Covid-19 pandemic contributing 83.460 working hours over seven months. In addition, the latter study found that medical students volunteered significantly more than other health students. These findings support that medical students are a willing and valuable support for the HCW during a pandemic. Moreover, the rising number of working hours with study year could imply that self-perceived competence is essential, as seen in other studies. [8]

The European Working Time Directive, issued by the council of Europe, has set a maximum workweek for 48 hours to protect the health and safety of all workers in the European Union. [17] The health of our students has to be considered during a prolonged pandemic as their contribution can exceed this maximum number of hours/week. A survey of medical students and newly graduated doctors in Brazil during the Covid-19 pandemic found a worsening in mental health among medical students and newly educated doctors. [18] All students at Aalborg University are offered help in difficult circumstances related to their life or studies. We do not have data on this topic, but staff members supporting students' mental health report a change in the severity of students requesting help, citing signs of depression, loneliness and other signs of degradation of mental health. This is a downside to the pandemic that should be offered attention among all groups of healthcare workers.

Factors of motivation differed between medical students working and not-working as pandemic healthcare staff. Medical students working evaluated "pride", "developing professional job profile", "pay", "becoming part of a historic event", "becoming part of the doctoral fellowship", and "the sense of being needed" significantly higher than non-working students. These findings detail the overall finding in a Brazilian study of a strong positive association between altruism and the support for participation of medical students in internships. [11] This study reported statements associated with a greater odds ratio for participation in the Covid-19 pandemic workforce to be "purpose or duty", "altruism", and "perception of good performance and professional identity." Also, among 257 nursing and medical students, medical students generally were willing to treat Covid-19 patients and felt they had a moral responsibility to do so. [19] An Indonesian study found that volunteers were motivated primarily by "shortage of medical personal", "sense of duty", and "solicitation by stakeholders". [10] However, the cause for differences within motivational domains between working and non-working medical students remains to be settled. Non-working students evaluated "losing time for studying" and "risk of getting infected" higher than working students. Our findings were supported by a study reporting that family safety (96%) and personal safety and health (68%) were the main factors for declining to work during an infections disease outbreak. [9] These findings were corroborated in a study reporting that primary factors diminishing willingness were "fear of own health", "absence of a cure", and "fear of harming patients". [10] In addition, our survey reports that students were dissatisfied with working conditions and that they saw work as a possibility to socialise with fellow students.

It was a strength of our study that all medical students were invited, thus diminishing selection bias. A further strength was the high response rate

resulting in low non-response bias and raising the validity of our findings.

It was a limitation that we did not include data on vaccination as many worked as frontline personnel. All students participating as a healthcare worker were offered vaccination early, and this could have been an incentive to join as an healthcare worker that we did not investigate. It is a limitation that the questionnaire was not validated, but a parallel use has been published. [3] Furthermore, the calculated number of working hours is based on self-reported data and may not be accurate. Finally, there were slight differences between the overall population of medical students and respondents within gender and study year.

Our findings may not be applicable to all areas, and countries as each country and medical school have seen the pandemic evolve differently and have faced different obstacles. However, as history has shown, this will not be the last pandemic, and we have contributed important information on medical students' as a vital source of motivated healthcare workers during a prolonged pandemic.

5.1 Conclusion

In conclusion, medical students have proven an invaluable and highly flexible healthcare worker resource during the pandemic. They can contribute within several areas of the healthcare system by filling in according to needs and work multiple hours. On average, the medical students worked half time on top of their full-time studies, and their contribution equalled approximately 205 full-time jobs during the first year of the Covid-19 pandemic. Students working gave markedly higher scores to the motivational domains of "pride", "job profile", "pay", "becoming part of a historic event", "becoming part of the doctoral fellowship", and "the sense of being needed" than non-working. Non-working students gave markedly higher scores to "losing time for studying" and "risk of getting infected" than working students. These findings may support policy- and decision-makers.

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Conflicts of interest

All authors declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could have influenced the submitted work.

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