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Support for mobilizing medical students to join the SARS-CoV-2 pandemic emergency healthcare workforce – a cross-sectional questionnaire survey

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Abstract:

Objective: Identifying points important for medical students to join the pandemic emergency healthcare workforce.

Design: Cross-sectional.

Setting: Aalborg University, Denmark.

Participants: All medical students.

Main outcome measures: Demographic characteristics and 11 motivational points scored on a Visual Analog Scale from 0 (low) to 100 (high) responding to the question: "*To what extent do you find the following statements important for you to join a national emergency pandemic workforce?*". The questionnaire was developed by an expert panel in a process of 4 iterations.

Results: Students responded from March 16th 2020 and 7 days forth. 486 students of 688 completed the survey. 80% had decided to join the pandemic emergency healthcare workforce. Ranked median scores for motivational statements were: care for fellow human beings, 100; learning opportunities, 90; pride in contributing, 83; being part of a team, 77; skills being needed, 75; own safety, 75; guidance in the work, 75; job opportunities, 73; duty, 66; salary, 62; participation in a historic event, 50. Interestingly, students added that support by the university and clarification study plans were priorities.

Conclusions: Results guide decisionmakers and colleagues on how to motivate or reinforce medical students in joining the pandemic emergency healthcare workforce.

Article summary:

Strengths and limitations of this study:

- Addresses the question on how to inspire medical students to join medical staff when a healthcare workforce is depleted during a pandemic, as one in four may abandon work to protect their families and themselves
- Investigates medical students motivation for joining the pandemic emergency healthcare workforce during the SARS-CoV-2 pandemic
- Presents detailed data on issues important to medical students and hands-on recommendations for clinicians and administrators
- As data are from a PBL-university using spiral learning, they may not be applicable to medical students from all universities

Introduction

In December 2019, a new disease emerged in Wuhan city, the capital of Hubei province in China: the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), previously known as 2019-nCoV.[1] The virus spreads rapidly, and mortality is a concern as death counts are climbing world-wide.[2] On the 11th of March 2020, the Director-General of the World Health Organization declared the outbreak of SARS-CoV-2 a pandemic.[2]

Turning to Europe, the impact of SARS-CoV-2 is currently seen in Italy with an immediate increase in intensive care unit admissions and fatalities have stunned the country.[3] Mid-February 2020, the alarm for an unknown presence of SARS-COV-2 in the Italian general population was set-off. Here, a patient tested positive for SARS-COV-2 and admitted to intensive care in Lodi, Lombardy, Italy. During the following 24 hours, an additional 35 cases were admitted without transmission from the first case. Thus, Italy sets the scene through a case-scenario for what is to come for healthcare systems across the world, with a high risk of these being pushed beyond capacities. Thus, promptly preparing health services to deal with such a scenario is crucial.

It is critical to be aware that healthcare staff is a finite resource that is likely to become depleted during a pandemic as a result of illness.[4] Further, one in four doctors and final-year medical students may abandon work during a pandemic, to protect their families and themselves.[5] The lack of healthcare workers has earlier been described during both the influenza pandemic of 1918 and the polio epidemic in 1952.[6,7] Here, medical students were key contributors to the pandemic emergency healthcare workforce and ensured vital care for patients. The same recruitment strategy could offer a solution to a healthcare workforce depletion during the current SARS-COV2 pandemic. Hence, it is important to clarify what motivates medical students to join a pandemic emergency healthcare workforce. This led us to conduct a survey among all medical students at Aalborg University, Aalborg, Denmark, on what motivates them to join the pandemic emergency healthcare workforce, as the pandemic was in its early phase.

Methods

This paper is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.[8]

Study design and setting

We conducted a cross-sectional study using a survey questionnaire distributed at one point in time. The questionnaire was distributed on the 16th of March 2020 to all medical students at Aalborg University through individual institutional e-mail addresses. Datacollection closed on the 23rd of March 2020.

Participants

We invited all medical students enrolled at Aalborg University, Aalborg, Denmark, at the time the questionnaire was distributed (n = 688). No exclusion criteria were applied. Admission to medical schools in Denmark rely on grades, medical education is free of charge, and it takes six years to become a medical doctor. At the medical school of Aalborg University, the guiding teaching principle is problem-based learning, and years four to six comprise learning in a clinical environment qualifying students to work as locum physicians when having completed the fourth year. The total number of medical students at Aalborg University increases by year groups as the medical education at Aalborg University expanded from an initial 35 graduating students in 2016 to an annual admission of 179 students from 2018 onwards.

The study did not involve patients.

Variables

Development of the research questionnaire

The questionnaire was constructed in a four-phase process. First, an expert panel was established comprising a medical student (AE) to ensure medical students' priorities, experience and preferences, a junior doctor (MSA), and a senior consultant with a focus on education (SA). This group performed a brainstorm on all likely

relevant motivational points that could motivate medical students to join the pandemic emergency healthcare workforce. Second, a selection of key points that were considered to influence medical students' motivation on volunteering for the pandemic emergency healthcare workforce during the SARS-CoV-2 crisis was performed. Third, the questionnaire was constructed, and a final iteration focused on adding missed domains by two experts on education (JE, SR). Fourth, a process of method optimisation was conducted to enhance the quality of the final questionnaire (GVBS, SA).

Content of the questionnaire

The questionnaire is available in the appendix in an English translation as well as the original version in Danish. It includes questions on both demographics and motivational factors. For demographics we recorded gender, age, number of semesters completed, and clinical experience obtained aside from clinical placements planned in the curriculum. For questions on motivational factors, we presented 11 motivational statements following an overarching question: "*To what extent do you find the following statements important for you to join a national emergency pandemic workforce?*" (translation from Danish: "I hvilken grad er følgende vigtigt for, at du melder dig til at indgå i et nationalt pandemi beredskab?"). The motivational statements included revolved around the care for fellow human beings, learning opportunities, pride in contributing, being part of a team, skills being needed, own safety, guidance in the work, job opportunities, duty, salary, and participation in a historic event. Students were asked to score each statement on a Visual Analog Scale from 0 to 100 with 0 being to a very low extent and 100 being to a very great extent. The questionnaire concluded by asking their status regarding joining the pandemic emergency healthcare workforce with reply options being: "Have joined", "Want to join", "Consider joining", "Have decided not to join", or "Undecided as to whether to join or not".

Data management

Data were collected and managed using Research Electronic Data Capture (REDCap) electronic data capture tools hosted at Region Nordjylland.[9,10] REDCap is a secure, web-based software platform designed to support

data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages, and 4) procedures for data integration and interoperability with external sources.

Bias

Selection bias in our available population was avoided by distributing the questionnaire to all medical students. We strived to avoid non-response bias by using neutral wording and formulations.

Statistical analysis

In Denmark, one semester is equal to a half year of education, and we merged semesters to report advancement in full study years completed. Age groups were constructed by 20 years and below, 21-25 years, 26-30 years, and 31 years or older. Years of clinical experience were calculated and students were grouped by below 1 year, 1-2 years, 2-3 years and more than 3 years. For the question on motivational factors, we considered a score above 60 as high and above 80 as very high.

Variables were summarised using standard descriptive statistics. If normally distributed, continuous, and discrete, variables were summarised using means with standard deviations. If non-normally distributed medians with interquartile range were used. Normality of distributions were checked using QQ-plots and histograms. Categorical data were displayed using proportions. Comparisons were performed using Mann-Whitney for comparison of two groups, Kruskal-Wallis test for comparison of several groups, and chi-squared test for comparing proportions. A p-value less than 0.05 was considered statistically significant.

Missing data accounted for 0.10% of demographic data and 0.36% of motivational statements. Therefore, imputations were not performed, and observations with missing data were otherwise included in the analyses.

The sample size was determined by the number of medical students enrolled at the bachelor and master programs in medicine at Aalborg University, Aalborg, Denmark, during the study period. The statistical software for the Social Sciences was used (IBM Corp. IBM SPSS Statistics for Windows, Version 13.0. NY: IBM Corp.)

Patient and public involvement:

Patient and public involvement was incorporated by giving AE a distinct role during the problem-based learning process.[11] AE contributed to the clarification of terms, had a separate time slot during brainstorming, and making the scribe list. All views by AE on each issue were recorded and considered. A similar emphasis was put on the student contribution put forward by AE during the discussion of problems and possible explanations drawn on the student's knowledge and identification of areas of incomplete knowledge during the review step.[11] This contributed to the selection of domains, and the construction of the questionnaire. AE added to the consideration of the burden and time required to participate in the survey. AE is a 5th-year medical student representing medical students by being the head of the Danish Medical Students organization for Anesthesiology and Traumatology, a member of Medical Students Council, a member of Aalborg University Hospital's steering committee on education of medical students to participate in the pandemic as well as a locum physician at the Department of Orthopaedic Surgery at Aalborg University Hospital. The experience along with contacts among fellow students and organisations will contribute to the dissemination of the survey results among students regionally and nationally.

Results

Characteristics of participants

The participation rate was 70.6% with 486 out of 688 medical students responding to the survey invitation, and with 415 (60.3%) responding within 48 hours. Table 1 lists the characteristics of the medical students

participating. The sample did not differ from the available population of medical students at Aalborg University in terms of gender (male/female, 32.3/67.7%; chi-squared 0.16, p>0.1), and age (median (IQR): 23 (3) years in the sample, p > 0.1). The median (IQR) of clinical experience was 3 (12) months. All but 35.2% had previous clinical experience. Being a substitute assistant nurse was the main non-curricular clinical occupation accounting for 35.8% of all medical students. Secondarily, being a locum physician was seen in 13.6% of all medical students and 27.5% of those in the final 3 clinical years.

Motivation scores

Four out of five stated that they had joined, or wanted to join the pandemic emergency healthcare workforce, while 18.4% (89) were undecided (Table 1).

Table 2 lists the scores for each statement ranked by score. In general, the scores were high or very high with "Help fellow humans", "Learning opportunity", and "Pride in contributing" receiving the highest scores. "To join the fellowship" and "My skills are needed" receive a high score along with "My protection is a priority" and "Supervisor will support me". "Participation in a historic event" and "Being paid" did not receive high scores.

Worries added by students

Additional motivational factors mentioned by responding students were primarily related to study activities. The competition for time used for reading, uncertainty regarding the need for reading, changing of study plans, and the risk of being barred from exams due to absence from clinical placements were concerns raised. Encouragement from the university was important to some. Also, the risk of being infected was listed as a priority. To the other end, helping future colleagues was emphasized along with the quality and kind of work they would participate in. Finally, it was stated that the questions should have been on what prevents medical students from contributing rather than on what motives them to join.

Differences among students

"Supervisor will support me" was given increasing priority with advancing study years. Scores for "This is expected from me" rose after the early study years. "Being paid" received low scores during the first 3 years, and was higher in medical students at the 3 final clinical years. Scores for "Help fellow humans" were higher by female students but scores were high for students of all genders.

The eight who had replied "decided not to participate" in the pandemic emergency healthcare workforce had markedly lower scores for "Help fellow humans" compared to those who replied "aimed to joined" or "had join" (median 77/100/100, p<0.001). The same accounted for "To join the fellowship" (65/75/80, p=0.005) and for "Proud to contribute" (60/86/90, p<0.001). "My protection is a priority" scored slightly different (97/75/75, p=0.056).

Discussion

Key results

The majority of medical students were willing to participate in the pandemic emergency healthcare workforce, but they had concerns that should be and can be addressed when acknowledged. Hospitals and senior colleagues can accommodate the request for guidance in the clinical work using available tools and thereby support unique learning opportunities for medical students.[12] Such collaborative efforts support medical students teaming up with the medical fellowship to further strengthen the push for participation and learning.[13] In addition, this can be a benefit to the students' self-satisfaction and appreciation of their efforts.

Importantly, medical students put forward a request for protection of themselves when participating in a pandemic emergency healthcare workforce. This concern should be addressed by hospitals during by eg. training sessions and theoretical prequalification before starting clinical work. The safety should also be addressed by senior colleagues during clinical work. There was limited emphasis on salary and academic resume, but these factors still gained a medium score and may be addressed during recruitment.

Factors linked to study activity should be addressed. The university should settle uncertainty concerning study plans and exams to provide clear guidance for students. Finally, students listed that encouragement by the university to participate in a pandemic emergency healthcare workforce could be an incentive.

Strengths and Limitations

A strength of this survey was the timing. The SARS-CoV-2 pandemic was announced at the time of sending out survey invitation, and death rates were high in China and rapidly rising in Southern Europe while the link was open. This emphasized the severity of the situation and may have encouraged medical students to consider whether to participate in the pandemic emergency workforce. A limitation was 29% non-participants. However, age, gender, and distribution between study years were comparable to the responders. It may be speculated that non-responders were undecided students. The scores of 18.4% of responders undecided on whether to join the pandemic emergency healthcare workforce, were just under median scores. Adding such scores is unlikely to alter the conclusions. A note must be taken that the survey was performed in Denmark, which has tax-funded healthcare and free education. This could influence the motivation of the students.

Interpretation

An earlier study reported that more than 80% of medical students in the US would volunteer to participate in the healthcare workforce during a pandemic.[4] Our numbers were similar for a tax-funded health care system in Europe. Also, a concern for educational interruptions with an ongoing pandemic crisis was similar between our medical students in Europe and a group in North America.[14] Motivation of healthcare workers in general during a pandemic parallel some of our findings among medical students, including safety, being part of a team, and feeling useful.[15,16]

Generalisability

The generalisability is affected in a few ways. First, the survey was conducted at a university using problem based learning and a spiral curriculum with the students embedded in the clinical environment for the final

three years.[17] Second, the education being for free may also influence motivation. However, medical students responded similar in two domains to those in North America suggesting similar responses despite these differnces.

Clinical implications

The most noticeable implication is that medical students provide a resource eager to contribute to patient treatment and care during a pandemic emergency if a few relevant needs are met as detailed in this report, and that this can easily be accomodated.

Future research

Future studies could evaluate if priorities changed with the crises at a distance and if priorities vary between medical students at universities with different curricula and pedagogical approaches to learning.

Conclusion

The present study provides a list of items and priorities to inspire and guide clinicians and administrators at both hospitals and universities to support recruiting medical students for a pandemic emergency healthcare workforce. Hands-on recommendations include emphasizing learning opportunity, supervision, acceptance of educational interruptions by, and support from, university.

Transparency statement:

The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned (and, if relevant, registered) have been explained.

Contributors:

Conceptualisation: MSA, SR, JE, AE and SA. Formal analysis: MSA and SA. Methodology: MSA, AE, SA, SR, JE and GVBS. Project administration: MSA and SA. Resources: SA, GVBS and JE. Software: GVBS. Supervision: SA and GVBS. Validation: JE. Visualisation: MSA. Writing – Original Draft Preparation: MSA. Writing – Review and editing: MSA, SA, GVBS, AE, SR, JE. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. Mike S Astorp is the guarantor of the study.

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Competing interests:

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and 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 appear to have influenced the submitted work.

Ethics:

Written informed consent was obtained from all students by agreeing to answer the questionnaire. Due to the study being a survey, ethical approval was not required according to the Danish Act on the Scientific

Ethical Committee System (Act no. 593, section 14, subsection 2). Approval was obtained from the Danish Data Protection Agency (record number 2020-030).

Data sharing statement:

The questionnaire will be shared in the appendix both in the original (Danish) and in a translation to English. Extra data is available by emailing the corresponding author while individual participant data cannot be shared for the reason of confidentiality.

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Dissemination to participants and related patient and public communities:

Results will be distributed to Danish government officials with responsibility for providing national healthcare, Aalborg University, The North Denmark Region, all medical students at Aalborg University, the Organization for Danish medical students (FADL), the organization for medical students at Aalborg University.

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Table 1
Characteristics of medical students participating in the survey

			%	N	
Age groups					
	up to 20 y		9.1	44	
	21-25 y		71,6	348	
	26-30 y		15,2	74	
	31+ y		4.1	20	
		total	100	486	
Gender*					
	Male		31.1	151	
	Female		68.5	332	
	Other		0.4	2	
		total	100	485	
Study year					total**
	1.		66.5	115	173
	2.		57.7	86	149
	3.		82.5	104	126
	4.		74.1	80	108
	5.		88.0	73	83
	6.		57.1	486	49
		overall	70.6	486	688
Clinical experience (years)*					
	< 1 y	***	76.0	369	
	1-2 y		12.2	59	
	2-3 y		6.0	29	
	3+ y		5.8	28	
		total	100.0	485	
Joins pandemic emergency workforce					
	Has joined		63.4	308	
	Aims to join		16.7	81	
	Considers to join		16.5	80	
	Don't know		1.9	9	
	Won't join		1.6	8	
Among decided					
	yes		98.0	389	
	no		2.0	8	

* missing data: 1 gender; 1 clinical experience
** the total number of medical students rise by study year as the education is expanding from the first doctors graduating in 2016.

Table 2
Scores for joining the pandemic emergency healthcare force as stated by medical students in reply to the question:
"To what extent do you find the following statements important for you to join a national emergency workforce for a pandemic?". Scores were on a scale from 0 to 100.

		Median	25; 75 percentiles	Mean	P; gender / study year
Care				92.8	
	Help fellow humans	100	88; 100		0.001 / 0.068
Learn				84.7	
	Learning opportunity	90	75; 100		ns / ns
Pride				79.0	
	Proud to contribute	83	66; 100		ns / ns
Team				73.3	
	To join the fellowship	77	60; 100		ns / ns
Needed				73.4	
	My skills are needed	75	60; 94		ns / 0.053
Precaution				71.7	
	My protection is a priority	75	50;99		0.024 / 0.085
Guidance				72.5	
	Supervisor will support me	75	55;93		0.014 / <0.001
Job				69.4	
	Enhance my academic resume	73	51; 93		0.030 / 0.003
Duty				60.1	
	This is expected from me	66	47; 80		ns / 0.001
Salary				60.9	
	Being paid	62	50; 84		ns / <0.001
History				50.9	
	Participate in a historic event	50	21; 76		0.060 / ns

ns: p >0.1 in Mann-Whitney and Kruskall-Wallis test for gender and study year respectively
15 responders had missing data comprising 0.3% of all data. Imputations were omitted.

English translation of the questionnaire:

#	Question:	Response:
1	Please provide your age in whole years.	Individual response in whole years.
2	Which gender do you identify yourself with the most?	1. Male. 2. Female. 3. Others.
3	How many semesters have you completed? This includes both semesters completed in the Bachelor and Masters programme in medicine.	1. 1 semester. 2. 2 semesters. 3. 3 semesters. 4. 4 semesters. 5. 5 semesters. 6. 6 semesters. 7. 7 semesters. 8. 8 semesters. 9. 9 semesters. 10. 10 semesters. 11. 11 semesters. 12. 12 semesters.
4	Aside from your university studies, how many full months of clinical experience have you gained currently? This includes both experiences gained as a substitute assistant nurse, ventilator assistant, locum physician, phlebotomist, or others.	Individual response in full months.
5	What are your other clinical experiences based on?	1. Substitute assistant nurse 2. Ventilator assistant 3. Locum physician 4. Phlebotomist 5. Others. 6. Not relevant
5a	If you selected "Others" in Question 5, what are your clinical experiences based on?	Individual response.
6	To what extent do you find the following statements important for you to join a national emergency preparedness for a pandemic?	

6a	- I would like to help my fellow human beings.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6b	- It is expected of me.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6c	- I will become a part of the fellowship of medical doctors.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6d	- I will enhance my academic resume.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6e	- Precautions have been taken so that I will not be infected during work.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6f	- I will be supervised in my work.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6g	- I will get paid for my work.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6h	- I will get an opportunity to learn something.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6i	- I will become a part of a historic event.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6j	- I will be told that there is a need for me.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6k	- I will get proud of contributing.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
7	Do you have any additional motivating motives not already asked about?	Individual response.
8	In terms of joining a national emergency preparedness against a pandemic, how would you weigh inclination over obligation to join?	Visual Analog Scale: 0 = Inclination to join, 100 = Obligation to join.
9	In terms of possibly joining a national emergency preparedness against a pandemic, which of the following statements best describes your decision?	1. I have volunteered. 2. I want to volunteer. 3. I am considering to volunteer. 4. I will not volunteer. 5. I do not know

Spørgeskema:

- Alder
- Hvilket køn identificerer du dig bedst med? (Vælg et: Mand, kvinde, andet)
- Hvor mange fulde semestre har du gennemført?
- Hvor mange fulde måneders klinisk erfaring ved siden af medicinstudiet har du på nuværende tidspunkt? (Dette både som FADL-sygeplejevikar (SPV), FADL-ventilatør og lægevikar)
- Hvad er din kliniske erfaring baseret på? (Vælg flere: FADL-sygeplejevikar (SPV), FADL-ventilatør og lægevikar, andet)

I hvilken grad er følgende vigtigt for at du melder dig til at indgå i et nationalt pandemi beredskab?

- Samfundssind (altruisme);
  Eksempel: jeg vil bidrage med det jeg kan, for at hjælpe mine medmennesker?

- Samfundspligt
  Eksempel: jeg bidrager fordi det forventes af mig

- Sammenhold
- Eksempel: Jeg er en del af det lægelige fællesskab

- Jobmulighed
  Eksempel: jeg har en chance for at få job i et fagligt nyt område

- Fysiske Rammer
  Eksempel: Jeg er sikker på, at der er taget forholdsregler, så jeg ikke bliver smittet under arbejdet

- Tryghed
  Eksempel: Jeg er sikker på at modtage tilstrækkelig supervision i trygge rammer

- Økonomi
  Eksempel: jeg er sikker på at få løn for arbejdet

- Læring
  Eksempel: at jeg får mulighed for at lære noget, jeg ellers ikke havde mulighed for

- Aktualitet

Eksempel: at jeg er en del af en historisk begivenhed

- Kriseberedskab
  Eksempel: Jeg får at vide, at der er brug for mig

- Stolthed
  Eksempel: at jeg vil føle en stolthed over at bidrage

- Har du yderligere årsager, som motiverer dig, der ikke er spurgt ind til?

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Support for mobilizing medical students to join the SARS-CoV-2 pandemic emergency healthcare workforce – a cross-sectional questionnaire survey

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Abstract:

Objective: Identifying points important for medical students to join the pandemic emergency healthcare workforce.

Design: Cross-sectional.

Setting: Aalborg University, Denmark.

Participants: All medical students.

Main outcome measures: Demographic characteristics and 11 motivational points scored on a Visual Analog Scale from 0 (low) to 100 (high) responding to the question: "*To what extent do you find the following statements important for you to join a national emergency pandemic workforce?*". The questionnaire was developed by an expert panel in a process of 4 iterations.

Results: Students responded from March 16th 2020 and 7 days forth. 486 students of 688 completed the survey. 80% had decided to join the pandemic emergency healthcare workforce. Ranked median scores for motivational statements were: care for fellow human beings, 100; learning opportunities, 90; pride in contributing, 83; being part of a team, 77; skills being needed, 75; own safety, 75; guidance in the work, 75; job opportunities, 73; duty, 66; salary, 62; participation in a historic event, 50. Interestingly, students added that support by the university and clarification study plans were priorities.

Conclusions: Results guide decisionmakers and colleagues on how to motivate or reinforce medical students in joining the pandemic emergency healthcare workforce.

Article summary:

Strengths and limitations of this study:

- Addresses the question on how to inspire medical students to join medical staff when a healthcare workforce is depleted during a pandemic, as one in four may abandon work to protect their families and themselves
- Investigates medical students motivation for joining the pandemic emergency healthcare workforce during the SARS-CoV-2 pandemic
- Presents detailed data on issues important to medical students and hands-on recommendations for clinicians and administrators
- As data are from a PBL-university using spiral learning, they may not be applicable to medical students from all universities

Introduction

In December 2019, a new disease emerged in Wuhan city, the capital of Hubei province in China: the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), previously known as 2019-nCoV.[1] The virus spreads rapidly, and mortality is a concern as death counts are climbing world-wide.[2] On the 11th of March 2020, the Director-General of the World Health Organization declared the outbreak of SARS-CoV-2 a pandemic.[2]

Turning to Europe, the impact of SARS-CoV-2 is currently seen in Italy with an immediate increase in intensive care unit admissions and fatalities have stunned the country.[3] Mid-February 2020, the alarm for an unknown presence of SARS-COV-2 in the Italian general population was set-off. Here, a patient tested positive for SARS-COV-2 and admitted to intensive care in Lodi, Lombardy, Italy. During the following 24 hours, an additional 35 cases were admitted without transmission from the first case. Thus, Italy sets the scene through a case-scenario for what is to come for healthcare systems across the world, with a high risk of these being pushed beyond capacities. Thus, promptly preparing health services to deal with such a scenario is crucial.

It is critical to be aware that healthcare staff is a finite resource that is likely to become depleted during a pandemic as a result of illness.[4] Further, one in four doctors and final-year medical students may abandon work during a pandemic, to protect their families and themselves.[5] The lack of healthcare workers has earlier been described during both the influenza pandemic of 1918 and the polio epidemic in 1952.[6,7] Here, medical students were key contributors to the pandemic emergency healthcare workforce and ensured vital care for patients. The same recruitment strategy could offer a solution to a healthcare workforce depletion during the current SARS-COV2 pandemic. Hence, it is important to clarify what motivates medical students to join a pandemic emergency healthcare workforce. This led us to conduct a survey among all medical students at Aalborg University, Aalborg, Denmark, on what motivates them to join the pandemic emergency healthcare workforce, as the pandemic was in its early phase.

Methods

This paper is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.[8]

Study design and setting

We conducted a cross-sectional study using a survey questionnaire distributed at one point in time. The questionnaire was distributed on the 16th of March 2020 to all medical students at Aalborg University through individual institutional e-mail addresses. Datacollection closed on the 23rd of March 2020.

Participants

We invited all medical students enrolled at Aalborg University, Aalborg, Denmark, at the time the questionnaire was distributed (n = 688). No exclusion criteria were applied. Admission to medical schools in Denmark rely on grades, medical education is free of charge, and it takes six years to become a medical doctor. At the medical school of Aalborg University, the guiding teaching principle is problem-based learning, and years four to six comprise learning in a clinical environment qualifying students to work as locum physicians when having completed the fourth year. The total number of medical students at Aalborg University increases by year groups as the medical education at Aalborg University expanded from an initial 35 graduating students in 2016 to an annual admission of 179 students from 2018 onwards.

The study did not involve patients.

Variables

Development of the research questionnaire

The questionnaire was constructed in a four-phase process. First, an expert panel was established comprising a medical student (AE) to ensure medical students' priorities, experience and preferences, a junior doctor (MSA), and a senior consultant with a focus on education (SA). This group performed a brainstorm on all likely

relevant motivational points that could motivate medical students to join the pandemic emergency healthcare workforce. Second, a selection of key points that were considered to influence medical students' motivation on volunteering for the pandemic emergency healthcare workforce during the SARS-CoV-2 crisis was performed. Third, the questionnaire was constructed, and a final iteration focused on adding missed domains by two experts on education (JE, SR). Fourth, a process of method optimisation was conducted to enhance the quality of the final questionnaire (GVBS, SA).

Content of the questionnaire

The questionnaire is available in the appendix in an English translation as well as the original version in Danish. It includes questions on both demographics and motivational factors. For demographics we recorded gender, age, number of semesters completed, and clinical experience obtained aside from clinical placements planned in the curriculum. For questions on motivational factors, we presented 11 motivational statements following an overarching question: "*To what extent do you find the following statements important for you to join a national emergency pandemic workforce?*" (translation from Danish: "I hvilken grad er følgende vigtigt for, at du melder dig til at indgå i et nationalt pandemi beredskab?"). The motivational statements included revolved around the care for fellow human beings, learning opportunities, pride in contributing, being part of a team, skills being needed, own safety, guidance in the work, job opportunities, duty, salary, and participation in a historic event. Students were asked to score each statement on a Visual Analog Scale from 0 to 100 with 0 being to a very low extent and 100 being to a very great extent. The questionnaire concluded by asking their status regarding joining the pandemic emergency healthcare workforce with reply options being: "Have joined", "Want to join", "Consider joining", "Have decided not to join", or "Undecided as to whether to join or not".

Data management

Data were collected and managed using Research Electronic Data Capture (REDCap) electronic data capture tools hosted at Region Nordjylland.[9,10] REDCap is a secure, web-based software platform designed to support

data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages, and 4) procedures for data integration and interoperability with external sources.

Bias

Selection bias in our available population was avoided by distributing the questionnaire to all medical students. We strived to avoid non-response bias by using neutral wording and formulations.

Statistical analysis

In Denmark, one semester is equal to a half year of education, and we merged semesters to report advancement in full study years completed. Age groups were constructed by 20 years and below, 21-25 years, 26-30 years, and 31 years or older. Years of clinical experience were calculated and students were grouped by below 1 year, 1-2 years, 2-3 years and more than 3 years. For the question on motivational factors, we considered a score above 60 as high and above 80 as very high.

Variables were summarised using standard descriptive statistics. If normally distributed, continuous, and discrete, variables were summarised using means with standard deviations. If non-normally distributed medians with interquartile range were used. Normality of distributions were checked using QQ-plots and histograms. Categorical data were displayed using proportions. Comparisons were performed using Mann-Whitney for comparison of two groups, Kruskal-Wallis test for comparison of several groups, and chi-squared test for comparing proportions. A p-value less than 0.05 was considered statistically significant.

Missing data accounted for 0.10% of demographic data and 0.36% of motivational statements. Therefore, imputations were not performed, and observations with missing data were otherwise included in the analyses.

The sample size was determined by the number of medical students enrolled at the bachelor and master programs in medicine at Aalborg University, Aalborg, Denmark, during the study period. The statistical software for the Social Sciences was used (IBM Corp. IBM SPSS Statistics for Windows, Version 13.0. NY: IBM Corp.)

Patient and public involvement:

Patient and public involvement was incorporated by giving AE a distinct role during the problem-based learning process.[11] AE contributed to the clarification of terms, had a separate time slot during brainstorming, and making the scribe list. All views by AE on each issue were recorded and considered. A similar emphasis was put on the student contribution put forward by AE during the discussion of problems and possible explanations drawn on the student's knowledge and identification of areas of incomplete knowledge during the review step.[11] This contributed to the selection of domains, and the construction of the questionnaire. AE added to the consideration of the burden and time required to participate in the survey. AE is a 5th-year medical student representing medical students by being the head of the Danish Medical Students organization for Anesthesiology and Traumatology, a member of Medical Students Council, a member of Aalborg University Hospital's steering committee on education of medical students to participate in the pandemic as well as a locum physician at the Department of Orthopaedic Surgery at Aalborg University Hospital. The experience along with contacts among fellow students and organisations will contribute to the dissemination of the survey results among students regionally and nationally.

Results

Characteristics of participants

The participation rate was 70.6% with 486 out of 688 medical students responding to the survey invitation, and with 415 (60.3%) responding within 48 hours. Table 1 lists the characteristics of the medical students

participating. The sample did not differ from the available population of medical students at Aalborg University in terms of gender (male/female, 32.3/67.7%; chi-squared 0.16, p>0.1), and age (median (IQR): 23 (3) years in the sample, p > 0.1). The median (IQR) of clinical experience was 3 (12) months. All but 35.2% had previous clinical experience. Being a substitute assistant nurse was the main non-curricular clinical occupation accounting for 35.8% of all medical students. Secondarily, being a locum physician was seen in 13.6% of all medical students and 27.5% of those in the final 3 clinical years.

Motivation scores

Four out of five stated that they had joined, or wanted to join the pandemic emergency healthcare workforce, while 18.4% (89) were undecided (Table 1).

Table 2 lists the scores for each statement ranked by score. In general, the scores were high or very high with "Help fellow humans", "Learning opportunity", and "Pride in contributing" receiving the highest scores. "To join the fellowship" and "My skills are needed" receive a high score along with "My protection is a priority" and "Supervisor will support me". "Participation in a historic event" and "Being paid" did not receive high scores.

Worries added by students

Additional motivational factors mentioned by responding students were primarily related to study activities. The competition for time used for reading, uncertainty regarding the need for reading, changing of study plans, and the risk of being barred from exams due to absence from clinical placements were concerns raised. Encouragement from the university was important to some. Also, the risk of being infected was listed as a priority. To the other end, helping future colleagues was emphasized along with the quality and kind of work they would participate in. Finally, it was stated that the questions should have been on what prevents medical students from contributing rather than on what motives them to join.

Differences among students

"Supervisor will support me" was given increasing priority with advancing study years. Scores for "This is expected from me" rose after the early study years. "Being paid" received low scores during the first 3 years, and was higher in medical students at the 3 final clinical years. Scores for "Help fellow humans" were higher by female students but scores were high for students of all genders.

The eight who had replied "decided not to participate" in the pandemic emergency healthcare workforce had markedly lower scores for "Help fellow humans" compared to those who replied "aimed to joined" or "had join" (median 77/100/100, p<0.001). The same accounted for "To join the fellowship" (65/75/80, p=0.005) and for "Proud to contribute" (60/86/90, p<0.001). "My protection is a priority" scored slightly different (97/75/75, p=0.056).

Discussion

Key results

The majority of medical students were willing to participate in the pandemic emergency healthcare workforce, but they had concerns that should be and can be addressed when acknowledged. Hospitals and senior colleagues can accommodate the request for guidance in the clinical work using available tools and thereby support unique learning opportunities for medical students.[12] Such collaborative efforts support medical students teaming up with the medical fellowship to further strengthen the push for participation and learning.[13] In addition, this can be a benefit to the students' self-satisfaction and appreciation of their efforts.

Importantly, medical students put forward a request for protection of themselves when participating in a pandemic emergency healthcare workforce. This concern should be addressed by hospitals during by eg. training sessions and theoretical prequalification before starting clinical work. The safety should also be addressed by senior colleagues during clinical work. There was limited emphasis on salary and academic resume, but these factors still gained a medium score and may be addressed during recruitment.

Factors linked to study activity should be addressed. The university should settle uncertainty concerning study plans and exams to provide clear guidance for students. Finally, students listed that encouragement by the university to participate in a pandemic emergency healthcare workforce could be an incentive.

Strengths and Limitations

A strength of this survey was the timing. The SARS-CoV-2 pandemic was announced at the time of sending out survey invitation, and death rates were high in China and rapidly rising in Southern Europe while the link was open. This emphasized the severity of the situation and may have encouraged medical students to consider whether to participate in the pandemic emergency workforce. A limitation was 29% non-participants. However, age, gender, and distribution between study years were comparable to the responders. It may be speculated that non-responders were undecided students. The scores of 18.4% of responders undecided on whether to join the pandemic emergency healthcare workforce, were just under median scores. Adding such scores is unlikely to alter the conclusions. A note must be taken that the survey was performed in Denmark, which has tax-funded healthcare and free education. This could influence the motivation of the students.

Interpretation

An earlier study reported that more than 80% of medical students in the US would volunteer to participate in the healthcare workforce during a pandemic.[4] Our numbers were similar for a tax-funded health care system in Europe. Also, a concern for educational interruptions with an ongoing pandemic crisis was similar between our medical students in Europe and a group in North America.[14] Motivation of healthcare workers in general during a pandemic parallel some of our findings among medical students, including safety, being part of a team, and feeling useful.[15,16]

Generalisability

The generalisability is affected in a few ways. First, the survey was conducted at a university using problem based learning and a spiral curriculum with the students embedded in the clinical environment for the final

three years.[17] Second, the education being for free may also influence motivation. However, medical students responded similar in two domains to those in North America suggesting similar responses despite these differnces.

Clinical implications

The most noticeable implication is that medical students provide a resource eager to contribute to patient treatment and care during a pandemic emergency if a few relevant needs are met as detailed in this report, and that this can easily be accomodated.

Future research

Future studies could evaluate if priorities changed with the crises at a distance and if priorities vary between medical students at universities with different curricula and pedagogical approaches to learning.

Conclusion

The present study provides a list of items and priorities to inspire and guide clinicians and administrators at both hospitals and universities to support recruiting medical students for a pandemic emergency healthcare workforce. Hands-on recommendations include emphasizing learning opportunity, supervision, acceptance of educational interruptions by, and support from, university.

Transparency statement:

The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned (and, if relevant, registered) have been explained.

Contributors:

Conceptualisation: MSA, SR, JE, AE and SA. Formal analysis: MSA and SA. Methodology: MSA, AE, SA, SR, JE and GVBS. Project administration: MSA and SA. Resources: SA, GVBS and JE. Software: GVBS. Supervision: SA and GVBS. Validation: JE. Visualisation: MSA. Writing – Original Draft Preparation: MSA. Writing – Review and editing: MSA, SA, GVBS, AE, SR, JE. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. Mike S Astorp is the guarantor of the study.

Funding:

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Competing interests:

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and 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 appear to have influenced the submitted work.

Ethics:

Written informed consent was obtained from all students by agreeing to answer the questionnaire. Due to the study being a survey, ethical approval was not required according to the Danish Act on the Scientific

Ethical Committee System (Act no. 593, section 14, subsection 2). Approval was obtained from the Danish Data Protection Agency (record number 2020-030).

Data sharing statement:

The questionnaire will be shared in the appendix both in the original (Danish) and in a translation to English. Extra data is available by emailing the corresponding author while individual participant data cannot be shared for the reason of confidentiality.

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Dissemination to participants and related patient and public communities:

Results will be distributed to Danish government officials with responsibility for providing national healthcare, Aalborg University, The North Denmark Region, all medical students at Aalborg University, the Organization for Danish medical students (FADL), the organization for medical students at Aalborg University.

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Table 1
Characteristics of medical students participating in the survey

			%	N	
Age groups					
	up to 20 y		9.1	44	
	21-25 y		71,6	348	
	26-30 y		15,2	74	
	31+ y		4.1	20	
		total	100	486	
Gender*					
	Male		31.1	151	
	Female		68.5	332	
	Other		0.4	2	
		total	100	485	
Study year					total**
	1.		66.5	115	173
	2.		57.7	86	149
	3.		82.5	104	126
	4.		74.1	80	108
	5.		88.0	73	83
	6.		57.1	486	49
		overall	70.6	486	688
Clinical experience (years)*					
	< 1 y	***	76.0	369	
	1-2 y		12.2	59	
	2-3 y		6.0	29	
	3+ y		5.8	28	
		total	100.0	485	
Joins pandemic emergency workforce					
	Has joined		63.4	308	
	Aims to join		16.7	81	
	Considers to join		16.5	80	
	Don't know		1.9	9	
	Won't join		1.6	8	
Among decided					
	yes		98.0	389	
	no		2.0	8	

* missing data: 1 gender; 1 clinical experience
** the total number of medical students rise by study year as the education is expanding from the first doctors graduating in 2016.

Table 2
Scores for joining the pandemic emergency healthcare force as stated by medical students in reply to the question:
"To what extent do you find the following statements important for you to join a national emergency workforce for a pandemic?". Scores were on a scale from 0 to 100.

		Median	25; 75 percentiles	Mean	P; gender / study year
Care				92.8	
	Help fellow humans	100	88; 100		0.001 / 0.068
Learn				84.7	
	Learning opportunity	90	75; 100		ns / ns
Pride				79.0	
	Proud to contribute	83	66; 100		ns / ns
Team				73.3	
	To join the fellowship	77	60; 100		ns / ns
Needed				73.4	
	My skills are needed	75	60; 94		ns / 0.053
Precaution				71.7	
	My protection is a priority	75	50;99		0.024 / 0.085
Guidance				72.5	
	Supervisor will support me	75	55;93		0.014 / <0.001
Job				69.4	
	Enhance my academic resume	73	51; 93		0.030 / 0.003
Duty				60.1	
	This is expected from me	66	47; 80		ns / 0.001
Salary				60.9	
	Being paid	62	50; 84		ns / <0.001
History				50.9	
	Participate in a historic event	50	21; 76		0.060 / ns

ns: p >0.1 in Mann-Whitney and Kruskall-Wallis test for gender and study year respectively
15 responders had missing data comprising 0.3% of all data. Imputations were omitted.

English translation of the questionnaire:

#	Question:	Response:
1	Please provide your age in whole years.	Individual response in whole years.
2	Which gender do you identify yourself with the most?	1. Male. 2. Female. 3. Others.
3	How many semesters have you completed? This includes both semesters completed in the Bachelor and Masters programme in medicine.	1. 1 semester. 2. 2 semesters. 3. 3 semesters. 4. 4 semesters. 5. 5 semesters. 6. 6 semesters. 7. 7 semesters. 8. 8 semesters. 9. 9 semesters. 10. 10 semesters. 11. 11 semesters. 12. 12 semesters.
4	Aside from your university studies, how many full months of clinical experience have you gained currently? This includes both experiences gained as a substitute assistant nurse, ventilator assistant, locum physician, phlebotomist, or others.	Individual response in full months.
5	What are your other clinical experiences based on?	1. Substitute assistant nurse 2. Ventilator assistant 3. Locum physician 4. Phlebotomist 5. Others. 6. Not relevant
5a	If you selected "Others" in Question 5, what are your clinical experiences based on?	Individual response.
6	To what extent do you find the following statements important for you to join a national emergency preparedness for a pandemic?	

6a	- I would like to help my fellow human beings.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6b	- It is expected of me.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6c	- I will become a part of the fellowship of medical doctors.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6d	- I will enhance my academic resume.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6e	- Precautions have been taken so that I will not be infected during work.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6f	- I will be supervised in my work.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6g	- I will get paid for my work.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6h	- I will get an opportunity to learn something.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6i	- I will become a part of a historic event.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6j	- I will be told that there is a need for me.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6k	- I will get proud of contributing.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
7	Do you have any additional motivating motives not already asked about?	Individual response.
8	In terms of joining a national emergency preparedness against a pandemic, how would you weigh inclination over obligation to join?	Visual Analog Scale: 0 = Inclination to join, 100 = Obligation to join.
9	In terms of possibly joining a national emergency preparedness against a pandemic, which of the following statements best describes your decision?	1. I have volunteered. 2. I want to volunteer. 3. I am considering to volunteer. 4. I will not volunteer. 5. I do not know

Spørgeskema:

- Alder
- Hvilket køn identificerer du dig bedst med? (Vælg et: Mand, kvinde, andet)
- Hvor mange fulde semestre har du gennemført?
- Hvor mange fulde måneders klinisk erfaring ved siden af medicinstudiet har du på nuværende tidspunkt? (Dette både som FADL-sygeplejevikar (SPV), FADL-ventilatør og lægevikar)
- Hvad er din kliniske erfaring baseret på? (Vælg flere: FADL-sygeplejevikar (SPV), FADL-ventilatør og lægevikar, andet)

I hvilken grad er følgende vigtigt for at du melder dig til at indgå i et nationalt pandemi beredskab?

- Samfundssind (altruisme);
  Eksempel: jeg vil bidrage med det jeg kan, for at hjælpe mine medmennesker?

- Samfundspligt
  Eksempel: jeg bidrager fordi det forventes af mig

- Sammenhold
- Eksempel: Jeg er en del af det lægelige fællesskab

- Jobmulighed
  Eksempel: jeg har en chance for at få job i et fagligt nyt område

- Fysiske Rammer
  Eksempel: Jeg er sikker på, at der er taget forholdsregler, så jeg ikke bliver smittet under arbejdet

- Tryghed
  Eksempel: Jeg er sikker på at modtage tilstrækkelig supervision i trygge rammer

- Økonomi
  Eksempel: jeg er sikker på at få løn for arbejdet

- Læring
  Eksempel: at jeg får mulighed for at lære noget, jeg ellers ikke havde mulighed for

- Aktualitet

Eksempel: at jeg er en del af en historisk begivenhed

- Kriseberedskab
  Eksempel: Jeg får at vide, at der er brug for mig

- Stolthed
  Eksempel: at jeg vil føle en stolthed over at bidrage

- Har du yderligere årsager, som motiverer dig, der ikke er spurgt ind til?

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Support for mobilizing medical students to join the COVID-19 pandemic emergency healthcare workforce – a cross-sectional questionnaire survey

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Abstract:

Objective: To identify what motivates medical students to join a pandemic emergency healthcare workforce

Design: Cross-sectional.

Setting: Aalborg University, Denmark.

Participants: All medical students.

Main outcome measures: Motivational points as perceived by the students to be important. Demographic characteristics and 11 motivational domains scored on a Visual Analog Scale from 0 (low) to 100 (high) responding to the question: "*to what degree are the following statements important for you to join a national emergency preparedness workforce?*". The questionnaire was developed by an expert panel in a process of 4 iterations.

Results:

A total of 486 students of 688 (70.6%) completed the survey within 7 days in March 2020. 80% had decided to join the pandemic emergency healthcare workforce. Ranked median scores for motivational statements in each domain were: care, 100; learn, 90; pride, 83; team, 77; needed, 75; safety, 75; supervision , 75; job, 73; duty, 66; salary, 62; historic, 50. Supervision ($p<0.001$), salary ($p<0.001$), and duty ($p=0.001$) were given increasing priority with advancing study years. Interestingly, students added that support by the university, and clarification study plans were priorities.

Conclusions: Results guide decisionmakers and colleagues on how to motivate or reinforce medical students in joining the pandemic emergency healthcare workforce. Importantly, students emphasised protection for themselves.

Article summary:

Strengths and limitations of this study:

- Participation rate was supported by the COVID-19 pandemic situation in March 2020
- All medical students at Aalborg University were invited
- The questionnaire mainly addresses positive motivational points for joining the pandemic healthcare workforce rather than reflections about possible problems associated with the recruitment.
- Data are from a PBL-university in a Scandinavian context and results may not be applicable to medical students in different contexts
- Student's characteristics did not differ between responders and non-responders

Introduction

In December 2019, a new virus emerged in Wuhan city, the capital of Hubei province in China: the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), previously known as 2019-nCoV.[1] The virus spreads rapidly, and mortality is a concern as death counts are climbing world-wide.[2] On the 11th of March 2020, the Director-General of the World Health Organization declared the outbreak of SARS-CoV-2 a pandemic.[2]

Turning to Europe, the impact of SARS-CoV-2 is currently seen in Italy with an immediate increase in intensive care unit admissions and fatalities have stunned the country.[3] Mid-February 2020, the alarm for an unknown presence of SARS-COV-2 in the Italian general population was set-off. Here, a patient tested positive for SARS-COV-2 and admitted to intensive care in Lodi, Lombardy, Italy. During the following 24 hours, an additional 35 cases were admitted without transmission from the first case. Thus, Italy sets the scene through a case-scenario for what is to come for healthcare systems across the world, with a high risk of these being pushed beyond capacities. Thus, promptly preparing health services to deal with such a scenario is crucial.

It is critical to be aware that healthcare staff is a finite resource that is likely to become depleted during a pandemic as a result of illness.[4] Further, one in four doctors and final-year medical students may abandon work during a pandemic to protect their families and themselves[5]. The lack of healthcare workers has earlier been described during both the influenza pandemic of 1918 and the polio epidemic in 1952.[6,7] Here, medical students were key contributors to the pandemic emergency healthcare workforce and ensured vital care for patients. A Belgian study conducted in 2009 suggested that more than 80% of medical students would contribute to care for pandemic patients.[8]

A recruitment strategy focusing on medical students as contributors could offer a solution to a healthcare workforce depletion during the current COVID-19 pandemic. Hence, it is important to identify what motivates medical students to join a pandemic emergency healthcare workforce. This led us to conduct a survey among all medical students at Aalborg University, Aalborg, Denmark, on what motivates them to join the pandemic emergency healthcare workforce, as the pandemic was in its early phase.

Methods

This paper is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.[9]

Study design and setting

We conducted a cross-sectional study using a survey questionnaire distributed at one point in time. The questionnaire was distributed on the 16th of March 2020 to all medical students at Aalborg University through individual institutional e-mail addresses. Data collection closed on the 23rd of March 2020.

Participants

We invited all medical students enrolled at Aalborg University, Aalborg, Denmark, at the time the questionnaire was distributed (n = 688). No exclusion criteria were applied. Admission to medical schools in Denmark rely on grades, medical education is free of charge, and it takes six years to become a medical doctor. At the medical school of Aalborg University, the guiding teaching principle is problem-based learning, and years four to six comprise learning in a clinical environment qualifying students to work as locum physicians when having completed the fourth year. Thus, a 4th-year medical student locum physician does supervised admissions and ward rounds with the attention of qualified doctors reviewing patients and notes.

The total number of medical students at Aalborg University increases by year groups as the medical education at Aalborg University expanded from an initial 35 graduating students in 2016 to an annual admission of 179 students from 2018 onwards.

The study did not involve patients.

Variables

Development of the research questionnaire

The questionnaire was constructed in a four-phase process. First, an expert panel was established comprising a medical student (AE) to ensure medical students' priorities, experience and preferences, a junior doctor (MSA), and a senior consultant with a focus on education (SA). This group performed a brainstorm on all likely relevant motivational domains that could motivate medical students to join the pandemic emergency healthcare workforce. Second, a selection of key domains that were considered to influence medical students' motivation on volunteering for the pandemic emergency healthcare workforce during the COVID-19 crisis was performed. Third, the questionnaire was constructed, and a final iteration focused on adding missed domains by two experts on education (JE, SR). Fourth, a process of method optimisation was conducted to enhance the quality of the final questionnaire (GVBS, SA).

Content of the questionnaire

The questionnaire is available in the appendix in an English translation as well as the original version in Danish. It includes questions on both demographics and motivational factors. For demographics, we recorded gender, age, number of semesters completed, and clinical experience obtained aside from clinical placements planned in the curriculum. For questions on motivational factors, we presented 11 motivational statements following an overarching question: "*To what degree are the following statements important for you to join a national emergency preparedness workforce?*" (translation from Danish: "I hvilken grad er følgende udsagn vigtige for, at du melder dig til at indgå i et nationalt pandemiberedskab?"). The motivational statements included revolved around the care for fellow human beings, learning opportunities, pride in contributing, being part of the doctoral fellowship, being needed, own safety, supervision, job opportunities, duty, salary, and participation in a historic event. Students were asked to score each statement on a Visual Analog Scale from 0 to 100 with 0 being to a very low extent and 100 being to a very great extent. The questionnaire concluded by asking their status regarding joining the pandemic emergency healthcare workforce with reply options being: "Have joined", "Want to join", "Consider joining", "Have decided not to join", or "Undecided as to whether to join or not".

Data management

Data were collected and managed using Research Electronic Data Capture (REDCap) electronic data capture tools hosted at Region Nordjylland.[10,11] REDCap is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages, and 4) procedures for data integration and interoperability with external sources.

Bias

Selection bias in our available population was avoided by distributing the questionnaire to all medical students. We strived to avoid non-response bias by using neutral wording and formulations.

Statistical analysis

In Denmark, one semester is equal to a half year of education, and we merged semesters to report advancement in full study years completed. Age groups were constructed by 20 years and below, 21-25 years, 26-30 years, and 31 years or older. Years of clinical experience were calculated and students were grouped by below 1 year, 1-2 years, 2-3 years, and more than 3 years. For the question on motivational factors, we considered a score above 60 as high and above 80 as very high.

Variables were summarised using standard descriptive statistics. If normally distributed, continuous, and discrete, variables were summarised using means with standard deviations. If non-normally distributed medians with interquartile range were used. Normality of distributions were checked using QQ-plots and histograms. Categorical data were displayed using proportions. Comparisons were performed using Mann-Whitney for comparison of two groups, Kruskal-Wallis test for comparison of several groups, and chi-squared test for comparing proportions. A p-value less than 0.05 was considered statistically significant.

Missing data accounted for 0.10% of demographic data and 0.36% of motivational statements. Therefore, imputations were not performed, and observations with missing data were otherwise included in the analyses.

The sample size was determined by the number of medical students enrolled at the bachelor and master programs in medicine at Aalborg University, Aalborg, Denmark, during the study period. The statistical software for the Social Sciences was used (IBM Corp. IBM SPSS Statistics for Windows, Version 13.0. NY: IBM Corp.)

Patient and public involvement:

Patient and public involvement were hampered by the restrictions on unnecessary assemblies. Combined with the urgency of this study the public and patient involvement was limited to the inclusion of a representative medical student.

Patient and public involvement was incorporated by giving AE a distinct role during the problem-based learning process.[12] AE contributed to the clarification of terms, had a separate time slot during brainstorming, and making the scribe list. All views by AE on each issue were recorded and considered. A similar emphasis was put on the student contribution put forward by AE during the discussion of problems and possible explanations drawn on the student's knowledge and identification of areas of incomplete knowledge during the review step.[12] This contributed to the selection of domains, and the construction of the questionnaire. AE added to the consideration of the burden and time required to participate in the survey. AE is a 5th-year medical student representing medical students by being the head of the Danish Medical Students organization for Anesthesiology and Traumatology, a member of Medical Students Council, a member of Aalborg University Hospital's steering committee on education of medical students to participate in the pandemic as well as a locum physician at the Department of Orthopaedic Surgery at Aalborg University Hospital. The experience along with contacts among fellow students and organisations will contribute to the dissemination of the survey results among students regionally and nationally.

Results

Characteristics of participants

The participation rate was 70.6% with 486 out of 688 medical students responding to the survey invitation, and with 415 (60.3%) responding within 48 hours. Table 1 lists the characteristics of the medical students participating. The sample did not differ from the available population of medical students at Aalborg University in terms of gender (male/female, 32.3/67.7%; chi-squared 0.16, p>0.1), and age (median (IQR): 23 (3) years in the sample, p > 0.1). The median (IQR) of clinical experience was 3 (12) months. All but 35.2% had previous clinical experience. Being a substitute assistant nurse was the main non-curricular clinical occupation accounting for 35.8% of all medical students. Secondarily, being a locum physician was seen in 13.6% of all medical students and 27.5% of those in the final 3 clinical years.

Motivation scores

Four out of five stated that they had joined, or wanted to join the pandemic emergency healthcare workforce, while 18.4% (89) were undecided (Table 1).

Table 2 lists the scores for each statement ranked by score. In general, the scores were high or very high with "care for fellow human beings", "learning opportunities", and "Pride in contributing" receiving the highest scores. "being part of the doctoral fellowship" and "being needed" receive a high score along with "own safety" and "supervision". "Participation in a historic event" and "salary" did not receive high scores.

Worries added by students

Additional motivational factors mentioned by responding students were primarily related to study activities. The competition for time used for reading, uncertainty regarding the need for reading, changing of study plans, and the risk of being barred from exams due to absence from clinical placements were concerns raised. Encouragement from the university was important to some. Also, the risk of being infected was listed as a priority. To the other end, helping future colleagues was emphasized along with the quality and kind of work

they would participate in. Finally, it was stated that the questions should have been on what prevents medical students from contributing rather than on what motives them to join.

Differences among students

"supervision" was given increasing priority with advancing study years. Scores for "duty" rose after the early study years. "salary" received low scores during the first 3 years, and was higher in medical students at the 3 final clinical years. Scores for "care for fellow humans" were higher by female students but scores were high for students of all genders. "Salary" was given increasing priority with clinical experience ($p<0.001$).

The eight who had replied "decided not to participate" in the pandemic emergency healthcare workforce had markedly lower scores for "care for fellow humans" compared to those who replied "aimed to joined" or "had joined" (median 77/100/100, $p<0.001$). The same accounted for "being part of the doctoral fellowship" (65/75/80, $p=0.005$) and for "pride in contributing" (60/86/90, $p<0.001$). "safety" scored slightly different (97/75/75, $p=0.056$).

Discussion

Key results

Motivation for joining a pandemic emergency healthcare workforce was reported by medical students to be an urge to help fellow human beings, a learning opportunity and taking pride in contributing. In addition, motivational factors given priority were joining the doctoral fellowship, their help being needed, their own safety and guidance at work. The majority of medical students were willing to participate in the pandemic emergency healthcare workforce, but they had concerns that should be and can be addressed when acknowledged. Hospitals and senior colleagues can accommodate the request for supervision in the clinical work using available tools and thereby support unique learning opportunities for medical students.[13] Such collaborative efforts support medical students teaming up with the medical fellowship to further strengthen

the push for participation and learning.[14] In addition, this can be a benefit to the students' self-satisfaction and appreciation of their efforts.

Importantly, medical students put forward a request for protection of themselves when participating in a pandemic emergency healthcare workforce. This concern should be addressed by hospitals during by eg. training sessions and theoretical prequalification before starting clinical work. The safety should also be addressed by senior colleagues during clinical work. There was limited emphasis on salary and academic resume, but these factors still gained a medium score and may be addressed during recruitment.

Factors linked to study activity should be addressed. The university should settle uncertainty concerning study plans and exams to provide clear guidance for students. Finally, students listed that encouragement by the university to participate in a pandemic emergency healthcare workforce could be an incentive.

Strengths and Limitations

A strength of this survey was the timing. The COVID-19 pandemic was announced at the time of sending out survey invitation, and death rates were high in China and rapidly rising in Southern Europe while the link was open. This emphasized the severity of the situation and may have encouraged medical students to consider whether to participate in the pandemic emergency workforce. Also, this may have supported the high response rate of 71%. Age, gender, and distribution between study years were comparable between responders and non-responders. It may be speculated that non-responders were undecided students. The scores of 18.4% of responders undecided on whether to join the pandemic emergency healthcare workforce, were just under median scores. Adding such scores is unlikely to alter the conclusions.

A limitation of the study is that the constructed questionnaire primarily addresses positive motivational points as to joining the pandemic healthcare workforce and not what is impeding to the students. This could have further have helped to guide clinicians and administrators contributing to a further elaborate list of items and priorities to take into account. A note must be taken that the survey was performed in Denmark, which has tax-funded healthcare and free education. This could influence the motivation of the students. The

limitations regarding the involvement of the patient and public involvement may have hindered uncovering further relevant aspects and resulted in a limited representation of relevant groups.

Interpretation

An earlier study reported that more than 80% of medical students in the US would volunteer to participate in the healthcare workforce during a pandemic.[4] Our numbers were similar for a tax-funded health care system in Europe and they are in line with a Belgian study reporting that 80% of final year medical students would volunteer during a pandemic.[8] Also, a concern for educational interruptions with an ongoing pandemic crisis was similar between our medical students in Europe and a group in North America.[15] Motivation of healthcare workers in general during a pandemic parallel some of our findings among medical students, including safety, being part of a team, and feeling useful.[16,17]

Generalisability

The generalisability is affected in a few ways. First, the survey was conducted at a university using problem based learning and a spiral curriculum with the students embedded in the clinical environment for the final three years.[18] Second, the education being for free may also influence motivation. However, medical students responded similarly in two domains to those in North America suggesting similar responses despite these differences.

Clinical implications

The most noticeable implication is that medical students provide a resource eager to contribute to patient treatment and care during a pandemic emergency if few relevant needs are met as detailed in this report and that this can easily be accommodated. In the case of an evolving pandemic, occurrence of local outbreaks and secondary waves of infections, access to this resource will become important for decision- and policymakers, both for the sake of patients and healthcare personal.

Future research

Future studies could evaluate if priorities changed with the crises at a distance and if priorities vary between medical students at universities with different curricula and pedagogical approaches to learning. Also, they should explore factors impeding medical student response and their concern regarding protection.

Medical students may be motivated to contribute to the healthcare workforce if learning during a pandemic is relevant to learning objectives. Studies to explore such opportunities are warranted.

Conclusion

The present study provides a list of items and priorities to inspire and guide clinicians and administrators at both hospitals and universities to support recruiting medical students for a pandemic emergency healthcare workforce. Importantly, students emphasised safety for themselves. Hands-on recommendations include focussing on learning opportunity, supervision, acceptance of educational interruptions by, and support from, university.

Transparency statement:

The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned (and, if relevant, registered) have been explained.

Contributors:

Conceptualisation: MSA, SR, JE, AE and SA. Formal analysis: MSA and SA. Methodology: MSA, AE, SA, SR, JE and GVBS. Project administration: MSA and SA. Resources: SA, GVBS and JE. Software: GVBS. Supervision: SA and GVBS. Validation: JE. Visualisation: MSA. Writing – Original Draft Preparation: MSA. Writing – Review and editing: MSA, SA, GVBS, AE, SR, JE. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. Mike S Astorp is the guarantor of the study.

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Competing interests:

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and 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 appear to have influenced the submitted work.

Ethics:

Written informed consent was obtained from all students by agreeing to answer the questionnaire. Due to the study being a survey, ethical approval was not required according to the Danish Act on the Scientific

Ethical Committee System (Act no. 593, section 14, subsection 2). Approval was obtained from the Danish Data Protection Agency (record number 2020-030).

Data sharing statement:

The questionnaire will be shared in the appendix both in the original (Danish) and in a translation to English. Extra data is available by emailing the corresponding author while individual participant data cannot be shared for the reason of confidentiality.

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Dissemination to participants and related patient and public communities:

Results will be distributed to Danish government officials with responsibility for providing national healthcare, Aalborg University, The North Denmark Region, all medical students at Aalborg University, the Organization for Danish medical students (FADL), the organization for medical students at Aalborg University.

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Table 1
Characteristics of medical students participating in the survey

		%	N	
Age groups				
	up to 20 y	9.1	44	
	21-25 y	71,6	348	
	26-30 y	15,2	74	
	31+ y	4.1	20	
	total	100	486	
Gender*				
	Male	31.1	151	
	Female	68.5	332	
	Other	0.4	2	
	total	100	485	
Study year				total**
	1.	23.7	115	173
	2.	17.7	86	149
	3.	21.4	104	126
	4.	16.5	80	108
	5.	15.0	73	83
	6.	5.8	28	49
	total	100	486	688
Clinical experience (years)*				
	< 1 y	76.0	369	
	1-2 y	12.2	59	
	2-3 y	6.0	29	
	3+ y	5.8	28	
	total	100	485	
Joins pandemic emergency workforce				
	Has joined	63.4	308	
	Aims to join	16.7	81	
	Considers to join	16.5	80	
	Don't know	1.9	9	
	Won't join	1.6	8	
	total	100	486	
Among decided				
	yes	98.0	389	
	no	2.0	8	
	total	100	397	

* missing data: 1 gender; 1 clinical experience
** the number of medical students enrolled by each study year

Table 2

Scores for joining the pandemic emergency healthcare force as stated by medical students in reply to the question (the students were not shown the domains presented in this table):

"To what degree are the following statements important for you to join a national emergency preparedness workforce for a pandemic?". Scores were on a scale from 0 to 100.

Domain	Question asked	Median	25; 75 percentiles	Mean	P; gender / study year
Care				92.8	
	I would like to help my fellow human beings	100	88; 100		0.001 / 0.068
Learn				84.7	
	I will be provided an opportunity to learn something	90	75; 100		ns / ns
Pride				79.0	
	I will take pride in contributing	83	66; 100		ns / ns
Team				73.3	
	I become a part of the doctoral fellowship	77	60; 100		ns / ns
Needed				73.4	
	I am informed that I am needed	75	60; 94		ns / 0.053
safety				71.7	
	Precautions have been taken to prevent me from getting infected during work	75	50;99		0.024 / 0.085
supervision				72.5	
	I will receive supervision in my work	75	55;93		0.014 / <0.001
Job				69.4	
	I develop my professional job profile	73	51; 93		0.030 / 0.003
Duty				60.1	
	It is expected from me	66	47; 80		ns / 0.001
Salary				60.9	
	I get paid for my work	62	50; 84		ns / <0.001
History				50.9	
	I become part of a historic event	50	21; 76		0.060 / ns

ns: p >0.1 in Mann-Whitney and Kruskall-Wallis test for gender and study year respectively

15 responders had missing data comprising 0.3% of all data. Imputations were omitted.

Questionnaire English:

#	Question:	Response:
1	Please provide your age in whole years.	Individual response in whole numbers.
2	Which gender do you identify yourself with the most?	1. Male. 2. Female. 3. Others.
3	How many semesters have you completed? This includes both semesters completed in the Bachelor and Masters programme in medicine.	1. 1 semester. 2. 2 semesters. 3. 3 semesters. 4. 4 semesters. 5. 5 semesters. 6. 6 semesters. 7. 7 semesters. 8. 8 semesters. 9. 9 semesters. 10. 10 semesters. 11. 11 semesters. 12. 12 semesters.
4	Aside from your university studies, how many full months of clinical experience have you gained currently? This includes both experiences gained as a substitute assistant nurse, ventilator assistant, locum physician, phlebotomist, or others.	Individual response in full months provided as a whole number in a textbox.
5	What is your clinical experience based upon? (please select one of more of the following answers)	1. Substitute assistant nurse 2. Ventilator assistant 3. Locum physician 4. Phlebotomist 5. Others. 6. Not relevant
5a	If you selected "Others" in Question 5, what are your clinical experiences based on?	Individual text response.
6	to what degree are the following statements important for you to join a national emergency preparedness workforce?	

6a	- I would like to help my fellow human beings	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6b	- It is expected from me	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6c	- I become a part of the doctoral fellowship	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6d	- I develop my professional job profile	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6e	- Precautions have been taken to prevent me from getting infected during work	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6f	- I will receive supervision in my work	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6g	- I get paid for my work.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6h	- I will be provided an opportunity to learn something	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6i	- I become part of a historic event	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6j	- I am informed that I am needed	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6k	- I will take pride in contributing	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
7	Do you have further causes for motivation that have not been addressed?	Individual response.
8	In terms of joining a national emergency preparedness against a pandemic, how would you weigh inclination over obligation to join?	Visual Analog Scale: 0 = Inclination to join, 100 = Obligation to join.
9	In terms of possibly joining a national emergency preparedness against a pandemic, which of the following statements best describes your decision?	1. Have joined. 2. I want to join. 3. I am considering to join. 4. I will not join. 5. I do not know

Questionnaire Danish:

#	Question:	Response:
1	Indtast din alder i fulde år.	Individuelt respons I hele tal
2	Hvilket køn kan du bedst identificere dig med?	1. Mand. 2. Kvinde. 3. Andet.
3	Hvor mange fulde semestre har du gennemført (dvs. både bachelor- og kandidatsemestre)?	1. 1 semestre. 2. 2 semestre. 3. 3 semestre. 4. 4 semestre. 5. 5 semestre. 6. 6 semestre. 7. 7 semestre. 8. 8 semestre. 9. 9 semestre. 10. 10 semestre. 11. 11 semestre. 12. 12 semestre.
4	Hvor mange fulde måneders klinisk erfaring ved siden af medicinstudiet har du på nuværende tidspunkt? - Dette både som FADL-sygeplejevikar (SPV), FADL-ventilatør, lægevikar, 'stikker' eller andet.	Individuel angivelse af antal måneder som tal i tekstboks
5	Hvad er din kliniske erfaring baseret på? (Vælg venligst en eller flere af nedenstående svarmuligheder)	1. FADL sygeplejevikar (SPV) 2. FADL ventilatør 3. Lægevikar 4. 'Stikker' 5. Andet 6. Ikke relevant
5a	Hvis du valgte andet i spørgsmål 5: Hvad er din kliniske erfaring ellers baseret på?	Individuelt respons I tekstboks
6	I hvilken grad er følgende udsagn vigtige for, at du melder dig til at indgå i et nationalt pandemiberedskab?	
6a	- Jeg vil gerne hjælpe mine medmennesker.	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6b	- Det forventes af mig	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad

6c	- Jeg bliver en del af det lægelige fællesskab.	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6d	- Jeg får udbygget min faglige jobprofil	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6e	- Der er taget forholdsregler, så jeg ikke bliver smittet under arbejdet.	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6f	- Jeg vil modtage supervision i mit arbejde	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6g	- Jeg får løn for arbejdet	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6h	- Jeg får mulighed for at lære noget	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6i	- Jeg bliver en del af en historisk begivenhed.	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6j	- Jeg får at vide, at der er brug for mig	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6k	- Jeg bliver stolt over at bidrage	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
7	Har du yderligere årsager, der motiverer dig, som ikke er spurgt ind til?	Individuelt respons I tekstboks.
8	Hvordan ville du vægte lyst og pligt ift. at indgå i et pandemiberedskab?	Visuel analog skala: 0 = Lyst, 100 = pligt.
9	Hvilke af nedenstående udsagn beskriver bedst din stillingtagen til evt. deltagelse i pandemiberedskabet?	1. Jeg har meldt mig 2. Jeg ønsker at melde mig 3. Jeg overvejer at melde mig 4. Jeg melder mig ikke 5. Ved ikke

STROBE statement for: "Support for mobilizing medical students to join the COVID-19 pandemic emergency healthcare workforce – a cross-sectional questionnaire survey" - by Mike A, et al.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **-page 1 line 2**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **-Page 2**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported- **page 4**
Objectives	3	State specific objectives, including any prespecified hypotheses **– page 2, line 2, page 4, line 21**
Methods		
Study design	4	Present key elements of study design early in the paper **page 5, line 5-7**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **– page 5, lines: 6-7**
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants **– Page 5, line 9-10**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **– Page 6**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **– Page 7, line 2-6**
Bias	9	Describe any efforts to address potential sources of bias **– Page 7 Line 9-10**
Study size	10	Explain how the study size was arrived at **– Page 5, line 9**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why**-page 7, line 17-22**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **- page 7, line 17-22**
		(*b*) Describe any methods used to examine subgroups and interactions **page 7, line 17-22**
		(*c*) Explain how missing data were addressed **-page 8, line 1**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy **– N/A**
		(*e*) Describe any sensitivity analyses – **N/A**
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **– page 9 line 3-4**
		(b) Give reasons for non-participation at each stage **– Strengths and limitations, page 11**
		(c) Consider use of a flow diagram **– N/A, Only one stage**

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders – **page 9, line 5 - 10**
		(b) Indicate number of participants with missing data for each variable of interest – **page 8, line 1-3; table 1**
Outcome data	15*	Report numbers of outcome events or summary measures **– page 18 + 19, table 1, table 2**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **– page 19, table 2**
		(*b*) Report category boundaries when continuous variables were categorized – **N/A**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **– N/A**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **– No subgroup analysis, but categorization of clinical experience described on page 7, line 17-22**
Discussion		
Key results	18	Summarise key results with reference to study objectives **- page 10, line 16-21**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **– page 11, line 20**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **page 12, line 4**
Generalisability	21	Discuss the generalisability (external validity) of the study results **page 12, line 12**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **– page 14, line 14**

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Support for mobilizing medical students to join the COVID-19 pandemic emergency healthcare workforce – a cross-sectional questionnaire survey

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Support for mobilizing medical students to join the COVID-19 pandemic emergency healthcare workforce – a cross-sectional questionnaire survey

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Abstract:

Objective: To identify what motivates medical students to join a pandemic emergency healthcare workforce

Design: Cross-sectional.

Setting: Aalborg University, Denmark.

Participants: All medical students.

Main outcome measures: Motivational points as perceived by the students to be important. Demographic characteristics and 11 motivational domains scored on a Visual Analog Scale from 0 (low) to 100 (high) responding to the question: "*to what degree are the following statements important for you to join a national emergency preparedness workforce?*". The questionnaire was developed by an expert panel in a process of 4 iterations.

Results:

A total of 486 students of 688 (70.6%) completed the survey within seven days in March 2020. 80% had decided to join the pandemic emergency healthcare workforce. Ranked median scores for motivational statements in each domain were: care, 100; learn, 90; pride, 83; team, 77; needed, 75; safety, 75; supervision , 75; job, 73; duty, 66; salary, 62; historic, 50. Supervision ($p<0.001$), salary ($p<0.001$), and duty ($p=0.001$) were given increasing priority with advancing study years. Interestingly, students added that support by the university and clarification study plans were priorities.

Conclusions: Results guide decision-makers and colleagues on how to motivate or reinforce medical students in joining the pandemic emergency healthcare workforce. Importantly, students emphasised protection for themselves.

Article summary:

Strengths and limitations of this study:

- A limitation was the focus on positive motivational points while omitting negative aspects.
- Student involvement in the construction of the questionnaire was hampered by complying to restrictions on gatherings and events
- Results may not be applicable to medical students in different contexts
- A strength of the study was the conduction of the survey while the COVID-19 pandemic was evolving
- Inviting all medical students at the university supported identifying changes in motivation with advancing study year

Introduction

In December 2019, a new virus emerged in Wuhan city, the capital of Hubei province in China: the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), previously known as 2019-nCoV.[1] The virus spreads rapidly, and mortality is a concern as death counts are climbing world-wide.[2] On the 11th of March 2020, the Director-General of the World Health Organization declared the outbreak of SARS-CoV-2 a pandemic.[2]

Turning to Europe, the impact of SARS-CoV-2 is currently seen in Italy with an immediate increase in intensive care unit admissions and fatalities have stunned the country.[3] Mid-February 2020, the alarm for an unknown presence of SARS-COV-2 in the Italian population was set-off. Here, a patient tested positive for SARS-COV-2 and admitted to intensive care in Lodi, Lombardy, Italy. During the following 24 hours, an additional 35 cases were admitted without transmission from the first case. Thus, Italy sets the scene through a case-scenario for what is to come for healthcare systems across the world, with a high risk of these being pushed beyond capacities. Thus, promptly preparing health services to deal with such a scenario is crucial.

It is critical to be aware that healthcare staff is a finite resource that is likely to become depleted during a pandemic as a result of illness.[4] Further, one in four doctors and final-year medical students may abandon work during a pandemic to protect their families and themselves.[5] The lack of healthcare workers has earlier been described during both the influenza pandemic of 1918 and the polio epidemic in 1952.[6,7] Here, medical students were key contributors to the pandemic emergency healthcare workforce and ensured vital care for patients. A Belgian study conducted in 2009 suggested that more than 80% of medical students would contribute to caring for pandemic patients.[8]

A recruitment strategy focusing on medical students as contributors could offer a solution to a healthcare workforce depletion during the current COVID-19 pandemic. Hence, it is essential to identify what motivates medical students to join a pandemic emergency healthcare workforce. This led us to conduct a survey among all medical students at Aalborg University, Aalborg, Denmark, on what motivates them to join the pandemic emergency healthcare workforce, as the pandemic was in its early phase.

Methods

This paper is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.[9]

Study design and setting

We conducted a cross-sectional study using a survey questionnaire distributed at one point in time. The questionnaire was distributed on the 16th of March 2020 to all medical students at Aalborg University through individual, institutional e-mail addresses. Data collection closed on the 23rd of March 2020.

Participants

We invited all medical students enrolled at Aalborg University, Aalborg, Denmark, at the time the questionnaire was distributed (n = 688). No exclusion criteria were applied. Admission to medical schools in Denmark rely on grades, medical education is free of charge, and it takes six years to become a medical doctor. At the medical school of Aalborg University, the guiding teaching principle is problem-based learning, and years four to six comprise learning in a clinical environment qualifying students to work as locum physicians when having completed the fourth year. Thus, a 4th-year medical student locum physician does supervised admissions and ward rounds with the attention of qualified doctors reviewing patients and notes.

The total number of medical students at Aalborg University increases by year groups as the medical education at Aalborg University expanded from an initial 35 graduating students in 2016 to an annual admission of 179 students from 2018 onwards.

The study did not involve patients.

Variables

Development of the research questionnaire

The questionnaire was constructed in a four-phase process. First, an expert panel was established comprising a medical student (AE) to ensure medical students' priorities, experience and preferences, a junior doctor (MSA), and a senior consultant with a focus on education (SA). This group performed a brainstorm on all likely relevant motivational domains that could motivate medical students to join the pandemic emergency healthcare workforce. Second, a selection of key domains that were considered to influence medical students' motivation on volunteering for the pandemic emergency healthcare workforce during the COVID-19 crisis was performed. Third, the questionnaire was constructed, and a final iteration focused on adding missed domains by two experts on education (JE, SR). Fourth, a process of method optimisation was conducted to enhance the quality of the final questionnaire (GVBS, SA).

Content of the questionnaire

The questionnaire is available in the appendix in an English translation as well as the original version in Danish. It includes questions on both demographics and motivational factors. For demographics, we recorded gender, age, number of semesters completed, and clinical experience obtained aside from clinical placements planned in the curriculum. For questions on motivational factors, we presented 11 motivational statements following an overarching question: "*To what degree are the following statements important for you to join a national emergency preparedness workforce?*" (translation from Danish: "I hvilken grad er følgende udsagn vigtige for, at du melder dig til at indgå i et nationalt pandemiberedskab?"). The motivational statements included revolved around the care for fellow human beings, learning opportunities, pride in contributing, being part of the doctoral fellowship, being needed, own safety, supervision, job opportunities, duty, salary, and participation in a historical event. Students were asked to score each statement on a Visual Analog Scale from 0 to 100 with 0 being to a very low extent and 100 being to a very great extent. The questionnaire concluded by asking their status regarding joining the pandemic emergency healthcare workforce with reply options being: "Have joined", "Want to join", "Consider joining", "Have decided not to join", or "Undecided as to whether to join or not".

Data management

Data were collected and managed using Research Electronic Data Capture (REDCap) electronic data capture tools hosted at Region Nordjylland.[10,11] REDCap is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages, and 4) procedures for data integration and interoperability with external sources.

Bias

Selection bias in our available population was avoided by distributing the questionnaire to all medical students. We strived to avoid non-response bias by using neutral wording and formulations.

Statistical analysis

In Denmark, one semester is equal to a half year of education, and we merged semesters to report advancement in full study years completed. Age groups were constructed by 20 years and below, 21-25 years, 26-30 years, and 31 years or older. Years of clinical experience were calculated, and students were grouped by below 1 year, 1-2 years, 2-3 years, and more than 3 years. For the question on motivational factors, we considered a score above 60 as high and above 80 as very high.

Variables were summarised using standard descriptive statistics. If normally distributed, continuous, and discrete, variables were summarised using means with standard deviations. If non-normally distributed medians with interquartile range were used. Normality of distributions was checked using QQ-plots and histograms. Categorical data were displayed using proportions. Comparisons were performed using Mann-Whitney for comparison of two groups, Kruskal-Wallis test for comparison of several groups, and the chi-squared test for comparing proportions. A p-value of less than 0.05 was considered statistically significant.

Missing data accounted for 0.10% of demographic data and 0.36% of motivational statements. Therefore, imputations were not performed, and observations with missing data were otherwise included in the analyses.

The sample size was determined by the number of medical students enrolled at the bachelor and master programs in medicine at Aalborg University, Aalborg, Denmark, during the study period. The statistical software for the Social Sciences was used (IBM Corp. IBM SPSS Statistics for Windows, Version 13.0. NY: IBM Corp.)

Patient and public involvement:

Patient and public involvement were hampered by restrictions on unnecessary assemblies. Combined with the urgency of this study, the public and patient involvement were limited to the inclusion of a representative medical student.

Patient and public involvement were incorporated by giving AE a distinct role during the problem-based learning process.[12] AE contributed to the clarification of terms, had a separate time slot during brainstorming, and making the scribe list. All views by AE on each issue were recorded and considered. A similar emphasis was put on the student contribution put forward by AE during the discussion of problems and possible explanations drawn on the student's knowledge and identification of areas of incomplete knowledge during the review step.[12] This contributed to the selection of domains, and the construction of the questionnaire. AE added to the consideration of the burden and time required to participate in the survey. AE is a 5th-year medical student representing medical students by being the head of the Danish Medical Students organization for Anesthesiology and Traumatology, a member of Medical Students Council, a member of Aalborg University Hospital's steering committee on education of medical students to participate in the pandemic as well as a locum physician at the Department of Orthopaedic Surgery at Aalborg University Hospital. The experience along with contacts among fellow students and organisations will contribute to the dissemination of the survey results among students regionally and nationally.

Results

Characteristics of participants

The participation rate was 70.6% with 486 out of 688 medical students responding to the survey invitation, and with 415 (60.3%) responding within 48 hours. Table 1 lists the characteristics of the medical students participating. The sample did not differ from the available population of medical students at Aalborg University in terms of gender (male/female, 32.3/67.7%; chi-squared 0.16, p>0.1), and age (median (IQR): 23 (3) years in the sample, p > 0.1). The median (IQR) of clinical experience was 3 (12) months. All but 35.2% had previous clinical experience. Being a substitute assistant nurse was the main non-curricular clinical occupation accounting for 35.8% of all medical students. Secondarily, being a locum physician was seen in 13.6% of all medical students and 27.5% of those in the final three clinical years.

Motivation scores

Four out of five stated that they had joined or wanted to join the pandemic emergency healthcare workforce, while 18.4% (89) were undecided (Table 1).

Table 2 lists the scores for each statement ranked by score. In general, the scores were high or very high with "care for fellow human beings", "learning opportunities", and "Pride in contributing" receiving the highest scores. "being part of the doctoral fellowship" and "being needed" receive a high score along with "own safety" and "supervision". "Participation in a historic event" and "salary" did not receive high scores.

Worries added by students

Additional motivational factors mentioned by responding students were primarily related to study activities. The competition for the time used for studying, uncertainty regarding the need for reading, changing of study plans, and the risk of being barred from exams due to absence from clinical placements were concerns raised. Encouragement from the university was essential to some. Also, the risk of being infected was listed as a priority. To the other end, helping future colleagues was emphasized along with the quality and kind of work

they would participate in. Finally, it was stated that the questions should have been on what prevents medical students from contributing rather than on what motives them to join.

Differences among students

"supervision" was given increasing priority with advancing study years. Scores for "duty" rose after the early study years. "salary" received low scores during the first three years, and was higher in medical students at the three final clinical years. Scores for "care for fellow humans" were higher by female students, but scores were high for students of all genders. "Salary" was given increasing priority with clinical experience ($p<0.001$).

The eight who had replied "decided not to participate" in the pandemic emergency healthcare workforce had markedly lower scores for "care for fellow humans" compared to those who replied "aimed to joined" or "had joined" (median 77/100/100, $p<0.001$). The same accounted for "being part of the doctoral fellowship" (65/75/80, $p=0.005$) and for "pride in contributing" (60/86/90, $p<0.001$). "safety" scored slightly different (97/75/75, $p=0.056$).

Discussion

Key results

The motivation for joining a pandemic emergency healthcare workforce was reported by medical students to be an urge to help fellow human beings, a learning opportunity and taking pride in contributing. In addition, motivational factors given priority were joining the doctoral fellowship, their help being needed, their safety and guidance at work. The majority of medical students were willing to participate in the pandemic emergency healthcare workforce, but they had concerns that should be and can be addressed when acknowledged. Hospitals and senior colleagues can accommodate the request for supervision in the clinical work using available tools and thereby support unique learning opportunities for medical students.[13] Such collaborative efforts support medical students teaming up with the medical fellowship to strengthen

the push for participation and learning further.[14] Also, this can be a benefit to the students' self-satisfaction and appreciation of their efforts.

Importantly, medical students responded that their safety while working was a priority. Hospitals should address this concern during training sessions and theoretical prequalification before students start clinical practice. Senior colleagues should further address and support safety during clinical work. The students' response uncovered a limited emphasis on salary and academic resume. Still, these factors were of some interest and may be discussed during recruitment.

Factors linked to study activity should be addressed. The university should settle uncertainty concerning study plans and exams to provide clear guidance for students. Finally, students listed that encouragement by the university to participate in a pandemic emergency healthcare workforce could be an incentive.

Strengths and Limitations

A strength of this survey was the timing. The COVID-19 pandemic was announced at the time of sending out survey invitation, and death rates were high in China and rapidly rising in Southern Europe while the link was open. This emphasized the severity of the situation and may have encouraged medical students to consider whether to participate in the pandemic emergency workforce. Also, this may have supported the high response rate of 71%. Age, gender, and distribution between study years were comparable between responders and non-responders. It may be speculated that non-responders were undecided students. The scores of 18.4% of responders undecided on whether to join the pandemic emergency healthcare workforce, were just under median scores. Adding such scores is unlikely to alter the conclusions.

A limitation of the study is that the constructed questionnaire primarily addresses positive motivational points as to joining the pandemic healthcare workforce and not what is impeding to the students. This could have further have helped to guide clinicians and administrators contributing to a further elaborate list of items and priorities to take into account. A note must be taken that the survey was performed in Denmark, which has tax-funded healthcare and free education. This could influence the motivation of the students. The

limitations regarding the involvement of the patient and the public may have hindered uncovering further relevant aspects and resulted in a limited representation of relevant groups.

Interpretation

An earlier study reported that more than 80% of medical students in the US would volunteer to participate in the healthcare workforce during a pandemic.[4] Our numbers were similar for a tax-funded health care system in Europe, and they are in line with a Belgian study reporting that 80% of final year medical students would volunteer during a pandemic.[8] Also, a concern for educational interruptions with an ongoing pandemic crisis was similar between our medical students in Europe and a group in North America.[15] The motivation of healthcare workers in general during a pandemic parallel some of our findings among medical students, including safety, being part of a team, and feeling useful.[16,17]

Generalisability

The generalisability is affected in a few ways. First, the survey was conducted at a university using problem-based learning and a spiral curriculum with the students embedded in the clinical environment for the final three years.[18] Second, education being for free may also influence motivation. However, medical students responded similarly in two domains to those in North America, suggesting similar responses despite these differences.

Clinical implications

The most obvious implication is that medical students provide a resource eager to contribute to patient treatment and care during a pandemic emergency if few essential needs are met as detailed in this report and that this can easily be accommodated. In the case of an evolving pandemic, occurrence of local outbreaks and secondary waves of infections, access to this resource will become essential for decision- and policy-makers, both for the sake of patients and healthcare personal.

Future research

Future studies could evaluate if priorities changed with the crises at a distance and if priorities vary between medical students at universities with different curricula and pedagogical approaches to learning. Also, they

should explore factors impeding medical student response and their concern for protection. Medical students may be motivated to contribute to the healthcare workforce if work during a pandemic is relevant to learning objectives. Studies to explore such opportunities are warranted.

Conclusion

The present study provides a list of items and priorities to inspire and guide clinicians and administrators at both hospitals and universities to support recruiting medical students for a pandemic emergency healthcare workforce. Importantly, students emphasised safety for themselves. Hands-on recommendations include focussing on learning opportunity, supervision, acceptance of educational interruptions by, and support from, university.

Transparency statement:

The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned (and, if relevant, registered) have been explained.

Contributors:

Conceptualisation: MSA, SR, JE, AE and SA. Formal analysis: MSA and SA. Methodology: MSA, AE, SA, SR, JE and GVBS. Project administration: MSA and SA. Resources: SA, GVBS and JE. Software: GVBS. Supervision: SA and GVBS. Validation: JE. Visualisation: MSA. Writing – Original Draft Preparation: MSA. Writing – Review and editing: MSA, SA, GVBS, AE, SR, JE. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. Mike S Astorp is the guarantor of the study.

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Competing interests:

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and 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 appear to have influenced the submitted work.

Ethics:

Written informed consent was obtained from all students by agreeing to answer the questionnaire. Due to the study being a survey, ethical approval was not required according to the Danish Act on the Scientific

Ethical Committee System (Act no. 593, section 14, subsection 2). Approval was obtained from the Danish Data Protection Agency (record number 2020-030).

Data sharing statement:

The questionnaire will be shared in the appendix both in the original (Danish) and in a translation to English. Extra data is available by emailing the corresponding author while individual participant data cannot be shared for the reason of confidentiality.

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Dissemination to participants and related patient and public communities:

Results will be distributed to Danish government officials with responsibility for providing national healthcare, Aalborg University, The North Denmark Region, all medical students at Aalborg University, the Organization for Danish medical students (FADL), the organization for medical students at Aalborg University.

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Table 1
Characteristics of medical students participating in the survey

		%	N	
Age groups				
	up to 20 y	9.1	44	
	21-25 y	71,6	348	
	26-30 y	15,2	74	
	31+ y	4.1	20	
	total	100	486	
Gender*				
	Male	31.1	151	
	Female	68.5	332	
	Other	0.4	2	
	total	100	485	
Study year				total**
	1.	23.7	115	173
	2.	17.7	86	149
	3.	21.4	104	126
	4.	16.5	80	108
	5.	15.0	73	83
	6.	5.8	28	49
	total	100	486	688
Clinical experience (years)*				
	< 1 y	76.0	369	
	1-2 y	12.2	59	
	2-3 y	6.0	29	
	3+ y	5.8	28	
	total	100	485	
Joins pandemic emergency workforce				
	Has joined	63.4	308	
	Aims to join	16.7	81	
	Considers to join	16.5	80	
	Don't know	1.9	9	
	Won't join	1.6	8	
	total	100	486	
Among decided				
	yes	98.0	389	
	no	2.0	8	
	total	100	397	

* missing data: 1 gender; 1 clinical experience
** the number of medical students enrolled by each study year

Table 2

Scores for joining the pandemic emergency healthcare force as stated by medical students in reply to the question (the students were not shown the domains presented in this table):

"To what degree are the following statements important for you to join a national emergency preparedness workforce for a pandemic?". Scores were on a scale from 0 to 100.

Domain	Question asked	Median	25; 75 percentiles	Mean	P; gender / study year
Care				92.8	
	I would like to help my fellow human beings	100	88; 100		0.001 / 0.068
Learn				84.7	
	I will be provided an opportunity to learn something	90	75; 100		ns / ns
Pride				79.0	
	I will take pride in contributing	83	66; 100		ns / ns
Team				73.3	
	I become a part of the doctoral fellowship	77	60; 100		ns / ns
Needed				73.4	
	I am informed that I am needed	75	60; 94		ns / 0.053
safety				71.7	
	Precautions have been taken to prevent me from getting infected during work	75	50;99		0.024 / 0.085
supervision				72.5	
	I will receive supervision in my work	75	55;93		0.014 / <0.001
Job				69.4	
	I develop my professional job profile	73	51; 93		0.030 / 0.003
Duty				60.1	
	It is expected from me	66	47; 80		ns / 0.001
Salary				60.9	
	I get paid for my work	62	50; 84		ns / <0.001
History				50.9	
	I become part of a historic event	50	21; 76		0.060 / ns

ns: p >0.1 in Mann-Whitney and Kruskall-Wallis test for gender and study year respectively

15 responders had missing data comprising 0.3% of all data. Imputations were omitted.

Questionnaire English:

#	Question:	Response:
1	Please provide your age in whole years.	Individual response in whole numbers.
2	Which gender do you identify yourself with the most?	1. Male. 2. Female. 3. Others.
3	How many semesters have you completed? This includes both semesters completed in the Bachelor and Masters programme in medicine.	1. 1 semester. 2. 2 semesters. 3. 3 semesters. 4. 4 semesters. 5. 5 semesters. 6. 6 semesters. 7. 7 semesters. 8. 8 semesters. 9. 9 semesters. 10. 10 semesters. 11. 11 semesters. 12. 12 semesters.
4	Aside from your university studies, how many full months of clinical experience have you gained currently? This includes both experiences gained as a substitute assistant nurse, ventilator assistant, locum physician, phlebotomist, or others.	Individual response in full months provided as a whole number in a textbox.
5	What is your clinical experience based upon? (please select one of more of the following answers)	1. Substitute assistant nurse 2. Ventilator assistant 3. Locum physician 4. Phlebotomist 5. Others. 6. Not relevant
5a	If you selected "Others" in Question 5, what are your clinical experiences based on?	Individual text response.
6	to what degree are the following statements important for you to join a national emergency preparedness workforce?	

6a	- I would like to help my fellow human beings	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6b	- It is expected from me	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6c	- I become a part of the doctoral fellowship	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6d	- I develop my professional job profile	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6e	- Precautions have been taken to prevent me from getting infected during work	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6f	- I will receive supervision in my work	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6g	- I get paid for my work.	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6h	- I will be provided an opportunity to learn something	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6i	- I become part of a historic event	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6j	- I am informed that I am needed	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
6k	- I will take pride in contributing	Visual Analog Scale: 0 = To a very low extent, 100 = To a very great extent
7	Do you have further causes for motivation that have not been addressed?	Individual response.
8	In terms of joining a national emergency preparedness against a pandemic, how would you weigh inclination over obligation to join?	Visual Analog Scale: 0 = Inclination to join, 100 = Obligation to join.
9	In terms of possibly joining a national emergency preparedness against a pandemic, which of the following statements best describes your decision?	1. Have joined. 2. I want to join. 3. I am considering to join. 4. I will not join. 5. I do not know

Questionnaire Danish:

#	Question:	Response:
1	Indtast din alder i fulde år.	Individuelt respons I hele tal
2	Hvilket køn kan du bedst identificere dig med?	1. Mand. 2. Kvinde. 3. Andet.
3	Hvor mange fulde semestre har du gennemført (dvs. både bachelor- og kandidatsemestre)?	1. 1 semestre. 2. 2 semestre. 3. 3 semestre. 4. 4 semestre. 5. 5 semestre. 6. 6 semestre. 7. 7 semestre. 8. 8 semestre. 9. 9 semestre. 10. 10 semestre. 11. 11 semestre. 12. 12 semestre.
4	Hvor mange fulde måneders klinisk erfaring ved siden af medicinstudiet har du på nuværende tidspunkt? - Dette både som FADL-sygeplejevikar (SPV), FADL-ventilatør, lægevikar, 'stikker' eller andet.	Individuel angivelse af antal måneder som tal i tekstboks
5	Hvad er din kliniske erfaring baseret på? (Vælg venligst en eller flere af nedenstående svarmuligheder)	1. FADL sygeplejevikar (SPV) 2. FADL ventilatør 3. Lægevikar 4. 'Stikker' 5. Andet 6. Ikke relevant
5a	Hvis du valgte andet i spørgsmål 5: Hvad er din kliniske erfaring ellers baseret på?	Individuelt respons I tekstboks
6	I hvilken grad er følgende udsagn vigtige for, at du melder dig til at indgå i et nationalt pandemiberedskab?	
6a	- Jeg vil gerne hjælpe mine medmennesker.	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6b	- Det forventes af mig	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad

6c	- Jeg bliver en del af det lægelige fællesskab.	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6d	- Jeg får udbygget min faglige jobprofil	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6e	- Der er taget forholdsregler, så jeg ikke bliver smittet under arbejdet.	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6f	- Jeg vil modtage supervision i mit arbejde	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6g	- Jeg får løn for arbejdet	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6h	- Jeg får mulighed for at lære noget	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6i	- Jeg bliver en del af en historisk begivenhed.	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6j	- Jeg får at vide, at der er brug for mig	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
6k	- Jeg bliver stolt over at bidrage	Visuel analog skala: 0 = I meget lav grad, 100 = I meget høj grad
7	Har du yderligere årsager, der motiverer dig, som ikke er spurgt ind til?	Individuelt respons I tekstboks.
8	Hvordan ville du vægte lyst og pligt ift. at indgå i et pandemiberedskab?	Visuel analog skala: 0 = Lyst, 100 = pligt.
9	Hvilke af nedenstående udsagn beskriver bedst din stillingtagen til evt. deltagelse i pandemiberedskabet?	1. Jeg har meldt mig 2. Jeg ønsker at melde mig 3. Jeg overvejer at melde mig 4. Jeg melder mig ikke 5. Ved ikke

STROBE statement for: "Support for mobilizing medical students to join the COVID-19 pandemic emergency healthcare workforce – a cross-sectional questionnaire survey" - by Mike A, et al.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **-page 1 line 2**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **-Page 2**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported- **page 4**
Objectives	3	State specific objectives, including any prespecified hypotheses **– page 2, line 2, page 4, line 21**
Methods		
Study design	4	Present key elements of study design early in the paper **page 5, line 5-7**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **– page 5, lines: 6-7**
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants **– Page 5, line 9-10**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **– Page 6**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **– Page 7, line 2-6**
Bias	9	Describe any efforts to address potential sources of bias **– Page 7 Line 9-10**
Study size	10	Explain how the study size was arrived at **– Page 5, line 9**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why**-page 7, line 17-22**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **- page 7, line 17-22**
		(*b*) Describe any methods used to examine subgroups and interactions **page 7, line 17-22**
		(*c*) Explain how missing data were addressed **-page 8, line 1**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy **– N/A**
		(*e*) Describe any sensitivity analyses – **N/A**
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **– page 9 line 3-4**
		(b) Give reasons for non-participation at each stage **– Strengths and limitations, page 11**
		(c) Consider use of a flow diagram **– N/A, Only one stage**

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders – **page 9, line 5 - 10**
		(b) Indicate number of participants with missing data for each variable of interest – **page 8, line 1-3; table 1**
Outcome data	15*	Report numbers of outcome events or summary measures **– page 18 + 19, table 1, table 2**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **– page 19, table 2**
		(*b*) Report category boundaries when continuous variables were categorized – **N/A**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **– N/A**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **– No subgroup analysis, but categorization of clinical experience described on page 7, line 17-22**
Discussion		
Key results	18	Summarise key results with reference to study objectives **- page 10, line 16-21**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **– page 11, line 20**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **page 12, line 4**
Generalisability	21	Discuss the generalisability (external validity) of the study results **page 12, line 12**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **– page 14, line 14**

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.