

# BMJ Open Quality Patient safety culture and associated factors in secondary health care of the Capital Region of Denmark: influence of specialty, healthcare profession and gender

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## ABSTRACT

**Background** We aimed to explore (1) the influence of healthcare professionals' (HCPs') specialty, profession, gender and length of employment on their perception of six dimensions of patient safety culture (PSC) and (2) the relation between these characteristics and the two dimensions of safety climate and perception of management.

**Methods** In a cross-sectional study, a Danish version of the Safety Attitudes Questionnaire was sent to all HCPs at a large regional hospital organisation. This included hospitals, the Emergency Services, the Regional Pharmacy and the Centre for Diabetes corporations. A total of 30 230 HCPs received the survey. Differences between specialties, professions, gender and years of employment were tested for each dimension of PSC. Differences in mean attitude scores were tested using analysis of variance and differences in having a positive attitude were tested using logistic regression.

**Results** In total, 15 119 (50%) HCPs returned the survey. Significant differences are seen across hospitals and corporations for all dimensions of PSC. The proportion of HCPs with a positive attitude was largest regarding job satisfaction (74.8%) and lowest regarding perception of management (43.9%). Significant differences are seen in physicians' and nurses' perception of PSC in the different specialties within all dimensions of PSC except for the dimension of recognition of stress. Significant differences in positive perception of teamwork climate are seen between anaesthesiologists' (69.4%) and surgeons' (41.7%). No significant gender differences were found between physicians' and nurses' perception of safety climate and of management. In addition, we found an influence of years of employment on PSC.

**Discussion** Significant differences were found in HCPs' perception of PSC between corporations, specialties and professions. The lowest proportion of HCPs with a positive perception of PSC was found within the dimensions of safety climate and perception of management. These differences may have implications for teamwork and patient safety.

## INTRODUCTION

Improving the culture of safety within health-care is an essential component of preventing

### WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ A culture of safety within healthcare is essential for preventing or reducing adverse events and improving overall healthcare quality.

### WHAT THIS STUDY ADDS

⇒ This large-scale study (N=15 119) identifies differences in perceptions of patient safety culture (PSC) across professions, specialties and organisational functions.

### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Differences in attitudes to PSC may originate in and/or influence how we work in multi-professional teams. The implications of these differences and how to involve healthcare professionals in creating a safe learning environment should be explored in future studies.

or reducing adverse events and improving overall healthcare quality. Healthcare organisations have shown a growing interest in patient safety culture (PSC), and assessment tools have been developed to understand the quality of the safety culture and to be able to change it.<sup>1</sup> Culture is the product of individual and group values, attitudes, competencies and behaviours that form a strong foundation on which to build a learning system. A systematic review suggests that interventions can improve perceptions of PSC.<sup>2</sup> In addition, several systematic reviews suggest evidence of the relationship between PSC and patient outcomes.<sup>3,4</sup> A recent report shows that more than 75% of countries in an Organisation for Economic Co-operation and Development (OECD) survey indicated their intention to expand their work with PSC in order to improve learning.<sup>5</sup>

The report *Free from Harm* by the National Patient Safety Foundation provides recommendations for achieving total system safety. One recommendation is to ensure that leaders establish and sustain a safety culture that enables and prioritises safety (2015).<sup>6</sup> Distributed leadership and strong staff support have been identified as critical for establishing a solid safety culture.<sup>7</sup> Previous studies, however, have indicated that management's perceptions are different from frontline staff's perception of PSC.<sup>8,9</sup>

Frontline staff's perceptions of PSC may be influenced by characteristics such as length of employment, gender and profession. Only a few studies have evaluated the impact of length of employment.<sup>10</sup> Studies of the association between healthcare professionals' (HCPs') profession and PSC indicate differences between physicians and nurses, for instance.<sup>9</sup> However, several of these studies were conducted in one hospital or a primary care setting. These data can be used at the unit level for the purpose of learning and improving practice as suggested in an editorial, as variability between units is higher than between hospitals.<sup>11</sup> However, healthcare is provided in multi-professional teams rather than by individuals and include team members from different professions and specialties. The association between specialty and PSC is less studied.

### The aim

The aims of this paper were to explore (1) the influence on HCPs' specialty, profession, gender, and length of employment on their perception of six dimensions of PSC and (2) the relation between these characteristics and the two dimensions of safety climate and perception of management.

## METHODS

We conducted a cross-sectional survey in a large regional hospital organisation in the Capital Region of Denmark from the 13 March until the 3 April 2019 using the Safety Attitudes Questionnaire (SAQ-DK), validated to the Danish context and culture.<sup>12</sup>

### Context

In 2001, a study of adverse events in Danish hospitals was conducted; its results contributed to the decision to introduce mandatory reporting of adverse events and a national, confidential reporting and learning system. A formal structure was established with both regional-situated and hospital-situated risk managers and patient safety key persons in each department. The Danish Act on Patient Safety was introduced in 2004, and the importance of a supportive culture to ensure a high level of patient safety was emphasised in the national strategy for quality improvement.

Healthcare in Denmark is organised in five regions and is publicly funded, which means equal access for the entire population. The hospitals (N=6) in the Capital Region of Denmark serve a population of 1.8 million inhabitants. All hospitals receive emergency cases. Five

of these hospitals are major hospitals with a wide range of specialties (see the Data analysis section). The total number of employees is approximately 40 000.

### Patient and public involvement

Breach in patient safety procedures led to the tragic death of patients suffering from meningitis. Root cause analysis was followed by workshops involving all stakeholders, including relatives and patient organisations. Consequently, a large plan for improving patient safety and the learning culture was initiated. In addition, it was decided to evaluate PSC in all hospitals and corporations in the region and disseminate the results at local, institutional and regional level.

### Participants

The SAQ-DK was sent to all employees involved in patient treatment in hospitals, the Emergency Services, the Regional Pharmacy and the Centre for Diabetes corporations. A total of 30 230 employees were invited to participate.

### Data sampling

The validated SAQ-DK consists of 31 items relating to six dimensions: teamwork climate, safety climate, job satisfaction, stress recognition, perception of management and working conditions. The adapted SAQ-DK is provided in online supplemental appendix 1. The number of items included in the survey was 34. Respondents answered each item on a 5-point Likert scale, where 1=disagree strongly, 2=disagree slightly, 3=neutral, 4=agree slightly and 5=agree strongly. Items were assumed to have interval properties. Items 2 and 11 were negatively worded.

In addition, we collected demographic data on age, gender, profession, years of employment and the specialty.

### Data analysis

Individual SAQ-DK item scores were converted to a 0–100-point scale where 1=0, 2=25, 3=50, 4=75 and 5=100. Items 2 and 11 were reversed so the values matched the positively worded items.

Two PSC outcome measures were used to quantify the HCPs' perceptions of PSC. The first measure was the mean attitude score, which was calculated as the mean value of the scaled items within each dimension for each individual.<sup>13</sup> The second measure (% positive) was the proportion of participants with a positive attitude within each dimension. A positive attitude was defined for each dimension as a mean attitude score  $\geq 75$  for each individual. If an item had a missing value, the mean attitude score was calculated based on the remaining items.

Descriptive analysis was presented as frequencies (N, %) for categorical variables and as mean and SD for quantitative variables.

Differences in the perception of PSC between hospitals, specialties, professions, gender and years of employment in current position were tested for each dimension of PSC. Differences between mean attitude scores were calculated using an analysis of variance, and differences

between having a positive attitude were calculated using logistic regression.

A 5% significance level was used. All analyses were performed using SAS V.9.4 (Statistical Analysis Software).

### Presentation of data

Data from the larger specialties Orthopaedic, Gynaecology and Obstetrics, Neurology, Paediatrics, Dermatology, Anaesthesiology and Psychiatry were analysed individually, whereas data from the smaller specialties were grouped. The smaller surgical specialties: ENT (ear, nose and throat) surgery, ophthalmic surgery, vascular surgery, thoracic surgery, urology, plastic surgery and breast surgery were grouped together and named *Surgery, small specialties*. Likewise, the internal medicine specialties relating to cardiology, pulmonology, haematology, oncology, nephrology, gastroenterology, geriatrics and infectious diseases were grouped and named *Internal Medicine*. The diagnostic specialties relating to radiology, pathology, clinical biochemistry, clinical physiology and clinical immunology were grouped together and named *Diagnostic specialties*.

The paper is prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (online supplemental table S1), STROBE checklist.<sup>14</sup>

## RESULTS

A total of 15 119 HCPs returned the survey, resulting in a response rate of 50% (37% and 61% for physician and nurses, respectively). We excluded 1135 HCPs from the analysis if they represented other professions than those mentioned in table 1, as the sample sizes for each of these professions were small. Hence, the study population consists of 13 984 HCPs.

Table 1 shows the characteristics of the included HCPs and their place of employment. Somatic hospitals represented by far the largest group of HCPs (N=11 408, 81.6%), followed by psychiatric units (N=2252, 16.1%). The Pharmacy, the Centre for Diabetes and the Emergency Services represented units with 107–184 HCPs. These differences in size should be kept in mind when interpreting the data. Nursing is by far the largest professional group (47.9%), followed by physicians (18.3%) and assisting nurses (8.4%). The sample includes HCPs in all age categories, although few in the category 20–24 years. The large majority are women (82.5%) and not clinical leaders (93.3%).

Significant differences in % positive are seen across hospitals and corporations for all dimensions of PSC (table 2). The proportion of HCPs with a positive attitude was largest regarding job satisfaction (74.8%) and lowest regarding perceptions of management (43.9%). The dimensions of safety climate and perceptions of management showed the lowest mean scores across all hospitals

and corporations (69.6 (SD 19.5) and 66.6 (SD 21.8)). A significant difference was seen between somatic hospitals and psychiatric units for these two dimensions (−2.9 (SD 0.4) and −3.6 (SD 0.5)).

### The specialties and professions

Significant differences in % positive are seen for both physicians' and nurses' perceptions of PSC in the different specialties within all dimensions of PSC except for the recognition of stress dimension, see table 3.

Within surgery, the lowest proportions of physicians with a positive perception were found for the dimension of safety climate.

Of all surgical specialties, the smaller surgical specialties and gynaecology/obstetrics had the most physicians with a positive perception of PSC (across dimensions). Across all specialties, dermatologists and neurologists had the most positive perception of PSC.

Among physicians, positive perceptions of teamwork differed significantly between anaesthesiologists (69.4%), gynaecologists (79.2%) and surgeons (41.7%) (see table 3). The percentages for physicians with a positive perception of the dimension of teamwork climate were 69.4%, 79.2% and 41.7%, respectively. Among nurses, the corresponding percentages were anaesthesiology (64.4%), gynaecology (74.8%) and surgery (67.8%). The nurses' perceptions of PSC were not as negative as the physicians' perception.

The main influence of profession is shown in table 4. Significant differences were seen between the different professions within all dimensions; midwives had the lowest proportion of staff (33.7%) with a positive attitude to safety climate.

### The relation between gender, years of employment and managerial function

We analysed the effect of gender in the two largest groups of HCPs. No significant gender differences were found between physicians' and nurses' perceptions of safety climate and perception of management. See online supplemental appendix 2.

We investigated the association between years in current position (stratified in five groups) for both physicians and nurses and their perception of safety climate and management. A significant relation was found for both professions (see table 5). For physicians, the worst attitude towards these dimensions was seen in the beginning (< 6 months) and for nurses, after 1–4 years.

Significant differences were found between respondents with and without managerial roles, except for stress recognition. Respondents with managerial functions reported more positive attitudes in all dimensions than respondents without managerial functions.

## DISCUSSION

### Main findings

This is the first large-scale Danish study identifying significant differences in HCPs' perceptions of PSC between

**Table 1** Characteristics of participants at institutional level

	All hospitals and corporations		All somatic hospitals						Psychiatric hospitals								
			Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Corporation 1	Corporation 2	Corporation 3						
Invitees (N)*	30,230	24,998	9,246	6,492	3,285	2,923	2,509	543	4,483	374	140	235					
Responders (N)†	15,119	12,254	4,490	3,329	1,714	1,269	1,189	263	2,393	181	107	184					
Response rate (%)	50,0	291	48,6	51,3	52,2	43,4	47,4	48,4	53,4	48,4	76,4	78,3					
Included (N)	13,984	11,408	<b>4,186</b>	<b>2,961</b>	<b>1,618</b>	<b>1,238</b>	<b>1,153</b>	<b>252</b>	<b>2,252</b>	<b>124</b>	<b>97</b>	<b>103</b>					
Profession																	
Nurse	6694	5647	2022	1391	776	715	622	121	939	76	32	0					
Physician	2556	2194	716	592	296	295	266	29	299	48	15	0					
Assisting nurse	1168	622	177	158	118	85	64	20	546	0	0	0					
Secretary	797	761	299	252	160	8	12	30	20	0	16	0					
Medical laboratory technologist	776	749	417	212	78	5	23	14	0	0	27	0					
Physiotherapist	461	404	133	83	56	52	69	11	56	0	1	0					
Radiographer	372	372	137	115	48	0	63	9	0	0	0	0					
Midwife	252	252	69	65	57	58	0	3	0	0	0	0					
Academic staff	237	44	25	10	4	1	4	0	191	0	2	0					
Occupational therapists	229	134	49	21	17	15	26	6	95	0	0	0					
Healthcare staff others	183	72	56	4	6	3	2	1	4	0	4	103					
Porter	146	146	77	57	1	1	2	8	0	0	0	0					
Paedagogical staff	113	11	9	1	1	0	0	0	102	0	0	0					
Organisational role																	
Clinical leader	931	732	287	198	80	72	85	10	186	2	9	2					
Employee	13,053	10,676	3,899	2,763	1,538	1,166	1,068	242	2,066	122	88	101					
Age groups (age intervals)																	
20–24 years	236	204	67	49	34	24	29	1	26	0	0	6					
25–29 years	1,543	1,294	437	332	153	163	188	21	232	0	7	10					
30–34 years	1,672	1,382	477	377	167	157	180	24	271	2	5	12					
35–39 years	1,571	1,280	504	324	170	120	135	27	260	8	8	15					
40–44 years	1,833	1,491	568	363	212	181	134	33	290	13	20	19					
45–49 years	1,650	1,322	473	363	192	132	134	28	295	11	11	11					
50–54 years	1,814	1,494	569	382	248	149	112	34	260	29	19	12					

Continued



**Table 1** Continued

	All somatic hospitals						Psychiatric hospitals					
	All hospitals and corporations	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Corporation 1	Corporation 2	Corporation 3		
55-59 years	1757	506	388	211	151	112	37	303	27	14	8	
60-	1908	585	383	231	161	129	47	315	34	13	10	
Gender												
Female	11 539	3474	2479	1390	1028	894	212	1782	93	89	98	
Male	2445	712	482	228	210	259	40	470	31	8	5	

\*Invited participants that received the questionnaire including staff on leave or long-term sick staff.

†Replied to the questionnaire.

specialties and professions. In addition, we found that years of employment influenced PSC. The lowest proportion of HCPs with a positive perception of PSC was found within the dimensions of safety climate and perception of management. Our findings suggest that how HCPs work in multi-professional teams may have an impact on their perception of PSC.

Overall, the perception of PSC in our sample is more positive than in the study by Kristensen *et al.*<sup>8</sup> We found the lowest proportion of HCPs with a positive perception in the dimensions of safety climate and perception of management. This is in contrast to the study by Tang *et al* which found the highest score in safety climate and the lowest in the dimension of working conditions.<sup>15</sup> Most of the participants in Tang's study were nurses >40 years old, whereas the nurses in our study were younger. This may explain the different findings in the two studies. Significant differences were found between hospitals and corporations in the present study. Previous studies have compared the safety culture dimensions and found that dimensions vary more at unit level than at hospital level.<sup>16</sup> In our study, we did not look at individual units but at specialties and professions. In the following sections, the overarching themes and possible implications of our findings are discussed.

### The specialties and professions

We found significant differences in perceptions of PSC between specialties and between professions. This is in agreement with previous studies.<sup>9 17 18</sup>

A positive association between PSC and patient outcome has previously been shown in a review of studies across countries and settings.<sup>19</sup> Hence, the differences found in HCPs' perceptions of PSC may affect how multi-professional teams function and may also influence patient outcomes. Especially, the considerable discrepancies in perceptions of teamwork climate between surgeons and anaesthesiologists are of concern, as social and cognitive skills are important for safe patient care in the operating theatre. Our findings are in agreement with previous findings.<sup>18</sup> For decades, anaesthesiologists have been aware of the importance of human factors for patient safety and been early adopters of training.<sup>20 21</sup> Previous studies have shown greater numbers of disruptive behaviour among surgeons than among non-surgeons, indicating that differences in perceptions of teamwork are of clinical relevance.<sup>22 23</sup> A recent systematic review shows that unacceptable behaviour negatively affects HCPs' clinical performance and patient outcomes.<sup>24</sup> Disruptive behaviour may also impact the HCPs' psychological safety and hence patient safety.<sup>25</sup> One of the key features of a PSC is HCPs feeling psychologically safe. Edmondson describes psychological safety as an individual's perception of the consequences of taking interactional risks in a particular context, such as speaking up if things go wrong, or asking for feedback or help.<sup>26</sup> The antecedents for psychological safety are good team leader behaviour, trust, mutual respect and a supportive organisational

**Table 2** Comparison of the proportion of HCPs with a positive attitude (% positive) and mean scale statistics across hospitals and corporations

	Psychiatric hospitals										Corporation			Difference between all somatic hospitals and psychiatry
	All hospitals and corporations	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Psychiatric hospitals	Corporation 1*	Corporation 2*	Corporation 3*	Difference between all groups	p-value	
Included (N)	13 984	4186	2961	1618	1238	1153	252	2252	124	97	103			
<b>Outcome: proportion of staff with a positive attitude (% positive)</b>														
Teamwork climate	68.3	67.0	69.6	68.0	68.2	71.9	57.5	70.2	52.4	68.0	55.3		<0.001	-2.0; 0.009
Safety climate	46.1	44.3	47.3	45.1	42.2	47.4	34.1	52.0	29.0	60.8	36.9		<0.001	-6.9; <0.001
Job satisfaction	74.8	74.2	76.6	75.2	72.6	77.9	64.7	75.8	45.2	77.3	71.8		<0.001	-0.80; 0.062
Stress recognition	60.0	58.2	60.8	62.3	63.0	61.2	61.1	57.9	70.2	57.7	59.2		0.002	2.4; 0.010
Perceptions of management	43.9	40.7	44.5	44.4	40.5	49.4	30.6	50.0	20.2	58.8	44.7		<0.001	-7.1; <0.001
Working conditions	65.1	65.1	67.6	65.9	62.7	66.2	56.7	62.3	60.5	78.4	68.9		<0.001	3.2; 0.13
<b>Outcome: the degree to which the participants perceive the culture positive (mean scale statistics; (mean (±SD)</b>														
Teamwork climate	78.7 (17.2)	78.6 (17.0)	78.0 (17.6)	79.4 (16.5)	78.2 (16.9)	80.4 (16.7)	74.2 (16.2)	79.8 (17.5)	69.1 (21.9)	80.4 (17.4)	77.3 (13.8)		<0.001	-1.2 (0.4); <0.001
Safety climate	69.6 (19.5)	68.9 (19.7)	70.4 (19.2)	68.8 (19.3)	67.7 (19.9)	70.5 (19.1)	65.5 (18.3)	72.1 (19.1)	57.3 (22.8)	73.7 (19.1)	66.8 (17.1)		<0.001	-2.9 (0.4); <0.001
Job satisfaction	81.4 (18.8)	81.3 (18.7)	81.1 (18.9)	82.1 (18.1)	81.0 (18.9)	80.3 (19.5)	76.0 (19.1)	82.4 (18.5)	66.3 (22.1)	83.2 (17.5)	81.0 (18.9)		<0.001	-1.0 (0.4); <0.001
Stress recognition	73.0 (22.7)	73.1 (22.6)	71.7 (23.4)	73.2 (22.4)	74.6 (22.3)	74.2 (21.9)	74.9 (20.4)	72.0 (23.0)	76.6 (23.9)	71.7 (23.1)	72.6 (24.1)		<0.001	1.1 (0.5); 0.002
Perceptions of management	66.6 (21.8)	66.1 (21.7)	65.0 (22.0)	66.8 (21.8)	67.2 (20.7)	64.4 (22.2)	58.4 (22.3)	69.7 (21.5)	48.5 (25.7)	72.6 (20.0)	69.9 (19.5)		<0.001	-3.6 (0.5); <0.001
Working conditions	75.1 (22.0)	75.3 (22.0)	74.9 (22.3)	76.4 (21.9)	75.4 (21.4)	74.2 (22.4)	69.0 (22.6)	74.0 (22.0)	75.4 (21.6)	82.4 (18.5)	78.2 (19.0)		<0.001	1.3 (0.5); 0.52

\*Corporation.

**Table 3** Comparison of the proportion of HCPs with a positive attitude (%) positive and mean scale statistics across specialties

	All	Surgery small specialties*	Orthopaedic surgery	Gynaecology obstetrics	Surgery	Internal medicine†	Neurology	Paediatrics	Anaesthesiology	Dermatology	Diagnostic specialist‡	Psychiatry	Difference across the specialties
<b>Physicians</b>													
<b>Outcome: proportion of staff with a positive attitude (% positive)</b>													
Teamwork climate	71.6	70.0	68.1	79.2	41.7	69.1	76.7	69.8	69.4	81.3	73.0	78.6	<0.001
Safety climate	48.3	46.5	35.0	60.4	19.4	45.1	54.3	36.7	52.3	56.3	55.0	56.1	<0.001
Job satisfaction	75.8	77.0	68.8	92.1	55.6	73.5	83.6	70.5	76.6	78.1	77.7	76.9	<0.001
Stress recognition	65.0	62.0	56.9	60.4	66.7	67.5	69.0	68.3	63.0	78.1	67.3	64.3	0.23
Perceptions of management.	47.5	48.4	38.1	56.4	25.0	43.7	58.6	27.3	49.4	46.9	52.6	58.5	<0.001
Working conditions	66.0	66.2	51.3	81.2	55.6	63.3	69.0	63.3	65.5	75.0	76.3	66.3	<0.001
<b>Outcome: the degree to which the participants perceive the culture as positive (mean scale statistics; (mean ±SD))</b>													
Teamwork climate	80.3 (17.9)	79.7 (15.9)	77.9 (20.5)	85.3 (13.6)	71.0 (17.7)	78.9 (18.6)	83.6 (16.1)	77.9 (15.4)	79.2 (18.3)	80.5 (16.7)	80.7 (21.1)	84.0 (15.5)	<0.001
Safety climate	70.8 (19.9)	69.9 (18.6)	65.0 (23.2)	76.0 (17.2)	59.2 (17.7)	68.7 (21.0)	73.9 (19.2)	65.7 (19.3)	71.9 (19.4)	74.6 (16.9)	74.2 (20.5)	75.3 (16.8)	<0.001
Job satisfaction	82.5 (19.4)	83.0 (17.3)	79.4 (23.4)	90.9 (12.5)	71.8 (19.7)	80.9 (20.1)	85.7 (16.9)	79.5 (19.3)	82.7 (19.6)	82.6 (18.0)	83.4 (20.2)	83.9 (18.1)	<0.001
Stress recognition	76.4 (21.5)	75.0 (21.7)	73.1 (25.0)	74.1 (20.8)	77.0 (22.4)	78.3 (21.5)	79.4 (20.6)	78.3 (21.2)	74.0 (21.0)	82.2 (22.2)	75.8 (19.9)	76.3 (21.2)	0.049
Perceptions of management.	68.7 (21.3)	69.5 (18.8)	63.1 (25.1)	74.1 (16.8)	59.7 (18.3)	67.4 (22.2)	73.5 (20.7)	60.8 (19.2)	68.0 (21.3)	69.2 (16.7)	69.2 (22.8)	74.5 (18.9)	<0.001
Working conditions	76.1 (21.2)	74.8 (21.3)	70.4 (22.5)	85.4 (16.5)	71.7 (17.3)	74.4 (21.7)	78.8 (17.6)	75.5 (19.9)	74.9 (21.7)	80.6 (22.2)	81.5 (20.0)	75.9 (22.3)	<0.001
<b>Nurses</b>													
<b>Outcome: proportion of staff with a positive attitude (% positive)</b>													
Teamwork climate	70.3	75.4	68.0	74.8	67.8	73.7	60.6	71.0	64.4	80.5	83.9	68.6	<0.001
Safety climate	46.2	49.0	45.3	41.6	39.6	45.6	42.1	51.3	43.1	60.9	67.7	49.7	<0.001
Job satisfaction	76.0	80.2	71.1	81.7	71.3	76.9	71.4	74.7	73.9	85.1	83.9	75.1	<0.001
Stress recognition	62.5	60.4	62.3	65.1	61.3	63.7	64.1	70.5	59.9	60.9	58.1	60.2	0.032
Perceptions of management	44.9	48.1	48.2	49.5	40.9	44.6	45.6	38.1	40.1	67.8	61.3	49.0	<0.001
Working conditions	68.8	75.4	64.6	64.6	65.7	71.0	65.6	65.2	73.7	72.4	80.6	61.5	<0.001
<b>Outcome: the degree to which the participants perceive the culture positive (mean scale statistics; (mean ±SD))</b>													
													p-value

Continued

Table 3 Continued

	Surgery small specialties*	Orthopaedic surgery	Gynaecology obstetrics	Surgery	Internal medicine†	Neurology	Paediatrics	Anaesthesiology	Dermatology	Diagnostic specialities‡	Psychiatry	Difference across the specialities
All	79.2 (16.7)	80.1 (16.4)	79.0 (16.3)	82.1 (14.3)	78.1 (16.7)	80.2 (16.2)	75.0 (18.1)	79.5 (16.5)	76.5 (17.4)	82.7 (14.9)	79.3 (17.7)	<0.001
Teamwork climate	79.2 (16.7)	80.1 (16.4)	79.0 (16.3)	82.1 (14.3)	78.1 (16.7)	80.2 (16.2)	75.0 (18.1)	79.5 (16.5)	76.5 (17.4)	82.7 (14.9)	79.3 (17.7)	<0.001
Safety climate	69.6 (19.3)	71.6 (18.4)	68.1 (19.8)	68.1 (19.2)	65.7 (19.9)	69.6 (19.0)	68.4 (17.5)	72.3 (18.5)	67.5 (20.1)	77.1 (17.8)	71.2 (19.7)	<0.001
Job satisfaction	81.9 (18.5)	83.5 (18.6)	79.3 (20.6)	85.0 (15.9)	78.9 (21.9)	82.4 (18.1)	79.0 (20.7)	81.7 (17.1)	80.5 (18.9)	86.0 (15.9)	82.2 (17.9)	<0.001
Stress recognition	74.3 (22.0)	72.8 (23.2)	74.0 (21.3)	75.9 (19.8)	74.7 (21.7)	74.5 (21.7)	75.2 (23.2)	78.5 (20.0)	72.9 (22.3)	73.7 (20.5)	73.6 (22.9)	0.004
Perceptions of management.	66.6 (21.9)	68.7 (20.7)	67.3 (23.0)	67.9 (20.3)	63.0 (24.8)	66.6 (21.7)	67.1 (22.2)	64.1 (21.6)	63.3 (22.6)	75.7 (18.7)	69.0 (21.5)	<0.001
Working conditions	76.7 (21.7)	79.7 (20.3)	74.4 (23.0)	76.4 (21.6)	74.4 (24.8)	77.7 (21.7)	74.3 (23.1)	74.7 (21.0)	78.3 (20.9)	81.8 (21.8)	73.8 (21.9)	<0.001

\*Surgical specialities: Ear, nose and throat (ENT) surgery, ophthalmic surgery, vascular surgery, neurology, thoracic surgery, plastic surgery, breast and urology surgery.

†Internal medicine: cardiology, pulmonology, infectious diseases, haematology, nephrology, gastroenterology, geriatrics, oncology and endocrinology.

‡Diagnosics: radiology, clinical biochemistry, clinical physiology, pathology, clinical microbiology, clinical immunology.

context.<sup>26</sup> A team's psychological safety positively affects team performance.

Psychological safety is a complex phenomenon that is influenced by individual, team and organisational level factors; an issue that clearly warrants further study in future research.<sup>27</sup>

### Years of employment

We found that a positive perception of PSC was negatively associated with years of employment.

Interestingly, the lowest perception of safety climate and perception of management was seen after 1-4 years of employment of nurses and < 6 months of employment for physicians. Our study cannot explain this, but the discrepancy could be due to different educational structures and practices in Denmark. The introduction of newly employed nurses is usually short, which implies that nurses need to take more responsibility and work more independently after a year. An unpublished group interview study involving newly employed nurses supports this finding (submitted for publication). In Denmark, newly graduated physicians participate in a structured 1-year training programme after which they can work independently. This is followed by one or two introductory 1-year positions in a given specialty, which is then followed by residency, where the physician rotates between different departments to obtain the necessary competences. This could explain the low perception of PSC after 3-4 years. Apart from these differences in the early years, we found that the perception of PSC was related to age: the more senior, the more positive. This is in agreement with the findings of Mohammed *et al.*<sup>28</sup>

### The relation between gender and managerial function

No significant gender differences were found in physicians' and nurses' perceptions of safety climate and perception of management. This is in agreement with previous studies.<sup>9</sup>

Our study shows a more positive perception of PSC by HCPs holding a managerial function. This is in agreement with previous studies.<sup>8,9</sup> One of the recommendations is for leaders to establish and sustain a safety culture that enables and prioritises safety.<sup>6</sup> The question is whether leaders can live up to this. An interview study with first-line managers shows how they perceive their central role. None of them, however, mentions the possibility of an evaluation of PSC.<sup>29</sup> A safe learning environment and a positive learning culture are closely linked to PSC. Hence, leaders should support a learning culture and create an environment where HCPs feel comfortable and have opportunities to raise concerns, ask questions and learn from adverse events. In addition, leaders should take action on concerns raised by frontline staff.<sup>30</sup>

### Improvement of PSC

The differences found in perceptions of PSC can affect how multi-professional teams function and hence influence patient outcomes. Healthcare is provided by teams



**Table 4** Comparison of the proportion of HCPs with a positive attitude (% positive) and mean scale statistics across professions

	Physicians	Nurses	Assisting nurse	Midwives	Physio-therapist	Occupational therapists	Radiographer	Medical laboratory technologist	Secretaries	Porters	Pedagogical staff	Academic staff	p-value
<b>Included (N)</b>	2556	6694	1168	252	461	229	372	776	797	146	113	237	
<b>Outcome: proportion of HCPs with a positive attitude (% positive)</b>													
Teamwork climate	70.5	69.8	67.0	70.6	65.9	64.6	59.1	64.6	64.9	58.9	61.9	70.9	<0.001
Safety climate	48.3	46.3	48.2	33.7	44.0	46.7	38.7	46.8	43.8	39.7	45.1	50.2	<0.001
Job satisfaction	74.9	75.4	75.8	80.2	77.4	76.9	73.1	70.0	68.8	82.9	71.7	78.5	<0.001
Stress recognition	65.3	63.0	46.1	65.1	60.1	55.0	56.5	47.8	55.2	47.3	51.3	66.2	<0.001
Perceptions of management	47.0	44.5	43.0	38.9	39.7	48.5	36.6	44.2	36.8	34.2	37.2	54.0	<0.001
Working conditions	64.9	68.4	64.1	66.3	64.6	66.8	57.0	60.1	55.6	46.6	47.8	60.3	<0.001
<b>Outcome: the degree to which HCPs perceive the culture as positive (mean scale statistics; (mean (±SD))</b>													
Teamwork climate	79.9 (17.9)	78.9 (16.9)	77.9 (18.2)	80.3 (14.2)	77.2 (15.8)	77.1 (16.4)	76.1 (16.1)	78.0 (17.5)	77.9 (17.0)	76.2 (15.5)	75.5 (17.8)	80.8 (17.1)	<0.001
Safety climate	70.5 (20.2)	69.5 (19.5)	70.5 (19.7)	65.0 (18.6)	69.4 (17.6)	70.7 (18.3)	66.8 (19.4)	70.6 (19.2)	68.7 (18.7)	65.3 (21.4)	68.1 (20.3)	71.4 (19.1)	>0.001
Job satisfaction	82.0 (19.4)	81.5 (18.6)	81.8 (19.6)	83.9 (16.0)	81.4 (15.7)	82.7 (15.1)	79.1 (17.6)	79.3 (19.4)	78.9 (19.4)	84.8 (16.3)	79.1 (21.3)	82.9 (18.6)	>0.001
Stress recognition	76.4 (21.5)	74.6 (21.8)	64.5 (25.3)	77.1 (19.7)	73.1 (20.2)	72.0 (20.3)	70.2 (24.2)	65.9 (25.1)	69.0 (24.2)	64.0 (26.2)	71.9 (21.0)	77.6 (17.6)	<0.001
Perceptions of management	68.2 (21.6)	66.2 (22.1)	65.7 (22.6)	65.8 (21.0)	67.3 (19.2)	70.2 (18.1)	65.5 (20.7)	67.4 (21.4)	63.6 (20.8)	61.3 (24.0)	66.5 (23.7)	70.7 (20.5)	<0.001
Working conditions	75.7 (21.4)	76.4 (21.8)	75.4 (22.0)	76.9 (22.1)	74.9 (20.2)	75.5 (20.6)	71.0 (21.4)	72.0 (22.9)	71.3 (23.0)	66.8 (24.6)	62.8 (26.7)	72.6 (21.8)	<0.001

**Table 5** Relation between years in current position stratified for profession and the dimension safety climate and perception of management

			Proportion of HCPs with a positive attitude					
Outcome	Profession	Years in current position	N	N	%	OR	95% CI	Overall P-value
Safety climate	Nurses	<6 months	421	208	49.4	1.00	0.82 to 1.22	<0.001
		6–11 months	422	174	41.2	0.72	0.59 to 0.88	
		1–2 years	933	318	34.1	0.53	0.46 to 0.62	
		3–4 years	925	361	39.0	0.66	0.57 to 0.76	
		5 or more years	4062	2004	49.3	1	(ref)	
	Doctors	<6 months	214	69	32.2	0.42	0.31 to 0.56	<0.001
		6–11 months	133	47	35.3	0.48	0.33 to 0.69	
		1–2 years	215	97	45.1	0.72	0.54 to 0.96	
		3–4 years	196	79	40.3	0.59	0.44 to 0.80	
		5 or more years	1714	914	53.3	1	(ref)	
Perception of management	Nurses	<6 months	421	253	60.1	1.80	1.46 to 2.20	<0.001
		6–11 months	422	182	43.1	0.90	0.74 to 1.11	
		1–2 years	933	335	35.9	0.67	0.58 to 0.77	
		3–4 years	925	337	36.4	0.68	0.59 to 0.79	
		5 or more years	4062	1853	45.6	1	(ref)	
	Doctors	<6 months	214	88	41.1	0.72	0.54 to 0.97	0.083
		6–11 months	133	57	42.9	0.78	0.54 to 1.11	
		1–2 years	215	107	49.8	1.03	0.77 to 1.36	
		3–4 years	196	85	43.4	0.79	0.59 to 1.07	
		5 or more years	1714	842	49.1	1	(ref)	
			Degree to which the participant perceives the culture as positive					
Outcome	Profession	Gender	N	Mean	SD	Difference	95% CI	Overall P-value
Safety climate	Nurses	<6 months	421	72.5	16.7	1.87	–0.07 to 3.81	<0.001
		6–11 months	422	68.1	18.2	–2.54	–4.48 to –0.61	
		1–2 years	933	64.7	19.2	–5.99	–7.37 to –4.62	
		3–4 years	925	65.9	20.2	–4.78	–6.16 to –3.40	
		5 or more years	4062	70.7	19.5	0	(ref)	
	Doctors	<6 months	214	64.5	20.9	–8.06	–10.90 to –5.22	<0.001
		6–11 months	133	65.1	19.0	–7.43	–10.97 to –3.89	
		1–2 years	215	69.7	17.9	–2.83	–5.66 to 0.01	
		3–4 years	196	67.9	19.3	–4.63	–7.58 to –1.68	
		5 or more years	1714	72.5	20.1	0	(ref)	
Perception of management	Nurses	<6 months	421	73.9	18.1	6.97	4.77 to 9.17	<0.001
		6–11 months	422	65.8	21.7	–1.05	–3.24 to 1.15	
		1–2 years	933	62.4	21.7	–4.45	–6.01 to –2.89	
		3–4 years	925	62.0	23.0	–4.84	–6.41 to –3.27	
		5 or more years	4062	66.9	22.0	0	(ref)	
	Doctors	<6 months	214	66.3	21.6	–2.58	–5.60 to 0.43	0.027

Continued

Table 5 Continued

		Proportion of HCPs with a positive attitude				
6–11 months	133	66.6	20.4	–2.28	–6.04 to 1.49	
1–2 years	215	72.3	17.7	3.43	0.40 to 6.45	
3–4 years	196	67.4	20.2	–1.46	–4.61 to 1.69	
5 or more years	1714	68.9	21.7	0	(ref)	

rather than single individuals, and most teams in hospitals change team members often. This implies that great variations in the perception of PSC may influence teamwork negatively. It could, however, also be that the team members with a more positive perception of PSC could have a positive influence on team members with a less positive perception. Training teams to understand human factors and team skills are initiatives that can improve PSC.<sup>25 31</sup> Several reviews have demonstrated an effect of training emergency teams such as trauma-resuscitation surgical theatre teams.<sup>2 32</sup> Recently, this has been shown for ward teams, too.<sup>33 34</sup> Significant differences in PSC were found after a 12-month controlled study in two hospitals of a team-training intervention that focused on human factors, social and cognitive skills.<sup>34</sup>

Studies have emphasised the importance of leadership. We suggest viewing HCPs in hospitals and corporations as creative resources for ensuring PSC and patient safety by creating a psychologically supportive safe learning environment across specialties and professions.

### Work–life balance and PSC

The interplay between PSC, teamwork and HCPs' mental health has attracted growing attention in recent years. Among HCPs, an increasing incidence of burnout has been demonstrated, which seems to have an effect on patient safety.<sup>35</sup> In addition, HCPs often feel compelled to work more and take less time to recover from work.<sup>36</sup> Sexton *et al* have shown that a positive work-life balance is associated with better teamwork climate and safety climate.<sup>36</sup>

### Discussion of the method used

The sample is from a centralised hospital system, and a response rate of 50% is representative of the employees' attitudes to patient safety in such a large sample. However, differences in response rate between physician and nurses could indicate a minor response bias. The large volume is a strength as it meant that it was possible to do subgroup analyses which can be used strategically in healthcare. However, the differences in the number of HCPs in each of the corporations and specialties should be kept in mind when interpreting the data.

Results can be extrapolated to other regions in the country as the context and culture are comparable.

We used an adapted version of the validated version of SAQ-DK, as we changed four questions from the validated Danish translation of SAQ. This should be kept in mind

when comparing data. The changed questions are indicated in online supplemental appendix 1.

### Implications

This study is the second large-scale study of PSC in our country. Measuring PSC is meaningless unless data are used for discussions on how to continuously improve PSC at regional, hospital and departmental levels. Local plans for improvement can be implemented and follow-up studies can be planned. It seems to be difficult to effectuate these plans of improvement at departmental level, and as such, focusing on this aspect could be helpful in the future. Denmark has no plans yet to conduct a national study of PSC, while in other countries yearly/biannual measurements of PSC are mandatory. A recent report from the OECD advocates measurements of PSC for the purpose of learning and following the effect of initiatives to improve PSC since PSC has an effect on patient outcomes. In some countries, measurements are used to compare with other institutions.

### Future studies

Research on how to improve PSC across specialties and professions is needed, given HCPs' different perceptions of PSC. Previously, focus has been on how leaders can support PSC, but the questions are how HCPs themselves can contribute to creating a psychologically safe learning environment. We also need to conduct research across corporations and sectors and involve patients/citizens in how to improve patient safety. We believe that future research should explore the underlying barriers and facilitators for improving PSC across sectors, specialties and professions using qualitative methods such as observations, interviews and in situ simulation.

### CONCLUSION

Significant differences in HCPs' perception were found between corporations, specialties and professions. In addition, we found age-related differences and differences between HCPs with a managerial role versus none. The differences may have an impact on teamwork and patient safety and imply that further research is necessary to facilitate the involvement of HCPs in improving PSC.

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