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Job burnout among critical care nurses from 14 adult ICUs in northeastern China: the cross-sectional design based SUBLIN study

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Job burnout among critical care nurses from 14 adult ICUs in northeastern China: the cross-sectional design based SUBLIN study

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ABSTRACT

Objectives The shortage of qualified nurses is one of the critical challenges in the field of healthcare. Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave. The purpose of this study was to provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout among Liaoning ICU Nurses.

Design Observational study.

Setting Fourteen ICUs from 10 tertiary level hospitals in Liaoning, China.

Primary measures Burnout was measured with the 22-item Chinese version of Maslach Burnout Inventory (MBI) questionnaires.

Results The study population is a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high EE and DP scores together with a low PA score.

Conclusions The present study indicated the moderate distribution of burnout among ICU nurses in Liaoning, China. This kind of investigation into the burnout level of this population could catch more attention to ICU caregivers.

Strengths and limitations of this study

- This is the first study to state the actual, overall situation regarding burnout status among ICU nurses in Liaoning, China, to the best of the authors' knowledge.
- This multi-center 'Study to Understand Burnout among Liaoning ICU Nurses' revealed that as many as 16% of the ICU nursing team showed a high level of burnout in all emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA) dimensions.
- There may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies and etc, the results are not generalizable to all Chinese ICU nurses as a whole.
- The researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided.

INTRODUCTION

Around the world, the shortage of qualified nurses is one of the critical challenges in the field of healthcare.[1-3] This shortage is a multidimensional phenomenon,[4,5] and can be attributed to low job satisfaction, lack of managerial support, poor career opportunities and etc.[6,7] Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave.

According to the nature, nursing is a stressful occupation due to the direct exposure to various kinds of working environments and conditions which include anxiety and depression. In China, the Chinese public is greatly dissatisfied with the high cost and low quality of health care.[8-11]

The study communities, Intensive Care Units (ICU) nurses were selected for three main reasons. First, as just described, with the background of China public's dissatisfaction and the high costs of intensive care, there is tense relationship between doctors and patients. More efforts have been made to improve quality of life for patients, while the care providers deserve equal attention. Second, noises, light and the radiation from those monitoring equipment that run all day long pose direct impact to the ICU nurses. Third, critical care medicine was accredited as an independent subspecialty of clinical medicine by Ministry of Health of the People's Republic of China just in January 2009. Critical care courses and educational programs taught at hospitals and universities with various kinds of duration and clinical practice are established to meet the crying need of training during the infancy stage of critical care research in mainland China.[12] Those in-service ICU nurses are the main part of supporting faculty for those training. Clear picture about the burnout status can provide some background information for the target solutions.

To provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout, the present cross-sectional study, 'Study to Understand Burnout among Liaoning ICU Nurses (the SUBLIN study)', was conducted to report findings.

METHODS

Study units and subjects

A cross-sectional survey was conducted during October and November 2010 in Liaoning province, northeastern China. The ICU nurses that work in the 17 intensive care units from 10 tertiary level hospitals were selected as the target population. The principal investigator and co-principal

investigators contacted the head nurse of each participating ICUs via meeting or telephone to share the project objectives and collect the feedback on the questionnaire to be used. After the questionnaire approved by the project core team member and the head nurses of included ICUs, those head nurses assisted in contacting the nurse staff in first-line clinical positions who agreed to participate and arranging the schedule that the nurse could be available. The self-administered anonymous questionnaire addressed demographic data and burnout was adopted during the interview. Demographic information included age, gender, education level, marital status, professional title, the entire period of employment as a nurse and an ICU nurse. All the ICU nurses were in a sufficiently good physical and mental condition to provide reliable answers. The study was conducted after obtaining institutional ethical clearance and all the participants provided oral informed consent.

Measurement of burnout

Burnout was measured with the Chinese version of Maslach Burnout Inventory (MBI) questionnaires. It consists of three dimensions: emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA). The total scale consists of 22 items, among which the EE dimension is measured by nine items, the DP dimension is measured by five items, and the measurement of PE dimension is based on eight items. Each of the items is scored on a Likert scale from 0 to 6. The score are defined according to how often the statement is experienced, from 'never' (0) to 'every day'(6). Higher scores on the EE and DP dimensions and lower scores on the PA dimension indicate higher level of burnout. Cut-off criteria of the MBI were EE:low, less than 19, moderate, 19-26, high more than 26, DP: low: less than 6, moderate, 6-9, high, more than 9, and PA: low, more than 39, moderate 34-39, high, less than 34. Given the fact that the definition of burnout is still controversial, in the present study those individuals that with high EE scores and DP scores together with a low PA score were identified as having a high degree of burnout,[13] and the distribution data in each subscale was also provided.

Statistical analysis

Age group was classified as <30, 30 to 40 and >40 years. Years of experience as a registered nurse was grouped as <5, 5-10, 11-19 and more than Comparisons of MBI scores for

demographics and years of experience as a registered nurse or an ICU nurse were tested by the Student t-test, ANOVA, and Chi-square test. The Student t-test and ANOVA were done using SPSS software (SPSS 12.0 for windows, SPSS Inc., Chicago, IL, USA). The Chi-square test was performed with the software Epi Info™ 3.4.3 (Version 3.4.3 Centers for Disease Control and Prevention, Atlanta, GA, USA). All the P values were two-sided with the P-value less than 0.05 considered as statistically significant.

RESULTS

Among the invited 17 ICUs, 14 ICUs from 10 tertiary level hospitals responded actively and were included in the present study. All the ICUs were closed-type ICU with the available 24-hour a day presence of junior or internmediate intensivist, and all the nurses' working-shift was 12-hour shift. The characteristics of the 14 included ICUs are shown in Table 1. For the 10 hospitals, half were university and university affiliated hospitals, 3 hospitals with more than 2,000 beds and the biggest one with 4,300 beds. The number of admissions in each included ICUs varied from 120 to 890 per year.

Table 1 Characteristics of 14 included Intensive Care Units in Liaoning province, China, the SUBLIN study

Characteristics	Number (% or interquartile)
Type of hospital	
University and University affiliated	5 (50%)
Public	5 (50%)
Number of Hospital beds (in 2009)	
≥ 1000	5 (50%,)
< 1000	5 (50%)
ICU treatment provision by patient category	
Medical	10 (71.4%)
Surgical	4 (28.6%)
Number of ICU beds	Median: 12 Interval: 6-28 Interquartile interval: 9-15
Number of ICU admissions per year	Median: 300 Interval: 120-890 Interquartile interval: 165-600
ICU mortality in 2009 (%)	Median: 14.3% Interval: 4.5%-21.0% Interquartile interval: 9.2%-16.7%
Average ICU length of stay (days)	Median: 6.3 Interval: 3-30 Interquartile interval: 4.5-12.3
Number of ICU nurses	Median: 26 Interval: 10-76 Interquartile interval: 19-35
Patient-to-nurse ratio	Median: 2.2:1 Interval: 2.9:1 to 1.3:1 Interquartile interval: 2.5:1 to 1.9:1

After the introduction of the study objectives provided for 431 participants, five nurses finally refused to join and 426 copies of complete questionnaires were returned. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high EE and DP scores together with a low PA score. The proportion difference with statistical significance was only found in the group defined according to the years of experience as a registered nurse. About one quarter of those nurses that had been working as a registered nurse for 5 to 10 years had a high degree of burnout (Table 2).

When evaluated in each EE, DP and PA subscale, 184, 111 and 177 nurses stayed at the high level of burnout, respectively. Thus the most pronounced symptoms of burnout were emotional exhaustion and personal accomplishment. Among all the studied variables, the statistical significance was found for the DP scores among the nurses that with different education level, nurses that hold a junior college diploma were with a higher DP score when compared with the other two counterparts (Table 2).

Table 2 Sociodemographic characteristics of the ICU nurses in Liaoning province, China, the SUBLIN study

Variables	Number (%)	Number of nurses having a high degree of burnout	EE				DP				PA			
			Mean±SD	Low	Moderate	High	Mean	Low	Moderate	High	Mean	Low	Moderate	High
		68	24.55±12.36	149	93	184	7.05±6.50	214	101	111	35.08±9.36	154	95	177
Gender														
Female	377 (88.5%)	59	24.49±12.58	136	80	161	6.97±6.55	194	86	97	35.14±9.62	143	79	155
Male	49 (11.5%)	9	25.06±4.53	13	13	23	7.65±6.18	20	15	14	34.69±7.12	11	16	22
P value		0.63	0.73		0.39		0.49		0.33		0.70		0.06	
Age (years, Median, 25 yrs; interval,19-52 yrs; interquartile interval, 23-28 yrs)														
<30	357 (83.8%)	56	24.61±12.29	123	81	153	7.18±6.45	174	86	97	34.91±9.22	123	84	150
30-40	62 (14.6%)	11	24.29±12.84	24	10	28	6.50±6.76	35	14	13	35.79±10.36	28	9	25
>40	7 (1.6%)	1	24.14±13.50	2	2	3	5.14±5.90	5	1	1	37.71±7.68	3	2	2
P value		59 0.91	0.98		0.81		0.55		0.60		0.60		0.39	
Highest level of nurse education														
Secondary nursing school	57 (13.4 %)	7	24.98±12.98	19	13	25	6.49±5.90	29	15	13	34.00±10.02	17	12	28
Junior college	219 (51.4 %)	40	25.04±12.05	73	47	99	7.81±6.90	101	54	64	34.68±8.97	71	56	92
Bachelor and Master	150 (35.2%)	21	23.68±12.61	57	33	60	6.15±6.00	84	32	34	36.08±9.64	66	27	57
P value		0.39	0.56		0.88		0.04		0.40		0.24		0.11	
Job rank														
Nurse or nurse student	288 (67.6%)	40	24.29±11.97	100	66	122	7.01±6.33	143	73	72	35.20±8.83	104	67	117
Nurse Practitioner	95 (22.3%)	22	25.51±12.48	31	23	41	7.51±7.11	47	18	30	34.18±10.04	28	23	44
Nurse-in-charge and higher	43 (10.1%)	6	24.19±14.72	18	4	21	6.30±6.32	24	10	9	36.30±11.23	22	5	16
P value		0.09	0.70		0.33		0.59		0.52		0.44		0.13	
Marital status														
Unmarried	277 (65.0%)	38	24.35±12.48	99	60	118	6.96±6.46	140	68	69	35.12±9.20	99	67	111

Married	149 (35.0%)	30	24.93±12.17	50	33	66	7.21±6.59	74	33	42	35.02±9.70	55	28	66
P value		0.08	0.65		0.90		0.70		0.72		0.92		0.42	
Years of experience as a registered nurse (Median, 3 yrs; interval, 0-32 yrs; interquartile interval, 3-7 yrs)														
<5	268 (62.9%)	33	23.54±12.10	102	59	107	6.90±6.40	137	66	65	35.43±9.21	99	61	108
5-10	107 (25.1%)	27	27.38±12.33	29	24	54	7.99±6.99	47	23	37	33.58±8.95	30	27	50
11-19	39 (9.2%)	6	23.87±13.52	13	8	18	5.62±5.64	23	9	7	36.15±11.22	19	5	15
20 or more	12 (2.8%)	2	24.00±12.15	5	2	5	6.50±6.36	7	3	2	37.33±9.37	6	2	4
P value		0.02	0.06		0.54		0.23		0.35		0.23		0.27	
Years of experience as an ICU nurse (Median, 2 yrs; interval, 0-20 yrs; interquartile interval, 1-4 yrs)														
<5	332 (77.9%)	46	23.89±12.07	123	73	136	6.84±6.35	169	82	81	35.32±9.19	121	77	134
5-10	82 (19.2%)	20	27.38±13.44	22	18	42	7.83±7.18	40	14	28	33.65±9.92	26	17	39
10-19	10 (2.3%)	2	24.00±11.08	3	2	5	7.70±6.15	4	4	2	37.20±10.22	5	1	4
20 or more	2 (0.5%)	0	21.50±12.02	1	0	1	5.50±3.54	1	1	0	44.00±4.24	2	0	0
P value		0.11	0.15		0.63		0.63		0.35		0.22		0.40	

SD: Standard deviation. Percentages may not add up to 100% due to rounding.

DISCUSSION

This multi-center study revealed that as many as 16% of the ICU nursing team showed a high level of burnout in all three dimensions. The highest proportion of high-degree burnout (43.2%) was found in the emotional exhaustion dimension, followed by 41.2% in personal accomplishment dimension and 26.1% in depersonalization dimension. Given the fact that the well-being of the ICU nurses is of critical importance to the quality of critically ill patients who are likely to benefit from ICU care, this kind of investigation into the burnout level of this population could catch more attention to ICU caregivers.

In Liaoning, China, there are still no complete epidemiologic data to state the actual, overall situation regarding burnout status among ICU nurses, to the best of our knowledge, this is the first burnout study among Liaoning ICU nurses. Most of the respondents indicated that the investigation from nurses' perspective might contribute to not only the mutual understanding between nurse leaders, ICU managers and nurses, but also their greater self-awareness of burnout. This study strengthened the power of the Critical Care Special Committee nested in Nursing Association of China Liaoning Branch and added an appeal to the nurse students to work in ICU.

The present study has its limitations. Firstly, although the rate of response to the questionnaire was excellent, five nurses refused to join the study after the introduction of the study objectives. This refusal might have been related to that they were already exhausted at that time due to various reasons, such as, heavy work load. Secondly, the researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided. We tried to minimize the kind of worry, the anonymous questionnaire was a structured questionnaire, the participants only needed to put a tick opposite each choice, the pen they used was also provided by the stationery

office of each hospital. Thus, it was difficult to trace the participant information according to these tick marks. Thirdly, the number of nurses in each participating hospital was more than one thousand, the demographic data from only three participating ICUs were available to compare the nurses who returned the questionnaire with the representative sample of total registered nurses population, and no statistical differences were found. In addition, there may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies and etc, the results are not generalizable to all Chinese ICU nurses as a whole.

This proportion of burnout (16% in all 3 dimensions, and 26.1% to 43.2% in each single subscale) among Liaoning ICU nurses that experienced a high degree of burnout is in the range of several recently published studies that reported the distribution of high-level burnout among ICU nurses, around one-third of the ICU nurses having a high level of burnout.[14-17]

This result might help the ICU head nurse to take some actions to explore the feelings, concerns and difficulties of ICU nurses and explore possible solutions and interventions correspondingly.[18,19] High-risk factors[20] and possible protective factors[21,22] that associated with burnout level in Liaoning ICU nurses, such as work environment, job satisfaction, social support and coping strategies will be explored in the nest stage of the SUBLIN study.

Appendix-Study Team (SUBLIN Study), Chun-Mei Gu, Li-Huan Hu, Hong-Fei Li, Li-Hong Liu, Long-Feng Sun, Xuan Wang, Xiao-Jiang Yu, Jun-Li Zhang, Li-Hong Zhang, Shen-Ping Zhang, Wen-Jing Zhao, Li-Yuan Zheng.

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Contributors

XCZ conceived of the study, participated in its design and coordination. XZ AND PG had full access to all of the data in the study, took responsibility for the integrity of the data and the accuracy of the data analysis and drafted the manuscript. DSH participated in its design, analysis and coordination, and helped to draft the manuscript. All authors reviewed and approved the final manuscript.

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Competing interests

None

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	#1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	#2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	#4
Objectives	3	State specific objectives, including any prespecified hypotheses	#4
Methods			
Study design	4	Present key elements of study design early in the paper	#5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	#5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	#5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	#5-#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	#6
Bias	9	Describe any efforts to address potential sources of bias	#11
Study size	10	Explain how the study size was arrived at	#4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	#6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	#6
		(*b*) Describe any methods used to examine subgroups and interactions	#6
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA

		(*e*) Describe any sensitivity analyses	NA
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	#6-#8
		(b) Give reasons for non-participation at each stage	No
		(c) Consider use of a flow diagram	No
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	#8-#10
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	#9-#10
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	#8
		(*b*) Report category boundaries when continuous variables were categorized	#9-#10
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	#9-#10
Discussion			
Key results	18	Summarise key results with reference to study objectives	#11
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	#11-#12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	#12
Generalisability	21	Discuss the generalisability (external validity) of the study results	#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	#13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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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ABSTRACT

Objectives The shortage of qualified nurses is one of the critical challenges in the field of healthcare. Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave. The purpose of this study was to provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout among Liaoning ICU Nurses.

Design Observational study.

Setting Seventeen ICUs from 10 tertiary level hospitals in Liaoning, China.

Participants Four hundred and thirty-one ICU nurses from 14 ICUs nested in 10 tertiary level hospitals in Liaoning, China were invited during October and November 2010.

Primary measures Burnout was measured with the 22-item Chinese version of Maslach Burnout Inventory-Health Service Survey (MBI-HSS) questionnaires.

Results Fourteen ICUs responded actively and were included, the response rate was 98.8% among the 431 invited participants from these 14 ICUs. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high emotional exhaustion and depersonalization scores together with a low personal accomplishment score.

Conclusions The present study indicated the moderate distribution of burnout among ICU nurses in Liaoning, China. The investigation into the burnout level of this population could catch more attention to ICU caregivers.

Strengths and limitations of this study

- This is the first study to state the actual, overall situation regarding burnout status among ICU nurses in Liaoning, China, to the best of the authors' knowledge.
- This multi-center 'Study to Understand Burnout among Liaoning ICU Nurses' revealed that as many as 16% of the ICU nursing team showed a high level of burnout in all emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA) dimensions.
- There may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies and etc, the results are not generalizable to all Chinese ICU nurses as a whole.
- The researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided.

INTRODUCTION

Around the world, the shortage of qualified nurses is one of the critical challenges in the field of healthcare.[1-3] This shortage is a multidimensional phenomenon,[4,5] and can be attributed to low job satisfaction, lack of managerial support, poor career opportunities and etc.[6,7] Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave.

According to the nature, nursing is a stressful occupation due to the direct exposure to various kinds of working environments and conditions which include anxiety and depression. In China, the Chinese public is greatly dissatisfied with the high cost and low quality of health care.[8-11]

The study communities, Intensive Care Units (ICU) nurses were selected for three main reasons. First, as just described, with the background of China public's dissatisfaction and the high costs of intensive care, there is tense relationship between doctors and patients, an online survey revealed that 66% of 14,577 doctors said that their hospitals encountered one to three medical disputes per month.[10] More efforts have been made to improve quality of life for patients, while the care providers deserve equal attention. Second, noises, light and the radiation from those monitoring equipment that run all day long pose direct impact to the ICU nurses. Third, critical care medicine was accredited as an independent subspecialty of clinical medicine by Ministry of Health of the People's Republic of China just in January 2009. Critical care courses and educational programs taught at hospitals and universities with various kinds of duration and clinical practice are established to meet the crying need of training during the infancy stage of critical care research in mainland China.[12] Those in-service ICU nurses are the main part of supporting faculty for those training. Clear picture about the burnout status can provide some background information for the target solutions.

To provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout, the present cross-sectional study, 'Study to Understand Burnout among Liaoning ICU Nurses (the SUBLIN study)', was conducted to report findings.

METHODS

Study units and subjects

A cross-sectional survey was conducted during October and November 2010 in Liaoning province, northeastern China. The ICU nurses that work in the 17 intensive care units from 10 tertiary level hospitals were selected as the target population. The principal investigator and co-principal investigators contacted the head nurse of each participating ICUs via meeting or telephone to share the project objectives and collect the feedback on the questionnaire to be used. After the questionnaire approved by the project core team member and the head nurses of included ICUs, those head nurses assisted in contacting the nurse staff in first-line clinical positions who agreed to participate and arranging the schedule that the nurse could be available. The self-administered anonymous questionnaire addressed demographic data and burnout was adopted during the interview. Demographic information included age, gender, education level, marital status, professional title, the entire period of employment as a nurse and an ICU nurse. All the ICU nurses were in a sufficiently good physical and mental condition to provide reliable answers. The procedures were in accordance with the Declaration of Helsinki and the study was approved by the Ethical Committee of China Medical University. And to remove the participants' worries about that the handwriting on the anonymous questionnaires could be possibly tracked according to their signatures on the consent letter, all the participants provided oral informed consent only. After the head nurse informed the eligible participants about the survey, the head nurse in each ICU also explained that the participation was purely voluntary and the results that based on the collected questionnaire data would be published or presented in an academic symposium on ICU nursing. The head nurse designated at least 2 people to collect the completed questionnaires and check the integrity. The participating nurses were asked to finish the questionnaire within 5 days and they could complete the questionnaire either at home or on the working place.

The study population was a dynamic population, some events, such as sick leave, maternity leave or duty travel happened occasionally or frequently. After the negotiation between the principal investigator and the head nurse of each participating ICU, the survey schedule was fixed, and the available nurse participants were defined by the head nurse of each ICU.

Measurement of burnout

Burnout was measured with the self-reporting Chinese version of anonymous Maslach Burnout Inventory-Human Services Survey (MBI-HSS) questionnaires. Maslach Burnout Inventory-Human Services Survey version was It consists of three dimensions: emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA). The items in the emotional exhaustion subscale describe the feelings of being emotionally overextended and exhausted by one's work, the items in the Depersonalization subscale describe an unfeeling and impersonal response towards recipients of one's care or service, and the items in the personal accomplishment subscale describe feelings of competence and successful achievement in one's work with people.[13] The Maslach Burnout Inventory-Human Services Survey was translated into Chinese by Samantha Mei-Che Peng from The Hong Kong Polytechnic University, its Cronbach's α =0.73 for the whole questionnaire, 0.86, 0.76 and 0.76 for the three subscales.[14] The total scale consists of 22 items, among which the EE dimension is measured by nine items, the DP dimension is measured by five items, and the measurement of PE dimension is based on eight items. Each of the items is scored on a Likert scale from 0 to 6. The score are defined according to how often the statement is experienced, from 'never' (0) to 'every day'(6). Higher scores on the EE and DP dimensions and lower scores on the PA dimension indicate higher level of burnout. It has been indicated that cut-off points should be nation-specific and clinically derived to respond to cultural values, traditional gender roles and others.[15] Cut-off criteria of the MBI-HSS-C in the present study was discussed and determined by the project core team member, EE:low, less than 19, moderate, 19-26, high more than 26, DP: low: less than 6, moderate, 6-9, high, more than 9, and PA: low, more than 39, moderate 34-39, high, less than 34.[16] Given the fact that the definition of burnout is still controversial, in the present study those individuals that with high EE scores and DP scores together with a low PA score were identified as having a high degree of burnout,[13] and the distribution data in each subscale was also provided.

Statistical analysis

In China, most of the nurses are females, male nurses, as the minority part, may stay at different level of job burnout when being compared with the counterpart female nurses. Thus, the subgroup analysis was conducted to test the differences between male nurses and females. There is

increasing emphasis on higher entrance requirements of ICU nurses, and the amount of nurses' salary are closely related to the job rank. And the job rank of the nurses highly rely on the education level, the length of service, the quantity and quality of scientific output, for example, the number of first-authored publications, thus the education level, job rank, years of employment as a registered nurse, and years of employment as an ICU nurse were considered for subgroup analysis. Age group was classified as <30, 30 to 40 and >40 years. Years of experience as a registered nurse was grouped as <5, 5-10, 11-19 and more than 20 years. Around 30% of the study population held a junior college diploma and 45% of the study population graduated from secondary nursing school when they was first employed as a nurse, part of the nurses attended part-time courses to gain a higher degree. Detailed questions on education level could disclose too much personal information, so only the highest level of education was collected in the present survey to confirm the survey was anonymous. The marital status may also have an impact on the level of burnout, stratified analysis on marital status was conducted. Differences of MBI scores for demographics and years of experience as a registered nurse or an ICU nurse were tested by the Student t-test and ANOVA. For ordinal data, Mann-Whitney U test was adopted for comparison between two groups and the Kruskal-Wallis test for comparison between more than two groups. The proportion of the nurses having a high degree of burnout in each subgroup was tested by Chi-square test. The Student t-test, ANOVA, Mann-Whitney U test and Kruskal-Wallis test were done using SPSS software (SPSS 12.0 for windows, SPSS Inc., Chicago, IL, USA). The Chi-square test was performed with the software Epi Info™ 3.4.3 (Version 3.4.3 Centers for Disease Control and Prevention, Atlanta, GA, USA). All the P values were two-sided with the P-value less than 0.05 considered as statistically significant.

RESULTS

Among the invited 17 ICUs, 14 ICUs from 10 tertiary level hospitals responded actively and were included in the present study (Figure 1). For those uninvolved 3 ICUs, one ICU was at the rearrangement stage due to the decoration during the study period, one ICU was at the beginning stage of being short of ICU nurses, and one ICU was open-type ICU that the management mode was distinct from the other ICUs. All the included ICUs were closed-type ICU with the available 24-

hour a day presence of junior or internmediate intensivist, and all the nurses' working-shift was 12-hour shift. The characteristics of the 14 included ICUs are shown in Table 1. For the 10 hospitals, half were university and university affiliated hospitals, 3 hospitals with more than 2,000 beds and the biggest one with 4,300 beds. The number of admissions in each included ICUs varied from 120 to 890 per year.

Figure 1 here

Figure 1 Framework of Study to Understand Burnout among Liaoning ICU Nurses, the SUBLIN study

Table 1 Characteristics of 14 included Intensive Care Units in Liaoning province, China, the SUBLIN study

Characteristics	Number (% or interquartile)
Type of hospital	
University and University affiliated	5 (50%)
Public	5 (50%)
Number of Hospital beds (in 2009)	
≥ 1000	5 (50%,)
< 1000	5 (50%)
ICU treatment provision by patient category	
Medical	10 (71.4%)
Surgical	4 (28.6%)
Number of ICU beds	Median: 12 Interval: 6-28 Interquartile interval: 9-15
Number of ICU admissions per year	Median: 300 Interval: 120-890 Interquartile interval: 165-600
ICU mortality in 2009 (%)	Median: 14.3% Interval: 4.5%-21.0% Interquartile interval: 9.2%-16.7%
Average ICU length of stay (days)	Median: 6.3 Interval: 3-30 Interquartile interval: 4.5-12.3
Number of ICU nurses	Median: 26 Interval: 10-76 Interquartile interval: 19-35
Patient-to-nurse ratio	Median: 2.2:1 Interval: 2.9:1 to 1.3:1 Interquartile interval: 2.5:1 to 1.9:1

After the introduction of the study objectives provided for 431 participants, five nurses finally refused to join and 426 copies of complete questionnaires were returned, resulting in the response rate was 98.8%. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high EE and DP scores together with a low PA score. The proportion difference with statistical significance was only found in the group defined according to the years of experience as a registered nurse. About one quarter of those nurses that had been working as a registered nurse for 5 to 10 years had a high degree of burnout (Table 2).

When evaluated in each EE, DP and PA subscale, 184, 111 and 177 nurses stayed at the high level of burnout, respectively. Thus the most pronounced symptoms of burnout were emotional exhaustion and personal accomplishment. Among all the studied variables, the statistical significance was found for the DP scores among the nurses that with different education level, nurses that hold a junior college diploma were with a higher DP score when compared with the other two counterparts (Table 2).

Table 2 Sociodemographic characteristics of the ICU nurses in Liaoning province, China, the SUBLIN study

Variables	Number (%)	Number of nurses having a high degree of burnout	EE				DP				PA			
			Mean±SD	Low	Moderate	High	Mean	Low	Moderate	High	Mean	Low	Moderate	High
		68	24.55±12.36	149	93	184	7.05±6.50	214	101	111	35.08±9.36	154	95	177
Gender														
Female	377 (88.5%)	59	24.49±12.58	136	80	161	6.97±6.55	194	86	97	35.14±9.62	143	79	155
Male	49 (11.5%)	9	25.06±4.53	13	13	23	7.65±6.18	20	15	14	34.69±7.12	11	16	22
P value		0.63	0.73		0.32		0.49		0.25		0.70		0.16	
Age (years, Median, 25 yrs; interval,19-52 yrs; interquartile interval, 23-28 yrs)														
<30	357 (83.8%)	56	24.61±12.29	123	81	153	7.18±6.45	174	86	97	34.91±9.22	123	84	150
30-40	62 (14.6%)	11	24.29±12.84	24	10	28	6.50±6.76	35	14	13	35.79±10.36	28	9	25
>40	7 (1.6%)	1	24.14±13.50	2	2	3	5.14±5.90	5	1	1	37.71±7.68	3	2	2
P value		0.91	0.98		0.98		0.55		0.27		0.60		0.51	
Highest level of nurse education														
Secondary nursing school	57 (13.4 %)	7	24.98±12.98	19	13	25	6.49±5.90	29	15	13	34.00±10.02	17	12	28
Junior college	219 (51.4 %)	40	25.04±12.05	73	47	99	7.81±6.90	101	54	64	34.68±8.97	71	56	92
Bachelor and Master	150 (35.2%)	21	23.68±12.61	57	33	60	6.15±6.00	84	32	34	36.08±9.64	66	27	57
P value		0.39	0.56		0.47		0.04		0.15		0.24		0.10	
Job rank														
Nurse or nurse student	288 (67.6%)	40	24.29±11.97	100	66	122	7.01±6.33	143	73	72	35.20±8.83	104	67	117
Nurse Practitioner	95 (22.3%)	22	25.51±12.48	31	23	41	7.51±7.11	47	18	30	34.18±10.04	28	23	44
Nurse-in-charge and higher	43 (10.1%)	6	24.19±14.72	18	4	21	6.30±6.32	24	10	9	36.30±11.23	22	5	16
P value		0.09	0.70		0.96		0.59		0.59		0.44		0.17	
Marital status														
Unmarried	277 (65.0%)	38	24.35±12.48	99	60	118	6.96±6.46	140	68	69	35.12±9.20	99	67	111
Married	149	30	24.93±12.17	50	33	66	7.21±6.59	74	33	42	35.02±9.70	55	28	66

	(35.0%)													
P value		0.08	0.65		0.67		0.70		0.67		0.92		0.71	
Years of experience as a registered nurse (Median, 3 yrs; interval, 0-32 yrs; interquartile interval, 3-7 yrs)														
<5	268 (62.9%)	33	23.54±12.10	102	59	107	6.90±6.40	137	66	65	35.43±9.21	99	61	108
5-10	107 (25.1%)	27	27.38±12.33	29	24	54	7.99±6.99	47	23	37	33.58±8.95	30	27	50
11-19	39 (9.2%)	6	23.87±13.52	13	8	18	5.62±5.64	23	9	7	36.15±11.22	19	5	15
20 or more	12 (2.8%)	2	24.00±12.15	5	2	5	6.50±6.36	7	3	2	37.33±9.37	6	2	4
P value		0.02	0.06		0.19		0.23		0.15		0.23		0.22	
Years of experience as an ICU nurse (Median, 2 yrs; interval, 0-20 yrs; interquartile interval, 1-4 yrs)														
<5	332 (77.9%)	46	23.89±12.07	123	73	136	6.84±6.35	169	82	81	35.32±9.19	121	77	134
5-10	82 (19.2%)	20	27.38±13.44	22	18	42	7.83±7.18	40	14	28	33.65±9.92	26	17	39
11-19	10 (2.3%)	2	24.00±11.08	3	2	5	7.70±6.15	4	4	2	37.20±10.22	5	1	4
20 or more	2 (0.5%)	0	21.50±12.02	1	0	1	5.50±3.54	1	1	0	44.00±4.24	2	0	0
P value		0.11	0.15		0.29		0.63		0.76		0.22		0.23	

SD: Standard deviation. Percentages may not add up to 100% due to rounding.

DISCUSSION

This multi-center study revealed that as many as 16% of the ICU nursing team showed a high level of burnout in all three dimensions. For each subscale, the highest proportion of high-degree (43.2%) was found in the emotional exhaustion subscale, followed by 41.2% in personal accomplishment subscale and 26.1% in depersonalization subscale. Given the fact that the well-being of the ICU nurses is of critical importance to the quality of critically ill patients who are likely to benefit from ICU care, this kind of investigation into the burnout level of this population could catch more attention to ICU caregivers.

In Liaoning, China, there are still no complete epidemiologic data to state the actual, overall situation regarding burnout status among ICU nurses, to the best of our knowledge, this is the first burnout study among Liaoning ICU nurses. Most of the respondents indicated that the investigation from nurses' perspective might contribute to not only the mutual understanding between nurse leaders, ICU managers and nurses, but also their greater self-awareness of burnout. This study strengthened the power of the Critical Care Special Committee nested in Nursing Association of China Liaoning Branch and added an appeal to the nurse students to work in ICU. When focusing on the prevalence and the prevention of occupational burnout in order to develop effective interventions, a few characteristics should be taken into account. There is a linear relationship between emotional exhaustion and depersonalization, both subscales, emotional exhaustion and depersonalization can discriminate between burned out and non-burned out employees.[17] On the other hand, low levels of personal accomplishment and high degree of depersonalization in the burnout scores may actually be protective against stress.[18] Moreover, high levels of emotional exhaustion cause stress and that stress causes high levels of emotional exhaustion. In addition, depersonalization may reduce stress, whereas high degrees of personal accomplishment may increase stress levels.[19]

The present study has its limitations. Firstly, although the rate of response to the questionnaire was excellent, five nurses refused to join the study after the introduction of the study objectives. This refusal might have been related to that they were already exhausted at that time due to various reasons, such as, heavy work load. Secondly, the researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided. We tried to minimize the kind of worry, the anonymous questionnaire was a structured questionnaire, the participants only needed to put a tick opposite each choice, the pen they used was also provided by the stationery office of each hospital. Thus, it was difficult to trace the participant information according to these tick marks. Thirdly, the number of nurses in each participating hospital was more than one thousand, the demographic data of total registered nurses in the hospital was available for 3 hospitals, thus those data for the ICU nurses from those 3 nested ICUs could be compared to the total registered nurses of the hospital, and no statistical differences were found. In addition, there may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies and etc, the results are not generalizable to all Chinese ICU nurses as a whole.

This proportion of burnout (16% in all 3 dimensions, and 26.1% to 43.2% in each single subscale) among Liaoning ICU nurses that experienced a high degree of burnout is in the range of several recently published studies that reported the distribution of high-level burnout among ICU nurses, around one-third of the ICU nurses having a high level of burnout.[20-23] In 2005, a Maslach Burnout Inventory-General Survey based investigation was conducted in a convenience sample of staff nurses in Henan province in China, the participants were all females, mean age was 29 years with a range from 18 to 60 years and 66% had experience in nursing for 5

years or more. They focused on the nurses from provincial hospitals, supported the view that nurses commonly experience burnout and the study reported that scores for burnout of surgical and medical nurses were statistically significantly higher than those of other nurses, lower educational status was associated with higher levels of burnout in young nurses. However, in the present study, the highest proportion of the nurses that experiencing high degree of burnout was found for the nurses with 5 to 10 years' employment as a registered nurse. Around 11.5% of the participants in our study were males, and 63% of the included ICU nurses had less than 5 years of employment as a registered nurse. The differences between that study and our study revealed that burnout was associated with demographic characteristics, such as age, educational level, the kind of clinical setting and years of employment as a nurse or an ICU nurse, cautions should be exercised when comparing the results originated from different studies.[24]

This result might help the ICU head nurse to take some actions to explore the feelings, concerns and difficulties of ICU nurses and explore possible solutions and interventions correspondingly.[25,26] High-risk factors[27] and possible protective factors[28,29] that associated with burnout level in Liaoning ICU nurses, such as work environment, job satisfaction, social support and coping strategies will be explored in the nest stage of the SUBLIN study.

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Contributors

XCZ conceived of the study, participated in its design and coordination. XZ and PG had full access to all of the data in the study, took responsibility for the integrity of the data and the accuracy of the data analysis and drafted the manuscript. DSH participated in its design, analysis and coordination, and helped to draft the manuscript. All authors reviewed and approved the final manuscript.

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Competing interests

XCZ conceived of the study, participated in its design and coordination. XZ and PG had full access to all of the data in the study, took responsibility for the integrity of the data and the accuracy of the data analysis and drafted the manuscript. DSH participated in its design, analysis and coordination, and helped to draft the manuscript. All authors reviewed and approved the final manuscript.

Data Sharing Statement

No additional data available

Non **Appendix**-Study Team (SUBLIN Study), Chun-Mei Gu, Li-Huan Hu, Hong-Fei Li, Li-Hong Liu, Long-Feng Sun, Xuan Wang, Xiao-Jiang Yu, Jun-Li Zhang, Li-Hong Zhang, Shen-Ping Zhang, Wen-Jing Zhao, Li-Yuan Zheng.

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Job burnout among critical care nurses from 14 adult ICUs in northeastern China: a cross-sectional survey

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ABSTRACT

Objectives The shortage of qualified nurses is one of the critical challenges in the field of healthcare. Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave. The purpose of this study was to provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout among Liaoning ICU Nurses.

Design Observational study.

Setting Seventeen ICUs from 10 tertiary level hospitals in Liaoning, China.

Participants Four hundred and thirty-one ICU nurses from 14 ICUs nested in 10 tertiary level hospitals in Liaoning, China were invited during October and November 2010.

Primary measures Burnout was measured with the 22-item Chinese version of Maslach Burnout Inventory-Health Service Survey (MBI-HSS) questionnaires.

Results Fourteen ICUs responded actively and were included, the response rate was 98.8% among the 431 invited participants from these 14 ICUs. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high emotional exhaustion and depersonalization scores together with a low personal accomplishment score.

Conclusions The present study indicated the moderate distribution of burnout among ICU nurses in Liaoning, China. The investigation into the burnout level of this population could catch more attention to ICU caregivers.

Strengths and limitations of this study

- This is the first study to state the actual, overall situation regarding burnout status among ICU nurses in Liaoning, China, to the best of the authors' knowledge.
- This multi-center 'Study to Understand Burnout among Liaoning ICU Nurses' revealed that as many as 16% of the ICU nursing team showed a high level of burnout in all emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA) dimensions.
- There may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies and etc, the results are not generalizable to all Chinese ICU nurses as a whole.
- The researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided.

INTRODUCTION

Around the world, the shortage of qualified nurses is one of the critical challenges in the field of healthcare.[1-3] This shortage is a multidimensional phenomenon,[4,5] and can be attributed to low job satisfaction, lack of managerial support, poor career opportunities and etc.[6,7] Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave.

According to the nature, nursing is a stressful occupation due to the direct exposure to various kinds of working environments and conditions which include anxiety and depression. In China, the Chinese public is greatly dissatisfied with the high cost and low quality of health care.[8-11]

The study communities, Intensive Care Units (ICU) nurses were selected for three main reasons. First, as just described, with the background of China public's dissatisfaction and the high costs of intensive care, there is tense relationship between doctors and patients, an online survey revealed that 66% of 14,577 doctors said that their hospitals encountered one to three medical disputes per month.[10] More efforts have been made to improve quality of life for patients, while the care providers deserve equal attention. Second, noises, light and the radiation from those monitoring equipment that run all day long pose direct impact to the ICU nurses. Third, critical care medicine was accredited as an independent subspecialty of clinical medicine by Ministry of Health of the People's Republic of China just in January 2009. Critical care courses and educational programs taught at hospitals and universities with various kinds of duration and clinical practice are established to meet the crying need of training during the infancy stage of critical care research in mainland China.[12] Those in-service ICU nurses are the main part of supporting faculty for those training. Clear picture about the burnout status can provide some background information for the target solutions.

To provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout, the present cross-sectional study, 'Study to Understand Burnout among Liaoning ICU Nurses (the SUBLIN study)', was conducted to report findings.

METHODS

Study units and subjects

A cross-sectional survey was conducted during October and November 2010 in Liaoning province, northeastern China. The ICU nurses that work in the 17 intensive care units from 10 tertiary level hospitals were selected as the target population. The principal investigator and co-principal investigators contacted the head nurse of each participating ICUs via meeting or telephone to share the project objectives and collect the feedback on the questionnaire to be used. After the questionnaire approved by the project core team member and the head nurses of included ICUs, those head nurses assisted in contacting the nurse staff in first-line clinical positions who agreed to participate and arranging the schedule that the nurse could be available. The self-administered anonymous questionnaire addressed demographic data and burnout was adopted during the interview. Demographic information included age, gender, education level, marital status, professional title, the entire period of employment as a nurse and an ICU nurse. All the ICU nurses were in a sufficiently good physical and mental condition to provide reliable answers. The procedures were in accordance with the Declaration of Helsinki and the study was approved by the Ethical Committee of China Medical University. And to remove the participants' worries about that the handwriting on the anonymous questionnaires could be possibly tracked according to their signatures on the consent letter, all the participants provided oral informed consent only. After the head nurse informed the eligible participants about the survey, the head nurse in each ICU also explained that the participation was purely voluntary and the results that based on the collected questionnaire data would be published or presented in an academic symposium on ICU nursing. The head nurse designated at least 2 people to collect the completed questionnaires and check the integrity. The participating nurses were asked to finish the questionnaire within 5 days and they could complete the questionnaire either at home or on the working place.

The study population was a dynamic population, some events, such as sick leave, maternity leave or duty travel happened occasionally or frequently. After the negotiation between the principal investigator and the head nurse of each participating ICU, the survey schedule was fixed, and the available nurse participants were defined by the head nurse of each ICU.

Measurement of burnout

Burnout was measured with the self-reporting Chinese version of anonymous Maslach Burnout Inventory-Human Services Survey (MBI-HSS) questionnaires. Maslach Burnout Inventory-Human Services Survey version was It consists of three dimensions: emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA). The items in the emotional exhaustion subscale describe the feelings of being emotionally overextended and exhausted by one's work, the items in the Depersonalization subscale describe an unfeeling and impersonal response towards recipients of one's care or service, and the items in the personal accomplishment subscale describe feelings of competence and successful achievement in one's work with people.[13] The Maslach Burnout Inventory-Human Services Survey was translated into Chinese by Samantha Mei-Che Peng from The Hong Kong Polytechnic University, its Cronbach's α =0.73 for the whole questionnaire, 0.86, 0.76 and 0.76 for the three subscales.[14] The total scale consists of 22 items, among which the EE dimension is measured by nine items, the DP dimension is measured by five items, and the measurement of PE dimension is based on eight items. Each of the items is scored on a Likert scale from 0 to 6. The score are defined according to how often the statement is experienced, from 'never' (0) to 'every day'(6). Higher scores on the EE and DP dimensions and lower scores on the PA dimension indicate higher level of burnout. It has been indicated that cut-off points should be nation-specific and clinically derived to respond to cultural values, traditional gender roles and others.[15] Cut-off criteria of the MBI-HSS-C in the present study was discussed and determined by the project core team member, EE:low, less than 19, moderate, 19-26, high more than 26, DP: low: less than 6, moderate, 6-9, high, more than 9, and PA: low, more than 39, moderate 34-39, high, less than 34.[16] Given the fact that the definition of burnout is still controversial, in the present study those individuals that with high EE scores and DP scores together with a low PA score were identified as having a high degree of burnout,[13] and the distribution data in each subscale was also provided.

Statistical analysis

In China, most of the nurses are females, male nurses, as the minority part, may stay at different level of job burnout when being compared with the counterpart female nurses. Thus, the subgroup analysis was conducted to test the differences between male nurses and females. There is

increasing emphasis on higher entrance requirements of ICU nurses, and the amount of nurses' salary are closely related to the job rank. And the job rank of the nurses highly rely on the education level, the length of service, the quantity and quality of scientific output, for example, the number of first-authored publications, thus the education level, job rank, years of employment as a registered nurse, and years of employment as an ICU nurse were considered for subgroup analysis. Age group was classified as <30, 30 to 40 and >40 years. Years of experience as a registered nurse was grouped as <5, 5-10, 11-19 and more than 20 years. Around 30% of the study population held a junior college diploma and 45% of the study population graduated from secondary nursing school when they was first employed as a nurse, part of the nurses attended part-time courses to gain a higher degree. Detailed questions on education level could disclose too much personal information, so only the highest level of education was collected in the present survey to confirm the survey was anonymous. The marital status may also have an impact on the level of burnout, stratified analysis on marital status was conducted. Differences of MBI scores for demographics and years of experience as a registered nurse or an ICU nurse were tested by the Student t-test and ANOVA. For ordinal data, Mann-Whitney U test was adopted for comparison between two groups and the Kruskal-Wallis test for comparison between more than two groups. The proportion of the nurses having a high degree of burnout in each subgroup was tested by Chi-square test. The Student t-test, ANOVA, Mann-Whitney U test and Kruskal-Wallis test were done using SPSS software (SPSS 12.0 for windows, SPSS Inc., Chicago, IL, USA). The Chi-square test was performed with the software Epi Info™ 3.4.3 (Version 3.4.3 Centers for Disease Control and Prevention, Atlanta, GA, USA). All the P values were two-sided with the P-value less than 0.05 considered as statistically significant.

RESULTS

Among the invited 17 ICUs, 14 ICUs from 10 tertiary level hospitals responded actively and were included in the present study (Figure 1). For those uninvolved 3 ICUs, one ICU was at the rearrangement stage due to the decoration during the study period, one ICU was at the beginning stage of being short of ICU nurses, and one ICU was open-type ICU that the management mode was distinct from the other ICUs. All the included ICUs were closed-type ICU with the available 24-

hour a day presence of junior or internmediate intensivist, and all the nurses' working-shift was 12-hour shift. The characteristics of the 14 included ICUs are shown in Table 1. For the 10 hospitals, half were university and university affiliated hospitals, 3 hospitals with more than 2,000 beds and the biggest one with 4,300 beds. The number of admissions in each included ICUs varied from 120 to 890 per year.

Figure 1 here

Figure 1 Framework of Study to Understand Burnout among Liaoning ICU Nurses, the SUBLIN study

Table 1 Characteristics of 14 included Intensive Care Units in Liaoning province, China, the SUBLIN study

Characteristics	Number (% or interquartile)
Type of hospital	
University and University affiliated	5 (50%)
Public	5 (50%)
Number of Hospital beds (in 2009)	
≥ 1000	5 (50%,)
< 1000	5 (50%)
ICU treatment provision by patient category	
Medical	10 (71.4%)
Surgical	4 (28.6%)
Number of ICU beds	Median: 12 Interval: 6-28 Interquartile interval: 9-15
Number of ICU admissions per year	Median: 300 Interval: 120-890 Interquartile interval: 165-600
ICU mortality in 2009 (%)	Median: 14.3% Interval: 4.5%-21.0% Interquartile interval: 9.2%-16.7%
Average ICU length of stay (days)	Median: 6.3 Interval: 3-30 Interquartile interval: 4.5-12.3
Number of ICU nurses	Median: 26 Interval: 10-76 Interquartile interval: 19-35
Patient-to-nurse ratio	Median: 2.2:1 Interval: 2.9:1 to 1.3:1 Interquartile interval: 2.5:1 to 1.9:1

After the introduction of the study objectives provided for 431 participants, five nurses finally refused to join and 426 copies of complete questionnaires were returned, resulting in the response rate was 98.8%. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high EE and DP scores together with a low PA score. The proportion difference with statistical significance was only found in the group defined according to the years of experience as a registered nurse. About one quarter of those nurses that had been working as a registered nurse for 5 to 10 years had a high degree of burnout (Table 2).

When evaluated in each EE, DP and PA subscale, 184, 111 and 177 nurses stayed at the high level of burnout, respectively. Thus the most pronounced symptoms of burnout were emotional exhaustion and personal accomplishment. Among all the studied variables, the statistical significance was found for the DP scores among the nurses that with different education level, nurses that hold a junior college diploma were with a higher DP score when compared with the other two counterparts (Table 2).

Table 2 Sociodemographic characteristics of the ICU nurses in Liaoning province, China, the SUBLIN study

Variables	Number (%)	Number of nurses having a high degree of burnout	EE				DP				PA			
			Mean±SD	Low	Moderate	High	Mean	Low	Moderate	High	Mean	Low	Moderate	High
		68	24.55±12.36	149	93	184	7.05±6.50	214	101	111	35.08±9.36	154	95	177
Gender														
Female	377 (88.5%)	59	24.49±12.58	136	80	161	6.97±6.55	194	86	97	35.14±9.62	143	79	155
Male	49 (11.5%)	9	25.06±4.53	13	13	23	7.65±6.18	20	15	14	34.69±7.12	11	16	22
P value		0.63	0.73		0.32		0.49		0.25		0.70		0.16	
Age (years, Median, 25 yrs; interval,19-52 yrs; interquartile interval, 23-28 yrs)														
<30	357 (83.8%)	56	24.61±12.29	123	81	153	7.18±6.45	174	86	97	34.91±9.22	123	84	150
30-40	62 (14.6%)	11	24.29±12.84	24	10	28	6.50±6.76	35	14	13	35.79±10.36	28	9	25
>40	7 (1.6%)	1	24.14±13.50	2	2	3	5.14±5.90	5	1	1	37.71±7.68	3	2	2
P value		0.91	0.98		0.98		0.55		0.27		0.60		0.51	
Highest level of nurse education														
Secondary nursing school	57 (13.4 %)	7	24.98±12.98	19	13	25	6.49±5.90	29	15	13	34.00±10.02	17	12	28
Junior college	219 (51.4 %)	40	25.04±12.05	73	47	99	7.81±6.90	101	54	64	34.68±8.97	71	56	92
Bachelor and Master	150 (35.2%)	21	23.68±12.61	57	33	60	6.15±6.00	84	32	34	36.08±9.64	66	27	57
P value		0.39	0.56		0.47		0.04		0.15		0.24		0.10	
Job rank														
Nurse or nurse student	288 (67.6%)	40	24.29±11.97	100	66	122	7.01±6.33	143	73	72	35.20±8.83	104	67	117
Nurse Practitioner	95 (22.3%)	22	25.51±12.48	31	23	41	7.51±7.11	47	18	30	34.18±10.04	28	23	44
Nurse-in-charge and higher	43 (10.1%)	6	24.19±14.72	18	4	21	6.30±6.32	24	10	9	36.30±11.23	22	5	16
P value		0.09	0.70		0.96		0.59		0.59		0.44		0.17	
Marital status														
Unmarried	277 (65.0%)	38	24.35±12.48	99	60	118	6.96±6.46	140	68	69	35.12±9.20	99	67	111
Married	149	30	24.93±12.17	50	33	66	7.21±6.59	74	33	42	35.02±9.70	55	28	66

	(35.0%)													
P value		0.08	0.65		0.67		0.70		0.67		0.92		0.71	
Years of experience as a registered nurse (Median, 3 yrs; interval, 0-32 yrs; interquartile interval, 3-7 yrs)														
<5	268 (62.9%)	33	23.54±12.10	102	59	107	6.90±6.40	137	66	65	35.43±9.21	99	61	108
5-10	107 (25.1%)	27	27.38±12.33	29	24	54	7.99±6.99	47	23	37	33.58±8.95	30	27	50
11-19	39 (9.2%)	6	23.87±13.52	13	8	18	5.62±5.64	23	9	7	36.15±11.22	19	5	15
20 or more	12 (2.8%)	2	24.00±12.15	5	2	5	6.50±6.36	7	3	2	37.33±9.37	6	2	4
P value		0.02	0.06		0.19		0.23		0.15		0.23		0.22	
Years of experience as an ICU nurse (Median, 2 yrs; interval, 0-20 yrs; interquartile interval, 1-4 yrs)														
<5	332 (77.9%)	46	23.89±12.07	123	73	136	6.84±6.35	169	82	81	35.32±9.19	121	77	134
5-10	82 (19.2%)	20	27.38±13.44	22	18	42	7.83±7.18	40	14	28	33.65±9.92	26	17	39
11-19	10 (2.3%)	2	24.00±11.08	3	2	5	7.70±6.15	4	4	2	37.20±10.22	5	1	4
20 or more	2 (0.5%)	0	21.50±12.02	1	0	1	5.50±3.54	1	1	0	44.00±4.24	2	0	0
P value		0.11	0.15		0.29		0.63		0.76		0.22		0.23	

SD: Standard deviation. Percentages may not add up to 100% due to rounding.

DISCUSSION

This multi-center study revealed that as many as 16% of the ICU nursing team showed a high level of burnout in all three dimensions. For each subscale, the highest proportion of high-degree (43.2%) was found in the emotional exhaustion subscale, followed by 41.2% in personal accomplishment subscale and 26.1% in depersonalization subscale. Given the fact that the well-being of the ICU nurses is of critical importance to the quality of critically ill patients who are likely to benefit from ICU care, this kind of investigation into the burnout level of this population could catch more attention to ICU caregivers.

In Liaoning, China, there are still no complete epidemiologic data to state the actual, overall situation regarding burnout status among ICU nurses, to the best of our knowledge, this is the first burnout study among Liaoning ICU nurses. Most of the respondents indicated that the investigation from nurses' perspective might contribute to not only the mutual understanding between nurse leaders, ICU managers and nurses, but also their greater self-awareness of burnout. This study strengthened the power of the Critical Care Special Committee nested in Nursing Association of China Liaoning Branch and added an appeal to the nurse students to work in ICU. When focusing on the prevalence and the prevention of occupational burnout in order to develop effective interventions, a few characteristics should be taken into account. There is a linear relationship between emotional exhaustion and depersonalization, both subscales, emotional exhaustion and depersonalization can discriminate between burned out and non-burned out employees.[17] On the other hand, low levels of personal accomplishment and high degree of depersonalization in the burnout scores may actually be protective against stress.[18] Moreover, high levels of emotional exhaustion cause stress and that stress causes high levels of emotional exhaustion. In addition, depersonalization may reduce stress, whereas high degrees of personal accomplishment may increase stress levels.[19]

The present study has its limitations. Firstly, although the rate of response to the questionnaire was excellent, five nurses refused to join the study after the introduction of the study objectives. This refusal might have been related to that they were already exhausted at that time due to various reasons, such as, heavy work load. Secondly, the researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided. We tried to minimize the kind of worry, the anonymous questionnaire was a structured questionnaire, the participants only needed to put a tick opposite each choice, the pen they used was also provided by the stationery office of each hospital. Thus, it was difficult to trace the participant information according to these tick marks. Thirdly, the number of nurses in each participating hospital was more than one thousand, the demographic data of total registered nurses in the hospital was available for 3 hospitals, thus those data for the ICU nurses from those 3 nested ICUs could be compared to the total registered nurses of the hospital, and no statistical differences were found. In addition, there may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies and etc, the results are not generalizable to all Chinese ICU nurses as a whole.

This proportion of burnout (16% in all 3 dimensions, and 26.1% to 43.2% in each single subscale) among Liaoning ICU nurses that experienced a high degree of burnout is in the range of several recently published studies that reported the distribution of high-level burnout among ICU nurses, around one-third of the ICU nurses having a high level of burnout.[20-23] In 2005, a Maslach Burnout Inventory-General Survey based investigation was conducted in a convenience sample of staff nurses in Henan province in China, the participants were all females, mean age was 29 years with a range from 18 to 60 years and 66% had experience in nursing for 5

years or more. They focused on the nurses from provincial hospitals, supported the view that nurses commonly experience burnout and the study reported that scores for burnout of surgical and medical nurses were statistically significantly higher than those of other nurses, lower educational status was associated with higher levels of burnout in young nurses. However, in the present study, the highest proportion of the nurses that experiencing high degree of burnout was found for the nurses with 5 to 10 years' employment as a registered nurse. Around 11.5% of the participants in our study were males, and 63% of the included ICU nurses had less than 5 years of employment as a registered nurse. The differences between that study and our study revealed that burnout was associated with demographic characteristics, such as age, educational level, the kind of clinical setting and years of employment as a nurse or an ICU nurse, cautions should be exercised when comparing the results originated from different studies.[24]

This result might help the ICU head nurse to take some actions to explore the feelings, concerns and difficulties of ICU nurses and explore possible solutions and interventions correspondingly.[25,26] High-risk factors[27] and possible protective factors[28,29] that associated with burnout level in Liaoning ICU nurses, such as work environment, job satisfaction, social support and coping strategies will be explored in the nest stage of the SUBLIN study.

Appendix-Study Team (SUBLIN Study), Chun-Mei Gu, Li-Huan Hu, Hong-Fei Li, Li-Hong Liu, Long-Feng Sun, Xuan Wang, Xiao-Jiang Yu, Jun-Li Zhang, Li-Hong Zhang, Shen-Ping Zhang, Wen-Jing Zhao, Li-Yuan Zheng.

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Contributors

XCZ conceived of the study, participated in its design and coordination. XZ and PG had full access to all of the data in the study, took responsibility for the integrity of the data and the accuracy of the data analysis and drafted the manuscript. DSH participated in its design, analysis and coordination, and helped to draft the manuscript. All authors reviewed and approved the final manuscript.

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Competing interests

None

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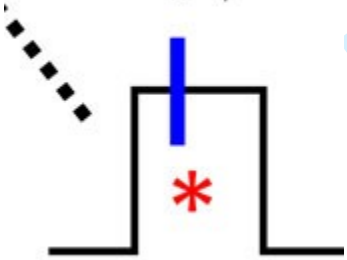
1. Figure Types

Line Art

Line art has sharp, clean lines and geometrical shapes against a white background. Line art is typically used for tables, charts, graphs, and gene sequences. You can use a program like Illustrator to create high-quality line art. A minimum resolution of 300 ppi will maintain the crisp edges of the lines and shapes.

- Format: TIFF or EPS
- Minimum Resolution: 300 ppi



Grayscale

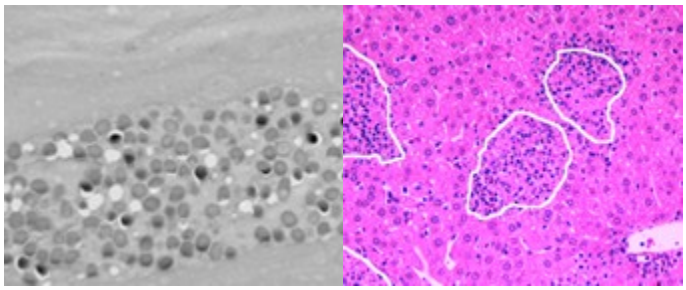
Grayscale figures contain varying tones of black and white. They contain no color, so grayscale is synonymous with "black and white." The gray scale is divided into 256 sections with black at 0 and white at 255. Software for preparation of grayscale art includes Photoshop.

- Format: TIFF or EPS
- Minimum Resolution: 300 ppi

Halftones

The best example of a halftone is a photograph, but halftones include any image that uses continuous shading or blending of colors or grays, such as gels, stains, microarrays, brain scans, and molecular structures. To prepare and manipulate halftone images, use Photoshop or a comparable photo-editing program.

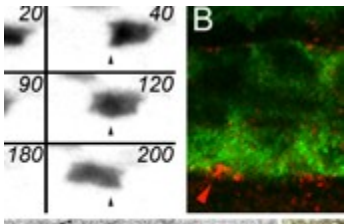
- Format: TIFF
- Minimum Resolution: 300 ppi



Combination Figures

Combination figures contain two or more types of images, for example, a halftone figure containing text. You should embed the images, group the objects, or flatten the layers, and flatten transparencies before saving as TIFF at a minimum of 300 ppi.

- Format: TIFF
- Minimum Resolution: 300 ppi



Convert PowerPoint Files to High-Resolution TIFFs

Caution: Do not add artwork to your PowerPoint slides by copying from another application and then pasting into PowerPoint. Your figures will be downsampled to screen resolution. Instead use Insert > Picture > From File.

Caution: Do not use File > Save as > TIFF. This will result in a low-resolution, poor-quality figure.

Convert Excel or Word Files to High-Resolution TIFFs

Windows 98, XP, Vista and Excel/Word 2003 or 2007:

Step I: Convert Excel/Word File to PDF

There are two possible ways to create PDFs from Excel/Word files: use the Adobe PDF menu in some versions of Excel/Word, or create a PDF via the Print command.

1. Open your file in Excel/Word. From the Adobe PDF menu, select Change Conversion Settings. The PDFMaker Settings dialog displays.
2. From the Conversion settings dropdown menu, select Press Quality. Uncheck View Adobe PDF result. Click OK.
3. From the Adobe PDF menu, select Convert to Adobe PDF. You will be asked to save the PDF file to a location of your choosing.
4. Click OK.

– OR -

1. Open your file in Excel/Word.
2. Select Print from the File dropdown menu.
3. Select the Adobe PDF (or similar driver) in the Printer Name window.
4. Click Properties. Change the Default Settings pull-down to Press Quality. Uncheck the "View Adobe PDF results" box if you don't want Acrobat to launch.
5. Click OK, then click OK. Pick where the PDF will be created, and click Save.

Step II: Convert Individual PDF Files to TIFFs

In Photoshop:

1. File→Open the PDF. You will need to do this one page at a time. Make sure you're importing it at 300ppi, RGB.
2. Use the Crop Tool (fifth from the top of the toolbar) to select an area close to the borders of your image. Hit Enter to apply the crop.
3. Layer→Flatten Image
4. Image→Image Size. Uncheck the Resample Image checkbox. If the Width is over 17.35cm, type 17.35 in the Width box (17.35cm is our maximum allowable width for figures). The Resolution will go up automatically as the Width decreases. If the resolution does not hit 300 when you make the Width 17.35, type 300 in Resolution and as long as Width doesn't go below 8.3cm, everything is fine. Also, the height cannot be more than 23.35. If the Height and Width are within these prescribed limits, no adjustment to your figure size needs to be made.
5. File→Save As. Save as TIFF, Image Compression set to LZW, Pixel Order set to Interleaved, Byte Order set to IBM PC.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	#1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	#2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	#4
Objectives	3	State specific objectives, including any prespecified hypotheses	#5
Methods			
Study design	4	Present key elements of study design early in the paper	#5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	#5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	#5,#7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	#6-#7
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	#6-#7
Bias	9	Describe any efforts to address potential sources of bias	#14
Study size	10	Explain how the study size was arrived at	#5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	#7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	#7-#8
		(*b*) Describe any methods used to examine subgroups and interactions	#8
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA

		(*e*) Describe any sensitivity analyses	NA
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	#7-#10
		(b) Give reasons for non-participation at each stage	#7
		(c) Consider use of a flow diagram	Yes
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	#8-#10
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	#9-#12
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	#10
		(*b*) Report category boundaries when continuous variables were categorized	#11-#12
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	#11-#12
Discussion			
Key results	18	Summarise key results with reference to study objectives	#13
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	#14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	#15
Generalisability	21	Discuss the generalisability (external validity) of the study results	#15
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	#16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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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Job burnout among critical care nurses from 14 adult ICUs in northeastern China: a cross-sectional survey

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Job burnout among critical care nurses from 14 adult ICUs in northeastern China: a cross-sectional survey

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Key words: Burnout, Intensive Care Units, nurses

Word count (main text): 2670 words

ABSTRACT

Objectives The shortage of qualified nurses is one of the critical challenges in the field of healthcare. Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave. The purpose of this study was to provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout among Liaoning ICU Nurses.

Design Observational study.

Setting Seventeen ICUs from 10 tertiary level hospitals in Liaoning, China.

Participants Four hundred and thirty-one ICU nurses from 14 ICUs nested in 10 tertiary level hospitals in Liaoning, China were invited during October and November 2010.

Primary measures Burnout was measured with the 22-item Chinese version of Maslach Burnout Inventory-Health Service Survey (MBI-HSS) questionnaires.

Results Fourteen ICUs responded actively and were included, the response rate was 87.7% among the 486 invited participants from these 17 ICUs. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high emotional exhaustion and depersonalization scores together with a low personal accomplishment score.

Conclusions The present study indicated the moderate distribution of burnout among ICU nurses in Liaoning, China. The investigation into the burnout level of this population could catch more attention to ICU caregivers.

Strengths and limitations of this study

- This is the first study to state the actual, overall situation regarding burnout status among ICU nurses in Liaoning, China, to the best of the authors' knowledge.
- This multi-center 'Study to Understand Burnout among Liaoning ICU Nurses' revealed that as many as 16% of the responding ICU nurses showed a high level of burnout in all emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA) dimensions.
- There may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies etc., the results are not generalizable to all Chinese ICU nurses as a whole.
- The researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided.

INTRODUCTION

Around the world, the shortage of qualified nurses is one of the critical challenges in the field of healthcare.[1-3] This shortage is a multidimensional phenomenon,[4,5] and can be attributed to low job satisfaction, lack of managerial support, poor career opportunities and etc.[6,7] Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave. According to the nature, nursing is a stressful occupation due to the direct exposure to various kinds of working environments and conditions which include anxiety and depression. In China, the Chinese public is greatly dissatisfied with the high cost and low quality of health care.[8-11]

The study communities, Intensive Care Units (ICU) nurses were selected for three main reasons. First, as just described, with the background of China public's dissatisfaction and the high costs of intensive care, there is tense relationship between doctors and patients, an online survey revealed that 66% of 14,577 doctors said that their hospitals encountered one to three medical disputes per month.[10] More efforts have been made to improve quality of life for patients, while the care providers deserve equal attention. Second, noises, light and the radiation from those monitoring equipment that run all day long pose direct impact to the ICU nurses. Third, critical care medicine was accredited as an independent subspecialty of clinical medicine by Ministry of Health of the People's Republic of China just in January 2009. Critical care courses and educational programs taught at hospitals and universities with various kinds of duration and clinical practice are established to meet the crying need of training during the infancy stage of critical care research in mainland China.[12] Those in-service ICU nurses are the main part of supporting faculty for those training. Clear picture about the burnout status can provide some background information for the target solutions.

To provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout, the present cross-sectional study, 'Study to Understand Burnout among Liaoning ICU Nurses (the SUBLIN study)', was conducted to report findings.

METHODS

Study units and subjects

A cross-sectional survey was conducted during October and November 2010 in Liaoning province, northeastern China. The 486 ICU nurses that work in the 17 intensive care units from ten tertiary level hospitals were selected as the target population. The principal investigator and co-principal investigators contacted the head nurse of each participating ICUs via meeting or telephone to share the project objectives and collect the feedback on the questionnaire to be used. After the questionnaire approved by the project core team member and the head nurses of included ICUs, those head nurses assisted in contacting the nurse staff in first-line clinical positions who agreed to participate and arranging the schedule that the nurse could be available. The self-administered anonymous questionnaire addressed demographic data and burnout was adopted during the interview. Demographic information included age, gender, education level, marital status, professional title, the entire period of employment as a nurse and an ICU nurse. All the ICU nurses were in a sufficiently good physical and mental condition to provide reliable answers. The procedures were in accordance with the Declaration of Helsinki and the study was approved by the Ethical Committee of China Medical University. And to remove the participants' worries about that the handwriting on the anonymous questionnaires could be possibly tracked according to their signatures on the consent letter, all the participants provided oral informed consent only. After the head nurse informed the eligible participants about the survey, the head nurse in each ICU also explained that the participation was purely voluntary and the results that based on the collected questionnaire data would be published or presented in an academic symposium on ICU nursing. The head nurse designated at least 2 people to collect the completed questionnaires and check the integrity. The participating nurses were asked to finish the questionnaire within 5 days and they could complete the questionnaire either at home or on the working place.

The study population was a dynamic population, some events, such as sick leave, maternity leave or duty travel happened occasionally or frequently. After the negotiation between the principal investigator and the head nurse of each participating ICU, the survey schedule was fixed, and the available nurse participants were defined by the head nurse of each ICU.

Measurement of burnout

Burnout was measured with the self-reporting Chinese version of anonymous Maslach Burnout Inventory-Human Services Survey (MBI-HSS) questionnaires. It consists of three dimensions: emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA). The items in the emotional exhaustion subscale describe the feelings of being emotionally overextended and exhausted by one's work, the items in the Depersonalization subscale describe an unfeeling and impersonal response towards recipients of one's care or service, and the items in the personal accomplishment subscale describe feelings of competence and successful achievement in one's work with people.[13] The Maslach Burnout Inventory-Human Services Survey was translated into Chinese by Samantha Mei-Che Peng from The Hong Kong Polytechnic University, its Cronbach's α =0.73 for the whole questionnaire, 0.86, 0.76 and 0.76 for the three subscales.[14] The total scale consists of 22 items, among which the EE dimension is measured by nine items, the DP dimension is measured by five items, and the measurement of PE dimension is based on eight items. Each of the items is scored on a Likert scale from 0 to 6. The scores are defined according to how often the statement is experienced, from 'never' (0) to 'every day'(6). Higher scores on the EE and DP dimensions and lower scores on the PA dimension indicate higher level of burnout. It has been indicated that cut-off points should be nation-specific and clinically derived to respond to cultural values, traditional gender roles and others.[15] Cut-off criteria of the MBI-HSS-C in the present study was discussed and determined by the project core team member, EE:low, less than 19, moderate, 19-26, high more than 26, DP: low: less than 6, moderate, 6-9, high, more than 9, and PA: low, more than 39, moderate 34-39, high, less than 34.[16] Given the fact that the definition of burnout is still controversial, in the present study individuals with high EE scores and DP scores together with a low PA score were identified as having a high degree of burnout,[13] and the distribution data in each subscale was also provided.

Statistical analysis

In China, most of the nurses are females, male nurses, as the minority part, may stay at different level of job burnout when being compared with the counterpart female nurses. Thus, the subgroup analysis was conducted to test the differences between male nurses and females. There is increasing emphasis on higher entrance requirements of ICU nurses, and the amount of nurses'

salary are closely related to the job rank. And the job rank of the nurses highly rely on the education level, the length of service, the quantity and quality of scientific output, for example, the number of first-authored publications, thus the education level, job rank, years of employment as a registered nurse, and years of employment as an ICU nurse were considered for subgroup analysis. Age group was classified as <30, 30 to 40 and >40 years. Years of experience as a registered nurse was grouped as <5, 5-10, 11-19 and more than 20 years. Around 30% of the study population held a junior college diploma and 45% of the study population graduated from secondary nursing school when first employed as a nurse, part of the nurses attended part-time courses to gain a higher degree. Detailed questions on education level could disclose too much personal information, so only the highest level of education was collected in the present survey to confirm the survey was anonymous. The marital status may also have an impact on the level of burnout, stratified analysis on marital status was conducted. Differences of MBI scores for demographics and years of experience as a registered nurse or an ICU nurse were tested by the Student t-test and ANOVA. For ordinal data, Mann-Whitney U test was adopted for comparison between two groups and the Kruskal-Wallis test for comparison between more than two groups. The proportion of the nurses having a high degree of burnout in each subgroup was tested by Chi-square test. The Student t-test, ANOVA, Mann-Whitney U test and Kruskal-Wallis test were done using SPSS software (SPSS 12.0 for windows, SPSS Inc., Chicago, IL, USA). The Chi-square test was performed with the software Epi Info™ 3.4.3 (Version 3.4.3 Centers for Disease Control and Prevention, Atlanta, GA, USA). All the P values were two-sided with the P-value less than 0.05 considered as statistically significant.

RESULTS

Among the invited 17 ICUs, fourteen ICUs from ten tertiary level hospitals responded actively and were included in the present study (Figure 1). For those uninvolved three ICUs, one ICU (25 employed nurses) was at the rearrangement stage due to the decoration during the study period, one ICU (fourteen employed nurses) was at the beginning stage of being short of ICU nurses, and one ICU (sixteen employed nurses) was open-type ICU that the management mode was distinct from the other ICUs. All the included ICUs were closed-type ICU with the available 24-hour a day

presence of junior or internmediate intensivist, and all the nurses' working-shift was 12-hour shift. The characteristics of the 14 included ICUs are shown in Table 1. For the 10 hospitals, half were university and university affiliated hospitals, 3 hospitals with more than 2,000 beds and the biggest one with 4,300 beds. The number of admissions in each included ICUs varied from 120 to 890 per year.

Figure 1 here

Table 1 Characteristics of 14 included Intensive Care Units in Liaoning province, China, the SUBLIN study

Characteristics	Number (% or interquartile)
Type of hospital	
University and University affiliated	5 (50%)
Public	5 (50%)
Number of Hospital beds (in 2009)	
≥ 1000	5 (50%,)
< 1000	5 (50%)
ICU treatment provision by patient category	
Medical	10 (71.4%)
Surgical	4 (28.6%)
Number of ICU beds	Median: 12 Interval: 6-28 Interquartile interval: 9-15
Number of ICU admissions per year	Median: 300 Interval: 120-890 Interquartile interval: 165-600
ICU mortality in 2009 (%)	Median: 14.3% Interval: 4.5%-21.0% Interquartile interval: 9.2%-16.7%
Average ICU length of stay (days)	Median: 6.3 Interval: 3-30 Interquartile interval: 4.5-12.3
Number of ICU nurses	Median: 26 Interval: 10-76 Interquartile interval: 19-35
Patient-to-nurse ratio	Median: 2.2:1 Interval: 2.9:1 to 1.3:1 Interquartile interval: 2.5:1 to 1.9:1

Out of 431 enrolled participants, 426 (98.8%) responded. Five nurses refused to return the questionnaire. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high EE and DP scores together with a low PA score. The proportion difference with statistical significance was only found in the group defined according to the years of experience as a registered nurse. About one quarter of those nurses that had been working as a registered nurse for 5 to 10 years had a high degree of burnout (*P*=0.02) (Table 2).

When evaluated in each EE, DP and PA subscale, 184, 111 and 177 nurses stayed at the high level of burnout, respectively. Thus the most pronounced symptoms of burnout were emotional exhaustion and personal accomplishment. Among all the studied variables, the statistical significance was found for the DP scores among the nurses that with different education level, nurses that hold a junior college diploma were with a higher DP score when compared with the other two counterparts (*P*=0.04) (Table 2).

Table 2 Prevalence of emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA) related to sociodemographic characteristics in 426 ICU nurses in Liaoning province, China

Variables	Number (%)	Number of nurses having a high degree of burnout	EE				DP				PA			
			Mean±SD	Low	Moderate	High	Mean	Low	Moderate	High	Mean	Low	Moderate	High
		68	24.55±12.36	149	93	184	7.05±6.50	214	101	111	35.08±9.36	154	95	177
Gender														
Female	377 (88.5%)	59	24.49±12.58	136	80	161	6.97±6.55	194	86	97	35.14±9.62	143	79	155
Male	49 (11.5%)	9	25.06±4.53	13	13	23	7.65±6.18	20	15	14	34.69±7.12	11	16	22
P value		0.63	0.73		0.32		0.49		0.25		0.70		0.16	
Age (years, Median, 25 yrs; interval,19-52 yrs; interquartile interval, 23-28 yrs)														
<30	357 (83.8%)	56	24.61±12.29	123	81	153	7.18±6.45	174	86	97	34.91±9.22	123	84	150
30-40	62 (14.6%)	11	24.29±12.84	24	10	28	6.50±6.76	35	14	13	35.79±10.36	28	9	25
>40	7 (1.6%)	1	24.14±13.50	2	2	3	5.14±5.90	5	1	1	37.71±7.68	3	2	2
P value		0.91	0.98		0.98		0.55		0.27		0.60		0.51	
Highest level of nurse education														
Secondary nursing school	57 (13.4 %)	7	24.98±12.98	19	13	25	6.49±5.90	29	15	13	34.00±10.02	17	12	28
Junior college	219 (51.4 %)	40	25.04±12.05	73	47	99	7.81±6.90	101	54	64	34.68±8.97	71	56	92
Bachelor and Master	150 (35.2%)	21	23.68±12.61	57	33	60	6.15±6.00	84	32	34	36.08±9.64	66	27	57
P value		0.39	0.56		0.47		0.04		0.15		0.24		0.10	
Job rank														
Nurse or nurse student	288 (67.6%)	40	24.29±11.97	100	66	122	7.01±6.33	143	73	72	35.20±8.83	104	67	117
Nurse Practitioner	95 (22.3%)	22	25.51±12.48	31	23	41	7.51±7.11	47	18	30	34.18±10.04	28	23	44
Nurse-in-charge and higher	43 (10.1%)	6	24.19±14.72	18	4	21	6.30±6.32	24	10	9	36.30±11.23	22	5	16
P value		0.09	0.70		0.96		0.59		0.59		0.44		0.17	
Marital status														
Unmarried	277 (65.0%)	38	24.35±12.48	99	60	118	6.96±6.46	140	68	69	35.12±9.20	99	67	111

Married	149 (35.0%)	30	24.93±12.17	50	33	66	7.21±6.59	74	33	42	35.02±9.70	55	28	66
P value		0.08	0.65		0.67		0.70		0.67		0.92		0.71	
Years of experience as a registered nurse (Median, 3 yrs; interval, 0-32 yrs; interquartile interval, 3-7 yrs)														
<5	268 (62.9%)	33	23.54±12.10	102	59	107	6.90±6.40	137	66	65	35.43±9.21	99	61	108
5-10	107 (25.1%)	27	27.38±12.33	29	24	54	7.99±6.99	47	23	37	33.58±8.95	30	27	50
11-19	39 (9.2%)	6	23.87±13.52	13	8	18	5.62±5.64	23	9	7	36.15±11.22	19	5	15
20 or more	12 (2.8%)	2	24.00±12.15	5	2	5	6.50±6.36	7	3	2	37.33±9.37	6	2	4
P value		0.02	0.06		0.19		0.23		0.15		0.23		0.22	
Years of experience as an ICU nurse (Median, 2 yrs; interval, 0-20 yrs; interquartile interval, 1-4 yrs)														
<5	332 (77.9%)	46	23.89±12.07	123	73	136	6.84±6.35	169	82	81	35.32±9.19	121	77	134
5-10	82 (19.2%)	20	27.38±13.44	22	18	42	7.83±7.18	40	14	28	33.65±9.92	26	17	39
11-19	10 (2.3%)	2	24.00±11.08	3	2	5	7.70±6.15	4	4	2	37.20±10.22	5	1	4
20 or more	2 (0.5%)	0	21.50±12.02	1	0	1	5.50±3.54	1	1	0	44.00±4.24	2	0	0
P value		0.11	0.15		0.29		0.63		0.76		0.22		0.23	

SD: Standard deviation. Percentages may not add up to 100% due to rounding.

DISCUSSION

This multi-center study revealed that as many as 16% of the ICU nursing team showed a high level of burnout in all three dimensions. For each subscale, the highest proportion of high-degree (43.2%) was found in the emotional exhaustion subscale, followed by 41.2% in personal accomplishment subscale and 26.1% in depersonalization subscale. Given the fact that the well-being of the ICU nurses is of critical importance to the quality of critically ill patients who are likely to benefit from ICU care, this kind of investigation into the burnout level of this population could catch more attention to ICU caregivers.

In Liaoning, China, there are still no complete epidemiologic data to state the actual, overall situation regarding burnout status among ICU nurses, to the best of our knowledge, this is the first burnout study among Liaoning ICU nurses. Most of the respondents indicated that the investigation from nurses' perspective might contribute to not only the mutual understanding between nurse leaders, ICU managers and nurses, but also their greater self-awareness of burnout. This study strengthened the power of the Critical Care Special Committee nested in Nursing Association of China Liaoning Branch and added an appeal to the nurse students to work in ICU. When focusing on the prevalence and the prevention of occupational burnout in order to develop effective interventions, a few characteristics should be taken into account. There is a linear relationship between emotional exhaustion and depersonalization, both subscales, emotional exhaustion and depersonalization can discriminate between burned out and non-burned out employees.[17] On the other hand, low levels of personal accomplishment and high degree of depersonalization in the burnout scores may actually be protective against stress.[18] Moreover, high levels of emotional exhaustion cause stress and that stress causes high levels of emotional exhaustion. In addition, depersonalization may reduce stress, whereas high degrees of personal accomplishment may increase stress levels.[19]

The present study has its limitations. Firstly, out of the 17 invited ICUs, three ICUs were excluded, one ICU was at the rearrangement stage due to the decoration during the study period, one ICU was at the beginning stage of being short of ICU nurses that the patient-to-nurse ratio was distinct from others, and one ICU was open-type ICU that the management mode was distinct from the other fourteen included ICUs. Although the rate of response to the questionnaire was excellent, five nurses refused to return the questionnaire after the introduction of the study objectives. This refusal might have been related to that they were already exhausted at that time due to various reasons, such as, heavy work load. Secondly, the researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided. We tried to minimize the kind of worry, the anonymous questionnaire was a structured questionnaire, the participants only needed to put a tick opposite each choice, the pen they used was also provided by the stationery office of each hospital. Thus, it was difficult to trace the participant information according to these tick marks. Thirdly, the number of nurses in each participating hospital was more than one thousand, the demographic data of total registered nurses in the hospital was available for 3 hospitals, thus those data for the ICU nurses from those 3 nested ICUs could be compared to the total registered nurses of the hospital, and no statistical differences were found. In addition, there may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies and etc, the results are not generalizable to all Chinese ICU nurses as a whole.

This proportion of burnout (16% in all 3 dimensions, and 26.1% to 43.2% in each single subscale) among Liaoning ICU nurses that experienced a high degree of burnout is in the range of several recently published studies that reported the distribution of high-level burnout among ICU nurses, around one-third of the ICU

nurses having a high level of burnout.[20-23] In 2005, a Maslach Burnout Inventory-General Survey based investigation was conducted in a convenience sample of staff nurses in Henan province in China.[24] In this study the participants were all females, mean age was 29 years with a range from 18 to 60 years and 66% had experience in nursing for 5 years or more. They focused on the nurses from provincial hospitals, supported the view that nurses commonly experience burnout. The authors reported that scores for burnout of surgical and medical nurses were statistically significantly higher than those of other nurses, lower educational status was associated with higher levels of burnout in young nurses. However, in the present study, the highest proportion of the nurses experiencing high degree of burnout was found for the nurses with 5 to 10 years' employment as a registered nurse. Around 11.5% of the participants in our study were males, and 63% of the included ICU nurses had less than 5 years of employment as a registered nurse. The differences between that study and our study revealed that burnout was associated with demographic characteristics, such as age, educational level, the kind of clinical setting and years of employment as a nurse or an ICU nurse, cautions should be exercised when comparing the results originated from different studies.[24]

This result might help the ICU head nurse to take some actions to explore the feelings, concerns and difficulties of ICU nurses and explore possible solutions and interventions correspondingly.[25,26] High-risk factors[27] and possible protective factors[28,29] that associated with burnout level in Liaoning ICU nurses, such as work environment, job satisfaction, social support and coping strategies will be explored in the nest stage of the SUBLIN study.

Appendix-Study Team (SUBLIN Study), Chun-Mei Gu, Li-Huan Hu, Hong-Fei Li, Li-Hong Liu, Long-Feng Sun, Xuan Wang, Xiao-Jiang Yu, Jun-Li Zhang, Li-Hong Zhang, Shen-Ping Zhang, Wen-Jing Zhao, Li-Yuan Zheng.

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Contributors

XCZ conceived of the study, participated in its design and coordination. XZ and PG had full access to all of the data in the study, took responsibility for the integrity of the data and the accuracy of the data analysis and drafted the manuscript. DSH participated in its design, analysis and coordination, and helped to draft the manuscript. All authors reviewed and approved the final manuscript.

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Competing interests

None

Data Sharing Statement

No additional data available

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Figure 1 Framework of Study to Understand Burnout among Liaoning ICU Nurses, the SUBLIN study

Job burnout among critical care nurses from 14 adult ICUs in northeastern China: a cross-sectional survey

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ABSTRACT

Objectives The shortage of qualified nurses is one of the critical challenges in the field of healthcare. Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave. The purpose of this study was to provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout among Liaoning ICU Nurses.

Design Observational study.

Setting Seventeen ICUs from 10 tertiary level hospitals in Liaoning, China.

Participants Four hundred and thirty-one ICU nurses from 14 ICUs nested in 10 tertiary level hospitals in Liaoning, China were invited during October and November 2010.

Primary measures Burnout was measured with the 22-item Chinese version of Maslach Burnout Inventory-Health Service Survey (MBI-HSS) questionnaires.

Results Fourteen ICUs responded actively and were included, the response rate was 87.7% among the 486 invited participants from these 17 ICUs. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high emotional exhaustion and depersonalization scores together with a low personal accomplishment score.

Conclusions The present study indicated the moderate distribution of burnout among ICU nurses in Liaoning, China. The investigation into the burnout level of this population could catch more attention to ICU caregivers.

Strengths and limitations of this study

- This is the first study to state the actual, overall situation regarding burnout status among ICU nurses in Liaoning, China, to the best of the authors' knowledge.
- This multi-center 'Study to Understand Burnout among Liaoning ICU Nurses' revealed that as many as 16% of the responding ICU nurses showed a high level of burnout in all emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA) dimensions.
- There may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies etc., the results are not generalizable to all Chinese ICU nurses as a whole.
- The researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided.

INTRODUCTION

Around the world, the shortage of qualified nurses is one of the critical challenges in the field of healthcare.[1-3] This shortage is a multidimensional phenomenon,[4,5] and can be attributed to low job satisfaction, lack of managerial support, poor career opportunities and etc.[6,7] Among the contributing factors, job burnout has been indicated as a risk factor of the intention to leave.

According to the nature, nursing is a stressful occupation due to the direct exposure to various kinds of working environments and conditions which include anxiety and depression. In China, the Chinese public is greatly dissatisfied with the high cost and low quality of health care.[8-11]

The study communities, Intensive Care Units (ICU) nurses were selected for three main reasons. First, as just described, with the background of China public's dissatisfaction and the high costs of intensive care, there is tense relationship between doctors and patients, an online survey revealed that 66% of 14,577 doctors said that their hospitals encountered one to three medical disputes per month.[10] More efforts have been made to improve quality of life for patients, while the care providers deserve equal attention. Second, noises, light and the radiation from those monitoring equipment that run all day long pose direct impact to the ICU nurses. Third, critical care medicine was accredited as an independent subspecialty of clinical medicine by Ministry of Health of the People's Republic of China just in January 2009. Critical care courses and educational programs taught at hospitals and universities with various kinds of duration and clinical practice are established to meet the crying need of training during the infancy stage of critical care research in mainland China.[12] Those in-service ICU nurses are the main part of supporting faculty for those training. Clear picture about the burnout status can provide some background information for the target solutions.

To provide a better understanding of the local status and reference data for coping strategies of ICU nurse burnout, the present cross-sectional study, 'Study to Understand Burnout among Liaoning ICU Nurses (the SUBLIN study)', was conducted to report findings.

METHODS

Study units and subjects

A cross-sectional survey was conducted during October and November 2010 in Liaoning province, northeastern China. The 486 ICU nurses that work in the 17 intensive care units from ten tertiary level hospitals were selected as the target population. The principal investigator and co-principal investigators contacted the head nurse of each participating ICUs via meeting or telephone to share the project objectives and collect the feedback on the questionnaire to be used. After the questionnaire approved by the project core team member and the head nurses of included ICUs, those head nurses assisted in contacting the nurse staff in first-line clinical positions who agreed to participate and arranging the schedule that the nurse could be available. The self-administered anonymous questionnaire addressed demographic data and burnout was adopted during the interview. Demographic information included age, gender, education level, marital status, professional title, the entire period of employment as a nurse and an ICU nurse. All the ICU nurses were in a sufficiently good physical and mental condition to provide reliable answers. The procedures were in accordance with the Declaration of Helsinki and the study was approved by the Ethical Committee of China Medical University. And to remove the participants' worries about that the handwriting on the anonymous questionnaires could be possibly tracked according to their signatures on the consent letter, all the participants provided oral informed consent only. After the head nurse informed the eligible participants about the survey, the head nurse in each ICU also explained that the participation was purely voluntary and the results that based on the collected questionnaire data would be published or presented in an academic symposium on ICU nursing. The head nurse designated at least 2 people to collect the completed questionnaires and check the integrity. The participating nurses were asked to finish the questionnaire within 5 days and they could complete the questionnaire either at home or on the working place.

The study population was a dynamic population, some events, such as sick leave, maternity leave or duty travel happened occasionally or frequently. After the negotiation between the principal investigator and the head nurse of each participating ICU, the survey schedule was fixed, and the available nurse participants were defined by the head nurse of each ICU.

Measurement of burnout

Burnout was measured with the self-reporting Chinese version of anonymous Maslach Burnout Inventory-Human Services Survey (MBI-HSS) questionnaires. It consists of three dimensions: emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA). The items in the emotional exhaustion subscale describe the feelings of being emotionally overextended and exhausted by one's work, the items in the Depersonalization subscale describe an unfeeling and impersonal response towards recipients of one's care or service, and the items in the personal accomplishment subscale describe feelings of competence and successful achievement in one's work with people.[13] The Maslach Burnout Inventory-Human Services Survey was translated into Chinese by Samantha Mei-Che Peng from The Hong Kong Polytechnic University, its Cronbach's α =0.73 for the whole questionnaire, 0.86, 0.76 and 0.76 for the three subscales.[14] The total scale consists of 22 items, among which the EE dimension is measured by nine items, the DP dimension is measured by five items, and the measurement of PE dimension is based on eight items. Each of the items is scored on a Likert scale from 0 to 6. The scores are defined according to how often the statement is experienced, from 'never' (0) to 'every day'(6). Higher scores on the EE and DP dimensions and lower scores on the PA dimension indicate higher level of burnout. It has been indicated that cut-off points should be nation-specific and clinically derived to respond to cultural values, traditional gender roles and others.[15] Cut-off criteria of the MBI-HSS-C in the present study was discussed and determined by the project core team member, EE:low, less than 19, moderate, 19-26, high more than 26, DP: low: less than 6, moderate, 6-9, high, more than 9, and PA: low, more than 39, moderate 34-39, high, less than 34.[16] Given the fact that the definition of burnout is still controversial, in the present study individuals with high EE scores and DP scores together with a low PA score were identified as having a high degree of burnout,[13] and the distribution data in each subscale was also provided.

Statistical analysis

In China, most of the nurses are females, male nurses, as the minority part, may stay at different level of job burnout when being compared with the counterpart female nurses. Thus, the subgroup analysis was conducted to test the differences between male nurses and females. There is increasing emphasis on higher entrance requirements of ICU nurses, and the amount of nurses'

salary are closely related to the job rank. And the job rank of the nurses highly rely on the education level, the length of service, the quantity and quality of scientific output, for example, the number of first-authored publications, thus the education level, job rank, years of employment as a registered nurse, and years of employment as an ICU nurse were considered for subgroup analysis. Age group was classified as <30, 30 to 40 and >40 years. Years of experience as a registered nurse was grouped as <5, 5-10, 11-19 and more than 20 years. Around 30% of the study population held a junior college diploma and 45% of the study population graduated from secondary nursing school when first employed as a nurse, part of the nurses attended part-time courses to gain a higher degree. Detailed questions on education level could disclose too much personal information, so only the highest level of education was collected in the present survey to confirm the survey was anonymous. The marital status may also have an impact on the level of burnout, stratified analysis on marital status was conducted. Differences of MBI scores for demographics and years of experience as a registered nurse or an ICU nurse were tested by the Student t-test and ANOVA. For ordinal data, Mann-Whitney U test was adopted for comparison between two groups and the Kruskal-Wallis test for comparison between more than two groups. The proportion of the nurses having a high degree of burnout in each subgroup was tested by Chi-square test. The Student t-test, ANOVA, Mann-Whitney U test and Kruskal-Wallis test were done using SPSS software (SPSS 12.0 for windows, SPSS Inc., Chicago, IL, USA). The Chi-square test was performed with the software Epi Info™ 3.4.3 (Version 3.4.3 Centers for Disease Control and Prevention, Atlanta, GA, USA). All the P values were two-sided with the P-value less than 0.05 considered as statistically significant.

RESULTS

Among the invited 17 ICUs, fourteen ICUs from ten tertiary level hospitals responded actively and were included in the present study (Figure 1). For those uninvolved three ICUs, one ICU (25 employed nurses) was at the rearrangement stage due to the decoration during the study period, one ICU (fourteen employed nurses) was at the beginning stage of being short of ICU nurses, and one ICU (sixteen employed nurses) was open-type ICU that the management mode was distinct from the other ICUs. All the included ICUs were closed-type ICU with the available 24-hour a day

presence of junior or internmediate intensivist, and all the nurses' working-shift was 12-hour shift. The characteristics of the 14 included ICUs are shown in Table 1. For the 10 hospitals, half were university and university affiliated hospitals, 3 hospitals with more than 2,000 beds and the biggest one with 4,300 beds. The number of admissions in each included ICUs varied from 120 to 890 per year.

Figure 1 here

Figure 1 Framework of Study to Understand Burnout among Liaoning ICU Nurses, the SUBLIN study

Table 1 Characteristics of 14 included Intensive Care Units in Liaoning province, China, the SUBLIN study

Characteristics	Number (% or interquartile)
Type of hospital	
University and University affiliated	5 (50%)
Public	5 (50%)
Number of Hospital beds (in 2009)	
≥ 1000	5 (50%,)
< 1000	5 (50%)
ICU treatment provision by patient category	
Medical	10 (71.4%)
Surgical	4 (28.6%)
Number of ICU beds	Median: 12 Interval: 6-28 Interquartile interval: 9-15
Number of ICU admissions per year	Median: 300 Interval: 120-890 Interquartile interval: 165-600
ICU mortality in 2009 (%)	Median: 14.3% Interval: 4.5%-21.0% Interquartile interval: 9.2%-16.7%
Average ICU length of stay (days)	Median: 6.3 Interval: 3-30 Interquartile interval: 4.5-12.3
Number of ICU nurses	Median: 26 Interval: 10-76 Interquartile interval: 19-35
Patient-to-nurse ratio	Median: 2.2:1 Interval: 2.9:1 to 1.3:1 Interquartile interval: 2.5:1 to 1.9:1

Out of 431 enrolled participants, 426 (98.8%) responded. Five nurses refused to return the questionnaire. The study population was a young population, with the median age 25 years old, interquartile range 19 to 52 years old and female nurses accounted the major part (88.5%). Sixty-eight nurses (16.0%) were found to have a high degree of burnout, earning high EE and DP scores together with a low PA score. The proportion difference with statistical significance was only found in the group defined according to the years of experience as a registered nurse. About one quarter of those nurses that had been working as a registered nurse for 5 to 10 years had a high degree of burnout (P=0.02) (Table 2).

When evaluated in each EE, DP and PA subscale, 184, 111 and 177 nurses stayed at the high level of burnout, respectively. Thus the most pronounced symptoms of burnout were emotional exhaustion and personal accomplishment. Among all the studied variables, the statistical significance was found for the DP scores among the nurses that with different education level, nurses that hold a junior college diploma were with a higher DP score when compared with the other two counterparts (P=0.04) (Table 2).

Table 2 Prevalence of emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA) related to sociodemographic characteristics in 426 ICU nurses in Liaoning province, China

Variables	Number (%)	Number of nurses having a high degree of burnout	EE				DP				PA			
			Mean±SD	Low	Moderate	High	Mean	Low	Moderate	High	Mean	Low	Moderate	High
		68	24.55±12.36	149	93	184	7.05±6.50	214	101	111	35.08±9.36	154	95	177
Gender														
Female	377 (88.5%)	59	24.49±12.58	136	80	161	6.97±6.55	194	86	97	35.14±9.62	143	79	155
Male	49 (11.5%)	9	25.06±4.53	13	13	23	7.65±6.18	20	15	14	34.69±7.12	11	16	22
P value		0.63	0.73		0.32		0.49		0.25		0.70		0.16	
Age (years, Median, 25 yrs; interval,19-52 yrs; interquartile interval, 23-28 yrs)														
<30	357 (83.8%)	56	24.61±12.29	123	81	153	7.18±6.45	174	86	97	34.91±9.22	123	84	150
30-40	62 (14.6%)	11	24.29±12.84	24	10	28	6.50±6.76	35	14	13	35.79±10.36	28	9	25
>40	7 (1.6%)	1	24.14±13.50	2	2	3	5.14±5.90	5	1	1	37.71±7.68	3	2	2
P value		0.91	0.98		0.98		0.55		0.27		0.60		0.51	
Highest level of nurse education														
Secondary nursing school	57 (13.4 %)	7	24.98±12.98	19	13	25	6.49±5.90	29	15	13	34.00±10.02	17	12	28
Junior college	219 (51.4 %)	40	25.04±12.05	73	47	99	7.81±6.90	101	54	64	34.68±8.97	71	56	92
Bachelor and Master	150 (35.2%)	21	23.68±12.61	57	33	60	6.15±6.00	84	32	34	36.08±9.64	66	27	57
P value		0.39	0.56		0.47		0.04		0.15		0.24		0.10	
Job rank														
Nurse or nurse student	288 (67.6%)	40	24.29±11.97	100	66	122	7.01±6.33	143	73	72	35.20±8.83	104	67	117
Nurse Practitioner	95 (22.3%)	22	25.51±12.48	31	23	41	7.51±7.11	47	18	30	34.18±10.04	28	23	44
Nurse-in-charge and higher	43 (10.1%)	6	24.19±14.72	18	4	21	6.30±6.32	24	10	9	36.30±11.23	22	5	16
P value		0.09	0.70		0.96		0.59		0.59		0.44		0.17	
Marital status														
Unmarried	277 (65.0%)	38	24.35±12.48	99	60	118	6.96±6.46	140	68	69	35.12±9.20	99	67	111

Married	149 (35.0%)	30	24.93±12.17	50	33	66	7.21±6.59	74	33	42	35.02±9.70	55	28	66
P value		0.08	0.65		0.67		0.70		0.67		0.92		0.71	
Years of experience as a registered nurse (Median, 3 yrs; interval, 0-32 yrs; interquartile interval, 3-7 yrs)														
<5	268 (62.9%)	33	23.54±12.10	102	59	107	6.90±6.40	137	66	65	35.43±9.21	99	61	108
5-10	107 (25.1%)	27	27.38±12.33	29	24	54	7.99±6.99	47	23	37	33.58±8.95	30	27	50
11-19	39 (9.2%)	6	23.87±13.52	13	8	18	5.62±5.64	23	9	7	36.15±11.22	19	5	15
20 or more	12 (2.8%)	2	24.00±12.15	5	2	5	6.50±6.36	7	3	2	37.33±9.37	6	2	4
P value		0.02	0.06		0.19		0.23		0.15		0.23		0.22	
Years of experience as an ICU nurse (Median, 2 yrs; interval, 0-20 yrs; interquartile interval, 1-4 yrs)														
<5	332 (77.9%)	46	23.89±12.07	123	73	136	6.84±6.35	169	82	81	35.32±9.19	121	77	134
5-10	82 (19.2%)	20	27.38±13.44	22	18	42	7.83±7.18	40	14	28	33.65±9.92	26	17	39
11-19	10 (2.3%)	2	24.00±11.08	3	2	5	7.70±6.15	4	4	2	37.20±10.22	5	1	4
20 or more	2 (0.5%)	0	21.50±12.02	1	0	1	5.50±3.54	1	1	0	44.00±4.24	2	0	0
P value		0.11	0.15		0.29		0.63		0.76		0.22		0.23	

SD: Standard deviation. Percentages may not add up to 100% due to rounding.

DISCUSSION

This multi-center study revealed that as many as 16% of the ICU nursing team showed a high level of burnout in all three dimensions. For each subscale, the highest proportion of high-degree (43.2%) was found in the emotional exhaustion subscale, followed by 41.2% in personal accomplishment subscale and 26.1% in depersonalization subscale. Given the fact that the well-being of the ICU nurses is of critical importance to the quality of critically ill patients who are likely to benefit from ICU care, this kind of investigation into the burnout level of this population could catch more attention to ICU caregivers.

In Liaoning, China, there are still no complete epidemiologic data to state the actual, overall situation regarding burnout status among ICU nurses, to the best of our knowledge, this is the first burnout study among Liaoning ICU nurses. Most of the respondents indicated that the investigation from nurses' perspective might contribute to not only the mutual understanding between nurse leaders, ICU managers and nurses, but also their greater self-awareness of burnout. This study strengthened the power of the Critical Care Special Committee nested in Nursing Association of China Liaoning Branch and added an appeal to the nurse students to work in ICU. When focusing on the prevalence and the prevention of occupational burnout in order to develop effective interventions, a few characteristics should be taken into account. There is a linear relationship between emotional exhaustion and depersonalization, both subscales, emotional exhaustion and depersonalization can discriminate between burned out and non-burned out employees.[17] On the other hand, low levels of personal accomplishment and high degree of depersonalization in the burnout scores may actually be protective against stress.[18] Moreover, high levels of emotional exhaustion cause stress and that stress causes high levels of emotional exhaustion. In addition, depersonalization may reduce stress, whereas high degrees of personal accomplishment may increase stress levels.[19]

The present study has its limitations. Firstly, out of the 17 invited ICUs, three ICUs were excluded, one ICU was at the rearrangement stage due to the decoration during the study period, one ICU was at the beginning stage of being short of ICU nurses that the patient-to-nurse ratio was distinct from others, and one ICU was open-type ICU that the management mode was distinct from the other fourteen included ICUs. Although the rate of response to the questionnaire was excellent, five nurses refused to return the questionnaire after the introduction of the study objectives. This refusal might have been related to that they were already exhausted at that time due to various reasons, such as, heavy work load. Secondly, the researcher in each participating ICU was the ICU head nurse, and to some extent, the firsthand acquaintance might affect the information those nurses provided. We tried to minimize the kind of worry, the anonymous questionnaire was a structured questionnaire, the participants only needed to put a tick opposite each choice, the pen they used was also provided by the stationery office of each hospital. Thus, it was difficult to trace the participant information according to these tick marks. Thirdly, the number of nurses in each participating hospital was more than one thousand, the demographic data of total registered nurses in the hospital was available for 3 hospitals, thus those data for the ICU nurses from those 3 nested ICUs could be compared to the total registered nurses of the hospital, and no statistical differences were found. In addition, there may have been important differences of various clinical settings, for example, work climate, the characteristics of the patients, work load, relationship between doctors and nurses, institutional policy, coping strategies and etc, the results are not generalizable to all Chinese ICU nurses as a whole.

This proportion of burnout (16% in all 3 dimensions, and 26.1% to 43.2% in each single subscale) among Liaoning ICU nurses that experienced a high degree of burnout is in the range of several recently published studies that reported the distribution of high-level burnout among ICU nurses, around one-third of the ICU

nurses having a high level of burnout.[20-23] In 2005, a Maslach Burnout Inventory-General Survey based investigation was conducted in a convenience sample of staff nurses in Henan province in China.[24] In this study the participants were all females, mean age was 29 years with a range from 18 to 60 years and 66% had experience in nursing for 5 years or more. They focused on the nurses from provincial hospitals, supported the view that nurses commonly experience burnout. The authors reported that scores for burnout of surgical and medical nurses were statistically significantly higher than those of other nurses, lower educational status was associated with higher levels of burnout in young nurses. However, in the present study, the highest proportion of the nurses experiencing high degree of burnout was found for the nurses with 5 to 10 years' employment as a registered nurse. Around 11.5% of the participants in our study were males, and 63% of the included ICU nurses had less than 5 years of employment as a registered nurse. The differences between that study and our study revealed that burnout was associated with demographic characteristics, such as age, educational level, the kind of clinical setting and years of employment as a nurse or an ICU nurse, cautions should be exercised when comparing the results originated from different studies.[24]

This result might help the ICU head nurse to take some actions to explore the feelings, concerns and difficulties of ICU nurses and explore possible solutions and interventions correspondingly.[25,26] High-risk factors[27] and possible protective factors[28,29] that associated with burnout level in Liaoning ICU nurses, such as work environment, job satisfaction, social support and coping strategies will be explored in the nest stage of the SUBLIN study.

Appendix-Study Team (SUBLIN Study), Chun-Mei Gu, Li-Huan Hu, Hong-Fei Li, Li-Hong Liu, Long-Feng Sun, Xuan Wang, Xiao-Jiang Yu, Jun-Li Zhang, Li-Hong Zhang, Shen-Ping Zhang, Wen-Jing Zhao, Li-Yuan Zheng.

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Contributors

XCZ conceived of the study, participated in its design and coordination. XZ and PG had full access to all of the data in the study, took responsibility for the integrity of the data and the accuracy of the data analysis and drafted the manuscript. DSH participated in its design, analysis and coordination, and helped to draft the manuscript. All authors reviewed and approved the final manuscript.

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Competing interests

None

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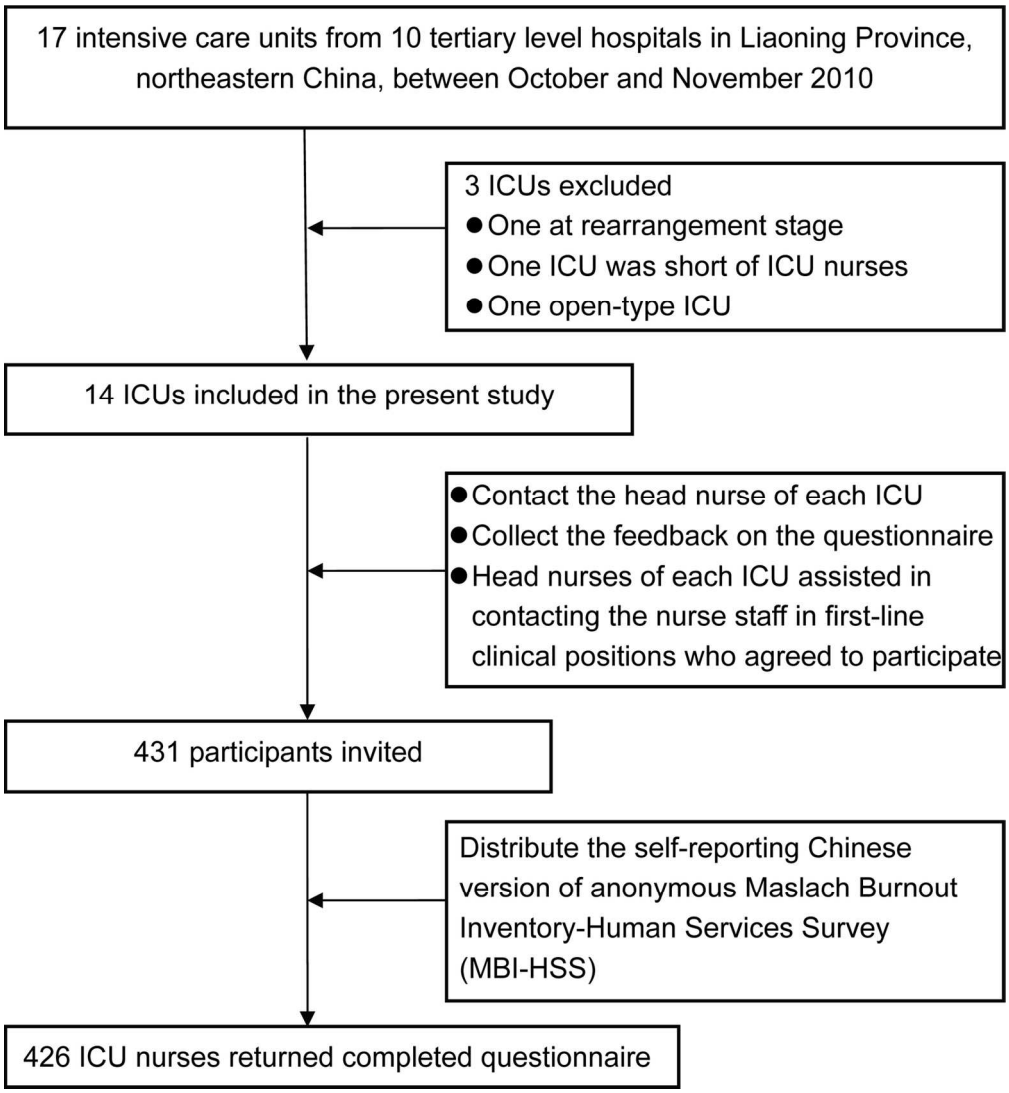

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	#1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	#2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	#4
Objectives	3	State specific objectives, including any prespecified hypotheses	#5
Methods			
Study design	4	Present key elements of study design early in the paper	#5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	#5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	#5,#7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	#6-#7
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	#6-#7
Bias	9	Describe any efforts to address potential sources of bias	#14
Study size	10	Explain how the study size was arrived at	#5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	#7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	#7-#8
		(*b*) Describe any methods used to examine subgroups and interactions	#8
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA

		(*e*) Describe any sensitivity analyses	NA
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	#7-#10
		(b) Give reasons for non-participation at each stage	#7
		(c) Consider use of a flow diagram	Yes
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	#8-#10
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	#9-#12
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	#10
		(*b*) Report category boundaries when continuous variables were categorized	#11-#12
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	#11-#12
Discussion			
Key results	18	Summarise key results with reference to study objectives	#13
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	#14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	#15
Generalisability	21	Discuss the generalisability (external validity) of the study results	#15
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	#16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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.