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A Systematic Review of Effort-Reward Imbalance among Health Workers

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ABSTRACT

The purpose of this article is to systematically collate effort-reward imbalance (ERI) rates among health workers internationally and to assess gender differences. The effort-reward (ER) ratio ranges quite widely from 0.47 up to 1.32 and the ERI rate from 3.5% to 80.7%. Many studies suggested that health workers contribute more than they are rewarded, especially in Japan, Vietnam, Greece, Germany - with ERI rates of 57.1%, 32.3%, 80.7% and 22.8%-27.6%, respectively. Institutions can utilise systems such as the new appraisal and reward system, which is based on performance rather than the traditional system, seniority, which creates a more competitive working climate and generates insecurity. Additionally an increased workload and short stay patients are realities for workers in a healthcare environment, whilst the structure of human resources for healthcare remains inadequate. Gender differences within the ER ratio can be explained by the continued impact of traditional gender roles on attitudes and motivations that place more pressure to succeed for men rather than for women. This systematic review provides some valued evidence for public health strategies to improve the ER balance among health workers in general as well as between genders in particular. An innovative approach for managing human resources for healthcare is necessary to motivate and value contributions made by health workers.

Key words: Systematic review; Effort-reward (ER); Effort-reward imbalance (ERI); Human resources for health; Health workers

INTRODUCTION

Psychosocial factors have been well documented as one of the significant contributors to one's health and well-being [1]. One of the theoretical models used by most researchers in this field is the effort–reward imbalance (ERI) model, which was developed in 1996 by Siegist [2]. This model is a measurement of psychosocial work stress comprising three psychometric scales, effort, reward, and over commitment. Effort can be measured by work demands, while reward could be assessed in terms of tangible and/or intangible dimensions, money, esteem, status, control over promotion prospects, and job security. Overcommitment is a reflection of excessive effort that one has made in fulfilling one's work. This model is useful to study working environments among different groups of populations by assessing if there is any negative imbalance between experienced contributions and gains at work [3]. Through this process, we are able to detect characteristics of the work environment – whether it is stressful or motivating – from which health conditions can also be indirectly predicted. However, health care settings may differ from others industries. It has been argued that health care providers are under greater pressure and workload [4, 5]. This could result in greater imbalance between effort and reward among health professionals. Prior studies in this domain showed inconsistent results that require further investigation.

Prior literature among different groups have demonstrated that levels and proportions of ERI are high. For example, this proportion was 22.3% among Chinese university teachers in a study by Pan et al.(2015) [6]. Guo et al (2014) researched adolescent students in China and found that up to 45% of them experienced ERI. This rate was 54% among those from families with low socioeconomic status and 41% in students from families with high socioeconomic status [7]. Gamage et al. (2015) suggest the prevalence of ERI among senior officers and managerial assistants was 74.6% and 80.5%, respectively [8]. Similarly, it was found that the rate of people experiencing ERI was high among health workers, who usually work under intensive workloads. This rate was around 20% in many studies. For instance, in the study of Hammig et al. (2012), 18% of staff in a hospital in Switzerland had an ERI ratio over 1 [9]. A study by Ohlander et al. (2014) of German physicians identified ERI rates 22.8% [10].

ERI among health staff can be influenced by many factors, one such factor is gender. Men and women can be affected in several ways. Reports have demonstrated that employed women experience poorer psychosocial work conditions (such as lower job control) than men.

Particularly, a study of Li et al, showed men scoring higher in 'effort' and 'overcommitment' but lower in 'reward' than women [11, 12]. A number of studies also highlighted the role of job position to the ERI, where nurses are likely to have a higher imbalance in effort-reward compared to physicians [13, 14] and registered nurses showed higher effort-reward ratios than nurse technicians [15]. In addition, a few studies have identified an association between ERI and work stress, and job dissatisfaction leading directly to the health problems such as cardiovascular risk and medical conditions, including Type-II-diabetes, as well as psychiatric disorders and symptoms [16, 17].

In a large-scale study looking at five European countries, Belgium, France, Germany, Sweden, and the UK, there were variations of the ERI model components based on occupation, education, age, and gender [18]. The effort score were higher in men than in women [19-21], whereas a reverse tendency was found in the UK study [22]. There was also a tendency of higher scores among older employees, especially in men when compared to other groups [19-22]. Lower effort was associated with increased age among elderly subjects [19, 22]. Mean effort was significantly higher among better-educated than among less-educated groups [19-22]. A clear gradient with higher reward scores was also observed among groups with higher working class [19, 21]. Men and women aged 45 – 54 were generally more likely to demonstrate highest overcommitment and employees with higher education also tended to exhibit higher overcommitment than those with lower education [18]. Overall, given the limitations of prior investigations, differing results of ERI among healthcare providers and a failure to explain contributors to these differences, we have undertaken a systematic review ERI study for the purposes of collating ERI rates among health workers internationally, identifying gender differences and potential determinants.

METHODS

Study selection

To be eligible, articles needed to be published in the English language between 1995 to 2015 in a peer-review journal, and report on ERI among health workers.

We only included those studies with an appropriate sample size, deemed as including at least 30 subjects. ERI was the main outcome, which is defined as an ER score > 1. Another outcome was the ERI rate which was calculated as the number of respondents with ER > 1 over the total sample.

Information sources

Relevant scientific publications were searched using PubMed, Embase, Cochrane and Google Scholar from inception of each database. Once articles for full text review were identified their references were checked for additional relevant publications. Reference lists of these articles were inspected to identify relevant additional articles.

Search strategy

Our full Pub-Med search strategy is shown below. This was also translated for use in other databases.

((((((((((((effort reward[Title/Abstract]) OR contribution reward[Title/Abstract]) OR contribution appreciation[Title/Abstract]) OR contribution recognition[Title/Abstract]) OR effort reward balance[Title/Abstract]) OR effort reward imbalance[Title/Abstract]) AND health worker[Title/Abstract]) OR health staff[Title/Abstract]) OR health professional[Title/Abstract]) OR health personnel[Title/Abstract]) OR health workforce[Title/Abstract]) OR health manpower[Title/Abstract]) OR health human resource[Title/Abstract]) OR human resources for health[Title/Abstract]))))))))))))

Quality assessment

Two of the authors independently screened all of the identified study titles and abstracts. If the articles met the initial inclusion criteria, they were then reviewed to ascertain whether all inclusion criteria were met. Any disagreements were resolved through consensus or consultation with a third reviewer. The reference lists of retrieved articles were hand searched for other key papers.

Main measures

In this section, we clarify the measure as identified from the studies included in this systematic review. There were two main scales. The first scale is termed 'extrinsic effort' (5-6 items) and the second 'reward' (10-11 items, including money, esteem, job security and promotion prospects). Responses to the items of 'extrinsic effort' and 'reward' were scored on a 5-point scale where a value of 1 indicates no respective stressful experience, and a value of 5 indicates very high stressful experience (1 = full disagreement, 4 = full agreement with statement). Consequently, with such a scoring, depending upon the number of items (the short or full form), the range for the scale 'effort' is 5 to 25 or 6 to 30, for the scale 'reward' 10 to 50 or 11 to 55. A ratio between the two scales 'effort' and 'reward' was used to detect the degree of mismatch between high cost and low gain. Because the number of effort items (5-6) was less than that of reward items (10-11), a coefficient "*k*" is applied to compute an effort-reward ratio as follows.

$$ER = k \frac{E}{R}$$

Where *E* is the effort score, *R* the reward score, *ER* the effort-reward ratio, and *k* a correction factor that is used to adjust for the unequal number of items of the effort and reward scores. Assuming that one effort item is equivalent to one reward item, we can define the correction factor k as follows.

$$k = \frac{Number\ of\ reward\ items}{Number\ of\ effort\ items}$$

In interpretation, for ER=1, the person reports one effort for one reward, for ER<1, there are less efforts for each reward, and for ER>1, the person reports more efforts for each reward. Using the cut-off point of 1.0, one can compute the percentage of ERI (any respondents with ER ratio of more than 1.0 is put in the enumerator and the denominator the entire sample).

Data synthesis, analysis and risks of bias

The quality of included articles was rated independently by 2 reviewers according to the checklist for observational studies produced by Elm et al [23]. Only those studies that met the criteria described in the checklist for observational studies were included for final analysis and discussion.

We extracted data on year of publication, study setting, geographic origin of publication, publication date, target population, intervention type, whether embedded within a trial, the nature analysis undertaken, modelling techniques used, main economic findings and funding source. We also extracted data on the analytic parameters used.

Research ethics

As this systematic review was primarily based on the published articles, not directly on human subjects, it is not necessary to get ethical approval from an institutional review board.

RESULTS

Study selection

The screening and selection of studies is summarized in Figure 1. We accessed and obtained 221 records identified through search databases and other sources. Of these records, 47 duplicate studies were removed. Among 174 records, 50 studies were excluded because they were qualitative investigations, did not include ERI indicators, did not have full text or did not refer to healthcare workers. We received the full text of 124 of 174 records (71.26%). Of these, 41 studies (23.56%) were included in the synthesis. 83 full text articles were excluded because of their weak validity based on the evaluation criteria.

INSERT FIGURE 1 ABOUT HERE

Study characteristics

In table 1, 41 articles which met the eligibility criteria were included in this systematic review. The studies were conducted in Japan (n=7), Brazil (n=3), China (n=5), France (n=5), Germany (3), the Netherlands (n=3), other European countries (3), and the remaining from Belgium, Columbia, Finland, Greek, Mongolia, Sweden, Switzerland, Taiwan, USA and Vietnam (1 study each). Thirty-six of 42 studies were quantitative cross-sectional studies and five were longitudinal studies (3 cohort and 2 follow-up studies). The largest study was conducted in 7 European countries by Hasselhorn et al. (2004) with a sample size of 21,729 and the smallest sample size of 57 was the study in Brazil by Fogaca et al. (2010). Most studies were carried out among healthcare workers (either physicians, nurses or both) in general hospitals and/or in healthcare settings. A study of Ortiz (2012) in Columbia included many subjects in different industries. The main objective of the included studies was to compare ERI between study subjects, most of whom were general practitioners and nurses.

INSERT TABLE 1 ABOUT HERE

In table 1, 41 studies on ERI among healthcare workers were identified, 26 of which indicate ER ratios and/or ERI rates as presented in table 2. This does not mean that the remaining (15) studies did not look at any of these indicators, but rather they reported the indicators by different groups. As seen in table 2, in terms of ER ratio, most studies showed a value of below 1 indicating that healthcare workers received more reward than their effort contributed to their organizations, while just two studies reported a ratio of one or greater. The ER ratio ranged quite widely from 0.47 up to 1.32 and the ERI rate also varied remarkably from 3.5% to 80.7%.

INSERT TABLE 2 ABOUT HERE

In table 3, only ten studies reported ER ratio by gender and/or explained the reasons why there were differences in ER ratio between men and women. Overall, most studies showed that women healthcare workers were more likely to report lower ER ratios, indicating lower effort and higher reward.

INSERT TABLE 3 ABOUT HERE

DISCUSSIONS

The results of the systematic review showed that most studies indicate an ER ratio of less than 1, meaning that healthcare workers are more likely to contribute less than they would be rewarded. However, they have made more contributions than they have received rewards. To illuminate, it has been argued that in health services delivery healthcare workers, doctors and nurses, bear a high workload. Doctors are required to take responsibility for consultations, diagnoses, and treatment decisions for patients, while nurses play nursing roles of caring for patients, administrative work, and as "subordinate" assistants to doctors when required [24]. This situation seems to be clearer in developing countries rather than in the developed world as nurse/doctor ratios have remained low in these countries [25, 26], in addition to high workloads. As a result, if one looks at the ER ratio, one may conclude that health workers receive more rewards than they contribute. Indeed, although few studies showed an ER ratio of more than 1

implying an ER imbalance, many studies reported a quite high percentage of ERI. Rather, among 18 studies revealing ERI rates, ranging from 3.5% to 80.7%, half (9 studies) indicated at least 20% of healthcare workers with ERI. This means one in every 5 healthcare workers working in health facilities demonstrate more effort and contribution than rewards received. This figure is much higher compared to that found in many other studies [15, 27-29]. As such, there is at least one group in the healthcare setting experiencing ERI, implying that doctors, nurses or both in certain clinical departments have been coping despite an overload of work.

Among the studies included in the current systematic review, special attention should be given to the studies reporting the highest ERI percentages in Asian and European countries - Japan, Vietnam, Greece, Germany - with ERI rates of 57.1% [5], 32.3% [4], 80.7% [30] and 22.8%-27.6% [10, 31, 32], respectively. Why are there such high rates of ERI in those nations? In Japan the ERI is high primarily because of the work ethos, which is seemingly required for health workers that have a very high overall work intensity [5]. More importantly the working life in Japan is changing dramatically [33] due to its recessive economy since the 1990s and increasing international competition. The most important reason could be that the traditional Japanese employment system and the seniority-based reward and promotion system no longer apply. A new reward system based on performance has been introduced, creating a competitive working climate as well as job insecurity [5]. In Vietnam, a high ERI rate can be explained by the workload requirements of healthcare workers, especially at higher levels of the healthcare system. The study by Giang was conducted in provincial hospitals. Better quality of health services at higher levels of the healthcare system – provincial and central hospitals, generate more and more people who transfer from lower to higher levels of the healthcare system, creating greater workload for health professionals. This fact is quite understandable given that the nurse/doctor ratio is much lower in provincial and central hospitals than in district health facilities and also remains very low as compared to other countries. At present this ratio is just 1.7, though it is expected to rise to 2.5-3.5 as specified by the regulation of the Vietnamese Ministry of Health [34], while the current rewarding system in the public sector in Vietnam is largely based on seniority rather than on workload and performance.

In Greece, a higher ERI rate can be explained by the age factor, where higher workload has been found in middle-aged populations [30]. In addition, the reward system for healthcare workers in Greece appears inadequate [30]. In Germany, healthcare workers are required to assume higher volumes of work, but receive comparatively lower rewards as compared to other European nations [10, 31, 32]. In particular, working conditions for hospital personnel in Germany are characterized by increasing patient numbers and short stays [32].

Another factor is gender. Most studies in our systematic review indicate that female healthcare workers are more likely to report lower ER ratios. This means that generally women have made lower efforts and received higher rewards than men. This difference in ER ratio between men and women can be explained by two main reasons. First is gender roles. According to Li et al. [11], in many countries, despite their higher education, women seemingly do not exhibit higher effort or higher commitment but receive higher reward. This is because of the continued impact of traditional gender roles on attitudes and motivations where pressure towards professional success has been placed much more on men than on women. Accordingly, men expose themselves more often to demanding situations and react by high intrinsic effort, while women are exposed to lower workloads as they are expected to accept more family-related obligations [35]. As Tallis [36] points out, women in many countries retain a key role to provide care for their family, husband, and/or sick children. Phinney [37] also notes that many men are concerned with choosing a woman who can provide them with an economically stable, happy, and harmonious home conducive to raising children. During the past few decades, for instance, healthcare status and empowerment for women such as those in China, especially in communist societies [38]. Women's essential rights at work have been well documented in the form of laws

and regulations in several developing countries [39]. Improved rewards, such as equal payment, working opportunity, and job security, have helped better improve women's conditions in comparison with the past [12]. However, this interpretation should lead to further in-depth investigation of gender roles in work and reward research.

Several limitations of this study need to be interpreted. Firstly, given that most of the included studies in the systematic review are of cross-sectional design, it is difficult to confirm causality of the observed associations. Also, although we have made extensive effort to find the articles for review, there were studies which did not report ERI rates as well as gender differences in the ER ratio and associated factors. Therefore it is not possible for us to conduct meta-analysis and make comparisons.

IMPLICATIONS FOR POLICY AND PRACTICE

To our knowledge, this study is the first to systematically review ERI rates among health workers and to assess gender differences. The study indicates that the ER ratio and the ERI rate ranges quite widely, suggesting that many health workers contribute more than they are rewarded, especially in some Asian and European countries. One of the reasons for the ERI is the new institutional system, which has looked at different ways of measurements. Another explanation could be related to increased workload required for health workers, because of the increased healthcare needs of the population Furthermore, several countries cultural perspectives have still placed different roles for men and women, these could also be contributors to ERI between genders.

Despite its limitations, this systematic review should provide some valued evidence for public health strategies to improve ER balance among health workers in general and reduce gender differences in ER ratio in particular. The first strategy is to improve working conditions for health workers so as to reduce their work stress as well as to facilitate their effort and contribution. At the same time, it is also important for countries to better institutionalize rewarding systems for health workers which should be based on performance rather than on seniority, but adaptation by culture and work nature is necessary. For whatever strategy, it is crucial to take gender roles into account. Both men and women should be balanced in terms of their social positions, working conditions and rewards, especially in countries where there are still inappropriate policies in these regards.

COMPETING INTEREST

We declare that we have no competing interests.

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Figure 1. Flow diagram for the selection of studies investigating the effort-reward imbalance among health workers

Table 1. Characteristics of included studies

Table 2. Rates of effort-reward imbalance among health workers

Table 3. Gender differences in effort-reward ratio among health workers and associated factors

Table 1. Characteristics of included studies

No	Reference	Country	Aims of the study	Study design and methods	Sample	Sample size	Study site
1.	[11]	China	To test the reliability and validity of the Chinese version of the 23- item effort–reward imbalance (ERI) questionnaire and to analyze its association with job dissatisfaction in a sample of Chinese healthcare workers	Cross-sectional using questionnaire	Healthcare workers	800	University hospitals of China
2.	[27]	Belgium	To analyze the impact of the effort–reward imbalance (ERI) model on intent to leave the current organization (ITL organization) and intent to leave the nursing profession (ITL profession) in a prospective way	Follow-up using questionnaire at baseline and 1 year later	Healthcare workers	1,531	Belgian participating institutions
3.	[1]	Brazil	To compare the psychometric adequacy of the demand-control-support (DCS) and the effort–reward imbalance (ERI) questionnaires in relation to their respective theoretical models among workers within the same psychosocial work environment.	Cross-sectional using questionnaire	Nursing personnel (nurses, nursing assistants, and nurses' aides)	1,509	Two hospitals in Rio de Janeiro
4.	[12]	China	To examine the association between work stress measured by job strain and effort-reward imbalance (ERI) and health functioning in a sample of hospital-based Chinese physicians	Cross-sectional using questionnaire	Clinical physicians	256 men and 266 women	In-patient wards of 3 general hospitals in Zhengzhou
5.	[40]	Demark	To test the psychometric properties of the Danish questionnaire measuring ERI, and secondly to analyze whether psychosocial work stress is associated with six indicators of poor self-rated health.	Cross-sectional using questionnaire	Nurses and nurses aides	367	The county of North Jutland
6.	[41]	The Netherlands	To investigate the relationship between Effort-Reward Imbalance (ERI) and employee well-being, using three different concepts of efforts (i.e. psychological demands, physical demands and emotional demands).	Cross-sectional survey using questionnaire	Ancillary health care workers	167	Two Dutch nursing homes
7.	[3]	Japan	To investigate the effects of ERI on quality of life among nurses at a Japanese general hospital.	Cross-sectional using questionnaire	Nurses	682	A general hospital located in urban Japan
8.	[42]	Germany	To test that an imbalance of high extrinsic efforts spent (i.e. job demands) and low extrinsic rewards obtained (e.g. poor promotion prospects) are	Cross-sectional using questionnaire	Nurses	204	a university hospital

			associated with the burnout syndrome: the depletion of nurses' emotional resources				
9.	[43]	Germany	To investigate whether nurses' efforts and rewards, as well as the effort–reward imbalance (ERI) and burnout, differ between subjects working in psychiatric vs. medical hospitals and between nurses under education and examined nurses respectively. Furthermore, the relationship between ERI and burnout was evaluated	Cross-sectional using questionnaire	Nurses	389	4 hospitals in Germany
10.	[13]	Taiwan	To investigate the association between job stress, psychological morbidity and quality of life in healthcare workers in three military hospitals.	Cross-sectional using questionnaire	Healthcare workers	791	3 military hospitals located in southern Taiwan
11.	[44]	Western and Eastern European countries	To compare associations of chronic work stress with adverse outcomes among nurses from several Western and Eastern European countries within the large European NEXT-study	Cross-sectional using questionnaire	Nurses	21,729	Belgium, Germany, France, Italy, The Netherlands, Poland, Slovekia.
12.	[9]	Switzerland	To explore the extent the two forms of Imbalance, ERI and Work-life imbalance, are associated with general psychological stress and burnout independent of each other and to compare them in this regard in a hospital setting.	Cross-sectional study using questionnaire	Nurses and physicians	502	Cantonal Hospital of Winterthur, a large public hospital
13.	[3]	Japan	To examine relationships between effort-reward imbalance (ERI) and depression and anxiety in nurses of a Japanese general hospital.	Cross-sectional using questionnaire	Nurses	406	A Japan hospital
14.	[45]	The Netherlands	To investigate health and work factors in relation to the frequency of short-term sickness absence among nurses.	Cross-sectional using self-reported questionnaire	Female nurses	459	A regional hospital in the Dutch province
15.	[15]	Brazil	To evaluate working conditions associated with health-related quality of life (HRQL) among nursing providers.	Cross-sectional using questionnaire	Registered nurses, nurse technicians and nurse assistants	695	São Paulo, Southeast Brazil

16.	[46]	Japan	To examine whether ERI in terms of low organizational reward (poor prospective and job insecurity) could be the most relevant and strongly associated with depression among private practice physicians.	A cross-sectional study using questionnaire	Private practice physicians who were currently working in clinical settings	1,317	In clinical settings in Japan
17.	[47]	Japan	To determine the association between psychosocial factors at work as defined by the effort-reward imbalance model and depression among Japanese medical residents	A cross-sectional study using questionnaire	Medical residents	227	Teaching hospitals in Japan
18.	[48]	Japan	To investigate the relationship between job stress and temperament among nurses in a general hospital and to provide insight into personality traits influencing their mental or physical health	A cross-sectional study	Nurses	326	A general hospital
19.	[49]	China	To determine the rate of burnout and the contributing factors behind it among physicians in Shanghai	A cross-sectional Study	Physicians	457	21 hospitals in Shanghai
20.	[14]	Sweden	To scrutinize how nurses and physicians, employed by the county councils in Sweden, assess their work environment in terms of effort and reward at the start of their career. The aim was also to estimate associations between work satisfaction and the potential outcomes from the effort–reward imbalance questionnaire	Cross-sectional using ERI questionnaire	Nurses and physicians who graduated in 1999	440	Sweden
21.	[50]	France	To test the hypothesis that some organizational constraints at the work-unit level may be related to depressive symptoms in hospital workers, either directly or through individual perceptions of Effort-reward imbalance (ERI)	Recruited from the baseline screening of an epidemiological cohort study (the ORSOSA study)	Female registered nurses and nursing aids working	3,316	190 work units in 7 French university hospitals
22.	[51]	The Netherlands	To investigate relationships between Effort-Reward Imbalance (ERI) and employee adverse health (i.e Psychosomatic complaints, physical symptoms, and exhaustion)	Cross-sectional using ERI questionnaire	Health-care workers	167	Dutch nursing homes
23.	[4]	Vietnam	To investigate the valid of ERI questionaire with health-care workers in several general hospitals and to describe the social environment in workplace and some related factors	Cross-sectional using ERI questionnaire	Health-care workers	300	3 general hospitals in Hanam
24.	[5]	Japan	To test the psychometric properties and criterion validity of the Japanese version of the	Cross-sectional using ERI questionnaire	Male dental technicians	105	Urban district of Fukuoka

			Effort Reward Imbalance (ERI) Questionnaire				prefecture, Japan
25.	[52]	China	To investigate the factors related to burnout among Chinese doctors	A cross-sectional study	Hospital doctors	1,202	Liaoning province
26.	[53]	Japan	To investigate the cross-sectional association between working hours, occupational stress and depression among physicians.	A cross-sectional study	Alumni of a medical school	706	Nara Medical University School of Medicine
27.	[54]	Mongolia	To examine the prevalence of burnout among doctors and nurses in Mongolia and identified the factors influencing their burnout	Cross-sectional using a self-reported ERI questionnaire (quantitative approach)	Doctors and Nurses	392	Ulaanbaatar
28.	[30]	Greece	To translate, adapt and validate the Effort-reward imbalance (ERI) questionnaire in a sample of Greek healthcare professionals.	Cross-sectional using a self-reported ERI questionnaire (quantitative approach)	Greek physicians, nurses, physiotherapists and laboratory staff	456	9 major Greek hospitals
29.	[55]	Switzerland	To explore the workplace experiences of first-year residents according to gender, type of training hospital, and clinical field.	Cohort studies	Junior physicians	497	Training hospital, and clinical field
30.	[56]	China	To examine how psychological capital (PsyCap), a positive psychological state, mediates the association between occupational stress and depressive symptoms among Chinese physicians.	Cross-sectional using a self-reported ERI questionnaire (quantitative approach)	Physicians employed in large general hospitals	998	Hospitals in Liaoning Province
31.	[57]	Finland	To examine associations of psychosocial factors with psychological distress and sleep problems in Finnish general practitioners (GPs) and specialists.	A cohort study from 2000 to 2010 (the Finnish Public Sector Cohort Study)	General practitioners (GPs) and specialists	1,418	In 10 municipalities
32.	[28]	France	To explore potential risk factors for work-related stress by, detailing working conditions and subjective hardship according to occupational category in health-care staff working with elderly patients.	Cross-sectional using ERI questionnaire (quantitative approach)	Housekeepers (HKs), nursing assistants (NAs) and nurses (Ns)	706 HKs, 1565 NAs and 378 Ns	Nursing homes and healthcare settings
33.	[58]	France	To identify the extent of burnout according to Gender To identify the extent of intent to leave (ITL) according to gender To determine the main reasons for leaving according to gender To determine the main reasons for burnout according to gender	Cross-sectional using a self-reported ERI questionnaire (quantitative approach)	Physicians	1,924	Hospitals

			To investigate the possibilities to promote work organization positive for both male andfemale physicians.				
34.	[59]	USA	To compare job demand – control and effort – reward imbalance models in examining the association of job stress with work – related musculoskeletal symptoms and to evaluate the utility of a combined model.	Cross-sectional using ERI questionnaire	Intensive – care unit (ICU) nurses	304	American association of Critical – Care Nurse (AACN) membership list
35.	[29]	France	To test the hypothesis that some specific organizational constraints may be related to upper limb musculoskeletal symptoms experienced by registered nurses, independently of the effort/reward imbalance model and major confounding factors	A longitudinal epidemiological survey in 2006 and 2008	Female registered nurses	2,194	7 French teaching hospitals
36.	[10]	Sweden, Germany	To compare the working conditions and the work stress between a migrated population of German physicians in Sweden and a population of physicians based in Germany	A cross – sectional survey using the 17 – item Germany	Physicians	646	In hospitals in both Sweden and Germany
37.	[60]	Switzerland	To investigate the perceived job stress, its association with the amount of working hours, and its impact on young physicians' self – reported health and their satisfaction with life during residency	An ongoing prospective survey of a cohort	Physicians	433	3 medical schools in German speaking Switzerland
38.	[61]	Brazil	To compare the balance between effort (E) and reward (R) among physicians and nurses working in pediatric (PED) and neonatal (NEO) Intensive Care Units.	Cross-sectional using ERI questionnaire (quantitative approach)	Physicians and nurses	57	Hospitals in Brazil
39.	[31]	Germany and Norway	To examine job satisfaction and job stress of German compared to Norwegian physicians in private practice.	Cross-sectional study	Physicians in Germany and Norwegian general practitioners and private practice specialists	754	In different healthcare settings in both Germany and Norway
40.	[62]	Colombia	To evaluate psychosocial factors at work in Colombia	Cross – sectional studies using Job Content Questionnaire and ERI Questionnaire	Nurses, bus drivers and one mixed occupational groups	294 nurses, 281 bus drivers, and one mixed occupational group with 661	In many setting – both private and public sectors

						participants	
41.	[32]	Germany	To analyze psychosocial stress in the workplace among hospital doctors working in surgical fields in Germany	Cross – sectional study using Job Content Questionnaire and ERI Questionnaire	Hospital doctors working in surgical fields	1,311	Hospitals

Table 2. Rates of effort-reward imbalance among health workers

References	Sample	Countries	Effort - reward ratio (Score)	ERI rate (%)
1. [11]	Health workers	China	0.66 ± 0.34	-
2. [27]	Health workers	Begium	0.54	4.4
3. [51]	Health workers	The Netherlands	-	10.2 – 11.4
4. [3]	Nurses	Japan	0.86 ± 0.42	-
5. [43]	Nurses	Germany	0.80 ± 0.3	20.7
6. [9]	Health workers	Switzerland	0.80 ± 0.3	18
7. [45]	Female nurses	The Netherlands	1.0 ± 0.3	-
8. [4]	Health workers	Vietnam	-	32.3
9. [15]	Nurses	Brazil	-	7.8
10. [5]	Dentists	Japan	-	57.1
11. [47]	Male technicians Medical residents	Japan	-	12.2
12. [48]	Nurses	Japan	0.90 ± 0.4	
13. [49]	Physicians	China	0.77 ± 0.46	21.88
14. [53]	Physicians	Japan	0.67 ± 0.36	14
15. [30]	Health workers	Greece	1.32 ± 0.41	80.7
16. [54]	Health workers	Mongolia	0.61 ± 0.28	-
17. [55]	Junior physicians	Switzerland	-	16.3
18. [56]	Physicians	China	-	19.07
19. [28]	Nurses	France	-	10.14
20. [59]	Nurses	USA	0.64 ± 0.33	-
21. [29]	Female nurses	France	0.70	10.7
22. [10]	Physicians	Sweden Germany	0.47 ± 0.24 (Sweden) & 0.80 ± 0.35 (Germany)	3.5 (Sweden) & 22.8 (Germany)
23. [60]	Physicians	Switzerland	0.79 ± 0.34	-
24. [31]	Physicians	Germany and Norway	-	27.6 (Germany) & 10.3 (Norway)
25. [62]	Nurses	Colombia	0.63	-
26. [32]	Surgical doctors	Germany	0.87 ± 0.37	25.1

Table 3. Gender differences in effort-reward ratio among health workers and associated factors

References	Effort-reward score		Reasons or explanations for differences
	Males	Females	
[11]	0.72	0.66	This fact may reflect a continued impact of traditional gender roles on attitudes and motivations where pressure towards professional success is felt much more directly by upwardly mobile men than by women. As a consequence, men expose themselves more often to demanding situations and react by high intrinsic effort. Women are exposed to a lower workload as they are expected to accept more family-related obligations. Furthermore, during the past five decades, Chinese women's working conditions and health status have been improved greatly, especially the empowerment of women in the communist society. The comparably equal payment and accessible opportunity at work make well-educated women perceive a higher reward from work than men.
[12]	0.28	0.27	During the past five decades, Chinese women's working conditions and health status have been improved greatly, and especially the empowerment for women in communist society. Women's essential rights at work have been legislated by relevant laws and regulations, such as the Law of Occupational Disease Prevention and Control, and the Regulation of Labor Protection for Women Workers. Comparably equal payment, accessible opportunity at work, and protected job security made women aware of their improved situation. A higher level of perceived reward at work may reflect this tendency.
[13]	0.99	1.15	While women were found to have higher extrinsic effort scores than men, there were no differences in intrinsic effort scores between the sexes. Men reported lower financial reward than women, while there was no significant sex difference in reported self-esteem reward. In women, we found a significantly lower social status control reward and lower total reward than in men, and their ER ratio was higher.
[14]	0.70	0.78	The women in the present study scored higher on work-related overcommitment (WOC) as compared with the men. Some studies also found that women tend to score higher on overcommitment compared with men and discuss the gender differences on WOC in terms of gender stereotypes; Women physicians still feel that they have to prove that they are as bright and successful as their male colleagues. In our opinion, the role of the WOC scale in relation to gender should be not only further studied in terms on women and men, but also evaluated in other ways in relation to gender. One of the questions is whether women or men, owing to their different roles in society, place the same value on what is being measured by the question
[53]	0.68	0.59	NI
[54]	0.58	0.68	High ERI score for female doctors in this study may be attributed to the domination of the health care delivery system by female professionals in Mongolia.
[30]	1.35	1.28	The results of the present study did not indicate gender differences with regard to effort and overcommitment among Greek health-care workers.

			However, women scored significantly higher on the reward dimension compared with men.
[55]	0.81	0.78	There are no significant differences between male and female residents. In the over-commitment scale, female junior physicians scored significantly higher than their male colleagues because of gender stereotypes, female physicians still feel compelled to prove that they are as bright, successful, and career- oriented, i.e, as driven by high intrinsic career motivation, as their male counterparts. This might contribute to the female doctors' tendency towards over-commitment.
[56]	0.88	0.85	These results indicate a gender difference in the association between occupational stress evaluated by the ERI scale and PsyCap among Chinese physicians. Females may be more sensitive to perceptions of occupational status than males. Hence more serious consequences might occur among females compared with males experiencing the same level of occupational stress. Moreover, female physicians confront more workplace adversity than males in terms of disdain, mistrust from the patients, and uncertain job prospects, as well as having the dual responsibilities of career and family. This leads females to pay more attention to their vested interests such as effort and reward, and thus affecting their PsyCap level at work. For male physicians, they generally have lower levels of caregiving burdens and family obligations than females. They can dedicate themselves whole-heartedly to their careers. Furthermore, they generally pay more attention to individual career development.
[32]	0.88	0.86	NI

Figure 1. Flow diagram for the selection of studies investigating the effort-reward imbalance among health workers