

Prevalence of Low Back Pain in Health Care Workers and Comparison with Other Occupational Categories in Iran: A Systematic Review

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What's Known

- Low back pain (LBP) has become a common symptom and a major health concern in productive age for both males and females in developing countries.
- Work characteristics may cause a broad range of musculoskeletal disorders, particularly LBP.
- There is limited evidence regarding the burden of LBP in Iran, with the majority of the locally published surveys being presented in Farsi.

What's New

- Global 1-year low-back year in acceptable studies is 24%.
- Global 1-year prevalence of LBP in workers, office workers, and health-care workers was 25%, 18%, and 58%, respectively.
- Knowledge of the prevalence of LBP among different jobs and their risk factors is critical.
- Whole prevalence of LBP was 40% in females and 39% in males.

Abstract

Background: There are few research studies evaluating the significance of low back pain (LBP) in Iran, even though the majority of locally published surveys are written in the Persian language. In the present review study, we aimed at appraising published articles related to the burden of LBP and its divergence among different jobs.

Methods: A comprehensive search was conducted in all accessible national and international electronic databases from 1948 to mid-2012. The international electronic databases were MEDLINE (PubMed), Web of Sciences, Google Scholar, Scopus, CINAHL, and the Iranian equivalents were SID, IRANDOC, IranMedex, and Magiran. The main search terms were musculoskeletal disorders, musculoskeletal symptoms, low back pain, back pain, and Iran. All keywords were searched electronically by three Boolean operators. The inclusion criteria were age ≥ 10 years, study focus on LBP prevalence, inclusion of both genders, and no limitation to the study design. A dedicated STROBE questionnaire was developed as a critical appraisal tool and the quality of the identified literature was examined according to the 5-point Linker scale. Articles scoring ≥ 3 on the Linker scale were appraised. Each literature was screened by four reviewers independently and possible disagreements were streamlined in a joint review meeting. The extracted data were entered into a dedicated table using Microsoft Office Excel program. Data were analyzed for homogeneity using the STATA software (version 11).

Results: Of the 51 articles that were included in the present review study, 35 articles reported 1-year LBP with Nordic questionnaire and 3 articles reported point prevalence of LBP. The calculated global prevalence of 1-year LBP in workers was 25% and LBP was the most prevalent issue among health care workers. There was no association between the prevalence of LBP and job classification among workers.

Conclusion: LBP is the most common issue among health care workers. It is recommended that future research should focus on this job category for investigating LBP prevalence. This allows parameters that increase the frequency of LBP to be assessed and subsequently permits the reduction or elimination of such factors.

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Keywords • Low back pain • Musculoskeletal diseases • Prevalence • Epidemiology • Healthy worker effect • Health personnel

Introduction

During the past decades, low back pain (LBP) has been one of the most leading causes of disease burden across the developed and developing countries.¹ LBP is widespread and is the most disabling factor in the workplace.² With a rapid transition to industrial lifestyle, LBP imposes a significant economic burden on governments, particularly in terms of health system costs, lost working days, reduced productivity and increased disability.^{3,4} Work-related LBP is estimated to cause 818,000 disability-adjusted life years lost (DALYs) annually.⁵

LBP has become a growing common symptom and a major health concern for the economically productive age group in the developing countries.⁶ Iran, as one of the developing countries in the Middle East, has a population of 75 million (50% are under 25 years) and 2 million work units. With such a high level of young adults, a major proportion of LBP is accelerated or exacerbated by occupational conditions.⁷ Awkward posture, repetitive work, manual handling of loads, overuse and work sites ill-adapted may cause a broad range of musculoskeletal disorders, particularly low back pain. Moreover, the information related to the prevalence rate of LBP among different jobs and associated risk factors is critical to provide adequate prevention.

There are few research studies evaluating the burden of LBP in Iran, even though the majority of locally published surveys are written in the Persian language. In the present review study, we aimed at appraising published research studies related to the burden of LBP and its divergence among different jobs.

Methods and Materials

Search Strategy

A comprehensive search was conducted in all accessible national and international electronic databases from 1948 to mid-2012. The international electronic databases were MEDLINE (PubMed), Web of Sciences, Google Scholar, Scopus, CINAHL, and the Iranian equivalents were SID (Scientific Information Database, www.sid.ir), IRANDOC (Iranian Research Institute for Information Science, www.irandoc.ac.ir), IranMedex (www.iranmedex.com), and Magiran (www.magiran.com). The main search terms were musculoskeletal disorders, musculoskeletal symptoms, low back pain, back pain, and Iran. The search was performed based on keywords in English for all motor engines and the terms in Persian were

used for the Persian electronic databases. All keywords were searched electronically by three Boolean operators. The titles and abstracts of all identified literature were screened and duplicated articles were omitted.

Inclusion Criteria

The inclusion criteria were age ≥ 10 years, study focus on LBP prevalence, inclusion of both genders, and no limitation to the study design. Additionally, the articles should have been written in either the English or the Persian language.

Methodological Appraisal

A dedicated STROBE questionnaire was developed as a critical appraisal tool. The quality of the identified literature was examined as shown in table 1. The modified STROBE questionnaire was scored according to the 5-point Linker scale (1: Incomplete, 2: Fairly complete, 3: Not bad, 4: Good, 5: Well defined) and the mean score of these items was calculated. Articles scoring ≥ 3 on the Linker scale were appraised. Each literature was screened by four reviewers independently and possible disagreements were streamlined in a joint review meeting.

Data Extraction

Data such as author's name, year of publication, study region, study design, sample size, age of participants, gender, description of LBP, assessment tool, LBP recall time period, and occupation were identified. The extracted data were then entered into a dedicated table using Microsoft Office Excel program.

Data Analysis

Data were analyzed for homogeneity using the STATA software (version 11). Significant heterogeneity was determined for the pooled estimate. A standard test for heterogeneity examined the null hypothesis that the true prevalences are identical in every study. We also measured the degree of inconsistency across articles (I^2). I^2 defines the proportion of variation in prevalence estimates that is due to genuine variation in prevalence rather than sampling error. Acceptable methodological quality was determined as the central tendency of the frequency distribution of methodological scores.

Sensitivity analysis of the articles not found to be methodologically sound was done to determine if there would have been any difference in the results, had these articles been included for analysis. Forest plots showed the distribution of the data in rank order for the prevalence estimate (lowest to highest ranks)

Table 1: The characteristics of articles included in a systematic review

Primary author	TSS*	Age (years)	Gender	Assessment tools	Occupation	Prevalence of LBP	Score#	Study design
Abdinejad F. 2002 ⁸	1,000	25-50	1	Question (WL, Ly, PP)	Farmer, Nurse, Office worker, Worker, Businessman	Ly=0.154, PP=0.70, WL=0.278 Ly (farmer=17%, nurse=13%, office worker=12.5%, worker=24%, businessman=10%) WL (farmer=37%, nurse=21%, office worker=27%, worker=41%, businessman=13%) PP (farmer=7.5%, nurse=5.5%, office worker=6.5%, worker=11.5%, businessman=4%)	3	C-S
Aghilinejad M. 2008 ⁹	47		1	Nordic Q (Ly)	Airplane pilot, Helicopter	Ly=(airplane pilot=0.35, helicopter=0.425)	4	C-S
Bagherinasami M. 2007 ¹⁰	4,813	11-14	1,2	Question (PP, WL)	Student	PP=0.15 WL=0.40	4	C-S
Bahrami A. 2009 ¹¹	278	25-34	1,2	Nordic Q (Ly)	Hospital staff	Ly=0.60	4	C-S
Choobineh A. 2007 ¹²	642	22-66	1,2	Nordic Q (Ly)	Nurse	Ly=0.54	3	C-S
Lahmi M.A. 2003 and Choobineh A.R. 2007 ¹³	1,439	13-81	1,2	Nordic Q (Ly)	Hand-woven carpet industry	Ly=0.45	4	C-S
Choobineh A.R. 2009 ¹⁴	156	Unknown	1	CCOHS (Ly)	Metal industry worker	Ly=0.54 (welder=62.2%, assemblers=51.2%, turning=63.6%, grinder=36.4%, operators=35.3%)	4	C-S
Choobineh A.R. 2008 ¹⁵	454	20-60	1	Nordic Q (Ly)	Rubber worker	Ly=0.502		C-S
DehghanMenshadi F. 2004 ¹⁶	132	21-60	1	Nordic Q (Ly)	Automobile factory employee	Ly=0.51	3	C-S
Eskandary D. 2011 ¹⁷	145	21-58	1	Nordic Q (Ly)	Automobile factory employee	Ly=0.51 (door and exhaust storage, tire and tank installing, tire and parts carriers)	4	C-S
Eskandary H. 1997 ¹⁸	1,000	15-65	1,2	Question (LW)	Office worker, Worker, Businessman, Student, Housewife	LW=0.42 (office worker=38.5%, worker=60%, businessman=38.3%, student=14.8%, housewife=54.2%)	3	C-S
Fouladideghi B. 2007 ¹⁹	150		1,2	Nordic Q (Ly)	Household goods company worker	Ly=0.23	4	
Ghafari M. 2006 ²⁰	13,769	Unknown	1,2	Nordic Q (Ly)	Industrial worker	Ly=0.21 (managers=1.3%, 4 office workers=0.9%, professional workers=1.6%, non-professional workers=2.6%)		
Ghamari F. 2010 ²¹	334	Unknown	1	Nordic Q (Ly)	Bakery	Ly=0.55	4	C-S
Ghasemkhani M. 2005 ²²	22	21-46	1	Nordic Q (Ly)	Hammerman, Miner	Ly=0.81 (worker=82% (18/22), HSE=4.5% (1/22))	2	
Habibi E. 2011 ²³	50	Unknown	1	Nordic Q (Ly, L3m, LW)	Carrying goods in dairy industry	Ly=0.86, LW=0.26, L3m=0.5	4	C-S
Habibi E. 2008 ²⁴	1,030	20-65	1	Nordic Q (Ly)	Steel making unit of Zobahan company	Ly=0.407	4	C-S

(Contd...)

Table 1: (Continued)

Primary author	TSS*	Age (years)	Gender	Assessment tools	Occupation	Prevalence of LBP	Score#	Study design
Habibi E. 2009 ²⁵	120	22-52	1,2	Nordic Q (Ly)	Nurse	Ly=0.89	3	C-S
Habibzade H. 2007 ²⁶	110	Unknown	1,2	Question	Nurse	Ly=0.43	3	C-S
Hosseini M. 2010 ²⁷	45	Unknown	1,2	Nordic Q (Ly)	Emergency department worker	Ly=0.51	4	C-S
Jafarinodoshan R. 2011 ²⁸	102	Unknown	1,2	Nordic Q (Ly)	Banker	Ly=0.18	3	C-S
Kangarlo H.R. 2006 ²⁹	1,931	Higher than 20	?	Spine disorders	Retired air force personnel	Ly=0.14	3	C-S
Keshtkaran A. 2007 ³⁰	75	31-40	1,2	Nordic Q (Ly, LW)	Medical reports department employer	Ly=0.75, LW=0.45	4	C-S
Khosroabadi A. 2010 ³¹	364		1,2	Nordic Q (Ly, LW)	Medical reports department employer	Ly=0.5, LW=0.43 Ly (paramedical worker=32%, health worker=57%, medical=61%) LW (paramedical worker=27%, health worker=40%, medical=48.6%)	4	C-S
Mehrdad R. 2008 ³²	217	Higher than 13	1	Nordic Q	Solid waste workers	Ly=0.456 (Iranian workers=36.8%, foreign workers=54.1%)	4	C-S
Mehrpavar A.H. 2011 ³³	92	23-55	1	Nordic Q (Ly)	Food industry worker	Ly=0.44	4	
Mirmohammadi 2009 ³⁴	217;145			Nordic Q (Ly)	Computer worker, Non-computer worker	Ly (computer worker=0.62, non-computer worker=0.57)	4	
MohseniBandpay M.A. 2005 ³⁵	4,813	11-14	1,2	Nordic Q	Student	Ly=0.17, LM=0.14, L3m=0.15	4	C-S
MohseniBandpay M.A. 2005-2006 ³⁶	1,226		1,2	question (Ly, LM, PP, WL)	Nurse	Ly=0.59, LM=0.56, WL=0.62, PP=0.51 (nurse=552 (50.3%), head nurse=81 (63.3%))	4	C-S
Naslsaraji J. 2008 ³⁷	144	15-60	1	Nordic Q (Ly)	Carpet restoration worker	Ly=0.8	3	C-S
Naslsaraji J. 2007 ³⁸	89		1	Nordic Q (Ly)	Construction worker	Ly=0.50	3	C-S
Pargali N. 2010 ³⁹	82		1,2	Question	Dentist	Ly=0.33	4	C-S
Parviz N. 2006 ⁴⁰	769	Unknown	1,2	Question (PP)	Nurse	Unknown	2	C-S
Pour Abbas R. 2004 ⁴¹	97		1,2	Nordic Q (Ly)	Dentist	Unknown	2	
Rahimi A. 2006 ⁴²	180	22-50	1,2	Question	Nurse	Ly=0.43	4	C-S
Rahimifard H. 2010 ⁴³	47	17-58	1	Nordic Q (Ly)	Painting workshop of furniture industry	Ly=0.38	4	C-S
Rahnama N. 2010 ⁴⁴	91	Unknown	1	Nordic Q (Ly)	Loabiran industry worker	Ly=0.26	4	
Ramezany F. 2006 ⁴⁵	296	Unknown	1,2	Question	Nurse	L3m=0.52	3	C-S
Rashidi M. 2007 ⁴⁶	128	Unknown	1,2	Unknown	Personnel of Semnan Azad University	Unknown	4	
Rezaee M. 2011 ⁴⁷	1,436	20-80	1,2	Body discomfort chart	Office worker	Ly=0.37, WL=0.92, PP=0.137	4	C-S

(Contd...)

Table 1: (Continued)

Primary author	TSS*	Age (years)	Gender	Assessment tools	Occupation	Prevalence of LBP	Score#	Study design
Sadeghi N. 2009 ⁴⁸	95	26-56	1	Body discomfort chart	Bus driver	Ly=0.22	3	C-S
Sadeghian F. 2005 ⁴⁹	235	19-50	1,2	Nordic Q (Ly)	Nurse	Ly=0.49	4	C-S
Saremi M. 2006 ⁵⁰	47	Unknown	1,2	Nordic Q (Ly, LW)	Dentist	Ly=0.46, LW=0.19	4	C-S
Shafizadeh K.R. 2011 ⁵¹	161	20-60	1,2	Nordic Q (Ly, LW)	Paramedic	Ly=0.5, LW=0.38	4	C-S
Shamsedini A. 2010 ⁵²	340	10-15	1,2	Nordic Q (LM), Body map	Student	LM=0.085	3	
Sharifnia SH. 2010 ⁵³	400	Unknown	1,2	Nordic Q (Ly)	Nurse	Ly=0.81	4	C-S
Soltanigard Faramarzi R. 2011 ⁵⁴	20	Unknown	1	Nordic Q (Ly)	Welder	Ly=0.52	2	C-S
Tajvar A. 2011 ⁵⁵	384	Unknown	1	Nordic Q (Ly, LW), CTD	Bakery	Ly=0.38	4	C-S

*TSS: Total sample size, #Score: Score of modified STROBE questionnaire, Ly: Last year, LM: Last month, LW: Last week, Gender 1: Male, Gender 2: Female, C-S: Cross-sectional study, PP: Point prevalence, WL: Whole life, L3m: Last 3 months

and a vertical reference at the line of unity. We estimated the potential influence of covariates on the prevalence estimates by a random effects regression model, using the “metareg” command in STATA. The meta-regression represented log odds ratios, which are presented as odds ratios with 95% confidence intervals. A multivariate meta-regression model was constructed to investigate which covariates were associated with prevalence estimates if there was an adjustment for other study covariates. The models were created by using a forward stepwise procedure and described in the results section.

Results

In this review, 641 articles were included from the Iranian databases (SID, IranMedex and Magiran) and further 54 papers from the international databases (PubMed, Scopus and Web of Science). Initially, 602 articles were excluded after reviewing their titles (deemed unrelated or duplicate) and then further 27 articles were excluded based on the title and abstract. Eventually, 49 articles complied with the inclusion criteria and were analyzed (figure 1).

Of the 49 articles that were included in the present review study, 35 articles reported 1-year LBP with the Nordic questionnaire (table 1). The global 1-year LBP in the selected studies was 24%. Only three screened articles reported point prevalence of LBP.

Six research studies have reported the prevalence of LBP in last year, with the global prevalence of 40% in women. The 1-year prevalence of LBP in men was reported in 22 articles with the global prevalence of 39%.

The prevalence of back pain associated with the gender of participants, mean age, and assessment tool were $P=0.005$, $P=0.05$, and $P=0.04$, respectively, although not related to the occupational category (table 1). Similarly, 1-year prevalence of LBP was related to gender and mean age, but it was not associated with the occupational category. The heterogeneity of data was examined and revealed significant heterogeneity across articles in the assessment tool ($P<0.05$). In meta-regression analysis (table 2), all evaluated methodological variables were not significantly associated with the LBP prevalence rate, except for the assessment tool ($P<0.05$). Therefore, we examined the LBP prevalence rate among different assessment tool subgroups.

Nordic questionnaire for the assessment of 1-year LBP in industrial workers was used in 15 articles. As shown in figure 2, the calculated global prevalence of LBP in workers was 25% ($I^2=99.7\%$, $P=0.000$). Among the industrial workers, gender was associated with the prevalence of LBP, while the mean age had no association with it (table 3).

The prevalence of LBP among office workers was assessed in 4 articles and the calculated global LBP prevalence was 18% ($I^2=99.6\%$, $P=0.000$) (figure 3). This value was reduced to 16% ($I^2=93.6\%$, $P=0.000$) after the exclusion of an article by Mirmohammadi et al. who reported a high prevalence of LBP among office workers.

As shown in figure 4, it was found that 58% of health care workers suffered from LBP in last year ($I^2=99.8\%$, $P=0.000$). Among the 11 articles that were reviewed, Abdinejad et al. reported a lower LBP prevalence (13%) in health care

workers ($I^2=93.6\%$, $P=0.000$). The mean age and gender were not associated with LBP prevalence (table 4).

Six articles reported LBP during last week and the LBP prevalence, not associated with age and occupational category, was reported at 32%.

Table 2: Association of LBP prevalence with gender, mean age, and assessment tools

	P value	T	SE
Assessment tools	0.04	2.23	0.05
Occupational category	0.85	-0.19	0.01
Mean age	0.051	2.19	0.005
Male to female ratio	0.005	-3.5	0.05
Constant	0.9	0.08	0.2

Table 3: Association of LBP prevalence among industrial workers, based on Beck depression inventory, with gender and mean age

	P value	T	SE
Occupational category	0.9	-0.10	0.006
Mean age	0.05	2.25	0.01
Male to female ratio	0.03	-2.46	0.07
Constant	0.5	0.66	0.25

Table 4: Association of back pain prevalence among health care workers, based on Beck depression inventory, with gender and mean age

	P value	T	SE
Mean age	0.47	0.78	0.024
Male to female ratio	0.26	-1.26	0.12
Constant	0.92	0.10	0.79

Discussion

Low back pain is one of the most common complaints and a major issue among working-age population. Different communities have reported different prevalence rates of LBP. In this article, as the first comprehensive review study in Iran, a systematic investigation of LBP prevalence was performed. It is shown that LBP is a major issue among different job categories in Iran, particularly among health care workers.

In the past, a limited number of research studies have been conducted in Iran that concluded job characteristics as an important factor. A literature review by Mousavi et al. on the LBP prevalence among the Iranian population was based on MEDLINE database, but lacked an appropriate analysis of the findings.⁶ It is worth mentioning that almost all publications on LBP prevalence in Iran are written in the Persian language, which could explain inadequate visibility of their findings.

The articles that were selected in the present review study contained incoherent LBP duration; however, we managed to identify most of the variations in the reported prevalence rates. Prevalence affects the recall bias, particularly prevalent in last year. In this study, we have reported LBP prevalence based on varied LBP duration. Biering-Sorensen et al. reported qualifying statements indicating that duration might enhance the accuracy of reporting.⁵⁶ Based on a self-reported questionnaire and examination, Janwantanakul et al.⁵⁷ reported the LBP prevalence of 55% in last four weeks,

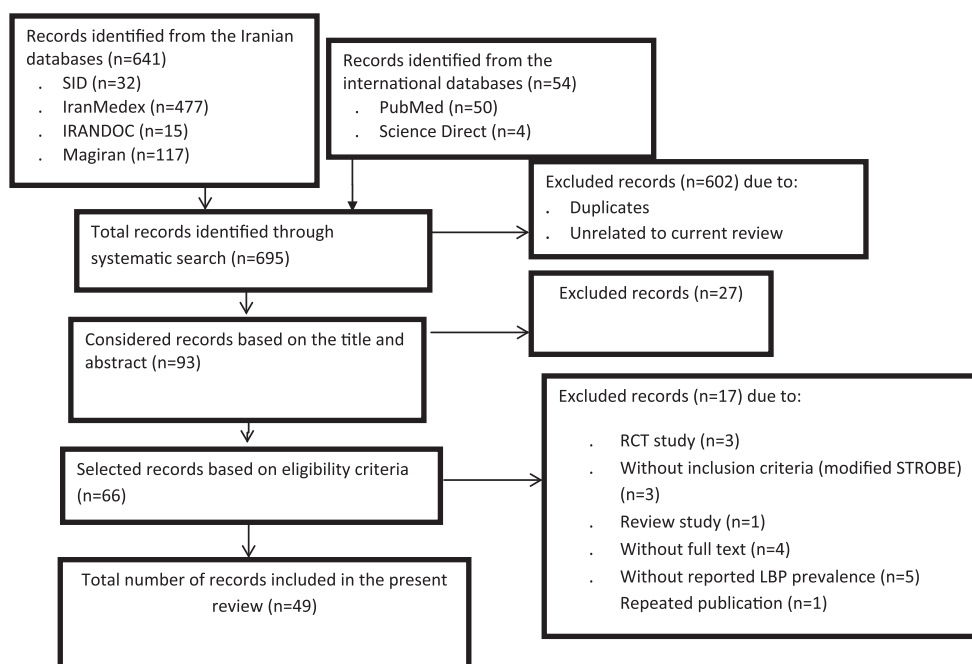


Figure 1: The flowchart of systematic search results of electronic databases together with the selection strategy.

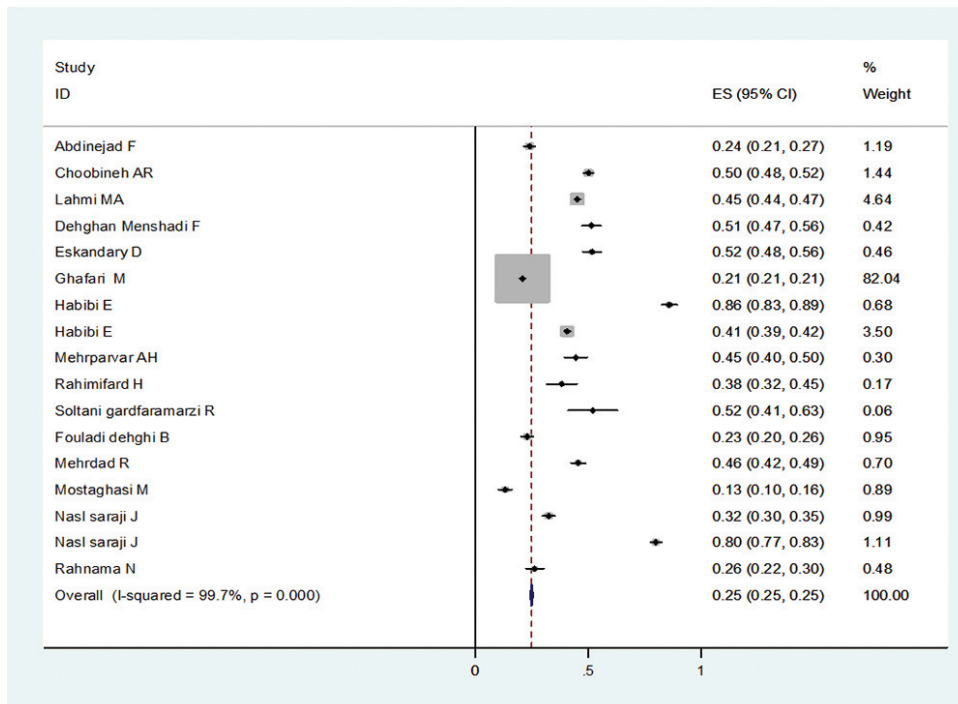


Figure 2: Forest plot of prevalence estimates and 95% confidence intervals from articles on LBP prevalence among workers.

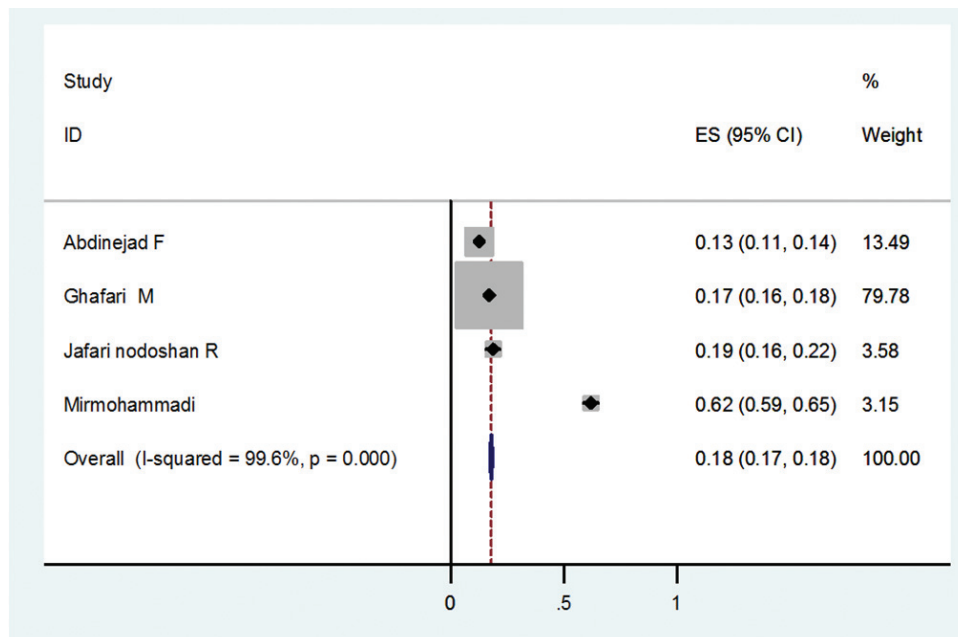


Figure 3: Forest plot of prevalence estimates and 95% confidence intervals from articles on LBP prevalence among office workers (n=4).

whereas in our review the global LBP prevalence in last year was lower. In contrast with few other studies,^{4,58,59} we observed equal LBP prevalence among men and women. The majority of the reviewed articles reported LBP in an industry and mainly among male patients. This may clarify the equal LBP prevalence in both genders. Among the articles reviewed in the present study, only two articles reported LBP in teenage patients. Generally, the reported LBP prevalence among

teenagers was lower than in adolescents. Similar reviews on this subject indicated that LBP prevalence increased in older age.⁷ We found a higher LBP prevalence in middle-aged patients; the age that represents the most economically productive years of working life. This may negatively affect a person's financial, social, and productivity conditions.⁶⁰⁻⁶³

Job category is a parameter that would have an effect on LBP. Similar to other research

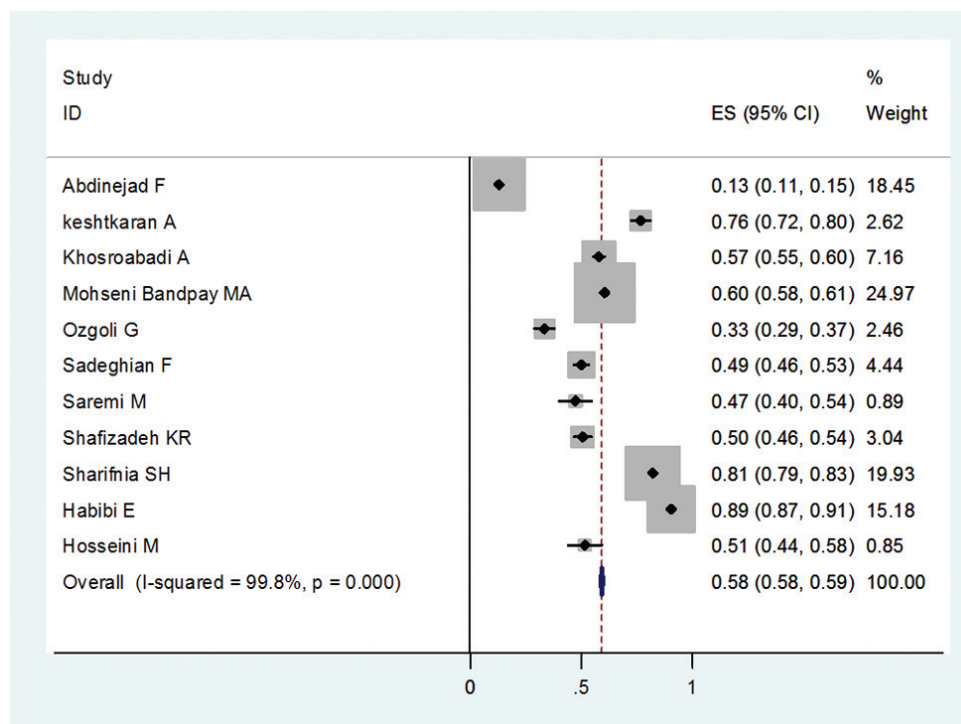


Figure 4: Forest plot of prevalence estimates and 95% confidence intervals from articles on LBP prevalence among health care workers.

studies,^{64,65} we also observed the highest prevalence of LBP in last year among health care workers (e.g. hospital staff, nurses, and dentists). The mean age, after adjustment for gender, was related to the LBP prevalence in last year. We noticed that LBP prevalence among health care workers in this review was higher than that stated by Jensen et al.⁶⁵

Although LBP is widespread but its etiology and cause are not well understood yet. Many research studies reported a strong association between LBP and occupational characteristics, being most prevalent among nurses.⁶⁶⁻⁷⁰ In a study, Sadeghian et al. indicated that age, somatization tendency, and the belief that pain is caused by occupation are risk factors at the baseline and the expectation of pain is a major factor during follow-up.⁷¹ In some studies, poor ergonomic conditions and particularly incorrect lifting posture have been implicated as relevant factors in LBP among most occupations.^{72,73} In the present study, the prevalence of LBP among office workers was high since the reported prevalence in one article was as high as 62%, whereas the other 3 articles reported it at lower than 20%. LBP prevalence among workers did not relate to job classification.

The main limitation of the present review study was the unavailability of a few databases (e.g. Scopus, Web of Science) to Iranian researchers. Additionally, few articles studied LBP prevalence in last week or point prevalence.

Only three articles stated point prevalence of LBP. The majority of the articles reported LBP prevalence in wide-ranging occupations. In addition to job characteristics, they attempted to evaluate other factors such as age, gender, history of accident or trauma, job satisfaction, marital status, educational status, stress, anxiety, depressive symptoms, and body mass index.⁶⁰ A detailed description of the study population, particularly occupational factors may improve the validity of population assessment.

Conclusion

Despite the fact that many of the reviewed articles did not provide a valid assessment tool for LBP and the LBP duration was not stated, we managed to conclude that LBP is the most common issue among health care workers. It is recommended that future research should focus on the LBP prevalence among health care workers. This allows parameters that increase the frequency of LBP to be assessed and subsequently permits reduction or elimination of such factors.

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Conflict of Interest: None declared.

References

1. David GC. Ergonomic methods for assessing exposure to risk factors for work-related musculoskeletal disorders. *Occup Med (Lond)*. 2005;55:190-9. doi: 10.1093/occmed/kqi082. PubMed PMID: 15857898.
2. Liebers F, Brendler C, Latza U. [Age- and occupation-related differences in sick leave due to frequent musculoskeletal disorders. Low back pain and knee osteoarthritis]. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz*. 2013;56:367-80. doi: 10.1007/s00103-012-1619-8. PubMed PMID: 23455554.
3. Meucci RD, Fassa AG, Faria NM. Prevalence of chronic low back pain: systematic review. *Rev Saude Publica*. 2015;49. doi: 10.1590/S0034-8910.2015049005874. PubMed PMID: 26487293; PubMed Central PMCID: PMC4603263.
4. Gouveia N, Rodrigues A, Eusebio M, Ramiro S, Machado P, Canhao H, et al. Prevalence and social burden of active chronic low back pain in the adult Portuguese population: results from a national survey. *Rheumatol Int*. 2016;36:183-97. doi: 10.1007/s00296-015-3398-7. PubMed PMID: 26661091.
5. Punnett L, Pruss-Ustun A, Nelson DI, Fingerhut MA, Leigh J, Tak S, et al. Estimating the global burden of low back pain attributable to combined occupational exposures. *Am J Ind Med*. 2005;48:459-69. doi: 10.1002/ajim.20232. PubMed PMID: 16299708.
6. Mousavi SJ, Akbari ME, Mehdian H, Mobini B, Montazeri A, Akbarnia B, et al. Low back pain in Iran: a growing need to adapt and implement evidence-based practice in developing countries. *Spine (Phila Pa 1976)*. 2011;36:E638-46. doi: 10.1097/BRS.0b013e3181fa1da2. PubMed PMID: 21270691.
7. Pourmalek F, Abolhassani F, Naghavi M, Mohammad K, Majdzadeh R, Holakouie Naeni K, et al. Direct estimation of life expectancy in the Islamic Republic of Iran in 2003. *East Mediterr Health J*. 2009;15:76-84. PubMed PMID: 19469429.
8. Abdinejad F, Emami M, Azadi M. The Relationship between various occupation and low back pain in men. *Research Medical Journal*. 2002;1:39-47.
9. Aghilinezhad M, GHIASVAND M, HESHMAT R, Farzampour S. Comparison of Musculoskeletal Complaints Between Helicopter and Aero Plane Pilots. *Journal of Army University of Medical Sciences*. 2008;5:1391-4.
10. Nesami MB, Bandpey MAM. Prevalence and Characteristics of Low Back Pain in Secondary School Children (Mazandaran-Iran). *Journal of Kermanshah University of Medical Sciences*. 2007;11.
11. Bahrami A, Akbari H, Namayandeh M, Abdollahi N. Assessment of the musculoskeletal complaints of Kashan university hospitals staffs in 2006. *Feyz Journals of Kashan University of Medical Sciences*. 2009;12:33-8.
12. Choobineh A, Rajaeefard A, Neghab M. Perceived demands and musculoskeletal disorders among hospital nurses. *Hakim Research Journal*. 2007;10:70-5.
13. Choobineh A, Hosseini M, Lahmi M, Khani Jazani R, Shahnavaiz H. Musculoskeletal problems in Iranian hand-woven carpet industry: guidelines for workstation design. *Appl Ergon*. 2007;38:617-24. doi: 10.1016/j.apergo.2006.06.005. PubMed PMID: 16999930.
14. Choobineh A, Solaymani E, Mohammad Beigi A. Musculoskeletal symptoms among workers of metal structure manufacturing industry in Shiraz, 2005. *Iranian Journal of Epidemiology*. 2009;5:35-43.
15. Choobineh A, Mokhtarzadeh A, Salehi M, Tabatabaei SHR. Ergonomic evaluation of exposure to musculoskeletal disorders risk factors by QEC technique in a rubber factory. *Jundishapur Scientific Medical Journal*. 2008;7:46-55.
16. Dehghan F, Ghasemi M, Rezasoltani A, Pashaei B. Prevalence of low back pain in automobile industry workers, 2003, Tehran, Iran. *Journal of school of Public Health and Institute of Public Health Research*. 2004;2:49-58.
17. Eskandari D, Ghahri A, Gholamie A, Kashani MM, Mousavi SGA. Prevalence of musculoskeletal disorders and work-related risk factors among the employees of an automobile factory in Tehran during 2009-10. *Feyz Journals of Kashan University of Medical Sciences*. 2011;14:539-45.
18. Eskandary H, Kohan S, Aflatoonian MR, Nikian Y. The prevalence of low back pain and its association with some demographic factors in the city of Kerman. *Journal of Kerman University of Medical Sciences*. 1997;4:125-31.
19. Fouladi Dehghi B, Dehghan H, Ebrahimi Ghavam Abadi L. Evaluation of Exposure to Risk Factor Associated with Musculoskeletal Disorders in a House Hold goods assembling Company. *Journal of Guilan University of*

- Medical Sciences. 2008;16:97-105.
20. Ghaffari M, Alipour A, Farshad AA, Yensen I, Vingard E. Incidence and recurrence of disabling low back pain and neck-shoulder pain. *Spine (Phila Pa 1976)*. 2006;31:2500-6. doi: 10.1097/01.brs.0000239133.29037.d0. PubMed PMID: 17023861.
 21. Ghamari F, Mohammadbeigi A, Khodayari M. Work stations revision by ergonomic posture analyzing of Arak bakery workers. *ZUMS Journal*. 2010;18:80-90.
 22. Ghasemkhani M, Rahimi M, Mosayeb Zadeh M. Musculoskeletal symptom survey among cement drillers. *Iran Occupational Health*. 2005;2:28-31.
 23. Habibi E, Gharib S, Shakerian M, Hasanzadeh A. Musculoskeletal disorders and ergonomics of workers involved with analyzing the situation manually carrying goods in the dairy industry. *Health System Research Winter*. 2011;6:649-57.
 24. Habibi E, Fereidan M, Pourabdian S. Prevalence of musculoskeletal disorders and associated lost work days in steel making industry. *Iran. J. Public Health*. 2008;37:83-91.
 25. Habibi E, Sadeghi N, Pourabdian S. The effect of cushion of air on vibration transmitted to vehicle drivers based on standard. *Journal of Shahrekord University of Medical Sciences*. 2009;11:10-5.
 26. Habibzade H, Motarefi H, Jafarizade H, Airemlou A, Lak Kh, Ebadi R, et al. Study of lowback pain prevalence in nurses who work in khoy hospitals in 1386. *Journal of Nursing and Midwifery Urmia University of Medical Sciences*. 2008;6:11-25. Persian.
 27. Hosseini M, Varmazyar S, Safari A. A study of the physical status of emergency wards' personnel in hospitals affiliated to Qazvin University of Medical Sciences through REBA (Rapid Entire Body Assessment) method and its relation with muscular and skeletal disorders in Qazvin, Iran. *Qom University of Medical Sciences Journal*. 2010;3:Pe32-Pe9, En5.
 28. Jafari NR, Halvani G, Vatanishoaa J, Salmani NZ. Survey of Musculoskeletal disorders among bank staff in Yazd. *Occupational Medicine*. 2011;3:1-7. Persian.
 29. KANGAR LH, Malekzadeh S, Alizadeh K, Shamshiri B, Zareei S. The Prevalence of Musculoskeletal Causes of Disability Retirement among Air Force Personnel during 1371-1382. *Annals of Military and Health Sciences Research*. 2006;4:813-8.
 30. Daniali A. Ergonomics Disorders in the Personnel of Medical Records Department at Training Hospitals of Shiraz University of Medical Sciences. *Health Information Management*. 2008;4:61-9.
 31. Khosroabadi A, Razavi S, Fallahi M, Akaberi A. The Prevalence of Musculoskeletal Disorders in Health-Treatment Employees at Sabzevar University of Medical Sciences, Iran in 2008. *Quarterly journal of Sabzevar University of Medical Sciences*. 2010;17:218-23. Persian.
 32. Mehrdad R, Majlessi-Nasr M, Aminian O, Malekhamadi SSF. Musculoskeletal disorders among municipal solid waste workers. *Acta Med Iran*. 2008;46:233-8.
 33. Mehrparvar A, Ranjbar S, Mostaghaci M, Salehi M. Risk assessment of musculoskeletal disorders by QEC method in a food production factory. *Occupational Medicine Quarterly Journal*. 2011;3:54-60.
 34. Mirmohammadi S, Mehrparvar A, Soleimani H, Lotfi MH, Akbari H, Heidari N. Musculoskeletal disorders among video display terminal (VDT) workers comparing with other office workers. *Iran Occupational Health*. 2010;7:11-4.
 35. Mohseni-Bandpay MA, Bagheri-Nasami M, Fakhri M, Ahmad-Shirvani M, Khaliliyan AR. Prevalence and risk factors of low back pain in school children age 11-14 years. *Journal of Gorgan University of Medical Sciences*. 2005;7:79-83. Persian.
 36. Mohseni-Bandpei MA, Fakhri M, Bagheri-Nesami M, Ahmad-Shirvani M, Khalilian AR, Shayesteh-Azar M. Occupational back pain in Iranian nurses: an epidemiological study. *Br J Nurs*. 2006;15:914-7. doi: 10.12968/bjon.2006.15.17.21904. PubMed PMID: 17077782.
 37. Saraji G, Ebrahimi L, Fouladi B. A survey on ergonomic stress factors of musculoskeletal system in Iranian carpet restoration workers. *Tehran University Medical Journal TUMS Publications*. 2008;65:25-32. Persian.
 38. Nasl Saraji J, Hajaghazadeh M, Hosseini S, Adl J. Musculoskeletal Disorders Study in a Construction Industry Workers. *Iran Occupational Health*. 2007;4:15-9. Persian.
 39. Pargali N, Jowkar N. Prevalence of musculoskeletal pain among dentists in Shiraz, Southern Iran. *Int J Occup Environ Med*. 2010;1:69-74. PubMed PMID: 23022788.
 40. Parviz N, Nasiri H, Ghaderi D. Low back pain prevalence and its risk factors. *Journal of Gorgan Bouyeh Faculty of Nursing & Midwifery*. 2006;9:22-6. Persian.
 41. Keshtkaran A, Daniali A. Ergonomics Disorders in the Personnel of Medical

- Records Department at Training Hospitals of Shiraz University of Medical Sciences. Health Information Management. 2007;4:61-9.
42. Rahimi A, Ahmadi F, Akhoond M. An Investigation into the Prevalence of Vertebral Column Pains among the Nurses Employed in Hamedan Hospitals, 2004. *Razi Journal of Medical Sciences*. 2006;13:105-14.
 43. Rahimifard H, Hashemi Nejad N, Choobineh A, Haidari H, Tabatabaei H. Assessment of Risk Factors and Prevalence of Musculoskeletal Disorders in Raw Furniture Preparation Workshops of the Furniture Industry. *Journal of School of Public Health and Institute of Public Health Research*. 2010;8:53-68.
 44. Rahnama N, Bambaiechi E, Ryasati F. The Effect of Eight Weeks Corrective Exercise with Ergonomic Intervention on Musculoskeletal Disorders among Loabiran Industry Workers. *Journal of Isfahan Medical School*. 2010;28:1-11.
 45. Ramezani BF, Nikbakht NA, Mohammadpour A. Low-back pain prevalence and its risk factors in nurses. *Iran J Nurs Midwifery Res*. 2006;1:37-42. Persian.
 46. Rashidi M. Study of prevalence and causes of low back pain in the islamic azad university of semnan. *Koomesh*. 2007;8:233-7. Persian.
 47. Rezaee M, Ghasemi M, Jafari NJ, Izadi M. Low back pain and related factors among Iranian office workers. *International Journal of Occupational Hygiene*. 2011;3:23-8.
 48. Sadeghi N, Habibi E. The survey of relation between Musculoskeletal Disorders and Anthropometric Indices in the bus drivers in Isfahan. *Iran Occupational Health*. 2009;6:6-14. Persian.
 49. Sadeghian F, Javanmard M, Khosravi A, Adelnia S. An epidemiological survey of Low back pain and its relationship with occupational and personal factors among nursing personnel at hospitals of Shahrood Faculty of Medical Sciences. *Jonob Teb Journal*. 2005;8:75-82.
 50. Saremi M, Lahmi M, Faghihzadeh S. The Effect of Ergonomic Intervention on Dentists' musculoskeletal Disorders. *Daneshvar Medicine*. 2006;13:55-62. Persian.
 51. Shafizadeh KR. Prevalence of musculoskeletal disorders among paramedics working in a large hospital in Ahwaz, southwestern Iran in 2010. *Int J Occup Environ Med*. 2011;2:157-65. PubMed PMID: 23022832.
 52. Shamsedini A, Hellisaz M, Dalvand H, Khatibi A, Sobhani V. The investigation of prevalence of musculoskeletal symptoms and discomfort caused by them in students of Tehran. *Annals of Military and Health Sciences Research*. 2011;8:271-6. Persian.
 53. Sharif Nia SH, Hagh-Doust AA, Haji-Hosseini F, Hojjati H, Javan-Amoli M. Effect of Occupational and Psychological Factors in Back Pain Nurses in AMOL City. *Journal of Rehabilitation*. 2012;12:93-101.
 54. Soltani R, Dehghani Y, Sadeghi Naiini H, Falahati M, Zokaii M. The welders posture assessment by OWAS technique. *OCCUPATIONAL MEDICINE Quarterly Journal*. 2011;3:34-9. Persian
 55. Tajvar A, Hasheminejad N, Bahrapour A, Chubineh A, Jalali A. Musculoskeletal disorders among small trades workers: A survey in the bakeries. *Bimonthly Journal of Hormozgan University of Medical Sciences*. 2012;15:304-10.
 56. Biering-Sorensen F, Hilden J. Reproducibility of the history of low-back trouble. *Spine*. 1984;9:280-6. PubMed PMID: 6233715.
 57. Janwantanakul P, Pensri P, Moolkay P, Jiamjarasrangsi W. Development of a risk score for low back pain in office workers--a cross-sectional study. *BMC Musculoskelet Disord*. 2011;12:23. doi: 10.1186/1471-2474-12-23. PubMed PMID: 21261997; PubMed Central PMCID: PMC3036671.
 58. Latza U, Karmaus W, Sturmer T, Steiner M, Neth A, Rehder U. Cohort study of occupational risk factors of low back pain in construction workers. *Occup Environ Med*. 2000;57:28-34. PubMed PMID: 10711266; PubMed Central PMCID: PMC1739856.
 59. Manchikanti L, Manchikanti KN, Cash KA, Singh V, Giordano J. Age-related prevalence of facet-joint involvement in chronic neck and low back pain. *Pain Physician*. 2008;11:67-75. PubMed PMID: 18196171.
 60. Hoy D, Bain C, Williams G, March L, Brooks P, Blyth F, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum*. 2012;64:2028-37. doi: 10.1002/art.34347. PubMed PMID: 22231424.
 61. Maniadakis N, Gray A. The economic burden of back pain in the UK. *Pain*. 2000;84:95-103. PubMed PMID: 10601677.
 62. Walker BF. The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. *J Spinal Disord*. 2000;13:205-17. PubMed PMID: 10872758.
 63. Luo X, Pietrobon R, Sun SX, Liu GG, Hey L. Estimates and patterns of direct health care expenditures among individuals with back pain in the United States.

- Spine. 2004;29:79-86. doi: 10.1097/01.BRS.0000105527.13866.0F. PubMed PMID: 14699281.
64. W IJ, Burdorf A. Patterns of care for low back pain in a working population. *Spine*. 2004;29:1362-8. PubMed PMID: 15187640.
65. Jensen JN, Holtermann A, Clausen T, Mortensen OS, Carneiro IG, Andersen LL. The greatest risk for low-back pain among newly educated female health care workers; body weight or physical work load? *BMC Musculoskeletal Disorders*. 2012;13:87.
66. Witkoski A, Dickson VV. Hospital staff nurses' work hours, meal periods, and rest breaks. A review from an occupational health nurse perspective. *AAOHN J*. 2010;58:489-97. doi: 10.3928/08910162-20101027-02. PubMed PMID: 21053797.
67. Sikiru L, Hanifa S. Prevalence and risk factors of low back pain among nurses in a typical Nigerian hospital. *Afr Health Sci*. 2010;10:26-30. PubMed PMID: 20811521; PubMed Central PMCID: PMC2895788.
68. Terzi R, Altin F. [The prevalence of low back pain in hospital staff and its relationship with chronic fatigue syndrome and occupational factors]. *Agri*. 2015;27:149-54. doi: 10.5505/agri.2015.26121. PubMed PMID: 26356104.
69. Sobaszek A, Fantoni-Quinton S, Delval M, Rejou P, Mauppin JM, Lefranc D, et al. Long-term assessment of a sanitary education and lumbar rehabilitation program for health care workers with chronic low back pain at the University Hospital of Lille. *J Occup Environ Med*. 2001;43:289-94. PubMed PMID: 11285878.
70. Ndejjo R, Musinguzi G, Yu X, Buregyeya E, Musoke D, Wang JS, et al. Occupational health hazards among healthcare workers in Kampala, Uganda. *J Environ Public Health*. 2015;2015:913741. doi: 10.1155/2015/913741. PubMed PMID: 25802531; PubMed Central PMCID: PMC4329737.
71. Sadeghian F, Hosseinzadeh S, Aliyari R. Do Psychological Factors Increase the Risk for Low Back Pain Among Nurses? A Comparing According to Cross-sectional and Prospective Analysis. *Saf Health Work*. 2014;5:13-6. doi: 10.1016/j.shaw.2013.11.004. PubMed PMID: 24932414; PubMed Central PMCID: PMC4048008.
72. Nachemson A. Towards a better understanding of low-back pain: a review of the mechanics of the lumbar disc. *Rheumatol Rehabil*. 1975;14:129-43. PubMed PMID: 125914.
73. Byrns G, Reeder G, Jin G, Pachis K. Risk factors for work-related low back pain in registered nurses, and potential obstacles in using mechanical lifting devices. *J Occup Environ Hyg*. 2004;1:11-21. doi: 10.1080/15459620490249992. PubMed PMID: 15202152.