



## ORIGINAL ARTICLE

# The association between self-reported low back pain and lower limb disability as well as the association between neck pain and upper limb disability

*Kendi kendine bildirilen bel ağrısı ve alt ekstremitte özürüllüğü arasındaki ilişkinin yanı sıra boyun ağrısı ve üst ekstremitte özürüllüğü arasındaki ilişki*

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## Summary

**Objectives:** To investigate the association between self-reported low back pain (LBP) and lower limb disability as well as the association between neck pain and upper limb disability.

**Methods:** A hundred twenty-six participants registered as a healthcare staff member were included in this cross-sectional study. The presence of neck and LBP were determined using the Nordic Musculoskeletal Questionnaire. Neck and LBP/disability were measured with the Neck Pain and Disability Scale (NPDS) and Oswestry Disability Index (ODI), respectively. Upper and lower limb disability were measured with the Quick Disabilities of Arm, Shoulder, and Hand (Quick-DASH) and Western Ontario and McMaster Osteoarthritis Index (WOMAC), respectively.

**Results:** Participants reporting LBP had more musculoskeletal complaints in the lower limbs ( $p<0.001$ ) and similarly participants reporting neck pain also reported more musculoskeletal complaints in the upper limbs ( $p<0.001$ ). There was a correlation between the ODI and WOMAC in the participant reporting LBP during the 12 months ( $\rho=0.510$ ,  $p<0.001$ ) and during the last 7 days ( $\rho=0.674$ ,  $p<0.001$ ). The NPAD was correlated with the Quick-DASH in the participants reporting neck pain during the last 12 months ( $\rho=0.659$ ,  $p<0.001$ ) and the last 7 days ( $\rho=0.734$ ,  $p<0.001$ ).

**Conclusion:** People reporting more severe LBP also reported high levels of lower limb disability. This association was also existing between the neck pain and upper limb disability.

Keywords: Disability; low back pain; lower limb; neck pain; upper limb.

## Özet

**Amaç:** Kendi kendine bildirilen bel ağrısı ve alt ekstremitte özürüllüğü arasındaki ilişkinin yanı sıra boyun ağrısı ve üst ekstremitte özürüllüğü arasındaki ilişkinin incelenmesi.

**Gereç ve Yöntem:** 126 sağlık çalışanı bu kesitsel çalışmaya dahil edildi. Boyun ve bel ağrısı varlığı İskandinav Kas İskelet Sistemi Anketi kullanılarak belirlendi. Boyun ve bel ağrısı/özürüllüğü sırasıyla Boyun Ağrısı ve Özürüllük Ölçeği (BAÖÖ) ve Oswestry Dizabilite İndeksi (ODI) ile değerlendirildi. Üst ve alt ekstremitte özürüllüğü sırasıyla Hızlı - Kol, Omuz ve El Sorunlar Anketi (Quick-DASH) ve Western Ontario ve McMaster Osteoartrit İndeksi (WOMAC) ile değerlendirildi.

**Bulgular:** Bel ağrısı olduğunu bildiren katılımcıların alt ekstremitelerdeki kas iskelet sistemi şikayetleri daha fazlaydı ( $p<0.001$ ) ve boyun ağrısı olduğunu bildiren katılımcılarda da benzer şekilde üst ekstremitelerde daha fazla kas iskelet sistemi şikayetleri bildirildi ( $p<0.001$ ). Son 12 ay boyunca ve son 7 gün içinde bel ağrısı olduğunu bildiren katılımcıların ODI ve WOMAC skorları arasında anlamlı bir korelasyon vardı (sırasıyla,  $\rho=0.674$ ,  $p<0.001$  ve  $\rho=0.510$ ,  $p<0.001$ ). Son 12 ay boyunca ve son 7 gün içinde boyun ağrısı olduğunu bildiren katılımcılarda BAÖÖ ve Quick-DASH arasında anlamlı bir korelasyon bulundu (sırasıyla,  $\rho=0.659$ ,  $p<0.001$  ve  $\rho=0.734$ ,  $p<0.001$ ).

**Sonuç:** Daha şiddetli bel ağrısı bildiren bireylerde alt ekstremitte özürüllüğü de daha yüksek düzeyde bildirilmektedir. Bu ilişki aynı zamanda boyun ağrısı ve üst ekstremitte özürüllüğü arasında da bulunmaktaydı.

Anahtar sözcükler: Özürüllük; bel ağrısı; alt ekstremitte; boyun ağrısı; üst ekstremitte.

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Submitted (Başvuru tarihi) 11.04.2016 Accepted after revision (Düzeltilme sonrası kabul tarihi) 05.12.2016 Available online date (Online yayımlanma tarihi) 26.12.2016

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## Introduction

Neck pain and low back pain (LBP) are two of the most common musculoskeletal conditions. Both of them have high prevalence and recurrence rates.<sup>[1]</sup> The annual incidence is approximately 36% and 18% for low back and neck pain, respectively.<sup>[2]</sup> Neck pain and LBP are associated with significant disability and comorbidities, which can significantly affect quality of life.<sup>[2,3]</sup>

Upper limb disability is a common musculoskeletal condition and its prevalence has been reported as 20% to 70% in the working population.<sup>[4,5]</sup> Upper limb disability can occur because of many clinical conditions such as neck problems.<sup>[6]</sup> For example, specific sensory, motor and reflex changes frequently accompany pain in the neck and upper limbs if someone has a cervical radiculopathy.<sup>[7]</sup> It is not clear what proportion of people with neck pain in the general population experience associated upper limb disability, but among people with neck pain, upper limb function is often impaired.<sup>[8,9]</sup>

Neck pain and its association with upper limb disability has comparatively well documented. Up to now, most of the studies on LBP have concentrated on changes in trunk coordination and lower limb movements in kinematic and kinetic manners.<sup>[10,11]</sup> However, lower limb disability had received little attention in association with LBP. We hypothesized that even self-reported LBP can also be associated with lower limb disability such as self-reported neck pain is associated with upper limb disability. The aim of this study was to investigate the association LBP/disability and lower limb disability as well as the association between neck pain/disability and upper limb disability.

## Materials and Methods

### Study design and participants

In total, 126 participants were recruited between June 2014 and November 2014 for this cross-sectional study. All the participants were registered by healthcare staff (i.e. not interns or trainees) who were working at the Dokuz Eylül University Hospital. The researchers randomly visited different departments during working hours for the data collection and the staff willing to participate was determined.

### Ethical approval

The Ethics Committee of Dokuz Eylül University approved the study and all participants provided informed consent before participating in the study.

### The measures

#### The Nordic Musculoskeletal Questionnaire

Presence of neck pain and LBP, and upper and lower limb complaints were determined by the NMQ which explores the presence of musculoskeletal symptoms in the 9 different body parts. The NMQ asks about grades of severity by using a measure of functional status, the presence of musculoskeletal symptoms during the last 12 months and 7 days. The Turkish version of the NMQ has appropriate psychometric properties, including good test-retest reliability, internal consistency and construct validity.<sup>[12]</sup>

#### The Neck Pain and Disability Scale (NPAD)

The Neck Pain and Disability Scale (NPAD) is a composite index which includes 20 items that measure the intensity of neck pain and related disability. The NPAD was originally developed in English,<sup>[13]</sup> however there are various other translations of the scale including Turkish version which showed adequate validity and reliability.<sup>[14]</sup> The NPAD measures problems with neck movements, neck pain intensity, effect of neck pain on emotion and cognition, and the level of interference with activities of daily living. Item scores range from 0 to 5 in quarter point increments. The NPAD score was calculated from the sum of the item scores. The possible range is from 0 (no pain) to 100 (maximal pain).

#### The Quick Disability of the Arm, Shoulder and Hand

The Disability of the Arm, Shoulder and Hand (DASH) is a 30-item measure to evaluate disability of upper extremities.<sup>[15]</sup> The DASH includes questions about activities of daily living, symptom questions and questions related to self-image and social functioning. The Quick-DASH is a shortened version of the DASH which has validated into Turkish.<sup>[16]</sup> The Quick-DASH has 11 items which measure physical function and symptoms in people with any or multiple musculoskeletal disorders of the upper limb. The Quick-DASH scores range from 0 to 100; 0 indicates no disability and 100 indicates the most severe disability.

#### The Oswestry Disability Index

The Oswestry Disability Index (ODI) is the most com-

monly used outcome measure for LBP.<sup>[17]</sup> It contains 10 topics which concern intensity of pain, lifting, ability to self-care, ability to walk and travel, ability to sit and stand, sexual function, social life, and sleep quality. Each topic category has 6 statements describing different potential scenarios in the person's life relating to the topic. The subject then checks the statement which most closely fits their situation. Each question is scored on a scale of 0–5, the first statement "0" indicates the least amount of disability and the last statement "5" indicates the most severe disability. The Turkish version of ODI had good comprehensibility, internal consistency, and validity.<sup>[18]</sup>

### **The Western Ontario and McMaster Osteoarthritis Index (WOMAC)**

The Western Ontario and McMaster Osteoarthritis Index (WOMAC) is a frequently-used and recommended disease-specific questionnaire which consists of 24 questions in 3 subscales (5 for pain, 2 for stiffness, and 17 for physical functioning).<sup>[19]</sup> The WOMAC is actually an outcome measure for patients with osteoarthritis. However, it was the only available questionnaire to evaluate the function and pain of the lower limbs which has been found to be reliable and valid in Turkish.<sup>[20]</sup>

### **Data analysis**

Normality of the data distribution was checked by the Kolmogorov-Smirnov test and histograms. The results for characteristics of participants were presented as percentages for categorical variables, and median and interquartile ranges (IQR) for continuous variables because since they were not distributed normally. Prevalence differences of musculoskeletal complaints in the upper and lower limbs between the participants with/without neck and LBP during the last 12 months and 7 days were evaluated using the Chi-square test. Correlations were analyzed by Spearman's rank correlation coefficient. The level of significance was set at  $p < 0.05$ . The data were analyzed using the SPSS for Windows software (ver. 20.0; SPSS Inc., Chicago, IL).

### **Results**

The study sample included 126 participants who were 61 medical secretaries, 27 care and cleaning staff, 24 nurses, and 14 physicians. Most of the participants were female (70.6%). The median work experience time was 11.75 (IQR, 4.63–20.87) years and

the median weekly working time was 40.0 (IQR, 40.0–48.0) hours. Seventy-three (57.9%) and 33 (26.2%) participants reported neck pain during the last 12 months and 7 days, respectively. LBP was reported by 87 participants (69.0%) for the last 12 months and 40 participants (31.7%) for the last 7 days. Characteristics of the study population are presented in Table 1.

### **Prevalence differences of musculoskeletal complaints in the lower limbs between the participants with/without LBP**

Eighty-seven participants with LBP during the last 12 months had significantly more musculoskeletal complaints in the hips/tights and knees ( $p < 0.001$ ) (Table 2). There were significant prevalence differences of musculoskeletal complaints in the all parts of lower limbs between the participants with and without LBP during the last 7 days ( $p < 0.001$ ) (Table 2).

### **Prevalence differences of musculoskeletal complaints in the upper limbs between the participants with/without neck pain**

There were 73 participants with neck pain during the last 12 months. These participants had significantly more musculoskeletal complaints in the shoulders and wrists/hands than the participants without neck pain ( $p < 0.001$ ) (Table 3). Thirty-three participants who had neck pain during the last 7 days had also more musculoskeletal complaints in the shoulders and wrists/hands ( $p < 0.001$ ) (Table 3).

### **Correlations between LBP/disability and lower limb disability**

There was a significant correlation between the ODI and WOMAC scores in the participant with LBP during the 12 months ( $\rho = 0.510$ ,  $p < 0.001$ ). The ODI and WOMAC scores were significantly correlated in the participants who reported LBP during the last 7 days ( $\rho = 0.674$ ,  $p < 0.001$ ). Figure 1 presents the scatter plots.

### **Correlations between neck pain/disability and upper limb disability**

The NPAD scores were significantly correlated with the Quick-DASH scores in the participants who had neck pain during the last 12 months ( $\rho = 0.659$ ,  $p < 0.001$ ). The NPAD scores of the participants with neck pain during the last 7 days were significantly correlated with the Quick-DASH scores ( $\rho = 0.734$ ,  $p < 0.001$ ). Scatter plots are presented in Figure 2.

**Table 1.** Characteristics of the study population (n=126)

	Frequency		Median (IQR)
	n	%	
Age (years)	–	–	36.0 (30.0–44.0)
Gender			
Female	89	70.6	–
Male	37	29.4	–
Body mass index (kg/m <sup>2</sup> )	–	–	24.93 (22.05–28.68)
Marital status			
Married	85	67.5	–
Single	41	32.5	–
History of smoking			
Yes	37	29.4	–
No	89	70.6	–
Occupation			
Medical secretary	61	48.4	–
Nurse	24	19.0	–
Physician	14	11.1	–
Cleaning and care staff	27	21.4	–
Education level			
Primary school	11	8.7	–
High school	30	23.8	–
Graduate	70	55.6	–
Post-graduate	15	11.9	–
Work experience in current job (years)	–	–	11.75 (4.63–20.87)
Working time (hours/week)	–	–	40.0 (40.0–48.0)
ODI	–	–	37.0 (24.0–50.0)
WOMAC	–	–	14.77 (0–34.09)
NPAD	–	–	14.0 (0–88.87)
Quick-DASH	–	–	11.36 (0–25.0)

IQR: Interquartile range; ODI: Oswestry Disability Index; WOMAC: Western Ontario and McMaster Osteoarthritis Index; NPAD: Neck Pain and Disability Scale; Quick-DASH: Quick Disability of the Arm, Shoulder and Hand.

## Discussion

This study demonstrated that people with LBP reported more musculoskeletal complaints in the lower limbs and people with neck pain also reported more musculoskeletal complaints in the upper limbs. The ODI scores were correlated with the WOMAC scores and the NPAD scores were also significantly correlated with the Quick-DASH scores. The results of our study confirm that people reporting more severe low back pain also report high levels of lower limb disability. This association was also existing between the neck pain and upper limbs disability.

It is not clear what proportion of neck pain sufferers in the general population experience associated upper limb disability, but among patients with neck pain, upper limb function is often impaired.<sup>[21]</sup> McLean et al. investigated the relationship between neck pain and upper limb disability in patients with non-specific neck pain and found that patients with severe neck pain/disability also report severe upper limb disability.<sup>[6]</sup> Another study conducted by Osburn and Jull demonstrated that 80% of the patients with nonspecific neck pain reported upper limb functional limitation.<sup>[9]</sup> The same study also indicated that the upper limb disability and neck pain were moderately-highly correlated, indicating the higher

**Table 2.** Prevalence differences of musculoskeletal complaints in the lower limbs between the participants with/without LBP during the last 12 months and 7 days

	Presence of LBP during the last 12 months					Presence of LBP during the last 7 days				
	n	%	n	%		n	%	n	%	
The area of pain	Yes (n=87)		No (n=39)			Yes (n=39)		No (n=84)		
Hips/tights	32	36.8	3	7.7	$\chi^2=11.358$ $p=0.001^*$	12	30.8	5	6.0	$\chi^2=13.772$ $p<0.001^*$
Knees	49	56.3	10	25.6	$\chi^2=10.180$ $p=0.002^*$	21	52.5	11	12.8	$\chi^2=22.721$ $p<0.001^*$
Ankles/feet	27	31.4	9	23.1	$\chi^2=0.905$ $p>0.05$	16	40.0	11	12.8	$\chi^2=12.005$ $p=0.001^*$

\*Significantly different according to the  $\chi^2$  test. LBP: Low back pain.

**Table 3.** Prevalence differences of musculoskeletal complaints in the upper limbs between the participants with/without neck pain during the last 12 months and 7 days

	Presence of neck pain during the last 12 months					Presence of neck pain during the last 7 days				
	n	%	n	%		n	%	n	%	
The area of pain	Yes (n=73)		No (n=53)			Yes (n=33)		No (n=93)		
Shoulders	49	67.1	12	22.5	$\chi^2=24.327$ $p<0.001^*$	17	51.5	9	9.7	$\chi^2=26.033$ $p<0.001^*$
Elbows	13	17.8	6	11.3	$\chi^2=1.009$ $p>0.05$	2	6.1	5	5.4	$\chi^2=0.022$ $p>0.05$
Wrists/hands	30	41.1	6	11.3	$\chi^2=13.339$ $p<0.001^*$	11	33.3	6	6.5	$\chi^2=15.080$ $p<0.001^*$

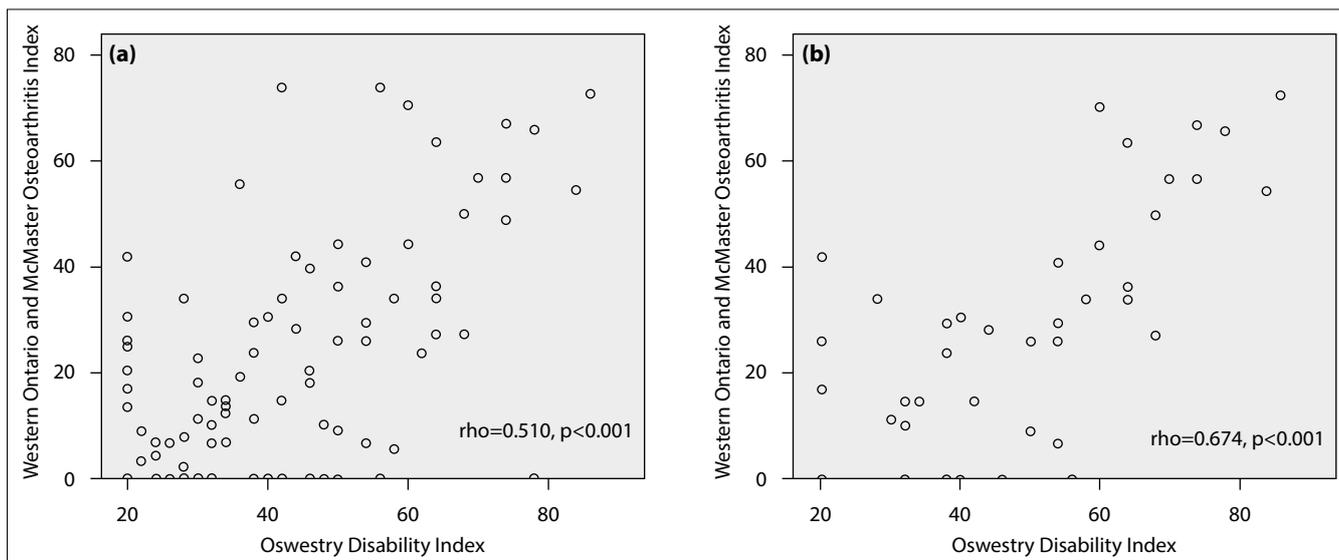
\*Significantly different according to the  $\chi^2$  test.

the neck pain severity the greater the upper limb functional restrictions.<sup>[9]</sup> The current study has also indicated that neck pain was associated with upper limb disability.

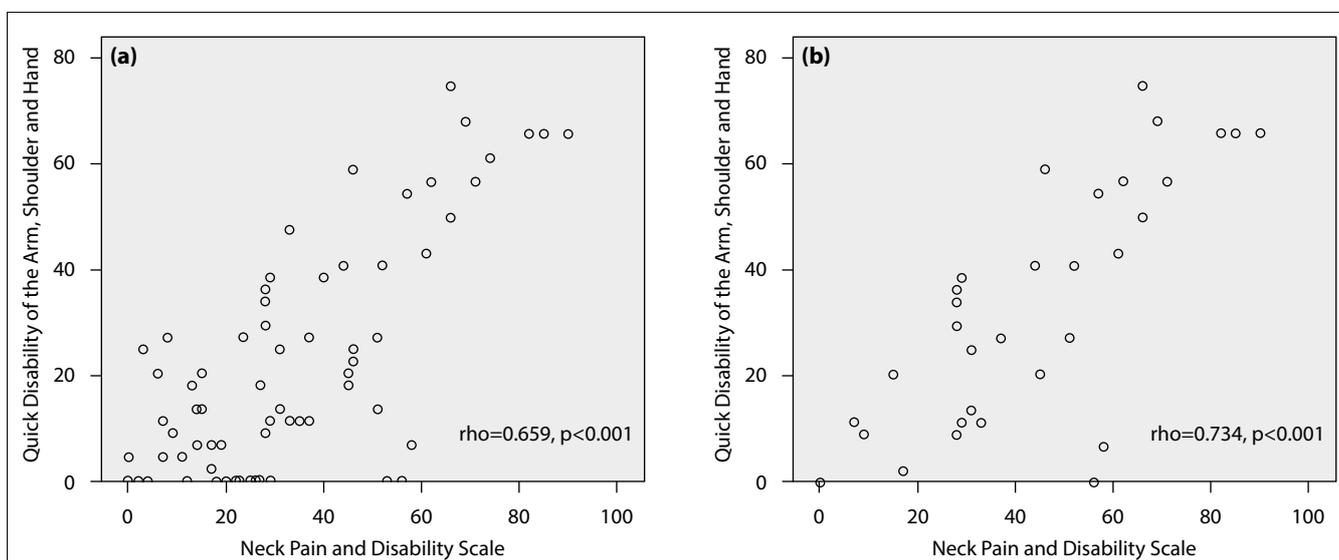
To the best of our knowledge, the current study is the first study which has investigated the association between the low back pain and lower limb disability. The results have indicated that people with low back pain report more musculoskeletal complaints in the lower limbs and the low back pain is associated with lower limb disability.

Although there is an association between the neck pain and upper limb disability, the causality is not

clear. A variety of mechanisms may account for this causality. The upper limbs are directly connected with the neck. The connecting components are skeletal and muscular structures. When there is physical workload to the upper limbs, this loading is transferred to the neck via these structures. Cervical segments move when the upper limbs are loaded and this may cause or increase the neck pain.<sup>[22]</sup> There could be an increasing in this loading with an impaired scapular control due to altered muscle activation patterns because of neck pain.<sup>[8,23,24]</sup> It may result in inhibition of using the upper limbs to prevent the neck from the pain. It is also known that neck pain can result in symptoms being referred into the upper limbs. For example, specific sensory, motor and re-



**Figure 1.** The scatter plots of the association between the ODI and WOMAC. **(a)** The participants with LBP during the last 12 months (n=87). **(b)** The participants with LBP during the last 7 months (n=39).



**Figure 2.** The scatter plots of the association between the NPAD and Quick-DASH. **(a)** The participants with neck pain during the last 12 months (n=73). **(b)** The participants with neck pain during the last 7 months (n=33).

flex changes frequently can accompany to the pain in the neck and upper limbs if a person has a cervical radiculopathy.<sup>[7,25]</sup> These changes result in disability in the neck and upper limbs.

If the functional use of upper limbs are limited because of a direct mechanical pain response in people with neck pain, this may result in physical deconditioning which may lead to reduced strength and endurance of muscles and further increases disability level of upper limbs.<sup>[26]</sup>

Several studies have indicated that there is an association between neck pain and upper limb disability.

However, most of the studies on low back pain concentrate on changes in trunk coordination and lower limb movements in kinematic and kinetic manners.<sup>[10,11,27]</sup> Lower limb disability received little attention in association with low back pain. Our study indicated that people with low back pain report more musculoskeletal complaints in the lower limbs and there is a significant correlation between low back disability/pain and lower limb disability/pain. The causality is also unclear like the causality of the association between the neck pain and upper limb disability.

Lower limb movements create forces on the spine and they can affect the lumbopelvic region. Clinical

studies shows that patients with low back pain often present disorientation or mal-alignment of the pelvis, reflected in asymmetry in lower limb posture – notably leg length inequality and compensatory changes at the feet i.e. pronation/supination and a resting asymmetry of the feet relative to the center of gravity.<sup>[28–30]</sup> The patients with low back pain have weak gluteal muscles, tight hamstring, and psoas muscles and quadratus lumborum.<sup>[31]</sup> They also have weak lower abdominal muscles including transversus abdominus and restricted range of hip motion.<sup>[32,33]</sup> These findings are consistent with the involvement of the lower limb in spinal function. Like a cervical radiculopathy result in specific sensory, motor and reflex changes in the upper limbs, a lumbar radiculopathy can also cause these changes in the lower limbs which restricts the functional capacity of the lower limbs. There is some evidence shows that the joints of the lower limb are involved in spinal function and that they may be involved in low back pain.<sup>[34]</sup> The evidence suggests that this involvement usually involves compensating for spinal dysfunction.

None of the mechanisms for the causality of the association between the neck pain and upper limb disability has been investigated in any depth; however, our study may help further investigations to explain the causality. Therefore, possible rehabilitation strategies which are appropriate for people with neck and low back pain can be designed.

### Limitations

There are some potential limitations of our study. The first limitation is the design of the study. Because the study design was cross-sectional, it is unknown whether people with neck and LBP developed upper and lower limb disability or vice versa. The second limitation of our study is about the generalizability because we only included participants who were healthcare staff member in the same university hospital. Lastly, there was no definite medical diagnosis for LBP or neck pain. Although the aim of the study was to investigate the self-reported LBP and neck pain, future studies should carry on the participants with definite medical diagnosis.

### Conclusion

People reporting more severe neck pain also report high levels of upper limb disability. This association

was also existing between the LBP and lower limb disability. The spine should not be viewed in isolation from the upper and lower limbs when considering the causes or treatment of neck and LBP. Clinicians should carefully assess upper and lower limb functional capacity during the examination of people reporting neck and LBP and, where indicated, incorporate rehabilitation in their management.

**Conflict-of-interest issues regarding the authorship or article: None declared.**

**Peer-review: Externally peer-reviewed.**

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