Comparison of the risk of developing lumbar herniated intervertebral disc between dentists and other occupations: A nationwide population-based study in Taiwan

Wei-Ta Huang MD | Shih-Feng Weng PhD |
Hung-Jung Lin MD, MBA | Shih-Bin Su MD, PhD |
Chien-Chin Hsu MD, PhD | Jhi-Joung Wang MD, PhD |
Chien-Cheng Huang MD, PhD

1Department of Emergency Medicine, Chi-Mei Medical Center, Liouying, Tainan, Taiwan
2Department of Healthcare Administration and Medical Informatics, Kaohsiung Medical University, Kaohsiung, Taiwan
3Department of Medical Research, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan
4Department of Emergency Medicine, Chi-Mei Medical Center, Tainan, Taiwan
5Department of Biotechnology, Southern Taiwan University of Science and Technology, Tainan, Taiwan
6Department of Emergency Medicine, Taipei Medical University, Taipei, Taiwan
7Department of Occupational Medicine, Chi-Mei Medical Center, Tainan, Taiwan
8Department of Leisure, Recreation and Tourism Management, Southern Taiwan University of Science and Technology, Tainan, Taiwan
9Department of Medical Research, Chi-Mei Medical Center, Tainan, Taiwan
10Department of Senior Services, Southern Taiwan University of Science and Technology, Tainan, Taiwan
11Department of Environmental and Occupational Health, College of Medicine, National Cheng Kung University, Tainan, Taiwan

Abstract

Objectives: Dentists may have a higher risk of developing lumbar herniated intervertebral disc (HIVD) due to prolonged sitting and improper postures during work. We conducted this study to delineate this issue, which is still unclear.

Methods: This nationwide population-based study was conducted using Taiwan National Health Insurance Research Database. We identified 10 734 dentists, 72 066 non-dentist health-care providers (HCPs), and an identical number of age- and gender-matched participants from the general population. The risk of developing lumbar HIVD among dentists, non-dentist HCPs, and general population was compared by tracing their medical histories between 2007 and 2011.

Results: The cumulative incidence rate of lumbar HIVD among dentists during the 5-year follow-up period was 1.40%. After adjusting for age, gender, and
1 | INTRODUCTION

Herniated intervertebral disc of the lumbar spine (lumbar HIVD), which is one of the most serious causes of low back pain, indicates the displacement of cartilage, fluid, or bone of an intervertebral disc outside the borders of the disc space or its joints. Lumbar HIVD has been reported to be the most common cause for performing lumbar spine surgery in working-age individuals. It has been observed that patients develop a herniated disc at an average age of 41 years, with the diagnosis being slightly more common in men than in women. An elevated body mass index (BMI) and being overweight (BMI: 25-30) and obese (BMI > 30) have been considered as the most important risk factors contributing to lumbar HIVD. Being overweight also increases the risk for recurrent herniation after microdiscectomy. Medical comorbidities such as diabetes and hyperlipidemia have also been reported as the risk factors for lumbar HIVD.

Several studies have proposed that lumbar HIVD is associated with the occupation or work content. A statistically significant positive association has been observed between lumbar HIVD and forward bending as well as accumulated weight lifting or carrying. Health-care providers (HCPs) have a high risk of developing lumbar HIVD because of their usual patient handling procedures such as lifting and moving patients. Dentists have been reported to have a high risk of developing musculoskeletal disorders because of prolonged static and improper sitting postures and body movements that cause extra musculoskeletal loading. The most prevalent musculoskeletal disorders among dentists, which also interfered with their daily activities, have been reported at the neck, lower back, and shoulder. However, most of the previous studies have included all types of musculoskeletal disorders and did not focus on lumbar HIVD alone. In addition, no study has yet compared the risk of developing lumbar HIVD between dentists and other occupations. Therefore, we conducted this nationwide population-based study to clarify this issue.

2 | MATERIALS AND METHODS

2.1 | Data sources

This study was conducted based on the Taiwan National Health Insurance Research Database (NHIRD). Taiwan has a single-payer National Health Insurance program that includes approximately the entire Taiwan population. The NHIRD containing registration files and original claims data for reimbursement is provided to the scientists in Taiwan for research purposes after de-identification.

2.2 | Identification of dentists, non-dentist HCPs, and general population

An identical number of age- and gender-matched dentists and non-dentist HCPs and participants was identified from the general population after matching for age and gender. The non-dentist HCPs included physicians, pharmacists, medical technicians, audiologists, consultant experts, clinical experts, dietitians, social workers, and language experts. Participants who had been diagnosed with lumbar HIVD (ICD-9-CM codes: 722.10, 722.52, 722.73, and 722.93) before 2007 were excluded. The criteria for diagnosing lumbar HIVD were based on the diagnosis on admission or ambulatory care for at least one time. Age subgroups were categorized as ≤34, 35-59, and ≥60 years. Comorbidities were defined as diabetes (ICD-9-CM code 250), hypertension (ICD-9-CM code: 401-405), hyperlipidemia (ICD-9-CM code: 272), malignancy (ICD-9-CM code: 140-208), stroke (ICD-9-CM code: 436-438), coronary artery disease (CAD) (ICD-9-CM code: 410-414), chronic obstructive pulmonary disease (COPD) (ICD-9-CM code: 496), liver disease (ICD-9-CM code: 570-576), renal disease (ICD-9-CM code: 580-593),
and mental disorder (ICD-9-CM code: 290-319), which were identified as possible confounding factors for this study. The comorbidities included in this study were based on the diagnosis of these diseases on admission for at least one time or ambulatory care for at least three times. Residential areas were divided into north, center, south, and east. In total, 10,734 dentists, 72,066 non-dentist HCPs, and an identical number of age- and gender-matched participants from the general population were identified for this study.

2.3 | Comparison of the risk of developing lumbar HIVD

The risk of developing lumbar HIVD was compared between dentists and general population, between non-dentist HCPs and general population, and between dentists and non-dentist HCPs by following up their medical histories between 2007 and 2011. Stratified analyses for age and gender subgroups were also performed to assess whether age and gender were effect modifiers.

| Table 1 | Demographic characteristics and comorbidities of dentists, non-dentist HCPs, and general population |
|---------|------------------------------------------------------------------------------------------------|
|          | Dentists (n = 10,734) | General population (n = 10,734) | p-value | Non-dentist HCPs (n = 72,066) | General population (n = 72,066) | p-value |
| Age (y)  | 43.72 ± 11.32          | 43.72 ± 11.32                | >0.999 | 42.52 ± 12.16                   | 42.52 ± 12.16                     | >0.999 |
| ≤34      | 2873 (26.77)           | 2873 (26.77)                | >0.999 | 22581 (31.33)                   | 22581 (31.33)                     | >0.999 |
| 35-59    | 6972 (64.95)           | 6972 (64.95)                |        | 43394 (60.22)                  | 43394 (60.22)                     |        |
| ≥60      | 889 (8.28)             | 889 (8.28)                  |        | 6091 (8.45)                     | 6091 (8.45)                       |        |
| Gender   |                          |                            |        |                                 |                                   |        |
| Male     | 8117 (75.62)           | 8117 (75.62)                | >0.999 | 44524 (61.78)                   | 44524 (61.78)                     | >0.999 |
| Female   | 2617 (24.38)           | 2617 (24.38)                | >0.999 | 27542 (38.22)                   | 27542 (38.22)                     | >0.999 |
| Comorbidity |                         |                            |        |                                 |                                   |        |
| Diabetes | 788 (7.34)             | 881 (8.21)                  | 0.018  | 4311 (5.98)                     | 4879 (6.77)                       | <0.001 |
| Hypertension | 1923 (17.92)         | 1754 (16.34)                | 0.002  | 11808 (16.38)                  | 10269 (14.25)                     | <0.001 |
| Hyperlipidemia | 1546 (14.40)        | 1211 (11.28)                | <0.001 | 9966 (13.83)                    | 6840 (9.49)                       | <0.001 |
| Malignancy | 233 (2.17)             | 272 (2.53)                  | 0.079  | 1859 (2.58)                     | 1923 (2.67)                       | 0.292  |
| Stroke   | 204 (1.90)             | 319 (2.97)                  | <0.001 | 1363 (1.89)                     | 1974 (2.74)                       | <0.001 |
| CAD      | 562 (5.24)             | 466 (4.34)                  | 0.002  | 3130 (4.34)                     | 2978 (4.13)                       | 0.047  |
| COPD     | 469 (4.37)             | 613 (5.71)                  | <0.001 | 5010 (6.95)                     | 4241 (5.88)                       | <0.001 |
| Liver disease | 1154 (10.75)       | 1040 (9.69)                 | 0.010  | 7147 (9.92)                     | 6314 (8.76)                       | <0.001 |
| Renal disease | 122 (1.14)           | 152 (1.42)                  | 0.068  | 879 (1.22)                      | 1088 (1.51)                       | <0.001 |
| Mental disorder | 894 (8.33)        | 1173 (10.93)                | <0.001 | 8765 (12.16)                    | 7906 (10.97)                      | <0.001 |
| Living area |                         |                            |        |                                 |                                   |        |
| North    | 5735 (53.43)           | 5612 (52.28)                | <0.001 | 34040 (47.23)                   | 38391 (53.27)                     | <0.001 |
| Center   | 2032 (18.93)           | 1901 (17.71)                |        | 14375 (19.95)                   | 12615 (17.51)                     |        |
| South    | 2801 (26.09)           | 3003 (27.98)                |        | 21971 (30.49)                   | 19670 (27.29)                     |        |
| East     | 166 (1.55)             | 218 (2.03)                  |        | 1680 (2.33)                     | 1390 (1.93)                       |        |

Data are number (%) or mean ± SD.
CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; HCP, health-care provider.
COPD, liver disease, renal disease, and mental disorder. The risk of developing lumbar HIVD was compared between dentists and non-dentist HCPs using unconditional logistic regression analysis by adjusting for age, gender, diabetes, hypertension, hyperlipidemia, malignancy, stroke, CAD, COPD, liver disease, renal disease, and mental disorder. SAS 9.4 for Windows (SAS Institute, Cary, NC, USA) was used for all analyses, and the significance level was set at 0.05 (two tails).

3 | RESULTS

We identified a total of 10,734 dentists and 10,734 age- and gender-matched participants from the general population for the comparisons (Table 1). The mean age (±SD) of the dentists was 43.72 ± 11.32 years. In terms of age subgroups, 26.77% of them were aged ≤34 years, 64.95% were aged 35-59 years, and 8.28% were aged ≥60 years. The majority of dentists were men (75.62%). Dentists had a significantly increased proportion of comorbidities of hypertension (17.92% vs 16.34%), hyperlipidemia (14.40% vs 11.28%), CAD (5.24% vs 4.34%), and liver disease (10.75% vs 9.69%) but a decreased proportion of comorbidities of diabetes (7.34% vs 8.21%), stroke (1.90% vs 2.97%), COPD (4.37% vs 5.71%), and mental disorder (8.33% vs 10.93%) than that among the general population. Regarding the comparison of residential areas, more number of dentists was living in the northern and central areas than that among the general population. We also identified 72,066 non-dentist HCPs and identical numbers of age- and gender-matched participants from the general population for the comparisons (Table 1). The mean age (±SD) of these individuals was 42.52 ± 12.16 years. Regarding age subgroups, 31.33% of them were aged ≤34 years, 60.22% were aged 35-59 years, and 8.45% were aged ≥60 years. There was a predominance of male non-dentist HCPs (61.78%). Non-dentists HCPs had an increased proportion of comorbidities of hypertension (16.38% vs 14.25%), hyperlipidemia (13.83% vs 9.49%), CAD (4.34% vs 4.13%), COPD (6.95% vs 5.88%), liver disease (9.92% vs 8.76%), and mental disorder (12.16% vs 10.97%), but a decreased proportion of comorbidities of diabetes (5.98% vs 6.77%), stroke (1.89% vs 2.74%), and renal disease (1.22% vs 1.51%) than that among the general population. Regarding the comparison of

| Variable | Number (%) | OR (95% CI) | AOR (95% CI) \(^a\) | p-value \(^b\) |
|----------|------------|-------------|-----------------|---------|
| Dentists (n = 10,734) | 150 (1.40) | 0.81 (0.66-1.01) | 0.80 (0.64-1.00) | 0.049 |
| General population (n = 10,734) | 184 (1.71) | 1.00 | 1.00 | |
| Age subgroup | | | | |
| ≤34 y | | | | |
| Dentists (n = 2873) | 26 (0.90) | 0.87 (0.51-1.47) | 0.83 (0.49-1.40) | 0.481 |
| General population (n = 2873) | 30 (1.04) | 1.00 | 1.00 | 1.00 |
| 35-59 y | | | | |
| Dentists (n = 6972) | 104 (1.49) | 0.79 (0.61-1.02) | 0.77 (0.60-1.01) | 0.056 |
| General population (n = 6972) | 132 (1.89) | 1.00 | 1.00 | 1.00 |
| ≥60 y | | | | |
| Dentists (n = 889) | 20 (2.25) | 0.91 (0.49-1.86) | 0.95 (0.49-1.81) | 0.866 |
| General population (n = 889) | 22 (2.47) | 1.00 | 1.00 | 1.00 |
| Gender subgroup | | | | |
| Male | | | | |
| Dentists (n = 8117) | 120 (1.48) | 0.86 (0.67-1.09) | 0.83 (0.65-1.07) | 0.150 |
| General population (n = 8117) | 140 (1.72) | 1.00 | 1.00 | 1.00 |
| Female | | | | |
| Dentists (n = 2617) | 30 (1.15) | 0.68 (0.43-1.08) | 0.71 (0.44-1.15) | 0.165 |
| General population (n = 2617) | 44 (1.68) | 1.00 | 1.00 | 1.00 |

AOR, adjusted odds ratio; CI, confidence interval; HCP, health-care provider; HIVD, herniated intervertebral disc; OR, odds ratio.

\(^a\)Adjusted for diabetes, hypertension, hyperlipidemia, malignancy, stroke, coronary artery disease, chronic obstructive pulmonary disease, liver disease, renal disease, and mental disorder.

\(^b\)For AOR.
residential areas, a lesser number of non-dentists HCPs were living in the northern area than that among the general population.

During the study period between 2007 and 2011, the cumulative incidence rates of lumbar HIVD among the dentists and the general population were found to be 1.40% and 1.71%, respectively (Table 2). Dentists were found to have a lower risk of developing lumbar HIVD than did the general population after adjusting for diabetes, hypertension, hyperlipidemia, malignancy, stroke, CAD, COPD, liver disease, renal disease, and mental disorder (adjusted odds ratio [AOR]: 0.80, 95% confidence interval [CI]: 0.64-1.00, \( p: 0.049 \)). Stratified analyses showed that dentists in the age subgroup of 35-59 years had a trend of lower risk of developing lumbar HIVD than that among the general population (AOR: 0.77, 95% CI: 0.60-1.01, \( p: 0.056 \)).

Non-dentist HCPs did not have a higher risk of developing lumbar HIVD than that among the general population (AOR: 1.07, 95% CI: 0.98-1.16, \( p: 0.121 \)) (Table 3). Stratified analyses showed that non-dentist HCPs in the age subgroup of \( \leq 34 \) years had a significantly higher risk of developing lumbar HIVD than did the general population (AOR: 1.33, 95% CI: 1.11-1.59, \( p: 0.003 \)).

The risk of developing lumbar HIVD was found to be significantly lower among dentists than that among the non-dentist HCPs (AOR: 0.81, 95% CI: 0.68-0.96, \( p: 0.015 \)) (Table 4). Stratified analyses revealed that male dentists had a lower risk than that among male non-dentist HCPs (AOR: 0.81, 95% CI: 0.67-0.99, \( p: 0.038 \)).

**4 | DISCUSSION**

This study identified a cumulative incidence rate of 1.40% of lumbar HIVD among dentists during the 5 years of follow-up. Dentists were found to have a lower risk of developing lumbar HIVD than that among the non-dentist HCPs and the general population. Stratified analyses revealed that this lower risk among dentists compared with that among non-dentist HCPs was detected only in the male population and that only the non-dentist HCPs in the age subgroup of \( \leq 34 \) years had a higher risk of developing lumbar HIVD than did the general population.

To our knowledge, this is the first study to report the incidence rate of lumbar HIVD among the dentists. Previous studies have reported that 47.6%-65.7% of dentists...
complained of low back pain, which was defined based on self-reports of the dentists. Lumbar HIVD described in this study was diagnosed by the treating physicians, which is more reliable and specific than the previous definitions. The major risk factor and the mechanism responsible for developing a lumbar HIVD among the dentists is the prolonged static posture (PSP). PSP may contribute to the following subsequent progressions: muscle fatigue, muscle imbalance, muscle ischemia or necrosis, pain, protective muscle contraction, and then, joint hypomobility, nerve compression, and HIVD.

The lower risk among dentists in this study is different from the general cognition, which may be due to the fact that non-dentist HCPs and general population may have more risk factors for developing a lumbar HIVD than those among the dentists. In addition, dentists may have more health-seeking behavior, self-treatment, and medical knowledge than that among the general population, including acute myocardial infarction, peptic ulcer disease, urolithiasis, and stroke due to their better medical knowledge.

Although this study reports a novel finding using a nationwide population-based design, some limitations still exist. First, there was no detailed information regarding the occupational exposure, including the working hours per week, the years of entering the workforce, and the physical activity while working, private lifestyle, and mental disorder.

### Table 4
Comparison of the risk of developing lumbar HIVD between dentists and non-dentist HCPs by unconditional logistic regression analysis

| Variable                          | Number (%) | OR (95% CI) | AOR (95% CI) | p-value |
|-----------------------------------|------------|-------------|--------------|---------|
| Dentists (n = 10,734)             | 150 (1.40) | 0.79 (0.67-0.94) | 0.81 (0.68-0.96) | 0.015   |
| Non-dentist HCPs (n = 72,066)     | 1,147 (1.59) | 1.00 | 1.00 |   |
| **Age subgroup**                  |            |             |              |         |
| ≤34 y                             |            |             |              |         |
| Dentists (n = 2,873)              | 26 (0.90)  | 0.69 (0.46-1.04) | 0.70 (0.47-1.05) | 0.081   |
| Non-dentist HCPs (n = 22,581)     | 219 (0.97) | 1.00 | 1.00 |   |
| 35-59 y                           |            |             |              |         |
| Dentists (n = 6,972)              | 104 (1.49) | 0.80 (0.65-0.98) | 0.83 (0.67-1.02) | 0.077   |
| Non-dentist HCPs (n = 43,394)     | 755 (1.74) | 1.00 | 1.00 |   |
| ≥60 y                             |            |             |              |         |
| Dentists (n = 889)                | 20 (2.25)  | 0.83 (0.52-1.33) | 0.89 (0.56-1.43) | 0.639   |
| Non-dentist HCPs (n = 6,091)      | 173 (2.84) | 1.00 | 1.00 |   |
| **Gender subgroup**               |            |             |              |         |
| Male                              |            |             |              |         |
| Dentists (n = 8,117)              | 120 (1.48) | 0.78 (0.64-0.94) | 0.81 (0.67-0.99) | 0.038   |
| Non-dentist HCPs (n = 44,524)     | 748 (1.68) | 1.00 | 1.00 |   |
| Female                            |            |             |              |         |
| Dentists (n = 2,617)              | 30 (1.15)  | 0.75 (0.52-1.09) | 0.80 (0.55-1.16) | 0.234   |
| Non-dentist HCPs (n = 27,542)     | 399 (1.45) | 1.00 | 1.00 |   |

AOR, adjusted odds ratio; CI, confidence interval; HCP, health-care provider; HIVD, herniated intervertebral disc; OR, odds ratio.

*Adjusted for age, gender, diabetes, hypertension, hyperlipidemia, malignancy, stroke, coronary artery disease, chronic obstructive pulmonary disease, liver disease, renal disease, and mental disorder.

For AOR.
nutrition, and BMI, which may be confounding factors for this study. However, we had adjusted for hypertension, diabetes, and hyperlipidemia, which could be the surrogates for private lifestyle, nutrition, and BMI. Second, dentists may treat themselves based on their medical knowledge, rather than seeking medical advice; therefore, using the claims data in this study might have underestimated the risk in dentists. Third, the follow-up period of 5 years may not be long enough to evaluate the effect of occupational exposure. A longer follow-up may be needed for a better evaluation. Fourth, due to the differences in occupational workload, race, culture, and medical resources, the results of this study may not be generalized to other nations.

5 | CONCLUSION

This is the first study comparing the risk of developing lumbar HIVD among dentists, non-dentist HCPs, and general population. In contrast to the general cognition, dentists were found to have a lower risk of developing lumbar HIVD than that among the general population and non-dentist HCPs. Additional risk factors in the general population and non-dentist HCPs when compared with the dentists may play the role. Despite this finding, it does not imply that dentists need not pay attention to their risk factors responsible for developing lumbar HIVD. These results could provide an important reference for the responsible authorities for policy making and promoting occupational health for all the HCPs. However, further studies regarding the detailed occupational exposure, with a longer follow-up period, and in other nations are warranted.

ACKNOWLEDGMENTS

This study was supported by a Grant from Kaohsiung Medical University Research Foundation (KMU-Q105015) and 106CM-KMU-13 from Chi-Mei Medical Center. We thank the National Health Insurance Administration, Ministry of Health and Welfare (managed by the National Health Research Institutes—Registered number NHIRD-102-057), for access to the Taiwan NHIRD. The conclusions in this study do not represent those of the National Health Insurance Administration, Ministry of Health and Welfare, or National Health Research Institutes.

DISCLOSURE

Approval of the research protocol: This study was strictly conducted according to the Declaration of Helsinki and approved by the Institutional Review Board at Chi-Mei Medical Center. Informed consent: As the NHIRD contains de-identified information, informed consents from the participants are waived, which does not affect the rights and welfare of the participants. Registry and the registration no. of the study/trial: N/A. Animal studies: N/A. Data sharing and data accessibility: N/A.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

AUTHORS’ CONTRIBUTIONS

W.T.H., C.C. Hsu, C.C. Huang, and S.F.W. designed the study and wrote the manuscript. S.F.W. performed the data analysis and wrote the manuscript. H.J.L., S.B.S., and J.J.W. provided clinical experience and wrote the manuscript. C.C. Huang and S.F.W. supervised the whole study. All authors read and approved the final manuscript.

ORCID

Chien-Cheng Huang https://orcid.org/0000-0003-3595-2952

REFERENCES

1. Fardon D, Milette P. Nomenclature and classification of lumbar disc pathology: recommendations of the combined task forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology. Spine (Phila Pa 1976). 2001;26(5):E93–E113.
2. Schroeder GD, Guyre CA, Vaccaro AR. The epidemiology and pathophysiology of lumbar disc herniations. Semin Spine Surg 2016;28(1):2-7.
3. Cummins J, Lurie JD, Tosteson TD, et al. Descriptive epidemiology and prior healthcare utilization of patients in the Spine Patient Outcomes Research Trial’s (SPORT) three observational cohorts: disc herniation, spinal stenosis, and degenerative spondylolisthesis. Spine (Phila Pa 1976). 2006;31(7):806-814.
4. Weiler C, Lopez-Ramos M, Mayer HM, et al. Histological analysis of surgical lumbar intervertebral disc tissue provides evidence for an association between disc degeneration and increased body mass index. BMC Res Notes. 2011:4:497.
5. Shiri R, Lallukka T, Karpinnen J, et al. Obesity as a risk factor for sciatica: a meta-analysis. Am J Epidemiol. 2014;179(8):929-937.
6. Meredith DS, Huang RC, Nguyen J, et al. Obesity increases the risk of recurrent herniated nucleus pulposus after lumbar microdiscectomy. Spine J. 2010;10(7):575-580.
7. Mobbs RJ, Newcombe RL, Chandran KN. Lumbar discectomy and the diabetic patient: incidence and outcome. J Clin Neurosci. 2001;8(1):10-13.
8. Longo UG, Denaro L, Spiezia F, et al. Symptomatic disc herniation and serum lipid levels. Eur Spine J. 2011;20(10):1658-1662.
9. Seidler A, Bolm-Audorff U, Siol T, et al. Occupational risk factors for symptomatic lumbar disc herniation; a case-control study. Occup Environ Med. 2003;60(10):821-830.
10. Ando S, Ono Y, Shimaoka M, et al. Associations of self estimated workloads with musculoskeletal symptoms among hospital nurses. Occup Environ Med. 2006;57(3):211-216.
11. Smedley J, Egger P, Cooper C, et al. Manual handling activities and risk of low back pain in nurses. *Occup Environ Med*. 1995;52(3):160-163.
12. Waters TR, Rockefeller K. Safe patient handling for rehabilitation professionals. *Rehabil Nurs*. 2010;35(5):216-222.
13. Valachi B, Valachi K. Mechanisms leading to musculoskeletal disorders in dentistry. *J Am Dent Assoc*. 2003;134(10):1344-1350.
14. Lehto TU, Helenius HY, Alaranta HT. Musculoskeletal symptoms of dentists assessed by a multidisciplinary approach. *Community Dent Oral Epidemiol*. 1991;19(1):38-44.
15. Leggat PA, Smith DR. Musculoskeletal disorders self-reported by dentists in Queensland, Australia. *Aust Dent J*. 2006;51(4):324-327.
16. National Health. Insurance Research Database. Background. https://nhird.nhri.org.tw/en/index.html. Accessed January 31, 2018.
17. Biller FE. Occupational hazards in dental practice. *Oral Hyg*. 1946;36:1994.
18. Gaowgzeh RA, Chevidikunnan MF, Al Saif A, et al. Prevalence of and risk factors for low back pain among dentists. *J PhysTher Sci*. 2015;27(9):2803-2806.
19. Shubha R, Savkar MK, et al. Self medication pattern among dentists with antibiotics. *Journal of Evolution of Medical and Dental Sciences*. 2013;2(46):9037-9041.
20. Venkataraman G, Gangadharappa SK, Jacob J, et al. Assessment of self-medication practice among students of a dental college of Bangalore city: a cross-sectional study. *J Indian Assoc Public Health Dent*. 2017;15(1):73-77.
21. Chen HF, Lee CH, Chang RE. Workload of attending physicians at an academic center in Taiwan. *J Chin Med Assoc*. 2010;73(8):425-430.
22. Chan FK, Hsu CC, Lin HJ, et al. Physicians as well as non-physician health care professionals in Taiwan have higher risk for lumbar herniated intervertebral disc than general population. *Medicine*. 2018;97(1):e9561.
23. Liu C, Huang CC, Hsu CC, et al. Higher risk for cervical herniated intervertebral disc in physicians: a retrospective nationwide population-based cohort study with claims analysis. *Medicine (Baltimore)*. 2016;95(41):e5055.
24. Chen YT, Huang CC, Weng SF, et al. Acute myocardial infarction: a comparison of the risk between physicians and the general population. *Biomed Res Int*. 2015:2015:904328.
25. Lin HY, Weng SF, Lin HJ, et al. Peptic ulcer disease in healthcare workers: a nationwide population-based cohort study. *PLoS ONE*. 2015;10(8):e0135456.
26. Chen MH, Weng SF, Hsu CC, et al. Urolithiasis risk: a comparison between healthcare providers and the general population. *BMC Health Serv Res*. 2016;16:273.
27. Tam HP, Lin HJ, Weng SF, et al. The risk of stroke in physicians: a population-based cohort study in Taiwan. *Epidemiology*. 2017;28(Suppl 1):S48-S53.

**How to cite this article:** Huang W-T, Weng S-F, Hsu C-C, et al. Comparison of the risk of developing lumbar herniated intervertebral disc between dentists and other occupations: A nationwide population-based study in Taiwan. *J Occup Health*. 2019;61:227–234. [https://doi.org/10.1002/1348-9585.12036](https://doi.org/10.1002/1348-9585.12036)