Analysis of The Relationship between Manual Handling and Individual Factors with De Quervain Syndrome in Workers of Heavy Equipment Manufacturing Company PT. K

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Abstract

Introduction: According to the European Occupational Disease Statistics in 2016, as much as 38.1% of Occupational Diseases are Musculoskeletal Disorders. Research in 2013 on the electrical assembly industry in Thailand showed that the most common cause of upper extremity MDS is De Quervain syndrome (DQS) with a prevalence of 13.03%. Previous studies showed that occupational factors are very important as risk factors for DQS, in addition to individual factors. Caused by excessive use of the muscles around the fingers to the wrist, sustained repetitive movements, forceful manual exertion and prolonged static position. In manufacturing industry, the production process need to use tools, machines, and still requires workers for manual work activities and work processes that cannot be replaced by machines. Because manual handling is one of the occupational risk factors for DQS, it is necessary to study DQS in manufacturing industry. This study aims to determine the prevalence of DQS, identify, and analyze the relationship between manual handling and individual factors related to DQS.
Method: This research method is a cross sectional using secondary data of PT K employees' Medical Check-Up (MCU) in 2021. The samples used was all employee's MCU data with total of 1244 samples. Independent variables include manual handling work factors and individual factors, include age, gender, and years of service. The dependent variable is the De Quervain Syndrome. The DQS was diagnosed with Finkelstein test.
Results: A total of 1244 respondents were obtained, with the DQS prevalence 9%. In the analysis of the relationship between manual handling work factor and individual factors (age, sex, and years of service) showed that no significant relationship with suspected DQS in PT K workers. Whereas the multivariate analysis showed that there were no factors that most dominantly influenced DQS, with p>0.05.
Conclusion: There is no significant relationship between manual handling work factor and individual factors on suspected DQS.
Keywords: De Quervain Syndrome, manual handling, finkelstein test

Abstrak

Latar belakang: *Menurut Statistik Penyakit Pekerjaan Eropa pada tahun 2016, 38,1% dari Penyakit Pekerja adalah gangguan musculoskeletal. Penelitian pada tahun 2013 di industri perakitan elektronik di Thailand menunjukkan bahwa penyebab paling umum dari gangguan musculoskeletal pada ekstremitas atas adalah sindrom De Quervain (DQS) dengan prevalensi 13,03%. Studi sebelumnya menunjukkan bahwa faktor-faktor pekerjaan sangat penting sebagai faktor risiko untuk DQS, selain faktor individu. Penyebabnya adalah penggunaan otot yang berlebihan di sekitar jari hingga pergelangan tangan, gerakan berulang yang berkepanjangan, usaha manual yang kuat, dan posisi statis yang berlangsung lama. Dalam industri manufaktur, proses produksi perlu menggunakan alat dan mesin, dan tetap memerlukan pekerja untuk aktivitas kerja manual dan proses kerja yang tidak dapat digantikan oleh mesin. Karena penanganan manual merupakan salah satu faktor risiko pekerjaan untuk DQS, perlu dilakukan studi mengenai DQS di industri manufaktur. Penelitian ini bertujuan untuk menentukan prevalensi DQS, mengidentifikasi, dan menganalisis hubungan antara penanganan manual dan faktor individu yang terkait dengan DQS.*
Metode: *Metode penelitian ini bersifat cross-sectional menggunakan data sekunder dari Medical Check-Up (MCU) karyawan PT K pada tahun 2021. Sampel yang digunakan adalah seluruh data MCU karyawan dengan total 1244 sampel. Variabel independen meliputi faktor kerja penanganan manual dan faktor individu, termasuk usia, jenis kelamin, dan tahun kerja. Variabel dependen adalah Sindrom De Quervain. DQS didiagnosis dengan tes Finkelstein.*
Hasil: *Total responden yang diperoleh adalah 1244, dengan prevalensi DQS sebesar 9%. Dalam analisis hubungan antara faktor kerja penanganan manual dan faktor individu (usia, jenis kelamin, dan tahun kerja) menunjukkan bahwa tidak ada hubungan signifikan dengan dugaan DQS pada pekerja PT K. Sedangkan analisis multivariat menunjukkan bahwa tidak ada faktor yang paling dominan memengaruhi DQS, dengan p>0,05.*
Kesimpulan: *Tidak ada hubungan signifikan antara faktor kerja penanganan manual dan faktor individu terhadap dugaan DQS.*
Kata kunci: *Sindrom De Quervain, penanganan manual, tes Finkelstein.*

Background

According to data from the International Labor Organization (ILO) in 2013, as many as 160 million workers are diagnosed with occupational diseases each year, and according to the European Occuaptional Disease Statistic in 2016, as many as 38.1% of occupational disease are musculoskeletal disorders or MSDs.[1] Research in the electrical assembly industry in Thailand, the most common cause of upper extremity MSDs was De Quervain syndrome with a prevalence of 13.03%.[4.]

Several previous studies have suggested that occupational factors are the important risk factors for DQS. These factors include excessive use of muscles from the fingers to the wrist, repetitive movements for a long period of time, forceful movements, and static work postures for long periods of time. The existence of musculoskeletal disorders in workers, if it occurs for a long time, will interfere with the ability of workers and reduce the productivity, efficiency and effectiveness of workers in performing their work.

In manufacturing industry, the production process is carried out using tools, machines and also human labor. The use of machine technology and sophisticated tools still requires workers to perform manual activities and work processes that cannot be replaced by machines. Since manual handling activities are one of the occupational risk factors for the occurrence of De Quervain's syndrome, it is necessary to study De Quervain's syndrome in manufacturing companies.

PT K is a heavy equipment manufacturing company in Indonesia that has perform the MCU program and has a good relationship with the university, in this case the University of Indonesia, so it is worthy to be a research site. In addition to work factors, it is also necessary to analyze individual factors associated with the presence of DQS.

Methods

This study uses the Cross Section method using secondary data, the results of the 2021 MCU of PT K workers that conducted at health provider appointed by the company. The sampling method used in the study was the saturated sampling method, a sampling technique in which all members of the population are used as samples. The total sample used was 1244 samples. The independent variable are manual handling and individual factors (age, gender, and length of service), the dependent variable is De Quervain Syndrome. The diagnosis of De Quervain Syndrome is based on the results of the Finkelstein test examination performed during the MCU. From these data, researchers sort samples that are included in the inclusion category, processed and analyzed the data using the SPSS computer program.

Univariate analysis was carried out to see the description of the frequency distribution both the independent variable and the dependent variable. The bivariate analysis used was the Chi-Square Test and also the Odds Ratio (OR) assessment. Bivariate analysist result with p value <0.25 then will be included in the multivariate analysis. The multivariate analysis used was logistic regression analysis because the variables were dichotomous.

Results

Table 1. Distribution of respondents according to individual characteristics

Variable	N=1244	%
Age		
<30 years old	200	16.1
≥30 years old	1044	83.9
Gender		
Male	1193	95.9
Female	51	4.1
Years of service		
<5 years	52	4.2
≥5 years	1192	95.8
Manual Handling		
Yes	243	19.5
No	1001	80.5
BMI		
Underweight-Normoweight	590	47.4
Overweight-Obese	654	52.6
Diabetes		
Yes	181	14.5
No	1063	85.5
Smoking		
Yes	352	28.3
No	892	71.7
Vibration hazard		
Yes	388	31.3
No	856	68.8
DQS		
Yes	112	9
No	1132	91

Table 1 shows that the characteristics of PT K employees are mostly ≥30 years old with 95.9% male. With a cut off working period/years of service of 5 years obtained by ROC calculation, 95.8% of workers have worked for more than 5 years. Most workers had an Overweight-Obese weight category, did not suffer from diabetes and did not smoke. For work factors, only 19.5% of workers do manual handling and 31.3% of employees are exposed to vibration. De Quervain Syndrome occurred in 9% of respondents.

Table 2. The relationship between individual factors and DQS in PT K workers

Individual factors	DQS		Total	P value	OR(CI95%)
	Yes n(%)	No n(%)			
Age					
≥30 years old	94 (9%)	950 (90.9%)	1044	0.999[CS]	1 (0.590-1.697)
<30 years old	18 (9%)	182 (90.9%)	200		
Gender					
Male	6 (11.8%)	45 (88,2%)	51	0.452[F]	1.36 (0.570-3.280)
Female	106 (8.9%)	1087 (91.1%)	1193		
Years of service					
≥ 5 years	107 (9%)	1085 (91%)	1192	0.876[F]	0.927 (0.361-2.381)
<5 years	5 (9.6%)	47 (90.4%)	52		

Table 3. The relationship between manual handling factors and DQS in PT K workers

Manual handling	DQS		Total	P value	OR(CI95%)
	Yes n(%)	No n(%)			
Yes	22 (9.1%)	221 (90.9%)	243	0.976[CS]	1.008 (0.618-1.643)
No	90 (9%)	911 (91%)	1001		

Table 4. The relationship between BMI, diabetes, smoking and vibration exposure and DQS in PT K workers

Variable	DQS		Total	P value	OR(CI95%)
	Yes n(%)	No n(%)			
BMI					
Under-Normoweight	44 (7.5%)	546 (92.5%)	590	0.07[CS]	0.694 (0.467-1.033)
Overweight-Obese	68 (10.4%)	586 (89.6%)	654		
Diabetes					
Yes	22 (12.2%)	159 (87.8%)	181	0.109[CS]	1.496 (0.911-2.455)
No	90 (13.3%)	586 (86.7%)	676		
Smoking					
Yes	34 (9.7%)	318 (90.3%)	352	0.612[CS]	1.116 (0.731-1.703)
No	78 (8.7%)	814 (91.3%)	892		
Vibration exposure					
Yes	38 (9.8%)	350 (90.2%)	388	0.512[CS]	1.147 (0.761-1.730)
No	74 (8.6%)	782 (91.4%)	856		

Table 5. Multivariate analysis of DQS in PT K workers

Variable	B	S.E.	p value	aOR	IK 95%	R^2
BMI	0.391	0.255	0.057	1.479	0.988-2.212	0.013
Diabetes	-0.378	0.206	0.138	0.685	0.416-1.129	
Constant	-1.670	0.615	0.007	0.188		

Table 2 presents the relationship between individual factors and DQS in PT K workers. For the purpose of statistical analysist, the age factor is categorized with a cut off of 30 years according to the reference, categorized in ≥30 years and <30 years. The analysis use the Pearson test, with a two-way p value (significance) of 0.999. Since the p value was >0.05, there was no statistical difference in the proportion of DQS in the ≥30 age group with the <30 age group, with OR value was 1 with 95% CI 0.590-1.697 indicating that the age group had no trend and no significant relationship with DQS.

The gender factor analysist use the Fisher test, with a two-way p (significancy) value was 0.452. With a P>0.05, there was no statistical difference in the proportion of DQS between males and females. The odds parameter or relationship tendency with OR value was 1.367 with 95% CI 0.570-3.280 indicating that statistically male gender has 1.367 times greater tendency than female to have DQS, but there is no significant relationship.

Furthermore, for the purpose of statistical analysist, the years of service factor was categorized with a cut off of 5 years according to the assessment with the ROC curve that had the highest significance value, categorized in ≥5 years and <5 years. The analysis use Fisher test with a two-way p value (significance) of 0.876. Since the P value was >0.05, there was no statistical difference in the proportion of DQS in the group of workers with ≥5 years of service and employees with <5 years of service. OR value was 0.927 with 95% CI 0.361-2.381 indicating that workers that works ≥5-year had a greater tendency to have DQS than the <5-year workers, but there was no significant association with DQS.

Table 3 presents the relationship between manual handling factors and DQS in PT K workers. The analysis use the Pearson test, with a two-way p (significance) value of 0.976. There is no statistical difference in the proportion of DQS in workers with manual handling activities and those who do not perform manual handling activities. The OR value is 1.008 with 95% CI 0.618-1.643 indicating that manual handling activity has no tendency and no significant relationship with DQS.

Table 4 presents the relationship between other individual and occupational factors that are based on references are the risk factors for DQS. BMI factors, for the purpose of statistical analysist, were categorized into underweight-normoweight and overweight-obese. Smoking, diabetes, and occupational vibration exposure factors were categorized into two, yes and no.

In the relationship between the BMI factor and DQS, the P value is 0.07. There is no statistical difference in the proportion of DQS in workers who have BMI in the underweight-normoweight category with the overweight-obese category. The OR value is 0.694 with 95% CI 0.467-1.033. indicating that the overweight-obese group had a greater tendency to have DQS than underweight-normoweight, but there was no significant association with suspected DQS.

In the association between Diabetes factor and DQS, the P value was 0.109. Since the P value was >0.05, there was no statistical difference in the proportion of DQS in workers with diabetes and without diabetes. The OR value of 1.496 with 95% CI 0.911-2.455 indicates that there is no significant relationship between diabetes DQS.

In the association between smoking factor and DQS, the P value was 0.612. Because the value of P>0.05, there is statistically no difference in the proportion of suspected DQS in workers who smoke and those who do not smoke. The OR value of 1.116 with 95% CI 0.731-1.703 shows that there is no significant relationship between smoking and DQS.

In the relationship between occupational vibration exposure to DQS, the P value is 0.512. Since the P value is >0.05, there is no statistically significant difference in the proportion of suspected DQS in workers exposed to vibration and those not exposed. The OR value is 1.147 with 95% CI 0.761-1.730 indicating that there is no significant relationship between vibration exposure and DQS.

The results of multivariate analysis show that there is no most dominant factor affecting De Quervain Syndrome (p>0.005). However, when viewed from the beta value, the most dominant factor affecting De Quervain Syndrome is BMI. The R2 value of 0.013 means that the variables tested, together, affect De Quervain Syndrome by only 1.3%.

Discussion

The finding of De Quervain Syndrome in PT K workers was determined from the results of the 2021 worker MCU examination with a positive Finkelstein test result. From this examination, it was found that 112 workers had De Quevain Syndrome. Based on previous research conducted in 2013 in the electrical assembly industry in Thailand, the prevalence of De Quervain Syndrome was 13.03%. The study was conducted with a walk through survey and was limited to workers in the factory but did not analyze the risk factors. In PT K workers, a prevalence of 9% was found using secondary data, complete with information of work factors and individual factors based on the literature as the risk factors for De Quervain Syndrome. The 9% prevalence rate can be due to the good implementation of OHS program at PT K.

In workers with De Quervain Syndrome, 83.9% are ≥ 30 years old. Based on bivariate analysis, there was no difference in the proportion of DQS in the age group ≥30 years with the age group <30 years and the OR indicating that the age group has no tendency and no significant relationship with DQS. The results of this study differ from the previous case-control study conducted by Stephane Stahl et al in Germany 'Work related etiology of de Quervain's tenosynovitis' 2015) which showed that there was a significant association between age and De Quervain syndrome.[17] This difference may occur due to differences in the age range used. The study used a cut off age of >50 years. Based on the literature, De Quervain Syndrome is associated with degenerative processes due to the influence of age. Muscles have maximum strength when reaching the age of 20-29 years, then after will decrease.

In the relationship between gender factors and De Quervain Syndrome, there is no statistical difference in the proportion of DQS between men and women. The OR indicating that statistically the male sex has a tendency 1.367 times greater than the female to have DQS, but there is no significant relationship. The results of this study differ from the existing literature, which states that there are differences in physiological factors of muscle strength in women that are lower than the muscle strength of men so that they are more susceptible to musculoskeletal disorders. Previous studies have also stated that the prevalence of De Quervain Syndrome is higher in women compared to men, such as research conducted by Adachi 'Prevalence of De Quervain Disease in the General Population and Risk Factors' in Japan (2011) which showed that women have a significantly greater risk of De Quervain syndrome.[18] This difference could be due to the number of female respondents in this study only 4.1% so that it does not represent the female population.

The results of this study are in line with previous research 'Upper Extemities Musculoskeletal Disorders: Prevalence and Associated Ergonomic Factors in an Electronic Assembly Factory' by Somthus Pullopdissakul in Thailand (2013) which showed that there was no significant relationship between upper extremity musculoskeletal disorders, including De Quervain Syndrome with gender.[4]

In the relationship between the years of service factor and De Quervain Syndrome, the P value is 0.805, with OR value was 0.927 with 95% CI 0.361-2.381 indicating that the ≥ 5 years of service group had a greater tendency to have DQS than the < 5 years of service, but there was no significant association with DQS.

From the results of previous cross sectional research conducted in 2011 by Dwi Hariani 'The Relationship of Working Period in Ice Cream Cone Printing Work with the Tendency to Get De Quervain's Tendonitis in Sibolga' shows that working period//years of service has a significant relationship with the tendency of De Quervain Syndrome. A narrative review by Siti Nurhalina 'Relationship between Working Period and Risk of De Quervain Syndrome in Industrial Workers' (2020) concluded that there is a relationship between working period and the risk of developing De Quervain Syndrome.

In the relationship between manual handling factors and De Quervain Syndrome, the P value is 0.976, with OR value is 1.008 with 95% CI 0.618-1.643, indicating that manual handling activities have no tendency and no significant relationship with DQS.

The results of the current study are different from previous cross section research, research conducted

by Audrey Petit Le Manac'h et al 'Risk factors for de Quervain's disease in a French working population' shows that bending, wrist twisting activities are the most significant occupational risk factors associated with De Quervain Syndrome.[3] The results in the current study show different results, possibly due to incomplete information regarding the length of manual handling activities carried out by respondents or because the data collection of manual handling activities is carried out individually by respondents.

However, there is also previous case control research conducted by Stephane Stahl et al in Germany 'Work related etiology of de Quervain's tenosynovitis' 2015) which shows that there is no significant difference in the findings of De Quervain syndrome in workers with manual activities with the control group, with a value of p>0.05.[17]

The relationship between manual handling activities in each department and De Quervain Syndrome was also analyzed. The results of the analysis also showed that there was no significant relationship between manual handling activities and the findings of De Quervain Syndrome in these departments. In addition to the possibilities mentioned earlier, the insignificant relationship may be due to the fact that PT has implemented its OHS program well.

In the relationship between BMI and DQS, the P value was 0.07 with OR value is 0.694 with 95% CI 0.467-1.033 indicating that the overweight-obese group had a greater tendency to have DQS than underweight-normoweight, but there was no significant association with DQS. Some previous studies such as research in Thailand conducted by Harnphadungkit K et al 'Cumulative Trauma Disorders in Laundry Service' in 2018 and research conducted by Audrey Petit Le Manac'h et al 'Risk factors for de Quervain's disease in a French working population' showed that there was a significant relationship between BMI and De Quervain Syndrome.[19]

However, there are also supporting studies such as those conducted by Satoshi Adachi 'Prevalence of De Quervain Disease in the General Population and Risk Factors' in Japan (2011) and research by Stephane Stahl et al in Germany 'Work related etiology of de Quervain's tenosynovitis' (2015) which shows that there is no significant relationship between body weight and the incidence of De Quervain Syndrome.[18]

In the relationship between Diabetes and DQS, the P value was 0.109, with OR value is 1.496 with 95% CI 0.911-2.455 indicating that there is no significant relationship between diabetes and DQS.

According to the literature, DQS is a musculoskeletal disorder in people with diabetes. A study in 2023 by Jiale Guo et al 'Type 2 diabetes and the risk of synovitis-tenosynovitis: a two-sample Mendelian randomization study' showed that diabetes increases the risk of tenosynovitis / De Quervain syndrome with a p value <0.05. However, the researchers obtained different results, and this may be due to the absence of information regarding how long the respondents have had diabetes, which may affect the magnitude of the risk of De Quervain Syndrome.

The results that are in line with the results of this study are research conducted by Satoshi Adachi 'Prevalence of De Quervain Disease in the General Population and Risk Factors' in Japan (2011) and Harnphadungkit K et al 'Cumulative Trauma Disorders in Laundry Service' in 2018 which shows that there is no significant relationship between diabetes and De Quervain Syndrome.[19]

In the relationship between smoking factors and DQS, the P value is 0.612 with the OR value is 1.116 with IK 95% 0.731-1.703 indicating that there is no significant relationship between smoking and DQS. The results of this study are in line with the research of Harnphadungkit K et al and also the study 'Upper Extemities Musculoskeletal Disorders: Prevalence and Associated Ergonomic Factors in an Electronic Assembly Factory' by Somthus Pullopdissakul in Thailand (2013) which showed that there was no significant relationship between smoking and De Quervain Syndrome.[19]

In the relationship between occupational vibration exposure to DQS, the P value is 0.512, with OR value is 1.147 with 95% CI 0.761-1.730 indicating that there is no significant relationship between vibration exposure and DQS. In previous research also conducted by Le Manac'h et al 'Risk factors for de Quervain's disease in a French working population' and Stahl et al research in Germany 'Work related etiology of de Quervain's tenosynovitis' 2015) which showed no significant relationship between vibration exposure and De Quervain Syndrome.[3,17]

The results of multivariate analysis show that there is no most dominant factor affecting DQS (p>0.005). However, from the beta value, the most dominant factor affecting DQS is BMI. The R2 value of 0.013 means that the variables tested, together, affect De Quervain Syndrome by only 1.3%.This study uses secondary

data so that there are limitations to obtaining more complete data. Using secondary data from the MCU questionnaire results has the possibility of errors in filling by responders, although this possibility has been overcome by assistance by MCU officers when filling out the questionnaire. In addition, there is no other information other than that in the MCU questionnaire that might support research, such as information of trauma history, history of arthritis, or activities outside of work which are also become the risk factors for De quervain syndrome.

Conclusion

In this study, it was discovered that 9% of all PT K manufacturing company workers who performed MCU in 2021 experience DQS. Of the 9% of workers with DQS, 83.9% were ≥30 years old, 94.6% were male, 51.8% had worked ≥5 years, 19.6% did manual handling work, 60.7% were in the overweight-obese group, 19.6% had diabetes, 30.4% smoked, and 33.9% were exposed to vibration. Statistically there is no relationship between individual factors such as age, gender, length of service , and manual handling work factors with De Quervain Syndrome in PT K workers.

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