

Original Article



Analyzing decline in quality of life by examining employment status changes of occupationally injured workers post medical care

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Received: Feb 14, 2022

Revised: May 14, 2022

Accepted: May 24, 2022

Published online: Jul 18, 2022

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ABSTRACT

Background: This study aimed to investigate the decline in quality of life (QOL) by examining changes in the employment status of workers who had completed medical treatment after an industrial accident.

Methods: This study utilized the Panel Study of Worker's Compensation Insurance cohort (published in October 2020) containing a sample survey of 3,294 occupationally injured workers who completed medical care in 2017. We divided this population into four groups according to changes in working status. A multivariate logistic regression model was utilized for evaluating QOL decline by adjusting for the basic characteristics and working environment at the time of accident. Subgroup analysis evaluated whether QOL decline differed according to disability grade and industry group.

Results: The QOL decline in the “maintained employment,” “employed to unemployed,” “remained unemployed,” and “unemployed to employed” groups were 15.3%, 28.1%, 20.2%, and 11.9%, respectively. The “maintained employment” group provided a reference. As a result of adjusting for the socioeconomic status and working environment, the odds ratios (ORs) of QOL decline for the “employed to unemployed” group and the “remained unemployed” group were 2.13 (95% confidence interval [CI], 1.51–3.01) and 1.47 (95% CI, 1.13–1.90), respectively. The “unemployed to employed” group had a non-significant OR of 0.76 (95% CI, 0.54–1.07).

Conclusions: This study revealed that continuous unemployment or unstable employment negatively affected industrially injured workers' QOL. Policy researchers and relevant ministries should further develop and improve “return to work” programs that could maintain decent employment avenues within the workers' compensation system.

Keywords: Quality of life; Employment status; Workers' compensation; Return to work

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Competing interests

The authors declare that they have no competing interests.

Author Contributions

Conceptualization: Lee WT, Won JU; Formal analysis: Lim SS; Methodology: Lee WT, Lim SS; Project administration: Won JU; Software: Lee WT, Lim SS; Supervision: Won JU; Validation: Lim SS; Visualization: Lee WT, Lim SS; Writing - original draft: Lee WT; Writing - review & editing: Kim MS, Baek SU, Yoon JH, Won JU.

BACKGROUND

Industrial accidents can cause considerable loss or decrease of workers' labor force and affect them in terms of not only economic losses but also their lives after medical care completion.¹⁻³ Consequently, the significance of efforts toward preventing industrial accidents has been emphasized, and interest in workers' rehabilitation, return to work, and subsequent quality of life (QOL) has been continuously increasing.^{4,5} The completion of medical care for workers affected by industrial accidents has a medical perspective; in this regard, after workers' recovery from illness or injury, their QOL changes. The social perspective includes enabling workers to return to work after the completion of medical care and helping them go back to their pre-accident lives, as far as possible.

QOL refers to overall health (encompassing physical and mental health as well as social relationships), and is related to family relationships, finances, work, community, health, freedom, and societal values.^{6,7} Industrial accidents severely impact workers' family relations, interpersonal relations, economic level, psychological aspects and QOL. Studies have shown that medical services, vocational rehabilitation programs, and social support are among the factors that affect the QOL after an industrial accident, and among them, social return through return to work plays an important role in improving workers' QOL.^{8,9} Failure to return to work can reduce workers' meaningful activities and increase the risk of social isolation; furthermore, it can reduce their self-efficacy.¹⁰ This return to work is affected by various factors, such as sex, age, demographic information, impairment, injury severity, occupation, length of service, economic factors, and return to work programs.^{11,12} However, the life of an occupationally injured worker cannot be restored only by return to work; daily life and work may also pose various problems.¹³ Nevertheless, workers who return to work after medical care tend to move away from policy support.¹⁴ Therefore, the measurement of workers' QOL after medical care, can be used as an indicator to evaluate the quality of the provided services.¹⁵

Studies have examined issues related to industrially injured workers' return to work during or immediately after care^{16,17}; however, research on changes in workers' status after the end of the treatment remains insufficient. In particular, few research papers have examined workers' QOL by continuously observing working status after return to work. Therefore, this study investigated whether subsequent changes in working conditions could affect workers injured in occupational accidents. A panel study that investigated the 1st and 2nd years after the completion of medical care was used to assess whether changes in working status affect QOL, and identify the type of such effects based on the disability grade and industry group type.

METHODS

Data and study population

This study utilized data from the Panel Study of Worker's Compensation Insurance (PSWCI) cohort established by the Korea Workers' Compensation & Welfare Service (KCOMWEL). This panel was created to collect data annually on the socioeconomic characteristics and labor market performance of industrial accident workers after completion of medical care, and to build data that contribute to policy establishment and development of the industrial accident insurance system. This survey was administered to 75,392 workers who had suffered an industrial accident and whose medical care was terminated between January and December

2017. Among them, the panel data were collected from 3,294 workers who were selected proportionally by sex and age after allocating by disability grade; furthermore, 2,965 people were retained until the second survey (90% retention rate). For data collection, a one-on-one personal interview was conducted using a tablet PC. Furthermore, this study examined 2,951 participants (14 people, whose working status was that of family workers, were excluded) to observe certain changes in working status after industrial accident-related medical care. The secondary source datasets analyzed in this study are available at the KCOMWEL repository, <https://www.comwel.or.kr/Researchinstitute/lay1/S1T20C187/contents.do>.

Variables

In the case of QOL, in response to overall satisfaction with housing, living, and social relationships in daily life, five categories of ordinal scales from 1; very dissatisfied to 5; very satisfied were used. This measuring method utilized the subjective indicators approach using subjective qualitative indicators, and this method has been widely used and has extensive literature proving its validity and reliability.¹⁸⁻²¹ The difference between the first and second responses indicated whether QOL deteriorated, remained the same, or improved.

The workers' working statuses for 2018 and 2019 were noted after the completion of medical care, divided into employment and unemployment statuses, with family workers excluded. Returned-to-work, re-employed, and self-employed persons were included under the employed category. The variable of employment status was answered by all participants, so the status for 2018 and 2019 can be obtained. Change in working status was divided into four groups: "maintained employment," "remained unemployed," "employed to unemployed," and "unemployed to employed."

Variables used in other studies were adjusted for sex, age, education level, and income. Age was classified into 30s and younger, 40–49, 50–59, and 60 years or older as given by the panel, and education level was classified into college or higher, high school graduation, middle school graduation or lower education. Household income was the sum of all earned and unearned income in 2018, including social insurance benefits, property income and financial income and was divided into quartiles (lowest [1Q] to highest [4Q]). Furthermore, the industry, and size of the workplace were indicated with regard to the particular workplace where the industrial accident had occurred, and the total number of hours worked at that time were divided based on the 52 hour-rule of the Korean Labor Standards Act. The characteristics of work performed before the occurrence of an industrial accident were adjusted through these variables. Industries were classified according to the Korean Standard Industrial Classification based on the International Standard Industrial Classification. In South Korea, the manufacturing and construction industries account for more than half of all industrial accidents; KCOMWEL has, similarly, used the above mentioned classification and divided industries into manufacturing, construction, and other industries.¹ In addition, the size of the workplace was divided into less than 5, 5–9, 10–29, and 30 or more according to the number of workers. The current study's assessment of the level of disability follows the disability levels specified by the Occupational Safety and Health Act of Korea; thus, a lower grade indicates a higher disability level. The grades were divided into three categories: grades 1 to 7 (high), grades 8 to 14 (low), and no disability grade.

Statistical analysis

After evaluating the study participants' baseline general characteristics, a χ^2 test of the demographic and occupational characteristics at the time of the occupational accident was

performed to identify any significant differences between the changes in QOL. Multivariate logistic regression analysis was performed after adjusting for factors related to the individual characteristics of workers and the work environment at the time of the industrial accident; this was done to understand how changes in working status affected QOL after medical care had been provided to occupationally injured workers. Subgroup analysis was performed to evaluate whether QOL decline differed based on the disability grade and the industry group. Analysis results with a *p*-value of 0.05 or less were considered significant, and all analyses were performed using R version 3.6.3 (R Project for Statistical Computing, Vienna, Austria).

Ethics statement

This study was approved by the Institutional Review Board of the author's institution (approval number: 4-2021-1744).

RESULTS

This study recruited 2,951 participants who were retained until the second survey was conducted. **Table 1** presents the sociodemographic characteristics and changes in QOL of the study subjects. The following results were obtained regarding patterns of change in employment status type: 2,451 subjects were in the “maintained employment” group, 199 in the “employed to unemployed” group, 728 in the “remained unemployed” group, and 394 in the “unemployed to employed” group. Males (2,438 persons) accounted for 82.6% of the total number of workers. Regarding disability, 318 persons (10.8%) were found to be in grades 1–7 (major disabilities), 2,053 persons (69.6%) in grades 8–14 (relatively low-level disabilities), and 580 (19.7%) had little or no disability. In the industrial group, there were 969 and 933 workers in the manufacturing and construction industries, respectively, accounting for 32.8% and 31.6% of total subjects. The group with the same or improved QOL changed from 3.08 (\pm 0.72) in the first survey to 3.39 (\pm 0.65) in the second survey, and the group with decreased QOL changed from 3.68 (\pm 0.59) to 2.59 (\pm 0.64). And there was a significant difference between the change in employment status and the change in QOL. The decline in QOL of the “maintained employment,” “employed to unemployed,” “remained unemployed,” and “unemployed to employed” groups accounted for 15.3%, 28.1%, 20.2%, and 11.9%, respectively. Furthermore, based on the disability grade, a 23% decline in QOL was observed in grades 1–7, and a 15.6% decline was observed in grades 8–14. **Table 2** shows the results of multivariate logistic regression that evaluated changes in working status and the level of QOL. The “maintained employment” group was used as a reference, and because of adjustment for socioeconomic status and the working environment at the time of the industrial accident, the odds ratio (OR) of the decline in QOL was 2.13 (95% confidence interval [CI], 1.51–3.01) in the “employed to unemployed” group; furthermore, the “remained unemployed” group had an OR of 1.47 (95% CI, 1.13–1.90). In the “unemployed to employed” group, the OR was 0.76 and not significant (95% CI, 0.54–1.07). In the analysis that used the “remained unemployed” group as a reference, the OR of the “employed to unemployed” group was 1.45 (95% CI, 1.51–3.01) (**Supplementary Table 1**).

Table 3 provides subgroup analysis results based on disability class and industry type. When divided by the disability grade, the risk was 3.24 for the “employed to unemployed” group in grades 1–7; likewise, an OR of 2.37 was obtained in grades 8–14. Furthermore, the “remained unemployed” group showed significant results when the disability level was 8–14. Based on industry group, the risk of a decline in construction workers' QOL (i.e., a change in their status from “employed to unemployed”) was 3.52 (95% CI, 1.86–6.56).

Injured workers' QOL and their employment status

Table 1. Changes in QOL according to general characteristics at baseline enrollment and working environment at the time of an industrial accident

Variable	Total (n = 2,951)	Change in QOL		p-value
		Same or improved (n = 2,451)	Decreased (n = 500)	
QOL				
1st survey in 2018	3.18 ± 0.74	3.08 ± 0.72	3.68 ± 0.59	< 0.01*
2nd survey in 2019	3.26 ± 0.71	3.39 ± 0.65	2.59 ± 0.64	< 0.01*
Employment status change				
Maintained employment	1,630 (55.2)	1,380 (84.7)	250 (15.3)	< 0.01
Employed to unemployed	199 (6.7)	143 (71.9)	56 (28.1)	
Remained unemployed	728 (24.7)	581 (79.8)	147 (20.2)	
Unemployed to employed	394 (13.4)	347 (88.1)	47 (11.9)	
Sex				
Male	2,438 (82.6)	2,032 (83.3)	406 (16.7)	0.394
Female	513 (17.4)	419 (81.7)	94 (18.3)	
Age (yr)				
39 or below	463 (15.7)	372 (80.3)	91 (19.7)	0.371
40–49	605 (20.5)	505 (83.5)	100 (16.5)	
50–59	1,049 (35.5)	881 (84.0)	168 (16.0)	
60 or above	834 (28.3)	693 (83.1)	141 (16.9)	
Education level				
Middle school or below	1,075 (36.4)	918 (85.4)	157 (14.6)	0.011
High school	1,358 (46.0)	1,121 (82.5)	237 (17.5)	
University	518 (17.6)	412 (79.5)	106 (20.5)	
Income				
1Q – Low	736 (24.9)	597 (81.1)	139 (18.9)	0.094
2Q	732 (24.8)	618 (84.4)	114 (15.6)	
3Q	749 (25.4)	611 (81.6)	138 (18.4)	
4Q – High	734 (24.9)	625 (85.1)	109 (14.9)	
Disability grades				
1–7 (High)	318 (10.8)	247 (77.7)	71 (22.3)	< 0.01
8–14 (Low)	2,053 (69.6)	1,733 (84.4)	320 (15.6)	
No grade	580 (19.7)	471 (81.2)	109 (18.8)	
Working hours				
≤ 52 hours (Normal)	2,368 (80.2)	1,978 (83.5)	390 (16.5)	0.186
> 52 hours (Long)	583 (19.8)	473 (81.1)	110 (18.9)	
Industry category				
Manufacturing	969 (32.8)	802 (82.8)	167 (17.2)	0.417
Construction	933 (31.6)	787 (84.4)	146 (15.6)	
Other	1,049 (35.5)	862 (82.2)	187 (17.8)	
Size of enterprises				
< 5 persons	544 (18.4)	433 (79.6)	111 (20.4)	0.023
5–9 persons	701 (23.8)	604 (86.2)	97 (13.8)	
10–29 persons	779 (26.4)	648 (83.2)	131 (16.8)	
≥ 30 persons	927 (31.4)	766 (82.6)	161 (17.4)	

Values are presented as mean ± standard deviation or number (%).

QOL: quality of life.

*Tested through t-test.

DISCUSSION

This study investigated whether certain changes in working status after an industrial accident-related medical treatment were related to changes in workers' QOL. Our findings confirmed that there was an increased risk of decline in QOL when workers remained unemployed or when their status changed from employed to unemployed after an industrial accident. This result was also significant when the variables impacting QOL were adjusted in previous studies. Moreover, the ORs of income, disability grade, long working hours, and workplace environment with less than five employees were not statistically significant, although they were marginally high; this result also agreed with previous studies.^{22,23} A decline in QOL

Table 2. Odds ratio of a logistic model for assessing changes in working conditions related to a decline in QOL

Variable	Model 1 ORs (95% CI)	Model 2 ORs (95% CI)	Model 3 ORs (95% CI)
Employment status change			
Maintained employment	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Employed to unemployed	2.16 (1.54–3.03)	2.22 (1.57–3.12)	2.13 (1.51–3.01)
Remained unemployed	1.40 (1.11–1.75)	1.52 (1.20–1.94)	1.47 (1.13–1.90)
Unemployed to employed	0.75 (0.54–1.04)	0.76 (0.54–1.06)	0.76 (0.54–1.07)
Sex			
Male		1.00 (Reference)	1.00 (Reference)
Female		1.11 (0.85–1.45)	1.12 (0.84–1.48)
Age (yr)			
39 or below		1.00 (Reference)	1.00 (Reference)
40–49		0.89 (0.64–1.22)	0.90 (0.65–1.24)
50–59		0.90 (0.66–1.22)	0.95 (0.70–1.30)
60 or above		0.96 (0.68–1.36)	1.05 (0.73–1.49)
Education level			
Middle school or below		1.00 (Reference)	1.00 (Reference)
High school		1.40 (1.09–1.80)	1.39 (1.08–1.79)
University		1.69 (1.22–2.33)	1.65 (1.18–2.32)
Income			
1Q – Low		1.27 (0.95–1.71)	1.24 (0.91–1.71)
2Q		1.02 (0.76–1.37)	1.02 (0.76–1.38)
3Q		1.30 (0.98–1.72)	1.29 (0.97–1.71)
4Q – High		1.00 (Reference)	1.00 (Reference)
Disability grades			
1–7 (High)			1.22 (0.84–1.79)
8–14 (Low)			0.89 (0.68–1.16)
No grade			1.00 (Reference)
Working hours			
≤ 52 hours (Normal)			1.00 (Reference)
> 52 hours (Long)			1.19 (0.92–1.54)
Industry category			
Manufacturing			1.00 (Reference)
Construction			0.98 (0.75–1.28)
Other			1.00 (0.78–1.29)
Size of enterprises			
< 5 persons			1.26 (0.95–1.68)
5–9 persons			0.82 (0.62–1.10)
10–29 persons			1.00 (0.77–1.29)
≥ 30 persons			1.00 (Reference)

QOL: quality of life; OR: odds ratio; CI: confidence interval.

was more evident in the group that received the disability grade compared to the group that lacked a disability grade; furthermore, based on the industry group, the decline was higher when workers in the construction industry experienced a change in their status, from “employed to unemployed.”

Table 3. Odds ratio of change in working status and decline in QOL according to the classification of disability grades and the industrial category (“Maintained employment” group is a reference)

Variable	Disability grades			Industrial category		
	1–7 (High) ORs (95% CI)	8–14 (Low) ORs (95% CI)	No grades ORs (95% CI)	Manufacturing ORs (95% CI)	Construction ORs (95% CI)	Others ORs (95% CI)
Employment status change*						
Maintained employment	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Employed to unemployed	3.24 (0.94–11.1)	2.37 (1.53–3.61)	1.46 (0.70–2.90)	1.84 (0.95–3.42)	3.52 (1.86–6.56)	1.65 (0.91–2.89)
Remained unemployed	1.42 (0.68–3.08)	1.57 (1.15–2.15)	1.23 (0.63–2.33)	1.61 (1.02–2.50)	1.40 (0.88–2.23)	1.55 (0.99–2.44)
Unemployed to employed	0.64 (0.13–2.35)	0.81 (0.53–1.20)	0.76 (0.35–1.54)	0.80 (0.40–1.50)	0.86 (0.47–1.51)	0.70 (0.39–1.21)

QOL: quality of life; OR: odds ratio; CI: confidence interval.

*The model adjusted for sex, age, education level, income, disability grades, working hours, industry, and size of enterprises.

Life satisfaction after industrial accidents has been reported to change negatively; it has also been acknowledged that QOL of workers who suffered industrial accidents is considerably lower than that of the normal population.^{24,25} A structural equation-based analysis of the effects of physical, psychological, and occupational factors on the life satisfaction of industrial accident-affected workers showed that occupational factors had a significant impact on life satisfaction and that the QOL of those who returned to work was high. Furthermore, depending on their working status after the accident, the workers could be divided into those who returned to their original workplaces and those who sought employment at other workplaces; the life satisfaction, job satisfaction, and even work sustainability of those who returned to their original workplaces were found to be relatively higher.^{26,27} Previous studies examined QOL based on workers' return to work after an industrial accident, in contrast to our study that investigated how certain changes in working status could affect QOL after industrially injured workers achieved post-treatment stability. There were also reports that working status could affect QOL in such patients who had various diseases. For instance, among Hodgkin-lymphoma survivors in Hungary between 2012 and 2015, employment status was found to affect QOL even after adjustment for disease stage, treatment, and side effects.²⁸ Among internationally recruited multiple sclerosis patients, patients' decision to not retire despite the diagnosis affected their QOL, which did not deteriorate after adjusting for the severity of the disease.²⁹ Also, it was found that the risk of deterioration in QOL was higher in the group with a higher education level than in the group with the education level of middle school graduation. Studies have shown that job satisfaction is lower when employed at a lower level than a job requiring one's education level, and the QOL may decrease due to low-demand labor after an industrial accident.³⁰ It can be expected that there may be a greater risk of a decline in QOL if workers with a highly educated worker falls into precarious employment despite the desire to fulfill a social role.

In the subgroup divided by disability grade, in **Table 3**, the OR increases as the disability grade increases in the "employed to unemployed" group. Considering that the OR of workers without a disability grade in the "remained unemployed" group was lower than that of workers with a disability grade (1-7, 8-14), it can be concluded that a more severe deterioration in physical function indicates a higher risk of change in QOL. Also, despite previous studies that disability grade has a great influence on QOL,^{16,27} it does not show a significant effect on change of QOL. In addition, even when classified by disability class, although the confidence interval was not significant in the stratified group with a small number of n, it is impressive that the changes in employment status still have a large impact. It suggests that the degree of social participation and independence from work has a great influence on the current QOL change regardless of the degree of disability. Among the industries, the construction industry stands out and the ratio of daily or casual workers to regular workers is high in this industry.^{31,32} Compared to other industries, this industry is more susceptible to industrial accidents and has higher job instability, which can easily lower QOL.

The KCOMWEL have been providing intensive rehabilitation services to industrially injured workers since 2001, and the "return to work" rate among such workers has achieved quantitative growth (from 25.6% in 2002 to 65.3% in 2018). As of 2018, 54,817 of 84,011 industrially injured workers who completed medical care returned to work. In our study, the number of workers who completed industrial accident treatment in 2017 and were employed the following year was 1,829 (out of 2,951); they accounted for 62.0%, which is a similar figure to that reported in 2018.¹ Nevertheless, the decline in QOL was higher in the "employed to unemployed" group, compared to that in the "remained unemployed"

group; this finding refutes the notion that simply returning to work will positively affect QOL (**Supplementary Table 1**). Workers may have found it difficult to properly adapt to the working environment because of their disability; furthermore, some workers may have been forced to enter an unsuitable working environment.³³ Returning to work and re-employment have important implications; however, employment stability, which indicates whether the obtained job can be maintained, has a considerable meaning. Therefore, rather than simply helping such workers obtain jobs, policy efforts should focus on helping them maintain a stable employment situation at their workplace after their medical care; furthermore, a strong “return to work” support program should be implemented to connect employees to a workplace where it is possible to maintain stable work, based on individual characteristics. Moreover, this study showed that several workers experienced changes in their working status patterns even in the first two years after the medical care; therefore, this change should be recognized and a long-term plan should be considered.

This study provides a nationally representative and more recent picture of the post-rehabilitation situation of workers, compared to previous studies. Furthermore, this study's main strength is that it did not analyze QOL during workers' recuperation or immediately after their return to work; rather, it analyzed changes in the jobs of the injured workers through follow-ups. However, our study has some limitations as well. First, as the cohort lasted several years, it would have been possible to illuminate the post-accident lives of industrially injured workers; however, there was a limit on the study data—that is, two years after completion of the medical care. Therefore, further research is necessary, with a longer follow-up period. Regarding this study's use of working status as a major variable, it was divided into the “employed” and “unemployed” groups. A more detailed explanation would have been possible if the changes were further subdivided (e.g., those who returned to their original workplace, whether they were employed at other jobs, or whether they were self-employed). Moreover, since it is secondary data, it was not possible to obtain quantitative QOL indicators that are comparable to other research and variables for the current working situations. Furthermore, it should be noted that the disability grade of an industrial accident involves merely substituting the physical disability with the grade; this cannot reflect the effect of each worker on the labor force. In this regard, many countries utilize the loss of labor capacity rate; however, in South Korea, compensation and management are carried out based only on the level of physical disability; therefore, it is impossible to understand the effect of disability level on the labor force properly.^{34,35}

CONCLUSION

In conclusion, this study showed how changes in working status after the completion of industrial accident-related medical care are related to a decrease in QOL. “Maintained unemployment” or “unstable employment” hampered restoration of the previous QOL, which is the main purpose of worker compensation provision. Thus, policy researchers and relevant government ministries should further develop and improve “return to work” programs that can maintain decent employment opportunities within the workers' compensation system.

ACKNOWLEDGEMENTS

The authors would like to thank all the participants of the Panel Study of Worker's Compensation Insurance.

SUPPLEMENTARY MATERIAL

Supplementary Table 1

Odds ratio of a logistic model for assessing changes in working conditions related to a decline in QOL ("Remained employed" group is a reference)

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