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Original Article

# The Type of Payment and Working Conditions

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ABSTRACT

*Background:* The type of payment is one of the important factors that has an effect on the health of employees, as a basic working condition. In the conventional research field of occupational safety and health, only the physical, chemical, biological, and ergonomic factors are treated as the main hazardous factors. Managerial factors and basic working conditions such as working hours and the type of payment are neglected. This paper aimed to investigate the association of the type of payment and the exposure to the various hazardous factors as an heuristic study.

*Methods:* The third Korean Working Conditions Survey (KWCS) by the Occupational Safety and Health Research Institute in 2011 was used for this study. Among the total sample of 50,032 economically active persons, 34,788 employees were considered for analysis. This study examined the relation between the three types of payment such as basic fixed salary and wage, piece rate, and extra payment for bad and dangerous working conditions and exposure to hazardous factors like vibration, noise, temperature, chemical contact, and working at very high speeds. Multivariate regression analysis was used to measure the effect of the type of payment on working hours exposed to hazards.

*Results:* The result showed that the proportion of employees with a basic fixed salary was 94.5%, the proportion with piece rates was 38.6%, and the proportion who received extra payment for hazardous working conditions was 11.7%.

*Conclusion:* The piece rate was associated with exposure to working with tight deadlines and stressful jobs. This study had some limitations because KWCS was a cross-sectional survey.



## 1. Introduction

Many studies have been made on various factors that affect the safety and health of workers in various industries, but research on the relation of payment type, as a specific working condition, to the health of workers has been scarce. In particular, the incentive system like piece rate wages, which pay a piece rate for each unit produced or action performed regardless of time, has been reported to affect the health of workers. Although this incentive system, from the employer's point of view, is a way of improving the productivity of workers in that it can induce workers to improve performance, it is also known that it adversely affects workers' health by speeding up on their production or by extending their working hours [1–8]. Recently, studies have demonstrated which type of payment scheme, among various types of payment schemes, elevates the occurrence of accidents in addition to having a negative effect on workers' health [9–14]. However, relatively little research has been carried out on this relationship in Korea. The types of payment are extremely diverse, and they are often applied differently to different employees. Thus, it is not easy to establish a database for each individual unit, including all the data about the various payment systems, working conditions, health status of workers, experiences of accidents, etc. The 3rd Korean Working Conditions Survey (KWCS) conducted by the Occupational Safety and Health Research Institute (OSHRI) in 2011, which contains the above information, is a unique empirical set of data that can be used for the analysis of the relationship between various payment schemes and working conditions.

The payment schemes are of various types. The earned income, which is paid as a wage, is generally composed of the fixed basic

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salary and wage, piece rates, and extra payment for overtime, bad and dangerous working conditions, Sunday work, and another payment based on profit sharing, etc. Among these payment schemes, those related to occupational health and safety are piece rate, extra payment for overtime, holiday work, bad and dangerous working conditions, etc. Most of these types result in the extension of the working hours and increase the exposure of workers to hazardous factors, which in turn will eventually affect the health of the workers. In general, productivity can be regarded as the most important criterion that companies use to determine the payment scheme for their employees. If these payment schemes adopted for improvement of productivity unexpectedly cause negative impacts on workers' health, then the expected benefits from the productivity improvements will be reduced.

This study identified various payment types that are being applied to the workers in Korea and conducted comparative analyses on the corresponding working hours exposed to hazards. Through these comparative analyses, the types of payment, as working conditions, which have the potential to negatively affect the workers' health were determined. Using the results of this study, we hope to find a strategy that can reduce the negative effect of payment schemes.

## 2. Materials and methods

In this study, differences in various aspects of the work environments depending on the type of payment were examined by using the data from the 3rd KWCS conducted by OSHRI. The following items were included in the data as the measured items of the individual payment scheme: the basic fixed salary and wage, piece rate, and extra payment for additional work and overtime, holiday work, bad and dangerous working conditions. In this study, the three questions asking which case was applicable to the respondents were used: basic fixed salary/wage, piece rate or productivity payments, extra payments compensating for bad or dangerous working conditions. Working environments was set as a dependent variable in this study, which refers to the status of exposure to hazardous factors per week. The survey questions about the hazardous factors are shown in Table 1, which use a 7-point scale except two questions, "work with enough time" and "stressful job", which use a 5-point scale. In these questions, levels of exposure to physical, chemical, biological, ergonomic, and psychosocial factors were included. In addition, working hours and discretions in job, which are included in the category of working conditions, were also included in the working environments in broad sense. Specifically, physical factors included vibrations, noise, high temperatures, low temperatures, and dust, whereas chemical factors included exposure to organic solvents, skin contact with chemical materials, and tobacco smoke from other people. Biological factors included direct contact with infectious substances, whereas ergonomic factors included painful positions, lifting or moving people, carrying or moving heavy loads, standing, repetitive hand or arm movements. Psychosocial factors included work with high speed required, work with tight deadlines, work with enough time, and stressful jobs.

As one of the occupational characteristics, the types of occupation were categorized into the following three categories. The first one is managerial, professional, and clerical occupations. The second one is services and sales occupations. The third one is skilled, unskilled, and operative occupations and the others. The types of economic sectors were classified into the following four categories: agriculture, fishing, and mining; manufacturing; construction; service and others.

The number of working hours per week with exposure to the various hazardous factors was used for the computation of the integrated index as a dependent variable. The integrated index was the sum of working hours exposed to 16 hazardous factors such as physical, chemical, biological, and psychosocial hazardous factors. The working hours exposed to hazardous factors was obtained by multiplying working hours per week by the degree of exposure (converting "all of the time" to 1, "almost all of the time" to 0.95, around 3/4 of the time to 0.75, half of the time to 0.5,

**Table 1**
Working hours per week exposed to various hazardous factors, compared between workers with and without each type of payment*

| Hazardous factor | | Basic fixed salary | | Piece rate | | Payment compensating for bad and dangerous work conditions | |
|---|---|---|---|---|---|---|---|
| | | Yes | No | Yes | No | Yes | No |
| Work hours per week | | 32,889 | 1,899 | 13,427 | 21,361 | 4,087 | 30,700 |
| Physical factors | Vibration from tools on hand, machinery, etc. | 7.68 | 10.05 | 7.33 | 8.12 | 12.35 | 7.21 |
| | Noise so loud that you would have to raise your voice to talk to people | 6.06 | 8.32 | 5.84 | 6.41 | 10.29 | 5.64 |
| | High temperatures which make you perspire even when not working | 5.13 | 9.70 | 4.88 | 5.69 | 10.70 | 4.67 |
| | Low temperatures whether indoors or outdoors | 3.50 | 7.06 | 3.69 | 3.69 | 8.45 | 3.06 |
| | Breathing in smoke, fumes (such as welding or exhaust fumes), powder or dust (such as wood dust or mineral dust) | 5.41 | 10.07 | 4.56 | 6.35 | 8.27 | 5.31 |
| Chemical factors | Breathing in vapors such as solvents and thinners | 1.89 | 2.68 | 1.74 | 2.05 | 3.23 | 1.76 |
| | Handling or being in skin contact with chemical products or substances | 2.11 | 2.69 | 1.81 | 2.34 | 3.42 | 1.97 |
| Biological factors | Tobacco smoke from other people | 2.63 | 4.87 | 2.24 | 3.08 | 3.35 | 2.68 |
| | Handling or being in direct contact with materials which can be infectious, such as waste, bodily fluids, laboratory materials, etc. | 1.29 | 1.75 | 1.11 | 1.45 | 2.07 | 1.22 |
| Ergonomics factors | Tiring or painful positions | 12.98 | 17.59 | 11.45 | 14.35 | 15.79 | 12.89 |
| | Lifting or moving people | 2.77 | 3.61 | 2.59 | 2.96 | 3.81 | 2.68 |
| | Carrying or moving heavy loads | 8.59 | 15.79 | 6.89 | 10.31 | 10.98 | 8.72 |
| | Standing | 18.18 | 24.18 | 15.07 | 20.67 | 19.58 | 18.37 |
| | Repetitive hand or arm movement | 21.96 | 26.65 | 19.71 | 23.79 | 25.68 | 21.76 |
| Psychosocial factors | Working at very high speed | 0.27 | 0.35 | 0.27 | 0.28 | 0.39 | 0.26 |
| | Working to tight deadline | 0.24 | 0.24 | 0.26 | 0.23 | 0.38 | 0.23 |
| | You have enough time to get the job done | 3.31 | 3.00 | 3.38 | 3.24 | 3.36 | 3.28 |
| | You experience stress in your work | 2.94 | 2.68 | 3.05 | 2.85 | 2.83 | 2.94 |

* All statistics of *t* value are significant at the level of 0.01 except for low temperature and work with high speed between piece rate applied group and non-applied group.

"around 1/4 of the time to 0.25, and "almost never" to 0). To examine the effect of the type of payment on the hours of exposure to hazardous factors, the independent variables included three dummy variables created from four types of combinations of piece rate and extra payment for bad and dangerous working conditions. Sociodemographic and occupational characteristics were included as control variables.

Simple descriptive statistical analysis was used for analyzing the status of each payment scheme primarily from the working-condition survey, whereas the mean difference test and the cross-tabulation analysis were used to identify the sociodemographic and occupational characteristics of respondents. Finally, multivariate regression analysis was used to measure the effect of each payment type on working hours with exposure to the various hazards.

## 3. Results

The total number of employees who were included in the analysis was 34,788 or 69.5% of the total respondents in KWCS. Among them, 27,566 (79.2%) were full time employees, 4,958 (14.3%) were temporary employees, and 2,264 (6.5%) were daily employees. Most of the respondents (94.5%) were classified into the basic fixed salary and wage group. The percentage of the cases with piece rate was 38.6%. Employees with extra payment for overtime, bad and dangerous working conditions, and holiday work were 35.6%, 11.7%, 28.5% respectively. Cases with payment based on the performance of the company was found to be 11.3%, and the cases with income from shares in the company were only 5.1%.

From the results of the analysis for identifying whether the fixed basic salary and wage and piece rate differed depending on the general characteristics, the fixed basic salary showed statistically significant variations between different age groups, occupations, economic sectors, income levels, and employment types, except for gender (Table 2). The piece rate showed statistically significant variations for all of the characteristics. The proportions of the cases with the piece rate were shown to be higher in the following groups: males, age 30–39 years, manufacturing, managerial, professional and clerk, high-income groups, and full-time employees in each characteristic. It is considered that more in-depth analysis needs to be conducted as a future study to identify the reason why the proportion of the piece rate workers appeared to be higher in managerial, professional, and clerical occupations than in services and sales or production occupations.

**Table 2**
The distribution of percentage of the type of payment by general characteristics

| Characteristics | Category | Mean fixed basic salary | Mean piece rate | Mean payment compensating for bad and dangerous work conditions |
|---|---|---|---|---|
| Gender | Male (20,533) | 94.7 | 45.1 | 14.9 |
| | Female (14,255) | 94.3 | 29.3 | 7.2 |
| Age (y) | 15–19 (429) | 76.1 | 10.6 | 4.5 |
| | 20–29 (6,958) | 95.7 | 33.5 | 9.0 |
| | 30–39 (9,881) | 97.5 | 47.8 | 13.4 |
| | 40–49 (9,262) | 94.9 | 43.3 | 13.3 |
| | 50–59 (5,902) | 92.4 | 33.2 | 11.8 |
| | ≥ 60 (2,355) | 86.1 | 15.1 | 7.7 |
| Industry | Agriculture, fishery, forest, mining (140) | 71.8 | 27.6 | 13.4 |
| | Manufacturing (7,101) | 97.7 | 46.8 | 17.7 |
| | Construction (2,698) | 85.7 | 32.0 | 14.1 |
| | Service (24,848) | 94.7 | 37.0 | 9.8 |
| Occupation | Clerk (15,790) | 98.6 | 48.9 | 11.2 |
| | Service & sale (6,558) | 93.7 | 33.3 | 7.5 |
| | Productive (12,440) | 89.8 | 28.3 | 14.7 |
| Type of employment | Full time (27,566) | 98.3 | 44.9 | 13.5 |
| | Temporary (4,958) | 88.3 | 16.3 | 6.1 |
| | Daily (2,264) | 62.9 | 10.6 | 3.4 |
| | Total (34,788) | 94.5 | 38.6 | 11.7 |

The results of the analysis identified whether working hours exposed to hazardous factors differed depending on the payment of the fixed basic salary, piece rate, and extra payment for bad and dangerous working conditions. As shown in Table 1, the group subjected to the fixed basic salary was found to be more exposed to the hazardous factors during working hours than the group that was not eligible for the fixed basic salary. However, as for standing or walking, repeated movement of hands and arms, and strict deadlines, no difference was observed. However, work with enough time for work-completion and work-related stress appeared to be higher in the group who received a fixed basic salary. In the relationship between the piece rate and working hours with exposure to hazardous factors, working hours with exposure to physical, chemical, biological, and ergonomic hazardous factors were shown to be less in the group eligible for piece rate than in the group not eligible for piece rate. However, piece rate did not have an effect on work with high speed, whereas work involving tight deadlines and work-related stress were shown to be higher in the group eligible for piece rate; also, work with enough time for work-completion was shown to be higher in the group eligible for piece rate. The working hours with exposure to physical, chemical, biological, ergonomic, and psychosocial hazardous factors were shown to be higher in the group eligible for extra payment for bad and dangerous working conditions. However, work-related stress was shown to be lower in the group subjected to extra payment for bad and dangerous working conditions than in the group that was not subjected to it.

Working hours with exposure to the various hazards per week were computed for a total of 16 hazardous factors. For multivariate regression analysis, the integrated index was composed and computed by adding up all of these weekly working hours of exposures to each of the 16 hazards. The variables relating to the category of work with enough time and work-related stress were excluded from the computations of the integrated index for exposed working hours because the two variables were measured in a 5-point scale. The effect of the types of payment on the integrated working hours of exposure was analyzed using multiple regression analysis. As shown in Table 3, there was difference between male and female employees. In male employees, the integrated working hours of exposure were longer for the group to receive both piece rate and extra payment for bad and dangerous working conditions, compared with the group that was not eligible for either the piece rate or extra payment for bad and dangerous working conditions. In addition, the integrated working hours of exposure were shown to be longer for the group subjected to the extra payment for bad and dangerous working conditions. However, the integrated working hours of exposure were shown to be shorter for the group subjected only to the piece rate than for the group subjected to neither the piece rate nor extra payment for bad and dangerous working conditions. But female employees with piece rate and extra payment for bad and dangerous working conditions simultaneously have not shown statistically significant difference of working hours exposed to 16 hazards compared with the reference group. The other categories of the type of payment have shown the same effect in male employees. From the results of the analysis, it is observed that the piece rate has influenced the integrated working hours of exposure more negatively when combined with the extra payment for bad and dangerous working conditions rather than by itself.

**Table 3**
The result of multiple regression analysis of the sum of exposed working hours per week for 16 hazards

| Characteristics | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Nonstandardized regression coefficient (B) | Standardized regression coefficient (β) | *t* | Nonstandardized regression coefficient (B) | Standardized regression coefficient (β) | *t* |
| Constant | 64.336 | | 11.067‡ | 17.564 | | 3.508‡ |
| Age | −0.450 | −0.046 | −8.102‡ | 0.073 | 0.011 | 1.365† |
| Work hours/wk | 4.227 | 0.452 | 82.807‡ | 4.112 | 0.618 | 94.994‡ |
| Educational level | −3.880 | −0.089 | −12.731‡ | −1.631 | −0.058 | −6.635‡ |
| Temporary employees | 12.314 | −0.033 | 5.981‡ | 8.953 | 0.041 | 6.180‡ |
| Daily employees | 46.613 | 0.097 | 15.946‡ | −1.267 | −0.003 | −0.507‡ |
| Managerial professional clerk§ | −62.935 | −0.271 | −37.832‡ | −51.327 | −0.299 | −27.521‡ |
| Service and sales§ | −44.976 | −0.132 | −21.714‡ | −25.091 | −0.130 | −14.221‡ |
| Agriculture fishery forest mining‖ | 24.801 | 0.012 | 2.315† | −16.995 | −0.014 | −2.286† |
| Manufacturing‖ | 34.451 | 0.129 | 23.298‡ | 14.617 | 0.060 | 8.827‡ |
| Construction‖ | 45.382 | 0.128 | 22.515‡ | −8.593 | −0.013 | −2.125† |
| Piece rate and extra payment for bad working conditions¶ | 14.249 | 0.038 | 6.933‡ | 2.107 | 0.006 | 0.909 |
| Extra payment for bad working conditions¶ | 27.603 | 0.049 | 9.193‡ | 9.843 | 0.014 | 2.350† |
| Piece rate¶ | −7.943 | −0.033 | −5.707‡ | −11.661 | −0.058 | −8.990‡ |
| *R* square | 0.449 | | | 0.476 | | |
| *F* value | 1,290.282‡ | | | 996.625‡ | | |

*$p < 0.10$.
†$p < 0.05$.
‡$p < 0.01$.
§ Reference group is skilled, unskilled and operative occupations.
‖ Reference group is service industry.
¶ Reference group is without piece rate and extra payment compensating for bad and dangerous working conditions.

## 4. Discussion

The results of this study indicate whether the working environments differed depending on the payment scheme; in particular to determine if the levels of exposure to the hazards varied depending on the types of payment, such as the fixed basic salary, piece rate, and extra payment for bad and dangerous working conditions. The levels of exposure to physical, chemical, and biological hazard factors were shown to be higher for the cases that were not eligible for the fixed basic salary and were eligible for the extra payment for bad and dangerous working conditions. However, they were shown differently for those working for a piece rate. Generally, the piece rate is known to increase workloads. In the results of this study, the effects of piece rate were shown to be insignificant in work with high speeds, but was significant in work with tight deadlines. In addition, in the cases of extra payment for bad and dangerous working conditions, work hours exposed to hazards were higher in most of the hazardous factors but work stress was lower. The results of the analysis have shown the effect of the payment schemes on the integrated working hours with exposure to the various hazards, which were computed by adding up all of these weekly hours of exposures related to the total of 16 hazardous factors. The integrated working hours of exposure were shown to be longer for the group subjected to both the piece rate and extra payment for bad and dangerous working conditions, compared with the group not eligible for either the piece rate or extra payment for bad and dangerous working conditions. However, the piece rate did not increase the integrated working hours of exposure by itself. These results can be interpreted to be related to the finding that the presence of the piece rate made differences only in work with tight deadline and work-related stress in bivariate statistical analysis. However, in the case where both piece rate and extra payment for bad and dangerous working conditions were applied simultaneously, the integrated working hours of exposure were shown to be influenced with statistical significance. Conclusively, the piece rate has increased the working hours of exposure in harmful and dangerous job types.

A number of studies on the issues of piece rate have been conducted [9]. Most of the studies identified that the piece rate system negatively affected workers' health and focused on clarifying the negative correlation with the health of workers by making comparisons between the workers receiving piece rate and those not receiving piece rate. Johansson et al [9] chronologically classified the existing researches on the health effects due to the piece rate system. Recent studies have mainly focused on risk behavior, security, or accident [10–14]. These studies have reported that workers subjected to the piece rate displayed more risky behaviors and experienced accidents more frequently. In addition, the accidents were shown to decrease when the piece rate system was changed into the hourly wage system. The second classification includes researches focusing on the physical burden and burnout [4,15]. In these studies, physical burden was found to be higher by more than twice in the case of workers receiving piece rate than in the case of workers not receiving piece rate. Also, working days were shown to be less in the case of workers receiving piece rate because of higher frequency of burnouts. Studies in the third category focused on musculoskeletal disorders or experiences of work-related injury and pain [16–20]. These studies found that the piece rate increased the number of work-related injuries, pains, and musculoskeletal disorders. The fourth category is related to disability and aging. Workers subjected to the piece rate showed higher number of experiences in disability as well as faster aging [21,22]. Other topics include early retirement [23], mental health [24], ill health symptoms [24], drug use [25], physiological response [26], unstable employment [27,28], etc.

Many of the above studies compare the workers receiving piece rate and those not receiving piece rate, or the workers eligible for piece rate and those eligible only for the fixed basic salary. In

addition, it is actually difficult to find studies on the mechanism that causes the piece rate to lead to the negative health-effects or the accident occurrence, because comparative analyses are mostly used in the process of clarifying the negative health-effects of the piece rate or difference between accident experiences. However, the studies clarifying the physiological responses of workers and the consequential health-effects are partly found. To overcome this limitation, studies are required to have comprehensive verification of the health-effects of the incentive system, the details or reasons for the occurrence of accident, as well as the negative health-effects of the piece rate or the mechanism of the accident occurrences.

In Korea, it is rare to find the cases in which the piece rate is operated independently from the fixed basic salary. In general, the payment scheme that is being widely used includes piece rate under the existing fixed basic salary structure. However, the piece-rate-only scheme is also being taken in a limited number of jobs. Therefore, studies clarifying the negative health-effects of the piece rate or the mechanism of the accident occurrence are needed to be conducted through long-term follow-up observation combined with the categorization of the types of payment schemes that are suitable for the Korean society.

This study has limitations in validating a causal relationship, because it has used the data from the KWCS generated by the cross-sectional survey. Thus, the study focused on the types of payment scheme that can be applied at present and the extent of exposure to hazardous factors at present or recently. Therefore, there are many limitations related to data availability, in conducting the study beyond the correlation analysis. However, considering that many recent studies are focused on the level of risk, such as risk behaviors or hazardous factors, the implications of this study are very important. In general, a harmful effect on health is caused by exposure to hazardous factors. Therefore, this study can be used to elucidate the negative impact of the incentive system on the workers' health, with regard to hazardous factors. Also, the exposure to hazardous factors can induce unsafe behavior, which may lead to accidents. In particular, as shown in the study, job characteristics requiring work with tight deadlines or which cause work-related stress will be able to provide clues for elucidating the mechanisms of negative health effects and the accidents due to the piece rate payment system.

Research on the health effects of the piece rate is an important topic regarding the health status of workers for business organizations, as shown in the U.S. National Occupational Safety and Health Strategy [29]. However, in Korea, social science studies involving work organizations are vulnerable in reality. Therefore, for the health protection of the workers, henceforward it is necessary to conduct studies on the properties of work organization to seek improvements for the organizational operations.

This study elucidated a correlation between payment scheme such as piece rate and extra payment for bad and dangerous working conditions and health of workers. Because the piece rate belongs to the subject of the work organizations or organizational operations, previous studies have focused mainly on physical, chemical, biological, and ergonomic hazardous factors. However, it is necessary to find ways to protect workers' health through studies on the managerial characteristics or the psychosocial factors of the work organization.

The study results show that the workers subjected to the piece rate system experienced more work-related stress or work with tight deadlines than those not subjected to the piece rate. However, the extent of exposure to other physical, chemical, and biological hazard factors was shown to be higher in the group not subjected to the piece rate, which is interpreted as the result of not controlling the various characteristics affecting the exposure to the hazardous factors. However, according to the previous studies, in the case of the piece rate workers, the experiences of work-related accident or injury was observed to become higher as the risk-taking behavior or the intensity of the work was increased to achieve higher productivity. In this regard, it is expected to perform the modeling analysis as a future study to demonstrate that the piece rate has an adverse effect on health and increases work-related accidents, based on the results of this study.

This study may be regarded as heuristic research, and it is difficult to find a study elucidating the effects of the incentive system on the health of workers in Korea. Therefore, in the fields of the occupational safety and health, henceforward it is necessary to conduct further studies on the characteristics of the work organizations on the basis of this study.

This study has many limitations since it used a cross-sectional survey design. In particular, this study remains at the level of correlation between the types of payment, including the piece rate, and working environments. Therefore, the mechanism and causal modeling may be investigated in future studies. In particular, the characteristics of health-effects in the work organization are represented through an indirect pathway, so it is expected that path analysis needs to be developed.

## Conflicts of interest

No potential conflicts of interest related to this article were reported.

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