

# Non-Regular Employment Status Is Associated with Psychological Distress among Young Researchers: A Cross-Sectional Study in Tsukuba, Japan

Tsukasa Takahashi,<sup>1</sup> Daisuke Hori,<sup>2</sup> Tomohiko Ikeda,<sup>1</sup> Yu Ikeda,<sup>1</sup> Nagisa Shiraki,<sup>1</sup> Christina-Sylvia Andrea,<sup>1</sup> Yuh Ohtaki,<sup>3</sup> Shotaro Doki,<sup>2</sup> Yuichi Oi,<sup>2</sup> Shinichiro Sasahara<sup>2</sup> and Ichiyo Matsuzaki<sup>2,4</sup>

<sup>1</sup>Graduate School of Comprehensive Human Sciences, University of Tsukuba, Tsukuba, Ibaraki, Japan

<sup>2</sup>Faculty of Medicine, University of Tsukuba, Tsukuba, Ibaraki, Japan

<sup>3</sup>Hospital Bando, Bando, Ibaraki, Japan

<sup>4</sup>International Institute for Integrative Sleep Medicine, Tsukuba, Ibaraki, Japan

Non-regular employment is increasing and its mental health impact is a globally important problem. In Japan, non-regularly employed researchers are increasing, especially within young age groups, because employment quotas were not sufficiently expanded against rapid increasing number of doctorate holders. It is therefore important to understand the relationship between non-regular employment and mental health. The significance of our research is to contribute to the improvement of researchers' mental health by clarifying the influence of employment status on psychological distress. We conducted a cross-sectional, web-based survey in 2017 via an anonymous, self-administered questionnaire distributed to workers in Tsukuba Science City, Japan. The survey questionnaire items included employment status, psychological distress, occupational stress, sex, age, and income. We analyzed 2,762 valid responses in two categories (1,850 regular employment, 912 non-regular employment) and two subcategories based on age according to the definition of "young researcher" by the Ministry of Health, Labor and Welfare (20-39 years vs. 40-59 years). Psychological distress was defined as a total K6 score of 5 or greater. Binomial logistic regression was used to calculate odds ratios and 95% confidence intervals for psychological distress. Non-regular employment was significantly associated with psychological distress in the age 20-39 group but not in the age 40-59 group. At the age 20-39 group, a negative association was shown between psychological distress and reward from work (i.e., pride in their job, ability utilization, and sense of accomplishment). Support to increase psychological work rewards may be important in reducing psychological distress for young non-regularly employed researchers.

**Keywords:** job stress; non-standard employment; psychological distress; research environment; young researcher  
Tohoku J. Exp. Med., 2019 September, 249 (1), 57-64. © 2019 Tohoku University Medical Press

## Introduction

Recently, the increase of non-regular workers has become a worldwide problem as, according to an International Labor Organization (ILO) report (2016), non-regular employment carries high mental health risks. There is no formal definition of non-regular employment. In general, non-regular employment is understood as employment that deviates from regular employment including full-time and unlimited time (ILO 2016). Non-regular employment includes fixed-term, part-time, dispatch and temporary employment. Non-regularly employed worker numbers are increasing in Japan and they continue to comprise more than 35% of all workers since 2011 (Statistic Bureau of

Japan 2017). Legal reforms on occupational health promulgated in 2018 indicate that the elimination of the unreasonable gap between regular and non-regular employment is one of the most important issues in Japan (Nagase 2018).

The well-being of non-regular workers is a major public concern. A growing number of studies have attempted to clarify the effect of non-regular employment on mental health and previous reports have repeatedly shown that non-regular employment workers are at high risk for mental health issues (Dooley et al. 2000; Dooley 2003; Rosenthal et al. 2012; Rönnblad et al. 2019). In a Japanese study comparing permanent and fixed-term workers, depression scores were higher in fixed-term workers (Inoue et al. 2011). On the other hand, several previous studies have

Received June 6, 2019; revised and accepted September 6, 2019. Published online September 27, 2019; doi: 10.1620/tjem.249.57.

Correspondence: Shinichiro Sasahara, M.D., Ph.D., Faculty of Medicine, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8575, Japan.

e-mail: s-sshara@md.tsukub.ac.jp

indicated no significant associations between non-regular employment and poor mental health (LaMontagne et al. 2014; Tanaka et al. 2017). The social effects of employment status therefore remain controversial.

The inconsistent results from studying the employment status effect on mental health may be due to not considering the effects of age, which is an important confounder. It has been suggested that non-regular employment has a large impact on mental health specifically among young age groups. In a study of workers aged 18-34 in Sweden, the experience of non-regular employment significantly increased the incidence of mental health problems (Canivet et al. 2016). A meta-analysis of studies examining the 18 to 35 years age range in Europe showed that young people with non-regular employment are at increased risk for mental health disorders (Vancea and Utzet 2017). Contrastingly, in the elderly, it has been suggested that non-regular employment may not always adversely affect mental health. A study of workers aged 55-64 years in Australia indicates that employment status is not related to mental health and that the transition from regular to non-regular employment may actually contribute to improvements in mental health (LaMontagne et al. 2014). These conflicting results highlight the need to separately examine young and old age groups with respect to non-regular employment and poor mental health.

In Japan, non-regular employment is increasing among young researchers. The number of doctorate holders increased rapidly in Japan due to a Ministry of Education, Culture, Sports, Science and Technology emphasis policy on graduate schools in 1991. The number of doctoral students, at 7,813 in 1990, ballooned to 15,283 in 2015 (National Institute of Science and Technology Policy 2018). However, it has been reported that the number of non-regularly employed researchers has subsequently increased because employment quotas for researchers were not sufficiently expanded (Kobayashi 2015). This may be partially due to Japan's Labor Contract Law revision of 2013 which states that fixed-term contracts must be converted to permanent employment when the contract term exceeds five years. The purpose of this revision was to stabilize employment but indications abound that this rule is leading to the termination of employment (Shinohara 2016), making it difficult for researchers to work in a permanently employed status (Hamamura 2015). According to official Japanese surveys, the proportion of non-regularly employed researchers was 27.2% in 2007, increasing to 39.2% in 2013 (National Institute of Science and Technology Policy 2015). This report reveals an increase in the percentage of regular employment age 40 and over although the percentage of non-regular employment increased at age 39 and under.

Several studies have been conducted on the mental health of researchers. Most university staff members feel stressed at work, burnout levels are higher among university staff than general staff, and university staff are at higher risk of developing mental disorders than other occupations

(Guthrie et al. 2018). In a study comparing occupational stress among several types of occupations, researchers have shown that the effect of stress enhancers, such as workload and mental workload, are high but stress reducers, such as job control and reward from work, are also high (Kageyama et al. 2001). In researchers, high stress is causative for performance degradation (Cooper 2007). However, there are only a limited number of reports focusing on the association of mental health and employment status among researchers. Considering the increase in non-regular employment among young researchers, it is urgent to disentangle the issue of whether employment status affects mental health or not.

In this study, we conducted a cross-sectional survey in Tsukuba Science City, one of the largest science cities in the world, in which is located a high concentration of research institutes. We have previously surveyed mental health among researchers in Tsukuba Science City (Kageyama et al. 2001; Tomotsune et al. 2009) and the purpose of this new study was to clarify the impact of non-regular employment on the mental health of researchers. We hypothesized that younger researchers (age 39 and under) have greater psychological distress due to non-regular employment than older researchers (age 40 and over).

## Methods

### *Study design and participants*

This web survey for workers was conducted in Tsukuba Science City during February, 2017. The Tsukuba Science City Network consists of 89 organizations, including research institutes, universities, educational funds, local governments, and private enterprises. The Tsukuba Science City Network has conducted Living Condition and Workplace Stress Survey once every five years from 1986 (Kageyama et al. 2001; Tomotsune et al. 2009; Hori et al. 2019). The purpose of this survey is to investigate the mental health status, living conditions, and workplace environments of workers in Tsukuba. In our research, the 7th living Condition and Workplace Stress Survey conducted in 2017 was used secondarily, focusing on researchers' data. Fifty-three organizations, mainly research institutes and educational institutes, participated, with a total of 19,481 workers.

Information on the questionnaire was sent to workers by an e-mail attachment which contained a link to a self-managed questionnaire form. Survey questionnaire items were: employment status, psychological distress, occupational stress, sex, age, marital status, income, work position, exercise habit, smoking status and occupation. Japanese and English version questionnaires were prepared, and either one was selected by the participants.

### *Questionnaire*

The employment status answers were "full-time staff without a fixed term," "full-time staff with a fixed term," "part-time staff" and "dispatched staff." "Full-time staff without a fixed term" was defined as regular employment, and the other employment statuses were defined as non-regular employment. The definition of non-regular employment in our study follows the ILO definition of standard employment, namely "work that is full time, indefinite, as well as part of a subordinate relationship between an employee and an employer" (ILO 2016).

Psychological distress was measured by the K6 Distress Scale (Kessler et al. 2002; Furukawa et al. 2008). This scale is comprised of six question items, each answered in five steps, with total scores ranging from 0 to 24 points and high scores indicate a high level of psychological distress. In this study, we defined that workers had psychological distress if their K6 score was 5 or more (Furukawa et al. 2008).

Evaluation of occupational stress was conducted using the Brief Scales for Job Stress (BSJS) (Nishikido et al. 2000). BSJS consists of 20 questions, whose answers are rated on a 5-point scale, along with subscales. The subscales consist of six categories: “workload,” “mental workload,” “problems in personal relationships,” “job control,” “support from colleges and superiors” and “reward from work.” “Reward from work” in BSJS mainly indicates a psychological reward. Each subscale is scored from 1.0 to 4.0 points.

Occupation selections were “researcher,” “technician,” “clerk” and “other” with additional classification into “manager” and “non-manager.” The income was classified into four groups of “less than 4 million,” “4-8 million,” “8-12 million” and “more than 12 million.” Marital status consisted of three options: “married,” “unmarried” and “disjunction.” Smoking choices were “smoking,” “ex-smoking” and “non-smoking.” The choices of exercise frequency were “less than once a month,” “several times a month,” “1 or 2 times a week” and “3 times a week and more.”

Of the 19,481 employees, 7,255 answered the questionnaire. Participants whose occupations were not researchers were excluded ( $n = 4,273$ ). Participants who had defects in their answers were also excluded ( $n = 26$ ). Participants aged 60 or higher who were nearing retirement were also excluded ( $n = 194$ ). Data from the remaining 2,762 researchers were then analyzed. The 20-59-year-old researcher cohort was further subdivided using age 39 as a cutoff according to the definition of “young researchers” by the Ministry of Health, Labor and Welfare (Harada 2017).

#### *Statistical analysis*

The chi-square test was used to evaluate differences in character for each employment status while the t-test was used to evaluate the mean value of BSJS. To analyze the effects of employment status on psychological distress, logistic regression analysis was performed with psychological distress as the objective variable and odds ratio (OR) and 95% confidence interval (95% CI) were also calculated. All statistical analyses were two-sided tests and the significance level was set at  $p$  value  $< 0.05$ . IBM SPSS for Windows (version 24.0; IBM Corp., Armonk, NY, USA) was used for all statistical analyses.

#### *Ethical considerations*

The web survey contained clear statements that participation was entirely voluntary, that it was an anonymous survey, that the privacy of the respondent would be respected, and that the data would be strictly controlled. In addition, it was clearly stated that participation was assented to submit data for analysis. This research proposal was reviewed and approved by the Ethics Committee of Faculty of Medicine, University of Tsukuba (approval #1374). All procedures were conducted in accordance with the ethical standards of the national research committee and the Helsinki Declaration (or equivalent).

## **Results**

### *Participant characteristics and occupational stress*

Participant characteristics and scores for occupational stress are shown in Table 1. The percentage of researchers who showed psychological distress in non-regular employment was significantly higher than in regular employment for all ages. There was a significant difference in the distribution of age groups for regular and non-regular employment, with 40-49 being the most common for regular employment and 30-39 for non-regular employment. There was also a significant difference in the distribution of income. The largest income group was 8-12 million yen in regular employment, and 4-8 million yen in non-regular employment. Other measured categories, such as occupational stress, workload, mental workload, problems in personal relationships, job control, and reward from work were significantly higher in regular employment and support from colleagues and superiors was significantly higher in non-regular employment.

In the age 20-39 bracket, the proportion of researchers who showed psychological distress was significantly higher in non-regular employment. The regular employment group more often had incomes of 8-12 million yen or more than 12 million yen while non-regular employment incomes were more often less than 4 million yen or 4-8 million yen. With regard to occupational stress, mental workload was significantly higher in the regularly employed personnel in this cohort.

In the age 40-59 group, there was no difference between non-regular and regular employment in the percentage of researchers who showed psychological distress and income trends with respect to regular and non-regular employment were similar to the younger cohort. Meanwhile, occupational stress, workload, mental workload, problems in personal relationships, job control, and reward from work were significantly higher in regularly employed personnel in this group.

### *Relationship between employment status and psychological distress*

A binomial logistic regression analysis was performed with psychological distress as the objective variable (Table 2). In this study, participant characteristics and occupational stress were introduced as explanatory variables in order to evaluate the impact of employment status on psychological distress independently. There was no significant association between psychological distress and employment at all ages (OR: 1.23, 95% CI: 0.99-1.53,  $p = 0.06$ ). Regarding occupational stress, reward from work showed a negative association with psychological distress and mental workload and problems in personal relationships showed a positive association.

A binomial logistic regression analysis was then performed with psychological distress as an objective variable to compare the age 20-39 and age 40-59 groups. A signifi-

Table 1. Descriptions of participant characteristics and occupational stress factors.

	All age				20-39 years old				40-59 years old			
	N	Employment status			Total	Employment status			Total	Employment status		
		Regular	Non-regular	p value		Regular	Non-regular	p value		Regular	Non-regular	p value
Psychological distress	2,762	1,850	912		1,123	542	581		1,639	1,308	331	
No	53.7%	56.4%	48.1%	< 0.01	48.9%	55.9%	42.3%	< 0.01	56.9%	56.6%	58.3%	0.57
Yes	46.3%	43.6%	51.9%		51.1%	44.1%	57.7%		43.1%	43.4%	41.7%	
Sex												
Male	72.6%	81.7%	54.2%	< 0.01	68.7%	76.0%	62.0%	< 0.01	75.3%	84.1%	40.5%	< 0.01
Female	27.4%	18.3%	45.8%		31.3%	24.0%	38.0%		24.7%	15.9%	59.5%	
Age												
20-29	7.3%	3.8%	14.6%		18.1%	12.9%	22.9%	< 0.01	-	-	-	
30-39	33.3%	25.5%	49.1%	< 0.01	81.9%	87.1%	77.1%		-	-	-	
40-49	33.3%	37.9%	23.9%		-	-	-		56.1%	53.6%	65.9%	< 0.01
50-59	26.1%	32.8%	12.4%		-	-	-		43.9%	46.4%	34.1%	
Income												
More than 12 million	19.7%	25.2%	8.6%		10.7%	17.3%	4.5%		25.9%	28.5%	15.7%	
8-12 million	39.3%	49.3%	19.0%	< 0.01	24.4%	36.3%	13.3%	< 0.01	49.5%	54.7%	29.0%	< 0.01
4-8 million	30.7%	23.0%	46.4%		46.2%	40.4%	51.6%		20.1%	15.8%	37.2%	
Less than 4 million	10.2%	2.4%	26.1%		18.7%	5.9%	30.6%		4.5%	1.0%	18.1%	
Position												
Manager	24.9%	33.8%	7.0%	< 0.01	7.5%	9.4%	5.7%	0.02	36.9%	43.9%	9.4%	< 0.01
Non-manager	75.1%	66.2%	93.0%		92.5%	90.6%	94.3%		63.1%	56.1%	90.6%	
Exercise												
Less than once a month	35.0%	34.3%	36.5%		35.5%	34.1%	36.8%		34.7%	34.4%	36.0%	
Several times a month	17.1%	16.0%	19.2%	< 0.01	18.7%	17.3%	20.0%	0.25	15.9%	15.4%	17.8%	0.12
1 or 2 times a week	30.2%	30.0%	30.6%		31.4%	32.5%	30.5%		29.3%	29.0%	30.8%	
3 times a week and more	17.7%	19.7%	13.7%		14.3%	16.1%	12.7%		20.0%	21.2%	15.4%	
Smoking status												
Smoking	8.9%	9.2%	8.3%		9.1%	10.1%	8.1%		8.8%	8.8%	8.8%	
Ex-Smoking	16.4%	18.4%	12.2%	< 0.01	11.5%	12.5%	10.5%	0.23	19.7%	20.9%	15.1%	0.06
Non-smoking	74.7%	72.4%	79.5%		79.4%	77.3%	81.4%		71.5%	70.3%	76.1%	
Marital status												
Married	71.8%	79.5%	56.0%		56.3%	68.8%	44.6%		82.4%	83.9%	76.1%	
Unmarried	25.7%	17.6%	42.1%	< 0.01	42.1%	29.3%	54.0%	< 0.01	14.5%	12.8%	21.1%	< 0.01
Divorced	2.5%	2.9%	1.9%		1.6%	1.8%	1.4%		3.2%	3.3%	2.7%	
Occupational stress												
Workload	2.40 (0.87)	2.50 (0.84)	2.20 (0.89)	< 0.01	2.37 (0.86)	2.40 (0.82)	2.34 (0.89)	0.24	2.43 (0.87)	2.54 (0.84)	1.97 (0.85)	< 0.01
Mental workload	2.44 (0.82)	2.53 (0.77)	2.25 (0.88)	< 0.01	2.49 (0.84)	2.58 (0.80)	2.41 (0.86)	< 0.01	2.40 (0.81)	2.51 (0.76)	1.96 (0.84)	< 0.01
Problems in personal relationships	2.00 (0.77)	2.03 (0.76)	1.93 (0.80)	< 0.01	1.95 (0.79)	1.98 (0.78)	1.92 (0.79)	0.25	2.03 (0.76)	2.05 (0.74)	1.96 (0.82)	0.06
Job control	2.99 (0.73)	3.03 (0.68)	2.92 (0.80)	< 0.01	3.05 (0.75)	3.08 (0.71)	3.02 (0.79)	0.21	2.95 (0.70)	3.00 (0.67)	2.75 (0.78)	< 0.01
Reward from work	3.11 (0.76)	3.15 (0.73)	3.02 (0.81)	< 0.01	3.15 (0.78)	3.19 (0.75)	3.11 (0.81)	0.07	3.08 (0.74)	3.14 (0.72)	2.86 (0.79)	< 0.01
Support from colleagues and superiors	2.83 (0.68)	2.78 (0.65)	2.91 (0.73)	< 0.01	2.97 (0.70)	2.95 (0.68)	2.99 (0.72)	0.31	2.73 (0.65)	2.71 (0.63)	2.78 (0.74)	0.10

Psychological distress, sex, age, income, position, exercise, smoking status and marital status are categorized items. These categorized items are indicated as a percentage and analyzed by chi-square test. Occupational stress is continuous numerical item. Each sub-items of occupational stress are indicated as averages (standard deviation) and analyzed by t-test.

cant positive association was found between non-regular employment and psychological distress in the 20-39 age range (OR: 1.54, 95% CI: 1.14-2.07,  $p < 0.01$ ). In this age bracket, reward from work showed a negative association with psychological distress and workload, mental workload and problems in personal relationships showed a positive association. In the age 40-59 group, there was no significant association between employment status and psychological distress (OR: 0.91, 95% CI: 0.65-1.28,  $p = 0.59$ ) while reward from work showed a negative association with psychological distress and mental workload and problems in personal relationships showed a positive association.

## Discussion

This study focused on the impact of non-regular employment on psychological distress among young researchers (age 20-39 years) in Tsukuba Science City. Binomial logistic regression analysis in this young cohort

indicates that non-regular employment and psychological distress are related, leading to poor mental health mediated by employment insecurity and a perceived threat to employment continuity and stability (Shoss 2017). Although non-regular employment has not been shown to increase employment insecurity, it has been shown that, at the macro level, there is an association between increased unemployment and employment insecurity (Shoss 2017).

A recent review concluded that the majority of surveys on employment insecurity are related to self-reported mental health (Llosa-Fernández et al. 2018), borne out by previous studies showing that mental health was worse among young, non-regularly employed workers and employment insecurity may be particularly large in this group (Canivet et al. 2016; Vancea and Utzet 2017). There has been no research that has yet evaluated the employment insecurity of non-regularly employed researchers. Future studies should therefore investigate the association between employment insecurity and psychological distress in young,

Table 2. Odds ratios for psychological distress associated with employment status, participant characteristics, and occupational stress factors.

	All age (n = 2,762)			20-39 years old (n = 1,123)			40-59 years old (n = 1,639)		
	OR	(95% CI)	p value	OR	(95% CI)	p value	OR	(95% CI)	p value
<b>Employment status</b>									
Regular		(ref.)			(ref.)			(ref.)	
Non-regular	1.23	(0.99-1.53)	0.06	1.54	(1.14-2.07)	< 0.01	0.91	(0.65-1.28)	0.59
<b>Sex</b>									
Male		(ref.)			(ref.)			(ref.)	
Female	1.27	(1.02-1.57)	0.03	1.39	(1.01-1.91)	0.04	1.30	(0.97-1.75)	0.08
<b>Age</b>									
20-29		(ref.)			(ref.)			-	
30-39	0.87	(0.60-1.26)	0.46	0.93	(0.64-1.37)	0.72		-	
40-49	0.77	(0.52-1.14)	0.19		-			(ref.)	
50-59	0.81	(0.53-1.22)	0.32		-		1.00	(0.79-1.26)	0.98
<b>Income</b>									
More than 12 million		(ref.)			(ref.)			(ref.)	
8-12 million	1.14	(0.90-1.45)	0.27	0.98	(0.60-1.60)	0.93	1.24	(0.94-1.64)	0.13
4-8 million	1.20	(0.91-1.59)	0.20	1.06	(0.65-1.73)	0.81	1.31	(0.91-1.89)	0.14
Less than 4 million	2.16	(1.44-3.25)	< 0.01	1.85	(1.01-3.37)	0.045	2.36	(1.24-4.49)	< 0.01
<b>Position</b>									
Manager		(ref.)			(ref.)			(ref.)	
Non-Manager	1.10	(0.88-1.37)	0.40	1.85	(1.10-3.12)	0.02	1.00	(0.78-1.29)	0.98
<b>Exercise</b>									
Less than once a month		(ref.)			(ref.)			(ref.)	
Several times a month	1.14	(0.90-1.46)	0.28	1.20	(0.83-1.75)	0.33	1.11	(0.80-1.54)	0.52
1 or 2 times a week	0.90	(0.73-1.10)	0.30	0.95	(0.68-1.32)	0.76	0.87	(0.66-1.15)	0.33
3 times a week and more	0.80	(0.63-1.03)	0.09	0.94	(0.61-1.43)	0.76	0.75	(0.55-1.02)	0.07
<b>Smoking status</b>									
Smoking		(ref.)			(ref.)			(ref.)	
Ex-smoking	1.06	(0.75-1.50)	0.75	1.39	(0.76-2.55)	0.28	0.95	(0.61-1.48)	0.82
Non-smoking	1.09	(0.80-1.47)	0.59	1.11	(0.69-1.78)	0.68	1.10	(0.74-1.64)	0.64
<b>Marital status</b>									
Married		(ref.)			(ref.)			(ref.)	
Unmarried	1.28	(1.02 - 1.60)	0.03	1.48	(1.07-2.04)	0.02	1.01	(0.72-1.41)	0.97
Divorced	0.92	(0.54 - 1.55)	0.74	0.86	(0.32-2.36)	0.77	0.86	(0.46-1.61)	0.64
<b>Occupational stress</b>									
Workload	1.13	(0.99-1.29)	0.06	1.37	(1.11-1.69)	< 0.01	0.99	(0.84-1.17)	0.91
Mental workload	1.94	(1.69-2.24)	< 0.01	1.72	(1.38-2.13)	< 0.01	2.12	(1.76-2.56)	< 0.01
Problems in personal relationships	1.59	(1.40-1.81)	< 0.01	1.49	(1.22-1.82)	< 0.01	1.68	(1.42-2.00)	< 0.01
Job control	0.88	(0.76-1.02)	0.08	0.84	(0.67-1.05)	0.13	0.89	(0.73-1.08)	0.24
Reward from work	0.61	(0.53-0.70)	< 0.01	0.63	(0.50-0.79)	< 0.01	0.59	(0.49-0.71)	< 0.01
Support from colleagues and superiors	0.93	(0.79-1.09)	0.36	0.93	(0.73-1.18)	0.54	0.94	(0.76-1.16)	0.57
Nagelkerke R <sup>2</sup>		0.25			0.27			0.24	

Statistical analyses were conducted with binomial logistic regression.

non-regular employees.

The present study assessed occupational stress related to psychological distress and factors that increase this distress were workload, mental workload, and problems in

personal relationships. Regarding the magnitude of occupational stress, there were no differences between regular and non-regular employment groups for workload and problems in personal relationships. Previous studies have

shown that occupational stress in the non-regularly employed is lower than in the regularly employed (Benach et al. 2004; Seto et al. 2006). In these studies, it is mentioned that non-regular employment may reduce occupational stress due to lower work responsibility but young, non-regularly employed researchers are often post-doctoral associates or tenure-track assistant professors. As researchers in these positions are required to have competitive achievements (*i.e.*, higher work responsibility) to achieve permanent employment in the future, non-regular employment may not reduce occupational stress as in other occupations. In the present study, the factor that ameliorated mental distress was the reward from work. Current research on occupational stress among researchers conducted in Japan indicates that high occupational stress in this group may be balanced by work rewards (Kageyama et al. 2001). Increasing the reward from work in young researchers may therefore ameliorate psychological distress. Reward from work in our study includes pride, ability utilization, and sense of accomplishment for work. The achievement in research are not directly included in reward from work, but may indirectly increase reward from work. In addition, increasing this factor improves research performance and may promote the acquisition of future permanent jobs. This cycle of work rewards supporting young, non-regularly employed researchers in their high occupational stress jobs by leading to research achievements may be important to improve psychological distress.

From ages 40-59, non-regular employment is not associated with psychological distress. It has been reported that the impact of non-regular employment on mental health is small, or rather reversed, in the elderly (LaMontagne et al. 2014). There are many elderly people in the deliberately non-regularly employed group and it is indicated that elderly workers may aim to reduce work commitment and stress (Keuskamp et al. 2013). In our study, the low occupational stress in non-regular employees aged 40-59 may be the reason why the mental distress between non-regular and regular workers were similar.

In our results, analyses for researchers of all ages indicate no association between non-regular employment and psychological distress. This result is not consistent with the results of a recent, large-scale systematic review (Rönnblad et al. 2019). On the other hand, there are also studies that show no differences in the state of mental health between the regularly and non-regularly employed. An Australian cohort study shows that transitioning from regular to non-regular employment is not harmful to mental health in older workers (LaMontagne et al. 2014). In a study of Japanese care service workers, there were no significant differences in depression between regularly and non-regularly employed workers (Tanaka et al. 2017). The relationship between employment status and mental health may therefore differ depending on country and occupation. In order to examine the relationship between employment status and mental health individually, it is necessary to conduct

detailed research with respect to the characteristics of each occupation.

Our results show that income is significantly related to psychological distress regardless of age group. Previous studies have also shown that income affects mental health (Fukuda and Hiyoshi 2012). As for compensation for non-regular employment, the issue of equal pay for equal labor is mentioned, but it is also indicated that less compensation may be set in response to the less job responsibilities for non-regular employment (Okunishi 2007). Further research is needed on the relationship between responsibility and compensation and mental health in non-regular employment.

The present study has several strengths. To our knowledge, this is the first study to clarify the relationship between researcher non-regular employment and psychological distress by age group. Our study has a considerable sample size, with a total of 2,762 participating researchers and 912 non-regularly employed researchers. In our study, information on participant characteristics, particularly income, and occupational stress was acquired and analyzed. Most previous studies have failed to adjust for income, even if adjusting for other indicators of socioeconomic status.

However, the present study also carries some limitations. First, because our study is a cross-sectional design, the causal relationship between mental distress and non-regular employment is not evaluated. For example, it may be difficult for researchers who have mental distress before work to obtain regular employment. A longitudinal study is therefore needed to disentangle the causal relationship. Second, the response rate is relatively low, so there may have been a non-response (or other type of) bias that could have affected our results. Researchers with psychological distress may not have participated in the survey due to absences and hesitation to answer. This selection bias would lead to an underestimation in our results. Third, in this study, not all factors related to non-regularly employed mental health are considered. In particular, deliberate non-regular employment is indicated to be a factor related to mental health but was not considered in this study (Takahashi et al. 2014).

In summary, we found a statistically significant association between non-regular employment and psychological distress in researchers aged 20-39 years. Young, non-regularly employed researchers might comprise a group particularly vulnerable to mental health risks. Considering the increasing amount of non-regular employment among young researchers in Japan, this study sheds light on the importance of supporting the upcoming generation in terms of mental health. Support to increase the work rewards for young non-regularly employed researchers may be important in reducing psychological distress and preventing mental disorders.

## Acknowledgments

We thank all participants in this study. We also thank the staff of Tsukuba Science City Network for their support. We would like to thank Dr. Bryan J. Mathis of the University of Tsukuba Medical English Communication Center for language revision.

## Conflict of Interest

The authors declare no conflict of interest.

## References

- Benach, J., Gimeno, D., Benavides, F.G., Martinez, J.M. & Torne Mdel, M. (2004) Types of employment and health in the European union: changes from 1995 to 2000. *Eur. J. Public Health*, **14**, 314-321.
- Canivet, C., Bodin, T., Emmelin, M., Toivanen, S., Moghaddassi, M. & Ostergren, P.O. (2016) Precarious employment is a risk factor for poor mental health in young individuals in Sweden: a cohort study with multiple follow-ups. *BMC Public Health*, **16**, 687.
- Cooper, C.L. (2007) Predictors of work performance among higher education employees : an examination using the ASSET model of stress. *Int. J. Stress Manag.*, **14**, 199-210.
- Dooley, D. (2003) Unemployment, underemployment, and mental health: conceptualizing employment status as a continuum. *Am. J. Community Psychol.*, **32**, 9-20.
- Dooley, D., Prause, J. & Ham-Rowbottom, K.A. (2000) Underemployment and depression: longitudinal relationships. *J. Health Soc. Behav.*, **41**, 421-436.
- Fukuda, Y. & Hiyoshi, A. (2012) Influences of income and employment on psychological distress and depression treatment in Japanese adults. *Environ. Health Prev. Med.*, **17**, 10-17.
- Furukawa, T.A., Kawakami, N., Saitoh, M., Ono, Y., Nakane, Y., Nakamura, Y., Tachimori, H., Iwata, N., Uda, H., Nakane, H., Watanabe, M., Naganuma, Y., Hata, Y., Kobayashi, M., Miyake, Y., et al. (2008) The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. *Int. J. Methods Psychiatr. Res.*, **17**, 152-158.
- Guthrie, S., Lichten, C.A., Van Belle, J., Ball, S., Knack, A. & Hofman, J. (2018) Understanding mental health in the research environment: a rapid evidence assessment. *Rand Health Q.*, **7**, 2.
- Hamamura, A. (2015) Problems on labor laws in relation to younger researchers. *Jpn. J. Labour Studies*, **660**, 16-26.
- Harada, T. (2017) Young researchers and grant-in-aid for scientific research. *SCJ Forum*, **22**, 68-70.
- Hori, D., Takao, S., Kawachi, I., Ohtaki, Y., Andrea, C.S., Takahashi, T., Shiraki, N., Ikeda, T., Ikeda, Y., Doki, S., Oi, Y., Sasahara, S. & Matsuzaki, I. (2019) Relationship between workplace social capital and suicidal ideation in the past year among employees in Japan : a cross-sectional study. *BMC Public Health*, **19**, 919.
- Inoue, M., Tsurugano, S. & Yano, E. (2011) Job stress and mental health of permanent and fixed-term workers measured by effort-reward imbalance model, depressive complaints, and clinic utilization. *J. Occup. Health*, **53**, 93-101.
- International Labour Organization (ILO) (2016) Non-standard employment around the world: understanding challenges, shaping prospects. [https://www.ilo.org/global/publications/books/WCMS\\_534326/lang-en/index.htm](https://www.ilo.org/global/publications/books/WCMS_534326/lang-en/index.htm) [Accessed: July 23, 2019].
- Kageyama, T., Matsuzaki, I., Morita, N., Sasahara, S., Satoh, S. & Nakamura, H. (2001) Mental health of scientific researchers. I. Characteristics of job stress among scientific researchers working at a research park in Japan. *Int. Arch. Occup. Environ. Health*, **74**, 199-205.
- Kessler, R.C., Andrews, G., Colpe, L.J., Hiripi, E., Mroczek, D.K., Normand, S.L., Walters, E.E. & Zaslavsky, A.M. (2002) Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol. Med.*, **32**, 959-976.
- Keuskamp, D., Mackenzie, C.R., Ziersch, A.M. & Baum, F.E. (2013) Deliberately casual? Workers' agency, health, and nonstandard employment relations in Australia. *J. Occup. Environ. Med.*, **55**, 620-627.
- Kobayashi, Y. (2015) The current status of fixed-term employment for researchers. *Jpn. J. Labour Studies*, **660**, 27-40.
- LaMontagne, A.D., Milner, A., Krnjacki, L., Kavanagh, A.M., Blakely, T.A. & Bentley, R. (2014) Employment arrangements and mental health in a cohort of working Australians: are transitions from permanent to temporary employment associated with changes in mental health? *Am. J. Epidemiol.*, **179**, 1467-1476.
- Llosa-Fernández, J.A., Menéndez-espina, S., Agulló-tomás, E. & Rodríguez-suárez, J. (2018) Job insecurity and mental health: a meta-analytical review of the consequences of precarious work in clinical disorders. *Anales de Psicología*, **34**, 211-223.
- Nagase, N. (2018) Measures to close the wage gap of standard and non-standard workers. *Jpn. J. Labour Studies*, **691**, 19-38.
- National Institute of Science and Technology Policy (2015) Survey on employment situation of university teachers. <http://www.nistep.go.jp/archives/22836> [Accessed: July 23, 2019] (in Japanese).
- National Institute of Science and Technology Policy (2018) Japanese science and technology indicators 2018. <http://www.nistep.go.jp/archives/37708> [Accessed: July 23, 2019] (in Japanese).
- Nishikido, N., Kageyama, T., Kobayashi, T. & Haratani, T. (2000) Assessment of job-stress using a brief questionnaire: its relations to depression among male workers of an information processing company. *Occup. Mental Health*, **8**, 73-82.
- Okunishi, Y. (2007) Perceptions of pay and work by standard and non-standard workers. *Jpn. Labor Review*, **6**, 116-134.
- Rönblad, T., Gronholm, E., Jonsson, J., Koranyi, I., Orellana, C., Kreshpaj, B., Chen, L., Stockfelt, L. & Bodin, T. (2019) Precarious employment and mental health: a systematic review and meta-analysis of longitudinal studies. *Scand. J. Work. Environ. Health*, **45**, 429-443.
- Rosenthal, L., Carroll-Scott, A., Earnshaw, V.A., Santilli, A. & Ickovics, J.R. (2012) The importance of full-time work for urban adults' mental and physical health. *Soc. Sci. Med.*, **75**, 1692-1696.
- Seto, M., Morimoto, K. & Maruyama, S. (2006) Work and family life of childrearing women workers in Japan: comparison of non-regular employees with short working hours, non-regular employees with long working hours, and regular employees. *J. Occup. Health*, **48**, 183-191.
- Shinohara, N. (2016) Revision of labor contract act and its effects on actual practice affairs. *Jpn. J. Ecology*, **66**, 181-191.
- Shoss, M.K. (2017) Job insecurity: an integrative review and agenda for future research. *J. Manag.*, **43**, 1911-1939.
- Statistic Bureau of Japan (2017) Labor force survey in 2017. <http://www.stat.go.jp/data/roudou/report/2017/index.html> [Accessed: July 23, 2019] (in Japanese).
- Takahashi, M., Morita, S. & Ishizu, K. (2014) The comparison of the mental health of full-time workers, part-time workers and unemployed people : focusing on the voluntariness of the employment situation and attitude towards work. *Jpn. J. Labour Studies*, **650**, 82-96.
- Tanaka, O., Maeda, E., Fushimi, M., Iwata, T., Shimizu, T., Saito, S. & Murata, K. (2017) Precarious employment is not associated with increased depressive symptoms: a cross-sectional study in care service workers of Japan. *Tohoku J. Exp. Med.*,

- 243, 19-26.
- Tomotsune, Y., Sasahara, S., Umeda, T., Hayashi, M., Usami, K., Yoshino, S., Kageyama, T., Nakamura, H. & Matsuzaki, I. (2009) The association of sense of coherence and coping profile with stress among research park city workers in Japan. *Ind. Health*, **47**, 664-672.
- Vancea, M. & Utzet, M. (2017) How unemployment and precarious employment affect the health of young people: a scoping study on social determinants. *Scand. J. Public Health*, **45**, 73-84.
-