

# Long-term Effectiveness of Overnight Shiftwork Implementation on Pediatric Residents' Wellness: A Cross-Sectional Survey

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## Research Article

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# Abstract

## Background

In Japan, the “Work Style Reform Bill” was partially enacted in 2019. In 2011, an Overnight Call Shift (OCS) system was introduced for pediatric training at the National Center for Child Health and Development (NCCHD). A questionnaire survey was conducted twice during the introduction of this system, finding a decrease in working hours, but no change in the depressive tendency of the residents. We conducted a follow-up survey in 2019 to investigate the long-term effectiveness of the OCS system to improve the pediatric residents’ wellness at NCCHD.

## Methods

A questionnaire-based cross-sectional survey was conducted for pediatric residents in 2019, and the results were compared to those of the previous survey in 2012. The questionnaire includes demographic data, working conditions data, and wellness assessment by the Center for Epidemiologic Studies Depression scale (CES-D) and the Maslach Burnout Inventory (MBI).

## Results

The collection rate for the 2019 survey was 94.5% (37 participants/39 eligible). Compared to 2012, there were no significant changes in demographic data and working hours, a significant increase by about 30% in residents who took daytime off *after* night work, about 10% decrease in residents who scored 16 and above on the CES-D, and a significant decrease in the mean score for depersonalization (DP) in the MBI.

## Conclusions

This survey demonstrated the long-term effectiveness of the implemented OCS system to improve pediatric residents’ wellness. This study provides evidence for the further initiative to improve pediatricians’ wellness for preparing for the government’s overtime regulations for physicians scheduled for 2024.

## Background

Initiatives to improve wellness and prevention of pediatric residents’ burnout have been attracting attention worldwide to maintain the quality of medical care and secure patient safety [1–4]. The Japan Pediatric Society reported in 2010 that overtime hours of hospital pediatricians were approximately 80 per month [5].

The single institution survey conducted at the National Center for Child Health and Development (NCCHD) in Japan showed that the working hours of the pediatric residents exceeded 75 hours per week in 2010 [6, 7]. In 2019, the Japanese government partially enacted the “Work Style Reform Bill”, and the overtime work hour regulations for physicians are scheduled to be enforced in 2024. The Ministry of

Health, Labour and Welfare has stated that the goal of “work style reform” is to “create a society that allows people to choose a preferred work style that suits their circumstances” [8]. With the increase in the number of pediatricians with diverse backgrounds in Japan [9, 10], it is necessary for the faculties of the postgraduate training programs to prepare flexible educational environments that allow for the diverse work styles of the residents [11].

NCCHD implemented an Overnight Call shift (OCS) system to improve the working environment and wellness (i.e., mental health) of the pediatric residents in 2011. As shown in Fig. 1, the OCS system allows night-work physicians to take daytime off, which was not present in the traditional shift system. Although the residents’ working hours decreased one year after the OCS implementation, the frequency of depressive symptoms did not change during the short-term duration (i.e., a year) [6, 7]. In the current study, we conducted a follow-up survey at NCCHD in 2019 to investigate the long-term effectiveness of the OCS system to improve the pediatric residents’ wellness, including the frequency of depressive symptoms and burnout.

## Methods

### Study site and participants

NCCHD is a 490-bed hospital specializing in children and perinatal care. It offers a three-year clinical training program for pediatric residents to become pediatric specialists in accordance with the regulations of the Japan Pediatric Society, with 10 to 14 residents per each resident year. They work night shifts in the general pediatric ward rotation, which is the core content of their training.

### Design

A questionnaire-based cross-sectional survey was conducted on 39 pediatric trainees enrolled in 2019, and the results were compared to that in 2012 of the previous survey conducted on 42 pediatric residents [7]. We used the Survey Monkey® online platform for the data collection.

### Data collection

We gathered the following demographic data: age, sex, marital status, resident year, and postgraduate year. Working hours per week, number of night or holiday duty shiftwork periods per month, number of days off per month, and compliance with the OCS system were also asked for investigating their working conditions. Regarding the mental wellness assessment, we used the Center of Epidemiologic Studies Depression scale (CES-D) [12] and Maslach Burnout Inventory (MBI) [13], which are widely used for screening depression and burnout, respectively. The cutoff of CES-D is 16 points, and a score of 16 and above is considered to indicate depressive symptoms. There are three components of MBI: Emotional Exhaustion (EE), Depersonalization (DP), and Personal Accomplishment (PA) [14].

# Analysis

Statistical analysis methods included Student's *t*-test for continuous variables and Fisher's exact test for categorical variables, with  $p < 0.05$  considered as statistically significant. We used EZR (version 1.54) statistical software [15], which is based on R and R commander, for the analysis.

## Ethical considerations

The study data was anonymized and approved by the Ethics Committee of NCCHD (No. 2318). Online consent was obtained from all survey participants.

## Results

The response rate for this 2019 survey was 94.5% (37 participants/39 eligible), and their data were compared with the data from the previous 2012 survey (response rate 97.6%; 41/42) [7].

## Demographics and working conditions data

There were no differences in the demographics and working conditions data between 2012 and 2019 (Table 1). Table 2 shows the residents' compliance with the OCS system. Although there was no change in the percentage of the residents responding that they could take daytime off *before* night work, the percentage of the residents who could take daytime off *after* night work increased significantly in 2019.

Table 1

Demographic and working conditions data

	2012 (n=41)	2019 (n=37)	<i>p</i>
Age, years, mean (SD)	29.0 (1.9)	29.5 (2.4)	0.31
Male, % (n)	56.0 (23)	45.9 (17)	0.50
Married, % (n)	31.0 (13)	29.7 (11)	1.00
1st year resident, % (n)	26.8 (11)	32.4 (12)	0.63
2nd year resident, % (n)	36.6 (15)	27.0 (10)	0.47
3rd year resident, % (n)	36.6 (15)	29.7 (11)	0.63
Postgraduate training, years, mean (SD)	4.0 (0.9)	4.4 (1.3)	0.75
Work time, hours/week, mean (SD)	64.9 (8.8)	66.7 (8.2)	0.36
Night or holiday duty shiftwork, periods/month, mean (SD)	3.9 (1.6) <sup>†</sup>	4.8 (0.9) <sup>‡</sup>	-
Off-duty days, days/month, mean (SD)	3.8 (1.4)	4.1 (1.1)	0.34

SD, standard deviation

<sup>†</sup> night shift only; <sup>‡</sup> night shift & holiday duty work

Table 2

Compliance with the Overnight Call Shift system, % (n)

		2012 (n=41)	2019 (n=37)	<i>p</i>
Residents who are able to take:	Daytime off <i>before</i> night work	70.7% (29)	70.3% (26)	1.00
	Daytime off <i>after</i> night work	31.7% (13)	64.9% (24)	<0.01

## Wellness

Table 3 shows the CES-D and MBI data in 2012 and 2019. Although no statistical significance was found in the frequency of the residents showing depressive symptoms (i.e., CES  $\geq$  16) and CES-D score, both frequency (31.7% vs 20.5%) and mean score (12.4 vs 10.3) were slightly improved in 2019. Furthermore, in the MBI, the mean DP subscale score significantly decreased in 2019, compared to the score in 2012 (9.4 vs 10.8,  $p = 0.04$ ).

Table 3

## Center for Epidemiologic Studies Depression scale and Maslach Burnout Inventory

	2012 (n=41)	2019 (n=39)	<i>p</i>
CES-D			
Residents with CES-D $\geq$ 16, % (n)	31.7 (13)	20.5 (8)	0.31
CES-D score, mean (SD)	12.4 (7.5)	10.3 (5.8)	0.17
MBI			
Emotional exhaustion, mean (SD)	13.5 (4.0)	12.0 (3.2)	0.13
Depersonalization, mean (SD)	10.8 (3.7)	9.4 (2.2)	0.04
Personal accomplishment, mean (SD)	17.2 (4.2)	17.0 (4.2)	0.78

CES-D, Center for Epidemiologic Studies Depression scale; MBI, Maslach Burnout Inventory; SD, standard deviation

## Discussion

This study investigated the long-term effects of implementing the OCS system at our institution as the pediatric residents' wellness improvement initiative. We found that one element (i.e., DP) of the burnout scale decreased, and the residents' compliance with the OCS system improved significantly eight years after the initiative implementation. This corroborates the 10% decrease in the frequency of depressive symptoms, although statistical significance was not found.

In our previous study focusing on the short-term outcomes of the initiative in 2011, we confirmed that the OCS system enabled us to reduce the residents' work hours from 75 hours to 65 hours per week by restricting them from working before the shift on the day of the night duty. However, residents could not take daytime off after night work due to the high workload related to workforce shortages, and there was no improvement in the frequency of depressive symptoms in the residents (32.3% vs 31.7%) [6, 7]. In 2018, the "Work Style Reform Bill" was passed in Japan and partially enacted in April 2019, and this governmental policy could have increased the awareness for the wellness improvement of physicians and driven the establishment of the OCS system in our hospital. Consequently, in 2019, the established OCS system allowed the residents to take daytime off after night work and improve their wellness, which was indicated by the improved frequency of depressive symptoms and burnout subscale scores.

Faculties of pediatric residency programs recently have been paying attention to improving the residents' wellness and learning environment [1–4]. A report from the United States indicated that many faculty leaders of pediatric residencies consumed their time and efforts to deal with the issues of residents' wellness, and the leaders demanded the faculty development programs to learn the solutions to those challenges [2]. It is also reported that almost all pediatric residency programs in North America have

developed wellness programs to prevent residents' burnout, but most of those wellness programs were not based on robust evidence [4]. In this context, our current study showed evidence of the effectiveness of the OCS system, and this may be the first report investigating the long-term outcome of the wellness program in pediatric residency programs in Japan.

According to educational theories, arranging the learning environment is also important to maintain the well-being of the trainees [16, 17]. Several studies have demonstrated the relationship between the pediatric residents' learning environment and their frequency of burnout [1, 3]. Specifically, the peer mentorship program has been suggested to provide the residents with "safe" training circumstances [18–20]. Therefore, it may be helpful to implement the peer mentoring program for arranging the residents' learning environment [21, 22].

There are several limitations to this study. First, this is a single-center study with a small sample size, and the results cannot be directly generalized to other programs in Japan. However, we believe that it is valuable to share our experiences of the OCS system implementation with other institutions to further improve pediatric residents' well-being in Japan. In this vein, this study could be a pilot trial for future multi-institution studies involving pediatric residents in Japan. Second, the longitudinal design might have included some confounding factors that affect the study outcomes. In addition, the subjects of each year (2011 and 2019) were not the same residents. However, we have confirmed that there were no significant differences in demographic data between the two groups. Furthermore, the selection process for entering residency and the training program structure have been unchanged during the study period. We therefore consider that the effect of the possible confounding factors on our study results was minimal, and this study's feasible and realistic approach provided meaningful evidence for postgraduate pediatric education in Japan. A multi-center survey with larger sample size is needed to overcome these limitations and create robust, generalizable evidence.

Although our initiative was successfully implemented, the mean work hours of our residents was still high (i.e., 67 hours per week). The governmental overtime work hour regulations for physicians are scheduled for 2024 in Japan; thus, a further initiative on a large scale is needed to meet the requirements for the regulations.

## Conclusions

The long-term effectiveness of the implemented overnight shiftwork system to improve pediatric residents' wellness has been successfully demonstrated. This study provides valuable evidence for the larger initiative to improve pediatricians' wellness for preparing for the government's overtime regulations for physicians scheduled in 2024.

The results of this survey were presented at the 124th Annual Meeting of the Japan Pediatric Society in Kyoto, 2021.

## **Abbreviations**

OCS, Overnight Call Shift; NCCHD, National Center for Child Health and Development; CES-D, Center for Epidemiologic Studies Depression Scale; MBI, Maslach Burnout Inventory; SD, standard deviation; DP, depersonalization (DP)

## **Declarations**

### **Ethics approval and consent to participate**

The study data was anonymized and the study methods were performed in accordance with the Declaration of Helsinki. The study was approved by the Ethics Committee of NCCHD (No. 2318). Written consent was obtained from all survey participants.

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

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### **Authors' contributions**

HN and ON designed and conducted the study, collected and analyzed data, and wrote the manuscript. MK and AI analyzed data and gave technical support and conceptual advice and edited the manuscript. All authors read and approved the final manuscript.

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## Figures

	Time	8	9	—————→	16	17	18	—————→	7	8	9
Traditional shift system	Work	MC	Daytime work			HO	Night work			MC	Off
Overnight Call Shift (OCS) system	Work	MC	Off			HO	Night work			MC	Off

**Figure 1**

The previous traditional shift system and the Overnight Call Shift (OCS) system implemented in 2011 at NCCHD are shown. In the traditional shift system, physicians who have worked during the daytime work directly at night. In the OCS system, physicians who have taken daytime off work at night. MC, morning conference; HO, hand-off meeting.