

Innovative Work Shift for Health Workers in the Health Service Providers in Handling COVID-19 Cases

Acim Heri Iswanto

Department of Public Health, Faculty of Health Science, Universitas Pembangunan Nasional Veteran Jakarta, Indonesia

Abstract

Working on shifts has the risk of being exposed to health problems, such as obesity and susceptibility to infections and hypertension. However, shift work is unavoidable for workers in sectors that require non-stop operations, such as health workers in the Health Service Providers. This article presented opinion about an optimal shift rotation pattern in reducing the health risks of shift health workers while increasing the effectiveness of the treatment of coronavirus (COVID-19) cases. In general, today's pattern of shift work for health workers is schemed in the eight-day cycle, in which employees work two days in the morning service for seven hours, two days in the evening service for seven hours, and another two days in the night service for ten hours, then followed by two days off. This pattern has the potential to cause burnout and decrease reaction time. The article identifies a new work shift pattern that can accommodate the risk of burnout while simultaneously assisting in the emergency of the corona outbreak. It emphasises the Morning-Evening-Night-Holiday work pattern as an innovative work model that should replace the old work pattern. There are seven advantages of the new work pattern: biological balance, availability of transportation, rapid recovery, reduced risk of COVID-19 transmission, increased patient satisfaction, increased self-control, and improved performance.

Keywords: burnout, corona outbreak, health workers, work risk, work shift

Introduction

The new coronavirus disease 2019 (COVID-19) initially appeared in Wuhan City, Hubei Province, China, in December 2019. Currently, the virus has spread to 213 countries and territories with 5,743,245 infected victims, 354,884 of whom died and 2,470,836 declared cured, resulting in a 13% fatality rate.¹ World Health Organization (WHO) officially declared COVID-19 as a global pandemic on March 11, 2020. Meanwhile, Indonesia declared the corona outbreak as a national disaster on April 13, 2020, through the Presidential Decree Number 12 of 2020 on the Stipulation of A Non-natural Disaster of the Spread of COVID-19 as a National Disaster. In Indonesia, COVID-19 has spread to 33 provinces and infected 23,851 people, of whom 1,473 died.² In line with this, there have been many local governments declaring the enactment of Large-Scale Social Restrictions (*Pembatasan Sosial Berskala Besar/PSBB*) in their areas.

The coronavirus has also affected the health workers caring for the patients. Psychologically, health workers may experience post-traumatic and burnout disorders.³

In the United States, the country with the most casualties in the world, an estimated 54.4% of doctors experience at least one burnout symptom due to the treatment of coronavirus.⁴ A Korean study on handling the Middle East respiratory syndrome (MERS) outbreak found that the average nurse experienced burnout due to high work stress, low support from family and friends, and poor hospital resources.⁵

Burnout is an urgent problem that must be treated because it has severe consequences including fatigue, stress, anxiety, depression, mood disorders, drug abuse, suicide, poor patient care, early retirement, and unexpected work stoppages.⁴ It may also have an impact on patient dissatisfaction, decreased patient outcomes, increased mortality, and failure to save patients.⁵

Burnout itself is a negative experience on employees who do not have the psychological and physical resources to meet work demands and expectations. The experience is characterized by the presence of emotional exhaustion (the feeling of overwhelm), depersonalization (the feeling that the self is not real or that one cannot be him/herself), as well as decreased personal achievement (lack of per-

Correspondence*: Acim Heri Iswanto, Department of Public Health, Faculty of Health Science, Universitas Pembangunan Nasional Veteran Jakarta, Raya Limo Street No. 1, Jakarta, Indonesia, E-mail: h.iswanto@upnvj.ac.id, Phone: +62-811-994-170

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sonal achievement).⁵

Concerning the COVID-19 outbreak, burnout may cause viral transmission, slow recovery, and even death for both patients and health workers due to the inability of health workers to protect themselves or because health workers give up or commit suicide. In Indonesia, as of April 16, 2020, 23 doctors (four of whom were professors) died from direct contact or indirect transmission from COVID-19.⁶ At least 12 nurses have also died due to the virus.⁷

Many factors are understood to be the causes of burnout. These factors can be classified into work factors, personal factors, and organizational factors. Work factors include prolonged stress from excessive workload and work hours. Personal factors cover work-life imbalances, lack of sleep, and inadequate support. Meanwhile, organizational factors comprise workload expectations, poor interpersonal communication, insufficient rewards, and negative leadership.⁴

Learning from the burnout experience of health workers in the previous outbreaks such as the MERS, SARS, and H1N1, researchers have suggested several measures to anticipate burnout as follows: providing adequate resources and consistent and up-to-date work guidance; recruiting additional health workers, volunteers, and administrative staff; expediting bureaucracy and licensing; allocating more budget; leveraging information technology intensively; implementing leadership to communicate clearly and efficiently; reducing workload; ensuring the safety and health of health workers and staff; training frontline workers; as well as protecting and supporting health workers with operational action plans.⁴

Several ideas have emerged in regards to reducing the workload of health workers and staff. Reducing the workload can be undertaken by creating a rest schedule; limiting working hours (especially in emergency and intensive care units); and providing regular psychosocial support, basic needs, and spiritual sessions.⁴ One idea to reduce the workload that should be applied is to change the work shift patterns of health workers and staff. Long work shift is one of the factors causing burnout on health workers. Studies show that nurses who work in shifts of 8-10 hours have lower burnout rates than nurses who continuously work for 12 hours.⁸ Conversely, working continuously for 13 hours or more leads to patient dissatisfaction.⁹

It is possible that the work shifts prevailing so far in many PPKs in Indonesia, especially those dealing with corona patients, are a source of burnout for health workers. Many media reports indicate that the shifts of health workers in dealing with the COVID-19 outbreak are exhausting. The Indonesian Doctors Association (*Ikatan Dokter Indonesia/IDI*), for example, claimed that there were doctors who died from fatigue in handling patients

and issued recommendations for reducing shift work time for health workers treating corona patients.¹⁰

Shift-based work

Shift-based work, which is work performed during unnatural working hours, is a work commitment that cannot be avoided by health workers or workers in sectors that require uninterrupted operations. Concerning this, the natural working hours are those hours that follow the circadian rhythm, which suggests work at daytime (as opposed to at night time). Ideally, humans work at this natural time because they are diurnal creatures that have a biological rhythm adapted for daytime activities and resting at night. Work shifts, however, require employees to work part-time at night.

Shift work leads to several health problems such as weight problems and susceptibility to infections or hypertension.^{11,12} These types of disorders can, in turn, lead to chronic diseases and infections in employees. However, the degree to which employees are affected by these disorders depends on four groups of factors, namely psychosocial factors, behavioral factors, physiological factors, and modification factors. The link between shift work and these factors is shown in Figure 1.

Psychosocial factors cover factors such as work tension, work satisfaction, work-life balance, and work stress. Behavioral factors include sleep behavior, physical activity, and eating patterns. Meanwhile, physiological factors constitute immunological effects, light, and vitamin D. These three groups of factors can be modified by interventions on three things: shift work characteristics, socio-demographic, and chronotypes. As for the latter, chronotypes are a variation on the circadian rhythms at the individual level. Although humans are generally diurnal and active during the day, some individuals may have a deviation from this pattern that they are categorized as the "night types".

Night-typed individuals characterize nocturnal creatures more for having higher activity at night biologically. Chronotypes are partly determined by genetic factors. Individuals with a morning chronotype sleep at 11:00 pm and wake up at 06:00 am on workdays and at 07:00 am on holidays. Individuals with a night chronotype sleep at 01:00 pm and wake up at 08:00 am on workdays and sleep at 03:00 pm and wake up at 12 noon on holidays.¹³

Shift work can take rotations with varying frequencies between morning, evening, and night work. Low rotation work is defined by a long rotation period, for example, one week's work in the morning, one week's work during the day, and one week's work at night; or two days' work in the morning, two days' work in the afternoon, and two days' work in at night, followed by a break of three days. High rotation work, on the other hand, is marked by a rapid rotation period, for example, one day's work in the

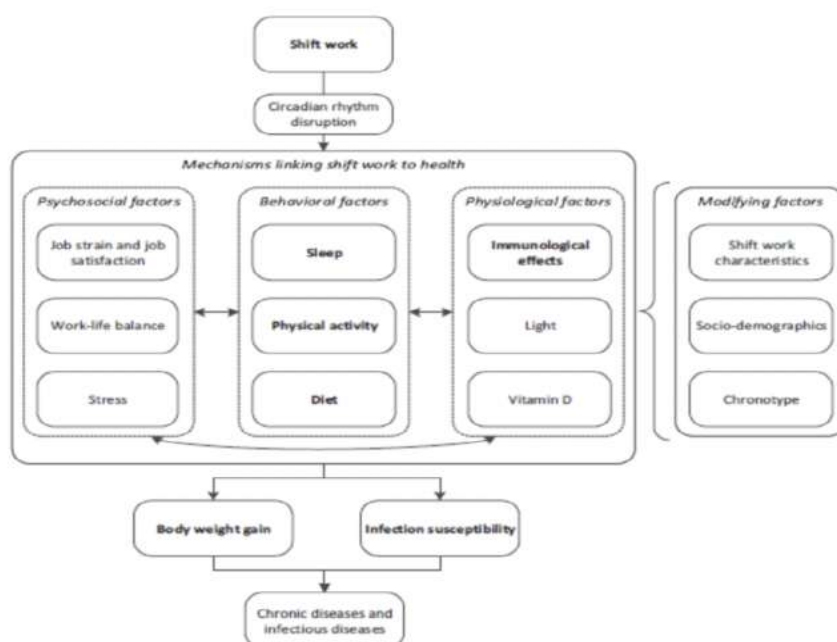


Figure 1. Factors Linking Shift Work with Health Problems¹²

morning, one day's work during the day, and one day's work at night, and two days of rest.¹⁴

Research shows that workers with rapid shift rotations may have disorders in decreased sleep duration and sleepiness at work compared to workers who work permanently (only day or only night).¹⁵ This is caused by the disruption of brain activity when staying awake, which brings in concentration decline and inability to communicate well with clients.⁹ However, this pattern can be reversed if workers are given a break of two days or more after working on the night shift.¹⁵

However, research in other contexts shows different results. A study on 315 nurses in Italy in 2015 compared burnout incidents between two work cycles: a long cycle (n = 105 people) with two workdays in the morning, two workdays in the afternoon, and two workdays at night, followed by a rest of three days; and a short cycle (n = 59 people) with one workday in the morning, one workday in the afternoon, one workday at night, and two days of rest.¹⁴ There was no significant difference (p-value = 0.160) in the two groups in terms of sleep quality. Also, no notable differences were found in terms of task performance (p-value = 0.728) or contextual performance (p-value = 0.997). Meanwhile, there was a significant difference (p-value = 0.040) between long shift nurses and short shift nurses in terms of burnout. Nurses with short shifts had lower burnout rates than nurses with long shifts. The researchers explained that this occurred because nurses with long shifts were more often exposed to patients and hospital environments than nurses with

short shifts.

In addition to the evidence from the above research, there are suppressive factors that allow for the restraint of the negative impacts of rapid shift patterns, at least in the context of health workers who treat corona patients. A study in Wuhan reveals that burnout is greatest among health workers who do not treat corona patients, as opposed to those workers who are at the forefront.¹⁶

This unexpected finding puts several intriguing explanations. First, the health workers have felt that there has been more control over the situation than before, that is when they only "stayed quiet" when the outbreak initially occurred. Second, the treatment of corona patients has become a priority, which causes non-corona patients to receive less attention. Although this is unfortunate, in the context of shifts, it makes the health workers with rapid shifts dealing with corona patients less stressed than the health workers treating non-corona patients. Third, the health workers who deal with corona patients are closer to decision-makers that they have access to information more quickly and accurately. This leads to a higher sense of achievement among them compared to those health workers treating non-corona patients. This effect is getting stronger, especially because their treatment results can be directly seen through the health statistics of corona sufferers.

This explains why there is unclear impact of three-period shift work on nurse burnout in the case of the MERS outbreak. Research in this context partially found that shift work affected nurse burnout while some other stu-

Table 1. Work Schedule (Old)

Employees	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
A	I	I	II	II	III	III	IV
B	II	II	III	III	IV	IV	I
C	III	III	IV	IV	I	I	II
D	IV	IV	I	I	II	II	III

Notes:

- I. Morning shift : 07:00 am - 02:00 pm (7 hours)
 II. Afternoon shift : 02:00 am - 09:00 pm (7 hours)
 III. Night shift : 09:00 pm - 07:00 am (10 hours)
 IV. Holiday

Table 2. Example of Modified Work Schedule

Employees	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
A	II	III	IV	I	II	III	IV
B	III	IV	I	II	III	IV	I
C	IV	I	II	III	IV	I	II
D	I	II	III	IV	I	II	III

Notes:

- I. Morning shift : 08:00 am - 04:00 pm (8 hours)
 II. Evening shift : 04:00 pm - 12:00 pm (8 hours)
 III. Night shift : 12:00 pm - 08:00 am (8 hours)
 IV. Holiday

dies did not find a significant relationship.^{17,18}

Results and Discussion

Based on the author's observations on several health service providers (HSPs), the applicable general shift schedule has a 6-day time off cycle with a pattern of 7-hour morning work pattern, 7-hour evening work, and 10-hour night work. The number of workers for each duty cycle is usually three people, but this data is not the same in all hospitals. Morning shift starts at 07:00 am. The following table illustrates the pattern of attendance of four employees with this work schedule.

The pattern on Table 1 shows an eight-day work cycle because on the ninth day, all four employees will be in the same combination again. A break of two days after the night shift is in accordance with previous research recommendations to restore the pattern of early life for health workers.¹⁵ However, this may still cause burnout because employees who work at night work up to 10 hours.⁸ Employees may experience fatigue and a decrease in psychomotor response time after working for long periods.¹⁹ Ideally, the working time should be eight hours, divided into three shifts, starting at 08:00 am to maintain work-life balance of employees.²⁰

One way to reduce workload is to develop new shift work schedule patterns that have shorter time off cycles. For example, holiday can be given every three days, half of the time off cycle in the usual work schedule. The duration of work is also balanced by eight hours on all shifts (morning, evening and night), because one day is 24

hours a day and divided by three shifts (eight hours per shift). The number of health workers per shift is reduced from three to two and the morning shift begins at 08:00 am. The following table (Table 2) illustrates the attendance pattern of four employees with a work schedule that has a four-day work cycle.

The advantages of this system lie in many aspects. The first is the aspect of biological balance. Although there is an increase in one hour from seven hours to eight hours in the morning and evening shifts, this increase is in line with the human circadian rhythms and is at a maximum limit of eight hours. Workers on the night shift also experience a better balance because work time decreases dramatically from eleven hours to eight hours. This reduces the negative effects of fatigue due to fighting the natural circadian rhythm. A study of 20 long night shift workers results in nine out of 20 workers sleeping during the day.²¹ Conversely, a schedule of rapid work shift prevents the emergence of sleep debt. A study on workers with a work rotation of 12 hours of daytime work, 12 hours of night work, and two days off, shows the prevention of sleep debt.²²

Secondly, the new system allows for transportation availability. With work coming in at 08:00 in the morning and 16:00 in the evening, transportation is still available. This is different from the old system in which morning service starts at 07:00, evening service at 14:00, and night service at 21:00. For workers in big cities like Jakarta, the difference in hours of coming to work between

en 07:00 am and 08:00 am hours is huge. At 07:00 am, the road is very congested and congestion occurs at many points. Traffic monitoring data shows that in Jakarta, on average Monday - Friday, traffic jam at 05:00 am is 9-16% while at 06:00 am increased to 37% - 48%.²³

Going early to work, as the sky is getting bright, can increase one's exposure to sunlight in the morning without having to be spoiled by air pollution. In fact, being in a traffic jam would cause physical fatigue to those who pass through it.²⁴ This makes employees want to sleep and rest more after experiencing a traffic jam.²⁵

Third, more frequent time off allows for faster work recovery before a buildup of fatigue befalls. Sleep deprivation leads to heart disease, diabetes, depression, fainting, accidents, weak cognition, and low quality of life.²⁶ Additionally, sleeping time under six hours per day may cause sleep debt that must be fulfilled immediately by the body. If the sleep debt is not paid, there will be problems with concentration and performance. Long cycle period of six days may cause a buildup of sleep debt that ultimately reduces employee performance, especially in the final days before the holiday. Because the last day of work is at night, the patient being treated might run the risk of medical errors. Moreover, employees may spend the first day of their time off sleeping, disrupting their roles in the family such as being a mother or a father. If the cycle period is short, there would almost be no build up of sleep debt and holidays can be treated as normal days without having to sleep excessively. Furthermore, a study comparing 24-hour and 72-hour break after a night shift does not highlight a significant difference, so the research concludes that one day's rest time is sufficient for employee work needs.²²

Fourth, fewer workers are needed to work on the shift. The reduction of employees from three to two employees per shift allows for the use of less labor and more efficient work because social interaction on things that are not relevant to work is limited. Moreover, this is in line with the physical distancing instruction because there are only two, rather than three personnel. Short work hours make employees more often work at home and not often come to health care centers.

Fifth, there would be an increase in patient satisfaction and a decrease in unwanted incidents. This is backed up by the fact that a short work cycle reduces the level of burnout in health workers.¹⁴ This will be especially favourable for patients who are treated at night as a prevention measure has been taken in regards to the risk of treatment errors which might have been caused by exhausted health workers.

Sixth, although the rest period is one day less than recommended for short shifts,¹⁴ this has been compensated by the nature of the work. Work that deals with the COVID-19 outbreak have been found to have different cha-

racteristics from work that deals with "everyday problems" in hospitals. In employees dealing the coronavirus, there is an increase in self-control, attention, and high support, all of which reduce the risk of burnout.¹⁶ This should be able to compensate for one day removed from time off. In fact, if the time off is kept for two days, psychological problems may arise for health workers, such as feeling helpless because they are not participating in critical tasks that require immediate actions.

Seventh, there is the possibility of improved performance. Although the study by Giorgi, *et al.*,¹⁴ find no significant differences between long shift workers and short shift workers, other studies have shown an increase in performance in employees who work short shifts.²¹ This is attributed to increased melatonin secretion. Melatonin is a hormone produced by the pineal family that runs in harmony with the circadian rhythms with its peak level at night. Short shift work allows for an increase in melatonin at night without interruption compared to long shift work.

An alternative to the Morning-Evening-Evening-Holiday model with 8-hour working hours above can be conceptualized as well. For example, the cycle of one day's work in the morning, one day's work in the evening, one day's work at night, and a two-day break from the study of Giorgi, *et al.*,¹⁴ can be applied while maintaining a long working time, though it may be less balanced when compared with the emergence of the corona outbreak case. Work shifts of three days in the morning, then time off, then three days' work in the afternoon, followed by time off, and then three days' work at night, then time off again, can also be considered as long as the working hours per shift are no more than eight hours and time off is fast. The point is we need to modify working hours and shift patterns that have existed now so that it is more balanced between the needs of health workers and the needs of COVID-19 patients.

Conclusion

There is indeed societal pressures on physicians and nurses engaged with Covid-19 cases to working as good as they can. However, if the working shift can decreasing health professionals performance and their wellbeing, then this would constitute sufficiently compelling reasons for change the shift pattern to be lighter and shorter. Because of this reason, and also because demands from physicians and nurses themselves, we propose an innovative work shift scheduling. The new work shift scheduling could solve some health problems experienced by physicians and nurses.

Abbreviations

WHO: World Health Organization; PSBB: *Pembatasan Sosial Berskala Besar* (Large-Scale Social Restrictions); MERS: Middle East respiratory

sindrome; IDI: *Ikatan Dokter Indonesia* (Indonesian Doctors Association); HSP: Health Service Provider.

Ethics Approval and Consent to Participate

Not Applicable

Competing Interest

Author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The data and materials of this study were available upon request to the first author.

Authors' Contribution

Acim Heri Iswanto contributed substantially to the conception, writing, and revising of the manuscript.

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