

Occupational Characteristics and Working Hours of Stroke and Myocardial Infarction Patients at a Hospital in Bangkok: A Descriptive Study

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ABSTRACT

OBJECTIVE The aim of this study was to investigate occupational risk factors, particularly focusing on working hours, in the patients with cerebrovascular diseases and cardiovascular diseases to help reduce the incidence of those diseases in the future.

METHODS This descriptive study was conducted retrospectively. Patients age 18 to 65 with a first diagnosis of acute stroke and acute myocardial infarction in the years 2019 to 2022 were included. Demographic data were obtained from in-patient records. Occupational data, including working hours and other missing data, were obtained through telephone interviews with the patients.

RESULTS After excluding individuals who were unemployed at the time of the disease incident, deceased, unwilling or unreachable to participate, a total of 146 patients were included in this study. Of those, 115 participants (78.8%) were first diagnosed with acute stroke and 31 participants (21.2%) were first diagnosed with acute myocardial infarction during the study period. The median and interquartile range of weekly working hours of all participants, participants with acute stroke, and participants with acute myocardial infarction were 56 (25), 56 (35), and 59 (27) hours per week, respectively. The range of working hours per week was from 4 to 112 hours. The majority of participants reported not engaging in dangerous work as defined by Thailand's Ministry of Labour, reported no significant occupational hazards, stated they had minimal stress and that they had control over their own job.

CONCLUSIONS The results indicate that the majority of stroke and myocardial infarction patients from this center worked ≥ 55 hours per week. Although the majority reported having no significant occupational factors, recognizing and incorporating a history of occupational factors could be beneficial in disease diagnosis, disease prevention, prevention of recurrence, and aiding the return-to-work process of the patients.

KEYWORDS overwork, cerebrovascular disease, cardiovascular disease, myocardial infarction, stroke, occupational disease, long working hours

INTRODUCTION

Acute stroke and acute myocardial infarction are the two leading causes of death of both men

and women in Thailand (1). These two diseases also rank at the top of causes of morbidity and disability-adjusted life years (DALYs) lost (1). Based on

available statistical information, it is evident that both acute stroke and myocardial infarction are very severe diseases that can profoundly impact patients, their families, and the entire country in the long term. It is well known that the primary method of preventing both stroke and myocardial infarction is changing modifiable risk factors, e.g., obesity, controlling underlying diseases, changing smoking habits and alcohol drinking habits, and engaging in physical activity (2-4).

Work and health are two subjects that are inescapably intertwined. Hazards in the workplace can lead to negative effects on health as well as poor health outcomes. Poor health can also impact ability to work, work effectiveness, workers' income, and productivity. A wide spectrum of occupational factors are considered risk factors for several diseases, including coronary heart disease and stroke. A comprehensive review of occupational risk factors for stroke found that job stress, working in extreme temperatures, long working hours, and shift work can increase the risk for stroke (5). A cross-sectional study in Poland showed a significant association between stress, noise, fine particulate dust and the incidence of myocardial infarction (6). The incidence of Karoshi, also known as death from overwork, with cerebrovascular diseases or cardiovascular diseases as the cause of death, has brought work stress and working hours into focus in Japan (7). A longitudinal study conducted in Sweden found that job strain and low job control increases risk for coronary heart disease (8). A case-control study conducted in Korea in 2002-2004 reported an increased risk for hemorrhagic stroke in individuals working ≥ 9 hours/day (9). A systematic review and meta-analysis of data from the USA, Europe, and Australia similarly found an increased risk for stroke and coronary heart disease in individuals working ≥ 55 hours/week compared to those who worked 35-40 hours/week (10). The World Health Organization's (WHO) systematic review of the effects of long working hours showed that working ≥ 48 hours per week is associated with stroke, and working ≥ 55 hours per week is associated with both stroke and ischemic heart disease (11,12). Working long hours has also been found to lead to an increase in adverse health behaviors, such as smoking, alcohol drinking, sleep deprivation, and lack of exercise. Additionally, it can cause psychological stress leading to

an increased release of stress hormones which, in turn, result in an increase of autonomic nervous system activity (11).

While numerous cases of work-related cerebrovascular diseases and cardiovascular diseases have been identified in Japan, Taiwan, and Korea (13), there have been no such cases reported in Thailand yet. Occupational factors are typically not included in the questions doctors or nurses ask when taking patients' history in Thailand. Recognizing occupational factors can significantly aid other specialists in providing better prevention and care for patients. In order to identify and provide appropriate compensation for patients with work-related cerebrovascular diseases and cardiovascular diseases, diagnostic criteria have been developed in Japan, Taiwan, and Korea. These criteria primarily emphasize three key aspects: psychological effects, short-term overwork in terms of work hours and overtime, and long-term overwork, which also takes into account work hours and overtime (13). The objective of this study was to examine the working hours and work characteristics of patients with acute stroke and myocardial infarction in Thailand and to identify potential occupational factors, including working hours, with the goal of reducing the incidence of work-related cerebrovascular and cardiovascular diseases in the future.

METHODS

This cross-sectional descriptive study was conducted retrospectively. Basic patient information was obtained through in-patient records. Information about health behaviors and occupational factors was obtained through telephone interviews with the patients conducted by a single interviewer. Ethical approval was granted by Nopparat Rajathanee Hospital (COA 44/2566).

Subjects

This census-based study was conducted among patients with a first diagnosis of acute myocardial infarction, including both ST segment elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (non-STEMI), as well as acute stroke, including both ischemic and hemorrhagic cases, from 2019 through 2022. From the International Classification of Diseases (ICD-10), I60, I61, I63, and I64 were selected for acute ischemic stroke and acute hemorrhagic

stroke, while I21 and I22 were chosen for acute myocardial infarction. The diagnosis was confirmed to be the initial incidence of the disease through a review of in-patient records and interviews with the patients. The inclusion criteria were the ability to communicate in Thai, age 18 to 65 years (selected as representative of the working population in Thailand), being employed either during or before the occurrence of the disease, and willingness to participate in the study. Exclusion criteria include missing information and a lack of patient's willingness to participate in the study. Out of 2,398 patients first diagnosed with either acute stroke or myocardial infarction, records of 571 in-patient were retrieved for an initial review. After excluding 28 deceased patients, 81 who were unemployed at the time of diagnosis, 21 who were unwilling to participate, and 295 who couldn't be reached, a total of 146 patients remained. All 146 patients were interviewed and included in the study.

Interview

The questions in the interview were developed based on a literature review, and their content validity was assessed by three experts using the Index of Item-Object Congruence (IOC). All telephone interviews were conducted by a single interviewer. The interview questions were divided into two parts: the first part focused on general background information and health behaviors, while the second part addressed participants' occupational information. The general demographics section included questions about education level, underlying diseases, minutes of exercise per week, hours of sleep per day, smoking, and drinking. Underlying diseases were identified as being present or absent at the time of the disease occurrence. Smoking and drinking were defined as yes or no at the time of disease occurrence.

The occupational factors section included questions about occupation, monthly income, job description, work intensity, weekly working hours, job control, stress, workplace hazards, history of work-related accidents, changes in work conditions during the 3 to 6 months prior to the disease occurrence, and abnormal situations at work during the 3 to 6 months before the disease occurrence. Weekly working hours are hours patient spent working, regardless of the work

location or whether the working time falls within official work hours. Patients were asked about the time they started their workday and their overtime working hours. Job description included categories of routine work, use of creativity, management, or self-owned business. The definition of dangerous work was classified according to Thailand's Ministry of Labour law in the Labour Protection Act of 2019. Dangerous work included jobs in confined spaces, working with radiation, welding, transporting hazardous materials, working with hazardous chemicals, jobs involving exposure to vibration, and jobs in extreme temperature conditions. Work intensity was graded as low, moderate, or heavy according to Thailand's Ministry of Labour Occupational Safety, Health, and Environmental Act of 2011. Stress was reported as yes or no and included whether the stress was related to work, income, health, and/or family. Job control was defined according to Karasek's model (14) to include a person's ability to influence what happens in their work environment, and classified as yes if the individual had decision-making authority over their own work. Questions for assessing job control were 'Do you have control over your work?' and 'Can you manage both time and work quantity by yourself?'. Abnormal situations and changes were defined following Japanese, Taiwanese, and Korean diagnostic criteria for work-related cardiovascular disease. Abnormal situations included unusual events that trigger extreme psychological tension, excitement, fear, stress, taking on an extreme physical workload, or a dramatic change in the working environment. Changes in work conditions refers to alterations in conditions that lead to mental and physical exhaustion. These changes can include an irregular work schedule, increased workload, heightened job responsibility, frequent travel, shift work, or exposure to extreme temperatures or noise. After obtaining informed consent from the patient via telephone, information from in-patient records was confirmed, and any missing information was collected.

Analysis

The data was analyzed using STATA SE version 18.0 software (STATA Corp. LLC, College Station, TX, USA). Descriptive analysis was used. Categorical data are presented as numbers and percentages,

while numerical data are presented as median and interquartile range. The median and interquartile range of each work characteristic are also presented.

RESULTS

This study included a total of 146 patients. Table 1 presents demographic data and working hours for each group of participants. Out of the 146 patients, 115 (78.8%) were first diagnosed with acute stroke and 31 (21.2%) were first diagnosed

with acute myocardial infarction. The majority of participants were male (67.8%). Participants' ages ranged from 28 to 65 years, with a median of 53 and an interquartile range of 12. The majority fell into the group of 45 years old and above (78.77%). Within the group under 45 years old, there were 22 males and 9 females. A BMI equal to or greater than 23 was considered as indicative of overweight, accounting for 78.1% of the total. In terms of health behavior, over 60% of the participants

Table 1. Demographic characteristics and working hours of each group in the study participants

Variables	Frequency, n (%)	Working hours, median hours/week (IQR)
Gender		
Male	99 (67.8)	56.0 (25.0)
Female	47 (32.2)	56.0 (28.0)
Age (years)		
<45	31 (21.2)	55.0 (25.0)
≥45	115 (78.8)	57.0 (27.0)
Age (years), median (IQR)	53 (12.0)	
Education		
None	2 (1.3)	56.0 (28.0)
Primary school	61 (41.8)	63.0 (28.0)
High school	47 (32.2)	54.0 (25.0)
University	36 (24.7)	55.0 (26.5)
BMI (kg/m ²)		
< 23	32 (21.9)	57.5 (22.0)
≥ 23	114 (78.1)	56.0 (27.0)
BMI (kg/m ²), median (IQR)	25.59 (5.5)	
Sleep duration per day (hours)		
Less than 8 hours/day	97 (66.4)	60.0 (32.0)
More than 8 hours/day	49 (33.6)	55.0 (18.0)
Sleep duration per day (hours), median (IQR)	6.75 (3.0)	
Exercise duration per week (mins)		
No exercise	111 (76.0)	57.0 (25.0)
Exercise less than 150 mins per week	20 (13.7)	63.0 (40.5)
Exercise more than 150 mins per week	15 (10.3)	54.0 (29.0)
Exercise duration per week (mins), median (IQR)	140 (220)	
Smoking		
No	77 (52.7)	56.0 (25.0)
Yes	69 (47.3)	56.0 (25.0)
Alcohol		
No	66 (45.2)	54.0 (21.0)
Yes	80 (54.8)	60.0 (31.0)
Underlying disease		
No underlying disease	57 (39.0)	57.0 (24.0)
Hypertension	71 (48.6)	54.0 (28.0)
Diabetes Mellitus	39 (26.7)	59.0 (36.0)
Dyslipidemia	33 (22.6)	54.0 (26.0)
Heart diseases	5 (3.4)	70.0 (30.0)
Others	21 (14.4)	57.0 (23.0)
Diagnosis		
Stroke	115 (78.8)	56.0 (25.0)
Myocardial Infarction	31 (21.2)	59.0 (27.0)

typically slept less than 8 hours per day. The majority of the participants didn't exercise (76%). About 47% of the participants were smokers, and 55% were alcohol drinkers at the time of the disease occurrence. Fifty-seven participants (39%) were free from any underlying disease at the time of the disease occurrence. Participants with hypertension, diabetes mellitus, and dyslipidemia at the time of the disease occurrence numbered 71 (48.6%), 39 (26.7%), and 33 (22.6%), respectively. The number of stroke participants with heart diseases, defined as arrhythmia, valvular heart dis-

ease, or old ischemic heart disease, was 5 (3.42%).

Details of occupational characteristics and working hours of each group are presented in Table 2. The overall median working hours of the participants was 56 hours per week, with an interquartile range of 25. The range of work duration per week ranged from 4 to 112 hours. Patients with the highest median working hours, 70 hours per week (interquartile range 30) were in the food and beverage services occupation group. The majority of participants were doing routine work (58.9%) and 36.3% of the participants owned their

Table 2. Occupational characteristics and working hours in each group of study participants

Variables	Frequency, n (%)	Working hours, median hours/week (IQR)
Working duration per week (hours)		
Less than 55 hours	68 (46.6)	
More than or equal to 55 hours	78 (53.4)	
Working duration per week (hours), median (IQR)	56 (25.0)	
Income per month (Bath), median (IQR)	15,000 (20,000)	
Dangerous work		
No	110 (75.3)	56.0 (27.0)
Yes	36 (24.7)	56.5 (22.5)
Job		
Routine work	86 (58.9)	56.5 (22.0)
Use of creativity	3 (2.1)	45.0 (14.0)
Management	4 (2.7)	59.5 (18.0)
Owning a business	53 (36.3)	60.0 (35.0)
Work intensity		
Light	21 (14.4)	45.0 (19.0)
Moderate	104 (71.2)	60.0 (29.0)
Heavy	21 (14.4)	57.0 (23.0)
Job control		
No	63 (43.2)	57.0 (22.0)
Yes	83 (56.8)	56.0 (30.0)
Stress in work/income matters		
No	95 (65.1)	54.0 (27.0)
Yes	51 (34.9)	65.0 (30.0)
Stress in personal matters		
No	111 (76.0)	55.0 (25.0)
Yes	35 (24.0)	57.0 (29.0)
Occupational hazards		
No occupational hazards	83 (56.8)	54.0 (28.0)
Physical hazards	13 (8.9)	60.0 (22.0)
Chemical hazards	43 (29.5)	56.0 (15.0)
Psychological hazards	19 (13.0)	72.0 (36.0)
History of work accident		
No	123 (84.2)	56.0 (25.0)
Yes	23 (15.8)	57.0 (30.0)
History of changes in work during the past 3 to 6 months		
No	123 (84.2)	55.0 (25.0)
Yes	23 (15.8)	63.0 (32.0)
History of abnormal situation in work during the past 3 to 6 months		
No	144 (98.6)	56.0 (26.0)
Yes	2 (1.4)	61.0 (8.0)

own business. Participants' occupations were grouped into categories: food and beverage workers, drivers, office workers, mechanics, builders, wholesalers, delivery personnel, general employees, security personnel, farmers, cleaners, programmers, healthcare workers, lawyers, tailors, and teachers. Table 3 presents the groups of occupations along with their median and interquartile range of working hours. The top three occupational groups were food and beverage services (18.49%), drivers (12.33%), and office workers (11.64%). About 71% of the participants were classified in the moderate intensity group. Thirty-six participants worked a dangerous work, with the majority involving welding and/or working with hazardous chemicals. Eighty-three participants (56.8%) stated that they had control over their jobs, 51 participants (34.9%) experienced stress related to work or income, and 35 participants (24.0%) experienced stress related to personal matters, e.g., health status or family issues. After evaluation of the initial telephone interview, 63 participants (43.2%) were found to have had occupational hazards, with majority experiencing chemical hazards (29.5%). In this study, 23 participants (15.8%) experienced changes in work and 2 (1.4%) experienced an abnormal situation at work around the time of the disease occurrence. Reported changes in work included change of workplace, adjustments of work schedules, change of occupation, increased workload, and heightened

workplace hazards. Reported abnormal situations at work included conflicts with one's superior and issues with one's own business.

DISCUSSION

The demographic data in this study are consistent with prior studies, which have reported that male gender, increased age, higher body mass index, low physical activity, alcohol consumption are risk factors for both stroke and myocardial infarction. The only factor in this study that differs from previous reports is smoking. The proportion of individuals who were smokers and nonsmokers at the time of the disease occurrence, unlike earlier studies, was approximately equal in the present study. This could be due to a general reduction in the number of smokers in the Thai population. As for underlying diseases, the largest group had hypertension, followed by diabetes mellitus and dyslipidemia, which is consistent with prior knowledge that these are risk factors for stroke and myocardial infarction.

A total of 16 participants (10.96%) were under the age of 45 with no underlying diseases. This group had a median of 55.5 working hours per week (IQR 23.5). Further exploration of this group revealed that 4 participants (2.74%) were under the age of 45, had no underlying diseases, denied smoking, and denied alcohol consumption. In this subgroup, the median working hours was 61.5 hours per week (IQR 35.5).

Table 3. Occupational groups and working hours

Occupational group	Frequency, n (%)	Working hours, median hours/week (IQR)
Food and beverage services	27 (18.49)	70 (30.0)
Office workers	18 (12.33)	54 (20.0)
Drivers	17 (11.64)	66 (22.0)
Builders	14 (9.59)	57 (16.0)
Wholesales	13 (8.90)	54 (31.0)
Mechanics	12 (8.22)	60 (18.5)
General employees	10 (6.85)	38 (18.0)
Delivery	8 (5.48)	55 (18.0)
Security personnel	8 (5.48)	84 (8.0)
Farmers	5 (3.42)	44 (13.0)
Cleaners	4 (2.74)	57 (7.5)
Programmers	3 (2.05)	45 (14.0)
Healthcare workers	3 (2.05)	40 (108.0)
Lawyers	2 (1.37)	37 (34.0)
Tailor	1 (0.68)	63*
Teacher	1 (0.68)	42*

*Data on only one patient available

The median working hours was 56 hours per week for all participants, 56 hours per week for participants with stroke, and 59 hours per week for participants with myocardial infarction. A study in Japan reported that over half of workers compensated for occupational cerebrovascular and cardiovascular diseases were confirmed to have overtime working hours ranging from 80 to 119 hours per month (15). The mechanism by which long working hours can cause stroke and myocardial infarction are divided into two major mechanisms: unhealthy behavior and chronic psychological stress (5). A recent WHO/ILO meta-analysis study reported that working 55 hours or more per week increases the risk of both stroke and myocardial infarction (11,12). One of the differences between the present study and the WHO/ILO study is the age of the participants. The WHO/ILO study included participants aged 15 years and above, considering them as paid workers. According to Thailand's Ministry of Labour, individuals aged 15 to 17 years old are considered children, while those aged 18 and above are considered adults. Thus, with the aim of focusing on the working population in Thailand, the age range of 18 to 65 years old was selected for this study. According to the Thai Ministry of Labour's Labour Protection Act of 2019, employees' working hours are not allowed to exceed 9 hours per day and 48 hours per week in the case of non-dangerous work, and 7 hours per day and 42 hours per week for dangerous work. Employees are not allowed to work overtime more than 36 hours per week, including work on weekends and holidays. The maximum working hours permitted by Thailand's law is 84 hours per week for non-dangerous work and 78 hours per week for dangerous work. However, it is not against the law to extend working hours as needed in cases where cessation of workflow would disrupt the entire process or in emergency conditions, provided there is an agreement with the employees. In this study, 16 participants (10.96%) reported working more than 84 hours per week. Two participants worked 112 hours per week, but this was due to having more than one job. In terms of occupational categories, security personnel had the highest median working hours, followed by workers in the food and beverage sector and drivers. A 2020 study in Korea reported that individuals who were self-employed or em-

ployers in the accommodation and food service industry had the highest working hours per week, while employees in the transportation industry had the highest working hours per week (16). A study of overwork-related cerebrovascular or cardiovascular diseases in Japan found that 30.7% of compensated cases worked in transport and postal activities, followed by wholesale and manufacturing (15).

In terms of chronic psychological stress, having no job control can lead to job stress, which can activate a neuroendocrine stress response, and, the same as long working hours, can lead to unhealthy behaviors (5). The majority of participants who reported having job control were in the 'owning a business' category, while the majority of participants who reported having no job control were in the 'routine work' category. About 43% of the participants (n=63) reported having no job control, and 26 participants, or about 41% of those who had no job control, had stress related to work or income matters. In this group, the median working hours was 61.5 with an IQR of 30. Three of the participants were aged under 45, had no underlying disease, but had no job control and were stressed by factors related to work or income matters. These three participants had a median of 57 working hours with an IQR of 23.

Shift work, considered to be psychological or organizational hazard, is an occupational factor that was found to reduce melatonin secretion leading to increased pressure and thrombus formation. Reduced duration of sleep due to shift work also can lead to altered body physiological processes. Shift work has been linked to a higher risk of stroke compared to day workers (17, 18). In this study 17 participants (11.64%) were shift workers and had been diagnosed with stroke. Their median weekly working hours was 72, with an IQR of 24.

In terms of physical hazards, heat and noise both had a possible association with cardiovascular diseases. Previous studies have tried to identify the relationship of noise and cardiovascular diseases (19-21). A recent WHO/ILO study about the effects of occupational exposure to noise on ischemic heart disease, stroke and hypertension, however, stated that there is still only limited evidence of harmfulness in humans (22). In the present study, 5 participants (3.42%) reported

being exposed to noise. Four were in the building category, and one was in the mechanics category. Only 2 participants reported being exposed to heat, one in the construction category and the other in the food and beverage service category. Four participants (2.74%) reported being exposed to physical hazards, having no job control, and having stress related to work or income matters. Those 4 participants had a median of 68 working hours with an IQR of 21.5.

Carbon monoxide, methylene chloride, nitroglycerin, solvents, pesticides, fluorocarbons, hydrocarbons, and heavy metals are chemical hazards associated with the development of cardiovascular disease (5,23). In this study, the majority of participants who reported being exposed to chemical hazards were in the mechanics category. Ten participants (6.85%) reported being exposed to chemical hazards, having no job control, and having stress related to work or income matters. This group of participants had a median of 58.5 working hours and an IQR of 6.

Examination of the criteria for diagnosing work-related cardiovascular disease in Japan, Korea, and Taiwan, which consider three key aspects of occupational factors, psychological, short-term overwork, and long-term overwork, suggests that adapting these criteria in Thailand would be a significant challenge. Obtaining records of working hours from formal workers is already a challenging task; obtaining objective evidence of working hours from informal workers would be an even greater challenge. History taking related to occupational factors could be a starting point for the development of a diagnostic procedure for Thailand and the establishment of Thailand-specific criteria in the future.

Occupational factors can be likened to small but crucial missing pieces of a jigsaw puzzle. These factors can aid in diagnosing diseases and in determining whether a patient is suffering from a work-related or occupational disease. After a diagnosis is made, adjustments to the workplace or other occupational factors could be implemented to prevent the disease from occurring in other workers. Accommodations in the workplace can greatly assist patients undergoing treatment upon their return to work and can also help prevent recurrence. It is evident that long working hours are associated with stroke and myocardial

infarction (11,12). Previous studies have also found that working ≥ 55 hours per week is associated with the risk of recurrent coronary heart disease, with a HR of 1.67 and a 95% CI of 1.10 to 2.53 (24). Other occupational factors may also be associated with disease recurrence, indicating the need for further study. For future study and diagnosis of work-related and occupational diseases, recognition of occupational factors is crucial.

There are several limitations in this study. Some degree of recall bias is inevitable in a retrospective study such as this. A telephone interview was chosen with the aim of obtaining as much detail as possible regarding working hours and other occupational factors in order to mitigate recall bias. Obtaining official or company records of working hours and other occupational factors presents a significant challenge. The second limitation of this study is the relatively low number of participants. Although this is a census-based study, the number of participants was still limited. A larger number of participants could provide a clearer image and offer more insights for future studies in Thailand. The third limitation of this study pertains to generalization. Since data collection in this study was from a single center, a multi-center study in the future might provide a better understanding of occupational factors in Thailand.

CONCLUSIONS

The number of working hours of the majority of stroke and myocardial infarction patients in this study did not exceed the limits set by Thailand's Ministry of Labour law, but did exceed those outlined in the WHO/ILO study. Most participants were employed in the food and beverage service industry and were not engaged in dangerous work. The majority reported they had control in their work, experienced minimal stress, and encountered no significant occupational hazards at their workplace. However, a small proportion did report experiencing stress and encountering occupational hazards. Recognizing and documenting the history of occupational factors could serve as a starting point for future studies, including disease diagnosis and disease prevention efforts. Furthermore, acknowledging of occupational factors during the return-to-work process of patients is crucial for facilitating work accommodations and preventing disease recurrence.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

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