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Research Paper

Association between early career nurses' social jetlag, affect, depression, and quality of life

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ABSTRACT

Background: Social jetlag in nurses is a long-standing challenge for nursing management. It has been attributed to the effects of shift work that disrupts nurses' circadian rhythms, may be detrimental to their health, and can lead to rapid turnover.
Aim: We aimed to identify the association between social jetlag, affect, depression, and quality of life of early career nurses.
Methods: In this cross-sectional study, 201 early career nurses at three tertiary hospitals in South Korea were included. Data were collected from May to July 2018. Social jetlag, affect, depression, and quality of life were measured using the Munich Chronotype Questionnaire (shift version), the Positive and Negative Affect Scale, the Centre for Epidemiological Studies Depression Scale (Korean version), and the Korean World Health Organization Quality of Life Scale (abbreviated version), respectively.
Findings: Participants' mean overall social jetlag and quality of life scores were 4 hours 28 minutes and 80.21, respectively. Multiple regression analyses identified overall social jetlag, positive and negative affect, and depression as factors influencing the nurses' quality of life.
Discussion: Understanding the implications of factors affecting early career nurses' quality of life, including social jetlag, is vital to ensure staff retention. Nursing management should consider the individual social jetlag of nurses when scheduling shifts and accordingly create institutional human resources management strategies to reduce negative affect and depression while promoting positive affect in early career nurses.
Conclusion: Social jetlag, negative affect, and depression negatively impact early career nurses' quality of life, whereas positive affect positively impacts their quality of life.

Summary of relevance

Problem or Issue

Early career nurses experience burnout, which increases their risk of turnover and may impact patient outcomes and safety.

What is already known

Due to their dynamic work-shifts schedule, nurses are severely affected by social jetlag. This has been a challenge for nursing management, warranting a deeper understanding of its effects on nurses' quality of life.

What this paper adds

Social jetlag, negative and positive affect, and depression impact early career nurses' quality of life. Nursing management should effectively manage nurses' shift schedules and implement strategies to reduce negative affect and depression while promoting positive affect in nurses.

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1. Introduction

Shift work disrupts circadian rhythms and increases the prevalence of chronic diseases such as diabetes (Kecklund & Axelsson, 2016) and all-cause mortality (Books et al., 2020). Social jetlag has been identified as a key risk factor for depression (Lee et al., 2016) and adversely affects nurses' physical and mental health (Books et al., 2020; Lee et al., 2016). It has been a long-standing challenge for nursing management, and a deeper look at the effects of shift work on nurses' quality of life is required.

The measurement of shift workers' circadian rhythm dysregulation has changed over time. Researchers have explored the effects of shift worker chronotype by classifying participants into different chronotypes (i.e., morning and evening types; Rodwell & Fernando, 2016) and investigating its influence on negative affect, subjective well-being, and sleep (Lee et al., 2015). Studies also examined the relationship between chronotype and tolerance for shift work (Lee et al., 2015) and found that evening types experienced more negative effects of shift work than did morning types. However, research regarding circadian rhythms has transformed since the concept of social jetlag was introduced (Wittmann et al., 2006). Social jetlag refers to asynchrony between an individual's internal and external clock (social working hours; Wittmann et al., 2006). Accordingly, research focus has shifted from using the simple classification of chronotypes to calculating more specific and individualised social jetlag (Roenneberg et al., 2019). Social jetlag is a sensitive indicator of misalignment between the sleep-wake cycle and circadian rhythm (Roenneberg et al., 2019). Owing to the nature of their work shifts, nurses are at a high risk of developing physical and mental health problems and experiencing severe levels of job stress and burnout (Chen et al., 2020). As this leads to turnover (Brook et al., 2021), the inflow of new nurses inevitably surges, thus increasing the proportion of young nurses. Xie et al. (2011) indicated that young nurses who work shifts in high-grade hospitals experience severe work stress, which often leads to burnout, and that policies or interventions are required for them. Research targets young nurses to understand their transition experiences (Kaihlanen et al., 2020) and the factors that influence their job stress and mental health (Chen et al., 2020).

1.1. Background

Research indicates that social jetlag is an inevitable, generalised phenomenon experienced by most regular and shift workers (Rutters et al., 2014; Vetter et al., 2015). Nurses are affected by social jetlag more severely than non-shift workers, owing to the dynamic shift work schedule compared to a temporary disturbance of their circadian rhythm (Kang et al., 2020). Uekata et al. (2019) reported that the social jetlag of nurses working three-shift rotations was 1.5 times that of nurses who only worked during the day. Moreover, social jetlag negatively affected the sleep quality of young nurses working three-shift rotations (Kang et al., 2020). Nurses' abilities to perform their jobs decreased as social jetlag increased, suggesting that it affected nurses' health and patient outcomes (Yong et al., 2016). Higher social jetlag was further associated with burnout among evening shift workers (Cheng & Hang, 2018). However, allowing shift workers to schedule their shifts using participatory scheduling software directly improved sleep, health, and quality of life, compared to traditional scheduling methods (Karhula et al., 2020).

Notably, nurses aged younger than 35 years and with less than 10 years of experience account for 50% of all nurses in the Western Pacific regions (World Health Organization, 2021). Early career nurses who experience burnout have a higher risk of job turnover (Marufu et al., 2021), which directly impacts patient outcomes and safety (Duffield et al., 2014). Accordingly, a World Health Organization (WHO) policy report suggested that strategies should target nurses aged younger than 35 years to improve health outcomes worldwide, thereby benefiting society in general (World Health Organization, 2021). Therefore, this study aimed to identify the association between social jetlag (i.e., discrepancies in circadian rhythms), affect, depression, and quality of life of early career nurses.

2. Methods

2.1. Design

This was a cross-sectional study.

2.2. Participants and data collection

Based on previous studies (Chen et al., 2020; Cho et al., 2020), we defined 'early career' as less than 10 years of accrued experience and an age younger than 35 years. The inclusion criteria were nurses (i) working three-shift rotations (transition times: 07:00, 15:00, and 22:30) in tertiary hospitals for one year to 10 years; and (ii) who understood the purpose and content of this study and agreed to participate voluntarily. The sample size required for the multiple regression analyses was 199 people, given a significance level of .05, power of .95, 15 variables, and medium effect size f^2 of 0.15 according to G*power 3.1.9.2. The questionnaire was distributed to 222 people, assuming a dropout rate of 10%.

Data were collected at three tertiary hospitals in South Korea from May to July 2018. The nursing departments of the hospitals reviewed the IRB approval letter, study proposal, and questionnaires, and then granted research permission. Questionnaires, including consent form and study information, were delivered to the nursing departments in-person. Nursing department officials (not related to this study) delivered the same to the unit managers and requested their cooperation. Additionally, the research assistants explained the study's purpose and method to the participants; an anonymous collection envelope along with $10 gift card as reward and questionnaires were provided to the participants after obtaining written informed consent. In total, 201 responses were retrieved (response rate 90.5%).

2.3. Measures

Referring to previous studies, sex (Tang et al., 2019), age (Chang & Jang, 2019), marital status (Han et al., 2014), and participation in religious services (Ferris, 2002) were included as general characteristics. Furthermore, the study's major variables—stress, social jetlag, chronotype, affect, depression, and quality of life—are defined in Supplementary Table 1.

2.3.1. Stress

We measured fasting salivary cortisol levels to evaluate participants' stress levels. Cortisol is a stress hormone that serves as a signalling molecule in the hypothalamic-pituitary-adrenocortical axis in response to stress (Holsboer & Ising, 2010). Participants' saliva samples were collected 30 minutes after waking on the second day of their two consecutive free days using Salivette®, consisting of a tube with a cotton swab.

2.3.2. Social jetlag

The Munich Chronotype Questionnaire (MCTQshift) was developed by Juda et al. (2013) based on the MCTQ (Roenneberg et al., 2012) to measure the social jetlag of shift workers. The MCTQshift measures sleep-wake patterns, such as the time of preparing to fall asleep, sleep onset, sleep latency, time of awakening, time to get up, and nap time. Working days and holidays are divided by day

work, evening work, and night work to calculate the time of mid-sleep on free days, corrected for sleep debt accumulated over the workdays during day/evening/night shifts. Accordingly, the overall social jetlag and the social jetlag for each shift of the shift worker can be calculated (Juda et al., 2013).

2.3.3. Chronotype

The Morningness–Eveningness Questionnaire (MEQ) is a chronotype evaluation tool developed by Horne and Östberg (1976). We used the Korean version (MEQ-K; Lee et al., 2014). The MEQ is the predominant measure used to study individual differences in the circadian rhythm (Lee et al., 2014). It classifies chronotypes into five types: extreme evening (16–30 points), moderate evening (31–41 points), neither (42–58 points), moderate morning (59–69 points), and extreme morning (70–86 points). The higher the score, the greater the extent that the respondent is a morning type. Cronbach's α was .82 at the time of development and .77 for the MEQ-K. In this study, Cronbach's α was .71.

2.3.4. Affect

The Positive and Negative Affect Scale (Watson et al., 1988) used to measure affect comprises 20 items, with 10 measuring negative affect and 10 measuring positive affect. Items are rated using a five-point Likert scale (1 point = *strongly disagree*, 5 points = *strongly agree*). Scores range from 10 to 50 points each for both positive and negative affect. Higher scores indicate more positive or more negative affect. At the time of development, Cronbach's α was .86 and .87 for positive and negative affect, respectively (Watson et al., 1988). In this study, Cronbach's α was .89 for positive affect and .87 for negative affect.

2.3.5. Depression

The Korean version of the Centre for Epidemiological Studies Depression Scale (CES-D; Chon et al., 2001), used to measure participants' level of depression, comprises 20 items rated on a four-point Likert scale (0 points = *1 day or less per week*, 3 points = *5 days or more per week*). Scores range from 0 to 80 points. Higher scores indicate more severe depression. Cronbach's α was .91 for the Korean version of CES-D (Chon et al., 2001) and .89 in the current study.

2.3.6. Quality of life

The Korean World Health Organization Quality of Life (WHOQOL) Scale abbreviated version (Min et al., 2002), used to measure the participants' quality of life, comprises 26 questions in four subdomains: physical health, psychological health, social relationships, and environment. Two questions query the overall quality of life. At the time of the WHOQOL scale development, Cronbach's α was .90. In this study, Cronbach's α was .88.

2.4. Ethical considerations

The research was conducted after receiving approval from the institutional review board of Euji University (approval number: *** 18-2; date of approval: 3 January 2018). Participants whose autonomy and anonymity were guaranteed provided informed consent to participate. The completed self-report questionnaires were sealed in anonymous collection envelopes, submitted to the nursing department, and collectively recovered by the researchers. The study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.

Table 1
Participants' general characteristics (N = 201).

Variable	Category	n (%)	M (SD)
Sex	Men	11 (5.5)	
	Women	190 (94.5)	
Age (years)			26.48 (2.63)
Marital status	Married	17 (8.5)	
	Single	184 (91.5)	
Participation in religious services	No	127 (63.2)	
	Yes	74 (36.8)	

Note. M, mean; SD, standard deviation.

Table 2
Cortisol level, circadian parameters, and social jetlag (N = 201).

Variable	Category	n (%)	M (SD)
Cortisol (saliva; μg/dl)			0.24 (0.29)
Chronotype (MEQ)	Extreme evening type	10 (5.0)	
	Moderate evening type	113 (56.2)	
	Neither	75 (37.3)	
	Moderate morning type	1 (0.5)	
	Extreme morning type	2 (1.0)	
Sleep duration (h:min)	Morning shift		6:39 (1:50)
	Evening shift		6:36 (1:39)
	Night shift		8:00 (2:04)
	Overall		6:49 (1:26)
SJL (absolute) (h:min)	Morning shift		3:40 (1:53)
	Evening shift		4:40 (1:50)
	Night shift		6:11 (1:56)
	Overall		4:28 (1:13)

Note. M, mean; MEQ, Morningness–Eveningness Questionnaire; SD, standard deviation; SJL, social jetlag.

2.5. Data analysis

Data analysis was performed using SPSS Statistics 24.0 (IBM, Armonk, NY). Participants' general characteristics, circadian type, social jetlag, and quality of life were summarised using descriptive statistics. Differences in quality of life according to general characteristics were analysed with t-tests and one-way analyses of variance. Relationships between significant variables were analysed using Pearson's correlation coefficients. The Kolmogorov–Smirnov test was used to assess the normality of variable distributions. Multiple stepwise regression analyses were used to identify the factors affecting the nurses' quality of life. Missing data were handled using the listwise deletion method.

3. Results

3.1. Participants' general characteristics and circadian sleep parameters

Participants' mean age was 26.48 years; 94.5% were women and 56.2% were moderate evening chronotype (Table 1). The mean overall social jetlag calculated by integrating all shifts was 4 hours and 28 minutes (Table 2).

3.2. Quality of life according to general characteristics and chronotype

Differences in quality of life according to the general characteristics and chronotype of the participants were statistically non-significant (Table 3).

3.3. Correlations among variables

Social jetlag was negatively correlated with age (r = -.16, p = .020), chronotype (r = -.23, p = .001), and quality of life

Table 3
Comparison of quality of life based on participants' general characteristics and chronotype (N = 201).

Variable	Category	n (%)	M (SD)	t/F	*p*
Sex	Men	11 (5.5)	82.82 (12.25)	0.81	.417
	Women	190 (94.5)	80.06 (10.84)		
Marital status	Married	17 (8.5)	84.53 (8.54)	1.71	.088
	Single	184 (91.5)	79.82 (11.03)		
Participation in religious services	No	127 (63.2)	79.93 (10.61)	0.48	.629
	Yes	74 (36.8)	80.70 (11.46)		
Chronotype (MEQ)	Extreme evening	10 (5.0)	74.40 (8.13)	0.94	.443
	Moderate evening	113 (56.2)	80.07 (10.60)		
	Neither	75 (37.3)	81.04 (11.51)		
	Moderate morning	1 (0.5)	86.00		
	Extreme morning	2 (1.0)	83.50 (19.09)		

Note. M, mean, MEQ, Morningness–Eveningness Questionnaire; SD, standard deviation.

(r = -.29, $p < .001$), and positively correlated with cortisol level (r = .26, $p < .001$) and depression (r = .14, $p = .042$; Table 4).

3.4. Factors affecting quality of life

Multiple stepwise regression analyses were performed. The factors that influenced the quality of life of the participants were positive affect ($\beta = .42$, $p < .001$), depression ($\beta = -.31$, $p < .001$), overall social jetlag ($\beta = -.21$, $p < .001$), and negative affect ($\beta = -.16$, $p = .011$). The model explained 44.0% of the variance (Table 5).

4. Discussion

In this study, a statistically significant positive correlation between social jetlag and fasting salivary cortisol levels was found. Although this result is consistent with the findings of Rutters et al. (2014), Polugrudov et al. (2016) found no evidence of a link between social jetlag and cortisol levels. Moreover, salivary cortisol negatively affects the quality of life (Hagger-Johnson et al., 2010) and plasma cortisol is found to have a negative association with psychological quality of life (Tang et al., 2019). Nevertheless, salivary cortisol had no significant relationship with quality of life in this study. The studies may have yielded inconsistent results because cortisol levels fluctuate considerably throughout the day, displaying substantial differences depending on the sampling time, and are highly sensitive to the surrounding environment (Holsboer & Ising, 2010). Although each fasting salivary cortisol sample was collected simultaneously, participants' individual circumstances differed; for example, the participants may have performed different duties before the sample collection.

The mean overall social jetlag of early career nurses was 4 hours 28 minutes. A similar finding with two-shift rotation workers (Fischer et al., 2016) has been reported—with 2 hours 33 minutes for the day shift and 5 hours 1 minute for the night shift. Social jetlag for the day shift was similar to that reported by Choi et al. (2017) at 3 hours 18 minutes. In a study on social jetlag among workers with a two-shift rotation (Uekata et al., 2019), the average social jetlag was 1 hour (range = 30–120 minutes), which differs from the overall social jetlag we found. As Uekata et al. (2019) did not use the MCTQ shift version for the calculations, their results may have incorrectly represented social jetlag regarding nurses' complex working schedules. In addition, the average age of the participants was 34.0 years (range = 27–42 years) and 41.0 years in studies by Uekata et al. (2019) and Fischer et al. (2016), respectively.

Typically, social jetlag tends to be higher with a late chronotype (Roenneberg et al., 2019) which is associated with younger age in adults (Roenneberg et al., 2012). For adults in their early 20s, social jetlag is remarkably high, being approximately twice that of persons in their 40s and thrice that of those in their 60s (Foster et al., 2013). The social jetlag in the current study may have been higher owing to the relatively young age of the participants. Among persons with an average age of 43.5 years, the overall social jetlag of those working three-shift rotations was 3 hours 6 minutes (Hulsegge et al., 2019), which was lower than that in the current study. Social jetlag increased in the order of day shift, evening shift, and night shift. As shift workers have been largely disregarded in chronotype research (Rodwell & Fernando, 2016), and few studies examine social jetlag among three-shift rotation workers, it is challenging to draw robust conclusions.

The multiple regression analyses results indicated that social jetlag was associated with the early career nurses' quality of life. Similar to the present study, chronotype did not influence the quality of life in a systematic review of studies of the chronotype and shift work tolerance of shift workers (Saksvik et al., 2011) because two-thirds of the participants belonged to neither type group. Instead, social jetlag (Roenneberg et al., 2019), a more specific and individually calculated value than chronotype, was associated with quality of life. This is consistent with (i) predictions made at the time of the MCTQ development (Roenneberg et al., 2003); and (ii) studies involving nursing students (Chang & Jang, 2019) and patients with sleep problems (Kayaba et al., 2018). However, there is no extant research on social jetlag and quality of life among shift work nurses; thus, comparative discussions must be conducted in the future.

Additionally, multiple regression analyses revealed that positive and negative affect and depression were significantly associated with the quality of life of early career nurses. This is consistent with a prior study involving nursing students (Chang & Jang, 2019). As negative affect and depression influence the quality of patient care and the health of individual nurses (Lee et al., 2016; Chen et al., 2020), the personal well-being of nurses was added to the standards of the American Nurses Credentialing Centre's Pathway to Excellence Program. As such, the dispositional characteristics of shift nurses can affect the outcomes for both nurses and patients. The shift work schedule should consider the characteristics of shift work and individual nurses' chronotype and negative affect (Rodwell & Fernando, 2016).

Moreover, as the circadian clock and human health are inseparable, strategies are needed to minimise the misalignment of the human circadian rhythm (i.e., social jetlag) to promote health in all relevant disciplines (Roenneberg & Merrow, 2016). Rosa et al. (2019) systematically reviewed the effects of shift work on health and emphasised that ergonomic changes are needed to schedule nurses' shift work to decrease adverse health effects. Vetter et al. (2015) applied a chronotype-adjusted schedule de-

Table 4
Correlation among variables (N = 201).

	Age	Cortisol	Social jetlag				Chronotype	Positive affect	Negative affect	Depression	QoL
			M	E	N	Overall					
	r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)		r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)
Age	1										
Cortisol	-.05 (.496)	1									
Social M	-.11 (.109)	.34 (<.001)	1								
jetlag E	-.16 (.023)	.11 (.137)	.47 (<.001)	1							
N	.04 (.587)	-.09 (.225)	-.20 (.004)	-.43 (<.001)	1						
Overall	-.16 (.020)	.26 (<.001)	.87 (<.002)	.77 (<.001)	-.09 (.214)	1					
Chronotype	.00 (.983)	.00 (.984)	-.26 (<.001)	-.24 (.002)	.28 (<.001)	-.23 (.001)	1				
Positive affect	-.02 (.806)	.06 (.387)	-.12 (.098)	-.10 (.171)	.11 (.137)	-.11 (.117)	.07 (.340)	1			
Negative affect	-.07 (.322)	-.16 (.023)	-.03 (.643)	-.03 (.642)	.02 (.834)	-.04 (.544)	-.10 (.165)	.13 (.072)	1		
Depression	-.12 (.088)	-.08 (.288)	.26 (<.001)	.08 (.264)	-.21 (.003)	.14 (.042)	-.12 (.080)	-.16 (.026)	.49 (<.001)	1	
QoL	.08 (.234)	-.01 (.939)	-.32 (<.001)	-.20 (.005)	.11 (.132)	-.29 (<.001)	.15 (.038)	.47 (<.001)	-.25 (<.001)	-.49 (<.001)	1

Note. E, evening shift; M, morning shift; N, night shift; QoL, quality of life.

Table 5
Factors influencing the early career nurses' quality of life (N = 201).

Step 1				**Step 2**				**Step 3**				**Step 4**							
Variables	B	β	*p*	Variables	B	β	*p*	Variables	B	β	*p*	Variables	B	SE	β	t	*p*	VIF	95% CI	
(Constant)	88.48			(Constant)	71.86		< .001	(Constant)	79.64		< .001	(Constant)	83.06	3.57		76.02	< .001		76.02	90.10
Depression	-0.61	-.49	< .001	Depression	-0.54	-.43	< .001	Depression	-0.50	-.40	< .001	Depression	-0.40	0.08	-.31	4.93	< .001	1.45	-0.55	-0.24
				Positive affect	0.61	.40	< .001	Positive affect	0.59	.38	< .001	Positive affect	0.64	0.08	.42	7.52	< .001	1.09	0.47	0.80
								Overall SJL	0.00	-.19	.001	Overall SJL	-0.00	0.00	-.21	3.79	< .001	1.04	-0.00	0.00
												Negative affect	-0.24	0.09	-.16	2.56	.011	1.41	-0.42	-0.06
Adjusted R^2 = 0.24				Adjusted R^2 = 0.39				Adjusted R^2 = 0.42				Adjusted R^2 = 0.44								
F = 62.32, p < .001				F = 64.81, p < .001				F = 49.64, p < .001				F = 39.92, p < .001								
												Durbin-Watson's du = 1.90 (du = 1.81, 4-du = 2.19)								
												Breusch–Pagan's χ^2 = 1.62 (p = .805)								
												Kolmogorov–Smirnov test (Z = 0.04, p = .952)								

Note. Stepwise method entered variables: marital status, saliva cortisol (μg/dl), morning shift SJL, evening shift SJL, night shift SJL, overall SJL, chronotype, positive affect, negative affect, and depression. CI, confidence interval; SE, standard error; SJL, social jetlag; VIF, variance inflation factor.

signed to minimise social jetlag in individuals, which led to an improved quality of sleep with reduced circadian disruption in shift workers, resulting in an improved quality of life. Nurses' quality of life was also significantly enhanced when shift work nurses directly participated in shift work schedules that considered their circadian rhythm (Karhula et al., 2020).

4.1. Limitations

The generalisability of the results is limited because self-reported data on the sleep-wake time were used rather than objective data, such as actigraphy or continuous melatonin sampling. In addition, since participants were conveniently sampled from two regions of South Korea, there was a possibility of selection bias, resulting in limited overall generalisability. Since nursing remains a highly gendered profession with associated biases in the workplace as women make up approximately 90% of the global nursing workforce (World Health Organization, 2021), it was difficult to generalise the results for men. Furthermore, as this study employed a cross-sectional design, there were limits to establishing causal relationships between the variables. Future research could address the limitations by using a longitudinal cohort study to examine the long-term effects of social jetlag.

5. Conclusions

Social jetlag, positive and negative affect, and depression impact early career nurses' quality of life. Therefore, early career nurses' shift schedules should be managed with consideration for social jetlag to promote their quality of life. Nursing managers must accordingly create institutional human resource management strategies to reduce negative affect and depression while promoting positive affect in early career nurses.

Data availability statement

The data presented in this study are available on request from the corresponding author and with permission of the Institutional Review Board of Eulji University.

Authorship contribution statement

S.J.C. and S.J.J.: Conceptualisation, methodology, formal analysis, investigation, resources, writing—original draft preparation, writing—review and editing. Funding acquisition S.J.J. All authors have read and agreed to the published version of the manuscript.

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Ethical statement

This study was approved by the institutional review board at Eulji University (approval number: EU18-2; date of approval: 3 January 2018).

Conflict of interest

The authors have no conflict of interest to declare.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.colegn.2022.10.005.

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