

Reliability and validity of culturally adapted executive function performance test for Thai people with substance-induced disorders

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ABSTRACT

Background: Recently, the executive function assessment tools in Thailand are mainly administered as the bottom-up approach using separate tasks of client skills more than as the top-down approach using activities in daily life contexts. These bottom-up assessments are focused on the components of executive function which are not relevant to client's participation in real situations.

Objectives: The aims of this study were to develop and appraise the standardization of Executive Function Performance Test in Thai version (EFPT-Th) which was culturally adapted as the performance-based executive function tests for Thai contexts.

Materials and methods: Back-translation process and expert's agreement were introduced to develop EFPT-Th. Thirty participants diagnosed with substance-induced disorders were recruited to examine the internal consistency, intra-rater reliability and inter-rater reliability. Moreover, the criterion validity was analyzed by the correlation with Behavioral Assessment of the Dysexecutive Syndrome (BADS).

Results: The internal consistency of EFPT-Th was considered to be acceptable (Cronbach's alpha=0.72). For intra-rater and inter-rater reliability of EFPT-Th total score demonstrated high level of coefficients (ICC=0.98 and 0.88, respectively). The criterion validity of EFPT-Th was reported significantly high negative correlations between the total EFPT-Th scores and the BADS total profile scores ($r=-0.63$, $p<0.01$).

Conclusion: The present study provides that EFPT-Th is the performance-based test of executive function which is culturally appropriate adaptation for Thai contexts. EFPT-Th also could be the benefit to occupational therapists to evaluate the executive function and determine the level of assistance for clients with executive dysfunction to engage in the instrumental activities or complex daily tasks.

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Introduction

Currently, it was reported that 225 million individuals worldwide possessed a drug addiction.¹ Chronic drug dependence correlated with cognitive impairment and executive dysfunction. Previous research showed that the long-term drug use can lead to the disturbances in synaptic functioning, receptor sensitivity and the synaptic reuptake mechanism in the brain. Especially, the prefrontal cortex is altered by chronic exposure to drugs causing executive dysfunction.²⁻⁶

Executive Function (EF) is an higher cognitive ability to conduct, prepare and combine information involving thought process, goal-directed action and self-regulation.⁷ Hughes and colleagues in 2005 also defined EF which comprises of inhibitory control, working memory, and attention flexibility.⁸ Lezak model divided EF into volition, planning, purposive action and effective performance that linked into the aspect of occupational therapy.^{9, 10} In occupational therapy, EF is a critical thought process of how individuals can participate in complex activities, non-routine tasks or unstructured actions.⁷ Therefore, executive dysfunction may cause the interference of complex activities in daily living such as housing application, childcare, driving a vehicle, instrumental activities of daily living, work, social skills and participation in community life.^{11, 12} An occupational therapist has a role in the rehabilitation that establishes the clients with executive dysfunction to independently participate and engage in activities.

Occupational therapists evaluate and treat substance-induced disorder in the area of executive dysfunction by conducting to promote learning strategies to participate the meaningful activities. Thus, the evaluation process to identify the EF problems is extremely crucial and important. Generally, the majority of the assessment are standardized neuropsychological tests i.e. Trail Making Tests,¹³ Digit span forward and backward: Wechsler Memory Scale-Revised¹⁴

and the Behavioral Assessment of the Dysexecutive Syndrome (BADS).¹⁵ These bottom-up assessments are examined EF components which did not link to the actual daily activities. Therefore, these neuropsychological tests cannot predict the capacity of EF in the real environment and context of the clients.¹⁶ According to the limitation of general EF tests, the Executive Function Performance Test (EFPT) is top-down assessment and has been developed by occupational therapists.¹⁷ Moreover, EFPT is a standardized performance-based EF test which is compiled with the Lezak model of EF components.^{9, 10} EFPT had been translated and culturally adapted into several languages and had been studied the psychometric properties in various groups including stroke, schizophrenia, homeless individuals and multiple sclerosis.¹⁸⁻²³ In Thailand, the international assessment instruments are mainly used to evaluate EF which are not relevant to client's participation in real situations. Therefore, occupational therapists need the standardized test that has the properties to evaluate EF components on the daily live activities within Thai context using timeless and low-cost expenses. Finally, the interpretation of EF test will be able to utilize planning and outcomes of occupational therapy programs as well as communicating with clients and multidisciplinary team.

EFPT had been translated and altered in many countries, for example, Sweden,¹⁹ United States,²⁰ Korea²² and Israel.^{24, 25} However, Thailand has significant cultural variants from other countries. Hence, the adopting EFPT would be considered to change and add the tasks including instruments and materials which are familiar with the Thai cultural contexts. Therefore, the purpose of this study was to establish the Executive Function Performance Test in Thai version (EFPT-Th). The psychometric properties of EFPT-Th including content validity, internal consistency, criterion validity, intra-rater and inter-rater reliability, were studied in the people with substance-induced disorders.

Table 1 Tasks replaced in agreement with the Thai culture in EFPT-Th.

EFPT tasks	EFPT-Th tasks
Making oatmeal	Making instant rice porridge (Simple cooking Task 1) Making omelet (Simple cooking Task 2)
Ordering groceries from local grocery store by phone	Requesting delivery of food from the restaurant by telephone
Compensate cable and telephone bills utilizing check	Compensate electricity bills and telephone bills utilizing cash

EFPT: Executive function performance test, EFPT-Th: Executive function performance test: Thai version

Materials and methods

Translation and Cultural Adaptation

The process of adapting the original EFPT version to Thai version comprised of 4 steps: The first step was the forward and backward translation. Two bilingual lecturers of occupational therapy were used for the forward translation then two bilingual experts who had 5- and 10-years' experience in psychosocial field were used for the backward translation. Lecturers and experts hadn't previously seen EFPT. For this step, EFPT-Th draft 1 was obtained.

The second step, there also were three occupational therapists with 5 years cognitive rehabilitation experience to agree and discuss of comparing the variances then rectifying the difference points until EFPT-Th was accomplished. EFPT-Th draft 2 was added and adapted the tasks familiar with the Thai context but it still composed of content, method and detail of EFPT original version as shown in Table 1.

The third step was the content validity. Three professionals were designated to fill agreement on the Index of item-Objective Congruence (IOC) and comment.²⁶

IOC for the components in each task exhibited a high level of agreement (IOC=0.67-1.00). EFPT-Th draft 3 was gained.

The final step was to test EFPT draft 3 with the healthy participants aged between 20-40 years. The results were examined as the pilot study to adjust and rectify the assessment. For this step, the completed EFPT-Th was achieved.

Psychometric properties study

Psychometric properties of EFPT-Th were studied including internal consistency, inter-rater and intra-rater reliability and criterion validity. Thirty participants were diagnosed with substance-induced disorder, participants were in occupational therapy programs at Somdet Chaopraya Institute of Psychiatry by a purposive sampling. The inclusion criteria were as follows: (1) who had been diagnosed with substance-induced disorder by Diagnostic and Statistical Manual of Mental Disorders (DSM)-5 (2) who had been screened from occupational therapists for cognitive problems with screening test, Montreal Cognitive Assessment (MoCA) and Trail Making Test (TMT) (3) aged between 20-40 years (4) who had got Mini-Mental State Examination-Thai version (MMSE-Th) scores of 22 or more (5) who had no visual, auditory, and communication impairments. The exclusion criteria included (1) who were diagnosed with substance-induced psychotic disorder (2) who had the problems of emotional and behavioral controls. Participants were informed about the research study according to ethical principles. This study was granted ethics approval from Mahidol University Central Institutional Review Board (COA No. MU-CIRB 2018/217.0511).

Measurements

EFPT is the performance-based standardized assessment that is used to assess the cognitive function²⁷ It composes of a macro-level view of cognition which all functional operations are examined as individual capacity. Because of the limitation in micro-level assessments, there is no transfer from cognitive process deficiencies to performance dysfunction.^{28, 29} EFPT is used to measure EF capacity and functional processing in the environmental context which were similar and adaptable to real life. EFPT scores derive from the assessment by tasks which are important for independent living and self-care, as follows, (1) simple cooking skills, (2) using a telephone, (3) medication management and (4) paying bills. In this study, EFPT-Th was adjusted and added tasks that were relevant to Thai culture and contexts. For EFPT-Th, the simple cooking tasks 1 and 2 were the making instant rice porridge and the making an omelet. While the participants performed each task of EFPT-Th, the five behavioral performance were scored including initiation, organization, sequencing, safety and judgment and completion. Scores were rated into 6 scales according to the cueing system (0=no cue required, 1=verbal guidance, 2=gestured guidance, 3=direct verbal assistance, 4=physical assistance and 5=therapist does the component for participant). The greater average score, the more needed cues and the more severity of executive function deficiencies.

Behavioral Assessment of the Dysexecutive Syndrome

(BADS)¹⁵ is a neuropsychological test, comprising 6 subtests, that measures the EF components including mental flexibility and shifting, planning and problem solving, systematic planning and spatial search, adherence to rules, time estimate, and switching between different tasks. The assessment process was established by 6 activities: The Rule Shift Cards test, Action Program test, Key Search test, Temporal Judgment test, Zoo Map test, Modified Six Elements Test. Each subtest has scores from 0 to 4 with the total score being 24. This assessment has been studied for reliability and validity in healthy, acquired brain injury, and schizophrenia samples.³⁰⁻³³ BADS can be assessed in the age range from 16-87 years and takes relatively 40 minutes to assess. This assessment is considered as a gold standard test because it is acknowledged as a standardized test for evaluating core functions of the executive function. In this study, BADS was utilized for the criterion validity of EFPT-Th.

EFPT-Th was used to assess thirty participants with substance-induced disorders. The performance was videotaped during the assessment process. The researcher rated scores following the criteria of EFPT-Th then summarized the scores in each task and the total score of EFPT-Th for determining the internal consistency. Additionally, the samples were assessed with 6 activities of the BADS. After that, the scores of EFPT-Th and the scores of the BADS were analyzed the correlation for measuring the criterion validity. Inter-rater reliability was also evaluated using thirty participants with substance-induced disorders by two occupational therapists who had clinical experience more than 5 years. Two occupational therapists independently rated the scores of EFPT-Th by observing video footages of performance. The scores of EFPT-Th from two raters were analyzed the correlation to determine the inter-rater reliability. For the intra-rater reliability, one occupational therapist was assigned to rate the scores of EFPT-Th by observing video footages of performance for two periods with 7 days interval to decrease the effect of recall bias.³⁴ The scores of first and second period were analyzed the correlation.

Statistical Analysis

All statistical analyses in this examination were performed by SPSS for Windows (Version 17.0; SPSS Inc., Chicago, IL). Demographic characteristics were calculated using descriptive statistic. Cronbach alpha coefficient were analyzed the internal consistency because EFPT-Th was scored with the Likert scale; which was considered to be ordinal scale. Spearman's rank correlation was considered to examine the criterion validity. Lastly, intra-class correlation coefficients (ICCs) were used to determine intra-rater reliability and inter-rater reliability.

Results

Descriptive data for the characteristics of the participants presented in Table 2. The sample group composed of thirty participants with twelve males (40%) and eighteen females (60%). The mean age of the sample was 31.10 (SD=6.23, range =20-40). The mean time of substance induced disorder

onset was 8.82 years (SD=7.30, range=0.08-25). Most of participants had lower secondary level education (43.33%). The majority (86.67%) of the participants had used stimulant drugs. The mean of MMSE score was 25.68 (SD=2.36, range=22-29).

Table 2 Demographic characteristics (n=30).

Characteristics	Participants	Percentage
Sex		
Male	12	40
Female	18	60
Substance type		
Alcohol	4	13.33
Cannabinoids	7	23.33
Stimulants	26	86.67
Education		
Primary education	11	36.67
Lower Secondary Education	13	43.33
Upper Secondary Education	4	13.33
Bachelor's Degree	2	6.67
	Mean (SD)	Range
Age (years)	31.10 (6.23)	20-40
Duration from onset (Years)	8.82 (7.30)	0.08-25
MMSE-Th score	25.68 (2.36)	22-29

MMSE-Th: Mini-mental state examination-Thai version

Intra-rater and inter-rater reliability

The average and range of the participants' scores in EFPT-Th were shown in Table 3. Mean of EFPT-Th total score was 12.86 (SD=4.01, range=3-24). The results indicated that participants required higher levels of assistance in the task using the telephone (mean=3.40, SD=1.44) and paying bills (mean=3.37, SD=0.86) than simple cooking task 1 (mean=2.80, SD=1.44), simple cooking task 2 (mean=1.70, SD=1.37) and medicine management (mean=1.60, SD=1.39).

Sequencing (mean=7.80, SD=2.49) and organization problems (mean=4.20, SD=1.88) were found the difficulties more than initiation (mean=0.00, SD=0.00), safety and judgement (mean=0.83, SD=1.06) and completion (mean=0.07, SD=0.13). The internal consistency of EFPT-Th considered to be high and acceptable (Cronbach's alpha=0.72) with the results of the internal consistency for each task range 0.58-0.80 as presented in Table 4.

Table 3 Mean, standard deviations and range scores of patients with substance induced disorder on the EFPT-Th (n=30).

Test	Mean (SD)	Range
EFPT-Th tasks		
Simple cooking Task 1 (Making instant rice porridge)	2.80 (1.44)	0-9
Simple cooking Task 2 (Making omelet)	1.70 (1.37)	0-6
Telephone use	3.40 (1.44)	0-7
Medication management	1.60 (1.39)	0-6
Bill payment	3.37 (0.86)	1-5
EFPT-Th components		
Initiation	0.00 (0.00)	0-0
Organization	4.20 (1.88)	0-9
Sequencing	7.80 (2.49)	2-14
Safety and judgment	0.83 (1.06)	0-3
Completion	0.07 (0.13)	0-2
Total score	12.86 (4.01)	3-24

EFPT-Th: Executive function performance test: Thai version

Table 4 The internal consistency of the EFPT-Th.

EFPT-Th	Cronbach's alpha
Items of all tasks on EFPT- Th	0.72
	Correlation of each task with the total score
Simple cooking (Making instant rice porridge)	0.67
Simple cooking (Making omelet)	0.80
Telephone use	0.68
Medication management	0.58
Bill payment	0.59

Intra-rater reliability was conducted on EFPT-Th score. The ICC were analyzed for the total score and each subtest scores. The results demonstrated the moderate to high intra-rater reliability of EFPT-Th. For the total EFPT-Th score, the ICC was 0.98 whereas the subtest ICC scores were 0.98 for simple cooking task 2 (making an omelet), 0.97 for simple cooking task 1 (making instant rice porridge), 0.97 for medication management, 0.94 for using the telephone

and 0.57 for paying bills. Additionally, the inter-rater reliability of the total EFPT-Th score, the ICC was 0.88, and subtest ICC scores were 0.91 for simple cooking task 1 (making instant rice porridge), 0.73 for managing medication, 0.70 for simple cooking task 2 (making omelet), 0.59 for telephone use and 0.58 for paying bills. These coefficients indicated that EFPT-Th had moderate to high levels of inter-rater reliability as shown in Table 5.

Table 5 Intra-rater and inter-rater reliability of EFPT-Th as demonstrated by intraclass correlation coefficients (ICC) and 95% confidence interval (CI).

	Intra-Rater ICC (3,1) (95% CI)	<i>p</i>	Inter-Rater ICC (2,1) (95% CI)	<i>p</i>
Simple cooking Task 1(Making instant rice porridge)	0.97 (0.94-0.99)	0.000	0.91 (0.80-0.96)	0.000
Initiation	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Organization	0.82 (0.62-0.91)	0.000	0.97 (0.94-0.99)	0.000
Sequencing	0.66 (0.28-0.84)	0.003	0.97 (0.94-0.99)	0.000
Safety and judgment	0.94 (0.88-0.98)	0.000	0.95 (0.90-0.98)	0.000
Completion	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Simple cooking Task 2 (Making omelet)	0.98 (0.95-0.99)	0.000	0.70 (0.37-0.88)	0.001
Initiation	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Organization	0.86 (0.70-0.93)	0.000	0.96 (0.91-0.98)	0.000
Sequencing	0.66 (0.28-0.84)	0.003	0.98 (0.97-0.99)	0.000
Safety and judgment	0.94 (0.88-0.97)	0.000	0.97 (0.94-0.99)	0.000
Completion	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Telephone use	0.94 (0.87-0.97)	0.000	0.59 (0.14-0.81)	0.009
Initiation	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Organization	0.84 (0.66-0.92)	0.000	0.96 (0.93-0.98)	0.000
Sequencing	0.77 (0.52-0.89)	0.000	0.91 (0.82-0.96)	0.000
Safety and judgment	0.87 (0.72-0.94)	0.000	0.98 (0.95-0.99)	0.000
Completion	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Medication management	0.97 (0.94-0.99)	0.000	0.73 (0.42-0.87)	0.000
Initiation	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Organization	0.59 (0.07-0.77)	0.000	0.96 (0.91-0.98)	0.000
Sequencing	0.82(0.61-0.91)	0.000	0.98 (0.95-0.99)	0.000
Safety and judgment	0.79 (0.57-0.90)	0.000	1.00 (0.00-0.00)	0.000
Completion	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000

Table 5 Intra-rater and inter-rater reliability of EFPT-Th as demonstrated by intraclass correlation coefficients (ICC) and 95% confidence interval (CI). (continues)

	Intra-Rater ICC (3,1) (95% CI)	<i>p</i>	Inter-Rater ICC (2,1) (95% CI)	<i>p</i>
Bill payment	0.57(0.12-0.75)	0.045	0.58 (0.12-0.80)	0.000
Initiation	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Organization	0.79 (0.56-0.90)	0.000	0.98 (0.96-0.99)	0.000
Sequencing	0.70 (0.38-0.86)	0.000	0.91 (0.80-0.96)	0.000
Safety and judgment	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
Completion	1.00 (0.00-0.00)	0.000	1.00 (0.00-0.00)	0.000
EFPT-Th total score	0.98 (0.97-0.99)	0.000	0.88(0.74-0.94)	0.000

EFPT-Th: Executive function performance test: Thai version

Criterion Validity

Table 6 presented the Spearman correlation coefficients between the total EFPT-Th scores and the BADS total profile scores. The results reported significantly high negative correlations ($r=-0.63$, $p<0.01$). Additionally, statistically significant low to moderate correlations were found between

the individual EFPT-Th task and the BADS total profile scores ranged from -0.33 to -0.52. The lower scores of the BADS indicated the greater EF problems (mean=67.27) whereas, the higher scores of EFPT-Th indicated the more cues were needed reflecting the greater executive dysfunction (mean=12.86).

Table 6 Spearman' rank correlation between EFPT-Th total score and Behavioral assessment of the dysexecutive syndrome (n=30).

EFPT-Th tasks	BADS total profile scores
Simple cooking (Making instant rice porridge)	-0.42*
Simple cooking (Making omelet)	-0.52**
Telephone use	-0.33*
Medication management	-0.35*
Bill payment	-0.33*
EFPT-Th total scores	-0.63**

EFPT-Th: Executive function performance test: Thai version, BADS: Behavioral assessment of the dysexecutive syndrome, * $p<0.05$; ** $p<0.01$

Discussion

Although, this study showed the difference in some backward translation of EFPT-Th from the original one but it presented in the same meaning because the process of translation was tailor-made for the Thai culture and contexts using occupation-based assessment. EFPT-Th can be used to assess people who perform activities in the real contexts. The quality and integrity of the translation process plays an important role to ensure that the cross-cultural research findings were accurate and not be weakened by the errors of translation.

The studies in various countries demonstrated that the method of operating the tasks of EFPT was varied in each culture by altering, adjunct, and determined cultural validity of tasks by professional recommendation. For instance, in Korea, the simple cooking task was altered from the oatmeal menu to rice porridge and modified the method of the using telephone task from calling the grocery store to ordering delivery food from restaurants.²² The study in Brazil, oatmeal was replaced by making coffee while calling the grocery store was replaced by calling to a pharmacy.²³ Thus, following the translation process the

researcher considered and modified the content, method, and procedures of tasks. EFPT-Th, the in the basic cooking task of oatmeal was replaced with making instant rice porridge because Thai people are not familiar with oatmeal. Instant rice porridge is a ready meal menu which has few sequences of actions to complete. Additionally, EFPT-Th also was considered to add Thai favorite simple cooking menu with more complex and sequenced tasks and to clarify the deficiencies in executive function which was an omelet menu. This result conforms to Goverover and colleague study¹⁸ that EFPT was used in multiple sclerosis. They added the casserole menu in the simple cooking task. The method and sequence of task for paying bills by check was altered because Thai people are familiar to pay a bill by cash rather than by check. Moreover, cable and telephone bills were replaced by electricity and telephone bills because they are more recognizable. These results were complied with a recent study in Korea. The task was altered from compensation by check to bank transfer which is more well-known with the Korean lifestyle.²²

The content validity of EFPT-Th presented that the IOC was average to high level (IOC=0.67-1.00). This result

suggested that the contents of the assessment were coherent with the executive function components. The internal consistency of EFPT-Th score was acceptable while the score on each subtest of EFPT-Th was also considered to be acceptable. Additionally, the reliability of EFPT-Th showed that the intra-rater reliability was high level as well as Inter-rater reliability was high level. The results were similar to previous studies of EFPT in various groups and countries.¹⁸⁻²³ Many factors may affect high levels of intra-rater reliability and inter-rater reliability. Firstly, the instruction of each task assessment has the consistency of words and directions. Secondly, EFPT have clearly scoring system and the score level can be separated into five levels of cueing which are identified the characteristic of assistance which, the assessors can precisely decide the score. The higher scores represent the more cueing need reflecting the greater EF problems. In this study, EFPT-Th has been confirmed with the EF related content, rating score system and the standard with high level of the psychometric properties.

For the criterion validity, the significant high correlations were found between the total scores of EFPT-Th and BADS total scores. This result consist with the previous studies in a schizophrenic population that present high correlation between EFPT and BADS.¹⁹ However, the correlations between the simple cooking tasks in EFPT-Th and the BADS total scores show moderate significant correlations while the another tasks; telephone use, medication management and bill payment had the low correlations. These results might be affected by the characteristics of tasks in EFPT-Th which were familiar with everyday tasks whereas the assessment tasks in BADS are novel tasks. The more novel and complex than everyday routine tasks, the more requiring higher-level thinking abilities to planning, organization and problem solving. These reasons may affect the correlation between EFPT-Th and BADS scores. BADS is the standardized test for measuring various aspects of executive function and it is bottom-up assessment that can be identified the separate problem of client's executive function. Therefore, this test cannot provide the information of capability, strategies or environment factors to perform the tasks.³⁵ On the contrary, EFPT-Th is top-down assessment that can be assessed the client's occupational performance in real life context providing the information of capability, strategies or environment factors during perform real tasks.³⁵ The result of present study supported that EFPT-Th demonstrated the psychometric properties to be the standardized test for the executive function assessment in Thai culture and contexts.

Limitation

Limitation of this study was a small sample size. The samples were between the ages of 20-40 and the majority of participants had been diagnosed stimulant drug use. All participants were in the same therapy setting. For the future study should be operated with a large sample size, use various age ranges with various diagnosis of drug use. Moreover, the participants were not excluded depression symptom that might be seen in the psychiatric patients with substance abuse which was the confounding factor

affecting cognitive assessments

Conclusion

EFPT-Th is performance-based executive function test that demonstrated the psychometric properties to use in the Thai culture and contexts. EFPT-Th was performed in participants with substance-induced disorder for the validity and reliability studies and presented outcomes of content validity, internal consistency, criterion validity, inter-rater reliability and intra-rater reliability of EFPT-Th were average to high. In summary, it was confirmed that EFPT-Th can be evaluated individuals with executive dysfunction.

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Conflicts of interest

The authors declare no conflicts of interests.

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