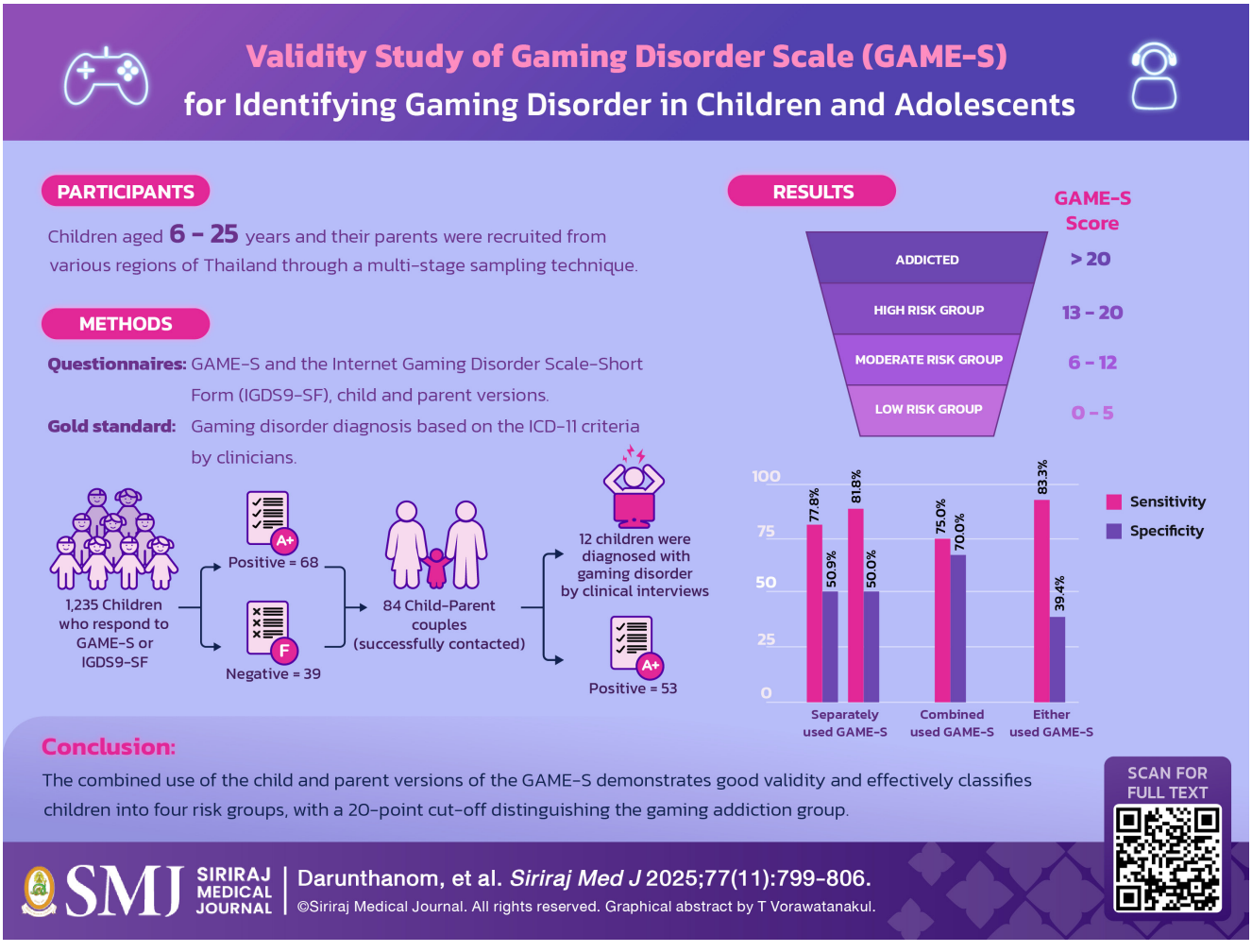
Validity of the Gaming Disorder Scale (GAME-S) for Identifying Gaming Disorder in Children and Adolescents

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ABSTRACT

Objective: This study aimed to evaluate the validity of the Gaming Disorder Scale (GAME-S) for diagnosing gaming disorder among children and adolescents in Thailand.

Materials and Methods: A total of 1,235 individuals, aged 6-25 years, and their parents were recruited from various regions of Thailand through a multi-stage sampling technique. Data were collected using both the child and parent versions of the GAME-S. The results were compared with ICD-11 clinical diagnoses of gaming disorder, conducted by trained clinicians. Concurrent validity was evaluated through the Thai version of the Internet Gaming Disorder Scale-Short Form (IGDS9-SF).

Results: A total of 1,235 children and adolescents and their parents participated to assess the correlation between the GAME-S and IGDS9-SF. For GAME-S diagnostic accuracy analysis, 84 child–parent pairs, balanced by gender (mean age = 13.48 years), were included. Sensitivities of the child and parent versions were 77.8% and 81.8%, respectively, while specificity was 50.9% and 50.0%. Combining both versions increased sensitivity to 75.0% and specificity to 70.0%. The GAME-S correlated strongly with IGDS9-SF (child: r=0.823, p=0.01; parent: r=0.82, p=0.01). Latent class analysis identified a four-class model as the best fit. The gaming addiction group was effectively characterized by a cut-off score of 20.

Conclusion: The combined use of both the child and parent versions of the GAME-S demonstrates good validity and is a reliable tool for screening children and adolescents for gaming disorder. Additionally, it can categorize children and adolescents into four risk groups, helping identify individuals and provide appropriate interventions for each group.

Keywords: Gaming disorder; sensitivity and specificity; questionnaire; children; adolescent (Siriraj Med J 2025; 77: 799-806)

INTRODUCTION

Gaming disorder is abnormal gaming behavior characterized by three core groups of symptoms, based on the *International Classification of Diseases, 11th Revision* (ICD-11) diagnostic criteria[1], including impaired control over gaming, prioritization of gaming over other activities, and continued gaming despite negative consequences. These behaviors must persist for at least 12 months and significantly impact daily life, including health, education, work, and relationships. The global prevalence of gaming addiction is estimated at 3.3%, with the prevalence in adolescents and young adults around 6.3%.[2] In Thailand, a nationwide survey in 2006 found gaming addiction prevalence among children and adolescents to be between 4.1% and 5.5%.[3]

Gaming disorder has been linked to various physical and psychological issues. Physically, prolonged gaming can lead to eye strain, back pain, irregular eating habits, and inadequate sleep due to prolonged gaming sessions. Psychologically, gaming disorder is associated with emotional instability, irritability, aggressive behavior, and difficulties with responsibility and social interaction. Children with gaming addiction may disengage from school, exhibit behavioral problems, or even engage in gambling and theft. Families of affected individuals often experience increased conflict and a reduced quality of life, both physically and mentally. If left untreated, gaming disorder can lead to long-term developmental and behavioral problems in children and adolescents.[3-5]

Early screening and intervention are crucial for effective treatment of gaming disorder.[6] Several assessment tools have been developed internationally and in Thailand to screen and assess gaming disorder.[7] Globally recognized tools include the Game Addiction Scale for Adolescents (GASA)[8], the Internet Gaming Disorder Scale–Short Form (IGDS9-SF)[9], and the Ten-Item Internet Gaming Disorder Test (IGDT-10).[10] In Thailand, two key tools have been developed: the Game Addiction Screening Test (GAST)[3], and the Gaming Disorder Scale (GAME-S).[11] Additionally, the Social-Media Addiction Screening Scale (S-MASS)[21] is another tool in Thailand developed to screen addiction. However, it focuses on social media, not gaming directly.

The GAME-S consists of nine items based on the ICD-11 criteria and was specifically designed for the Thai context, targeting individuals aged 10–24 years. It has demonstrated good reliability in both the self-report and parent-report versions.[11] In contrast, although the Game Addiction Screening Test (GAST) has shown reasonable utility, it was developed prior to the establishment of standardized diagnostic criteria for gaming disorder, limiting its diagnostic alignment. Some of its items—

such as "I have skipped class to play games"—may no longer reflect current gaming patterns, especially as online gaming has become more accessible without the need to skip school. Additionally, the GAST includes a relatively large number of items, which can increase respondent burden. Compared to GAST, the GAME-S is shorter, more relevant to contemporary behaviors, aligned with international diagnostic standards, and thus more practical and valid for both research and clinical screening.[11]

However, *Sangkhaphan's* study did not evaluate the criterion validity of the GAME-S or examine its cut-off point, both of which are important for clinical use and epidemiological studies. Therefore, this study aims to assess the sensitivity and specificity of the GAME-S by comparing its results with clinical interview diagnoses. Additionally, it will evaluate the concurrent validity of the GAME-S against the IGDS9-SF (Thai-version) in children and adolescents. Finally, we seek to classify risk groups for gaming disorder.

MATERIALS AND METHODS

Population and sample

This study was conducted as a questionnaire-based cross-sectional study. Data were collected between July and November 2023. The study population consisted of individuals aged 6 to 25 years in Thailand.

The sample included children and adolescents and their parents or guardians living in communities from 15 provinces, representing different country regions. A multi-stage stratified random sampling method was used to ensure proportional representation. The number of participants from each region was determined based on the population distribution of children and adolescents aged 6-25 years, as reported by the Department of Local Administration, Ministry of Interior. The selected regions included Bangkok, Central region (three provinces), Northern region (three provinces), Northeastern region (five provinces), and Southern region (three provinces), or a total of 15 provinces. Within each region, a province was purposively selected based on the availability of child and adolescent psychiatrists to ensure that participants identified as at high risk for gaming addiction could access appropriate care.

One district was randomly chosen within each selected province through simple random sampling. Participants were then randomly selected from urban and rural areas in equal numbers. For each area, two participants (one male and one female) were selected from each age group (6 to 25 years), totaling 80 participants per province. In total, 80 participants were recruited from each of the 14 regional provinces and 160 participants from Bangkok, for a planned total of 1,280 participants.

Sample size calculation

The sample size was determined using the n4Studies program and the formula for a finite population proportion.[12] The sample size calculation was as follows:

$$n = \frac{Np(1-p)z^2_{1-\frac{\alpha}{2}}}{d^2(N-1)+p(1-p)z^2_{1-\frac{\alpha}{2}}}$$

Thailand's estimated population of children and adolescents aged 6-25 years is 16,503,799 (N = 16,503,799).[13] The prevalence of gaming addiction was assumed to be 15%[14] with an acceptable margin of error of 2% (d = 0.02) and a 95% confidence level (Alpha (α) = 0.05, Z (0.975) = 1.96). Based on this, the minimum required sample size was 1,225 participants. To account for potential sample loss and incomplete data, the sample size was increased by 5%, resulting in a final sample size of 1,280 participants.

To evaluate the sensitivity and specificity of the GAME-S, participants who screened negative on both the GAME-S and IGDS9-SF (Thai version) were randomly selected and matched by gender, age, and province. The number of negative-screened participants was half the number of positive-screened participants. A 2:1 ratio of positive to negative cases was used to improve sensitivity estimation, in line with the screening objective of the GAME-S. A higher proportion of positive cases ensured sufficient power for analysis, as recommended in validity studies.[19,20]

Inclusion and exclusion criteria

The inclusion criteria included individuals aged 6 to 25 years and their parents or guardians who could communicate effectively in Thai. The exclusion criteria included individuals who were unable to complete the questionnaire.

All participants provided informed consent before participation. Written informed consent was obtained from parents or guardians, and written assent was obtained from children and adolescents, using signed paper forms. The study was conducted following ethical standards and approved by the Siriraj Institutional Review Board (SiRB), Faculty of Medicine Siriraj Hospital, Mahidol University (COA no. Si 209/2022).

Instruments

General Information Questionnaire: This questionnaire collected demographic details, including gender, age,

education level, academic performance, and socioeconomic status.

Gaming Disorder Scale (GAME-S): The GAME-S consists of the self-version and the parent-report version. Each version includes nine items, assessing three categories of gaming disorder symptoms based on the ICD-11 criteria: three items related to difficulty in controlling gaming, three items focused on prioritizing gaming over other important activities, and three items related to continuing gaming despite experiencing negative consequences. Responses were scored from 0 (not at all) to 3 (definitely). Gaming disorder was considered present if at least one item from each of the three symptom groups was rated at level three. The reliability of the GAME-S was validated, with Cronbach's alpha coefficients of 0.92 (self-version) and 0.96 (parent-version), and factor loadings ranging from 0.66 to 0.86. The Pearson correlation coefficients between the GAME-S and GAST were 0.87 for the self-version and 0.92 for the parent-version.

Internet Gaming Disorder Scale-Short Form (IGDS9-SF): The original IGDS9-SF was developed by *Pontes and Griffiths*[9] and the Thai version was translated by *Pornnapadol*.[15] It assesses gaming addiction in children and adolescents, with separate versions for children and adolescents, and parents. The scale consists of nine items based on the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5). The responses for each item are 'Yes' (one point) and 'No' (0 points). A total score of five or higher indicates gaming disorder. The Thai version of IGDS9-SF has a Cronbach's alpha coefficient of 0.913 (self-report version) and 0.922 (parent-report version).

Diagnosis of Gaming Disorder: Diagnosis was conducted through interviews with physicians and psychologists trained in assessing gaming disorder based on the ICD-11 criteria. The interrater reliability (Kappa) for the diagnosis of gaming disorder was 1.00.

Data collection process

The researchers collaborated with the Children and Youth Council of Thailand and local networks in each province to disseminate information within communities. Individuals who met the inclusion criteria and agreed to participate were provided with questionnaires.

Participants who screened positive for gaming disorder based on either the GAME-S or IGDS9-SF (Thai version) (either self-report or parent-report) were invited for clinical interviews to confirm the diagnosis. It should be noted that interviewers were aware of the participants' screening test scores; therefore, they were not blinded assessors.

Data analysis

Data analysis was conducted using SPSS version 18. Descriptive statistics were employed to present general information. To assess validity, sensitivity and specificity were calculated. Concurrent validity was assessed using Pearson's correlation coefficient. Additionally, latent class analysis (LCA) was performed to examine the underlying structure of the GAME-S and assess its ability to classify individuals based on response patterns. Model selection was guided by statistical fit indices and clinical interpretability.

RESULTS

1,058 parents and 1,235 children completed the GAME-S and IGDS9-SF (Thai version) questionnaires, including both child and parent versions. Among the children, 68 met the screening criteria for gaming disorder based on the GAME-S or IGDS9-SF (Thai version) and were eligible for diagnostic interviews. An additional 39 children who did not meet the criteria were randomly selected, bringing the total number of planned interviews to 107. Of these, 84 were successfully conducted, identifying 12 cases of gaming disorder.

Demographic characteristics of interviewed participants

Most parents were female (86.4%), with a mean age of 42.77 years, and 60.6% were married. Most parents had an educational level below a bachelor's degree, and household income was below 10,000 Thai baht (Table 1). Most children were male (59.4%), with a mean age of 13.48 years. Additionally, 47.4% of children were enrolled in grades 1-6, and 40.3% were in grades 7-12. Also, most children had a GPA between 3.00 and 4.00 (57.8%) (Table 2).

Sensitivity and specificity of the GAME-S

Sensitivity and specificity analysis showed that the child version of the GAME-S had a sensitivity of 77.8% and a specificity of 50.9%, while the parent version had a sensitivity of 81.8% and a specificity of 50.0%. When both versions were combined, the specificity improved, with a sensitivity of 75.0% and a specificity of 70.0%. Using either the child or parent version alone yielded the highest sensitivity (83.3%) but the lowest specificity (39.4%) (Table 3).

Concurrent validity of the GAME-S

Concurrent validity was evaluated using Pearson's correlation coefficient, which revealed a strong correlation between the GAME-S and IGDS9-SF (Thai version) in both the child ($r=0.82$, $p=0.01$) and parent ($r=0.81$, $p=0.01$) versions.

TABLE 1. Demographic data of parents.

Demographic data of parents (n=81)	n	%
Gender		
Male	12	14.8
Female	69	85.2
Age (mean ± S.D.)		
Range = 20-65 years	41.81 ± 9.69	
Education level		
Below bachelor's degree	52	64.2
Bachelor's degree	26	32.1
Higher bachelor's degree	3	3.7
Marital status		
Single	12	14.8
Living with spouse	51	63.0
Separated/widowed/divorced	18	22.2
Family monthly income (THB)		
< 10,000	30	37.0
10,000-20,000	29	35.8
Greater than 20,000	22	27.2

Note: S.D.=standard deviation. THB=Thai Baht

TABLE 2. Demographic data of children.

Demographic data of children (n=84)	n	%
Gender		
Male	50	59.5
Female	34	40.5
Age (mean ± S.D.)		
Range = 6-24 years	13.44 ± 4.79	
Education level		
Year 1-6	35	41.7
Year 7-12	32	38.1
University	8	9.5
Unreported	9	10.7
Grade Point Average		
0.00-2.00	6	7.2
2.01-2.50	13	15.5
2.51-3.00	18	21.4
3.01-3.50	27	32.1
3.51-4.00	20	23.8

Note: S.D. = standard deviation. THB = Thai Baht

TABLE 3. Sensitivity and specificity of the GAME-S.

Version	Sensitivity (%)	Specificity (%)
Child	77.8	50.9
Parent	81.8	50.0
Child + Parent Combined	75.0	70.0
Either Child or Parent	83.3	39.4

Latent Class Analysis (LCA)

LCA identified a 4-class model as the best fit for both parent-reported (AIC=6814.43, BIC=6854.15, entropy=0.836) and child-reported (AIC=7751.87, BIC=7792.82, entropy=0.854) GAME-S. The cut-off points derived from the 4-class LCA model are presented in Table 4.

DISCUSSION

This study assessed the validity of the GAME-S in diagnosing gaming disorder among children and adolescents. The results indicate that the GAME-S demonstrates acceptable sensitivity and specificity for detecting gaming disorder, with improved specificity and maintained sensitivity when combining reports from children and parents. Additionally, a strong correlation was found between the GAME-S and IGDS9-SF (Thai version) for both child and parent versions.

When compared to the IGDS9-SF (Thai version), a self-report measure for diagnosing gaming disorder based on ICD-11 criteria, the GAME-S child version showed higher sensitivity (77.8%) but lower specificity (50.9%) than the IGDS9-SF (50.0% and 97.6%, respectively). Combining the child and parent versions in the GAME-S maintained higher sensitivity (75.0% vs 50.0%), while improving specificity, though it remained lower (70.0% and 97.6%).

A similar pattern was observed when comparing the GAME-S to the IGDS9-SF (Thai version), which is used to diagnose gaming disorder based on the DSM-5 criteria. The GAME-S, whether the child-only version or the combined child and parent versions, consistently demonstrated higher sensitivity and lower specificity. These differences may be attributed to variations in the sample populations. In this study, participants were drawn from a community sample with balanced gender distribution, aged between 6 and 25 years, and predominantly from lower socioeconomic status. In contrast, the study by *Boonyapasert* et al. (2021)[16] used a clinical sample composed mainly of males aged 11-18 years, with higher socioeconomic status.

When compared to the GASA (Arabic version), a self-report measure, the GAME-S (in both the child-only and combined versions) showed comparable sensitivity to the GASA (Arabic version) (77.8%, 75.0%, and 76.9%, respectively). However, the GAME-S demonstrated lower specificity than the GASA (Arabic version) (50.9%, 70.0%, and 84.2%). These discrepancies may be due to

TABLE 4. Cut-off points from the four-class Latent Class Analysis model of the GAME-S.

Score (Total 0-27)	Parent-version (n=1,058)		Child-version (n=1,235)	
	n	%	n	%
0-5	451	42.6	602	48.7
6-12	327	30.9	356	28.8
13-20	220	20.8	233	18.9
>20	60	5.7	44	3.6

variations in the sample population and the criteria used as the diagnostic gold standard. The study by *Abolfotouh et al.* (2024)[17] involved adolescents recruited online who had higher parental education levels. Furthermore, their diagnostic approach was based on affirmative responses to items related to relapse, withdrawal, conflict, and problems, rather than the DSM-5 or ICD-11 criteria, and did not involve clinical interviews.

When compared to the IGDT-10 (Japanese version), a self-report measure, the GAME-S (in both the child-only and combined child-parent versions) demonstrated lower sensitivity (77.8%, 75.0%, and 87.5%) and lower specificity (50.9%, 70.0%, and 85.2%). These differences may be attributed to variations in the sample populations. In the study by *Mihara et al.* (2022)[18], participants were gamers aged 10-29 years, and clinical interviews based on DSM-5 criteria were used as the diagnostic gold standard for internet gaming disorder.

For risk classification, based on latent class analysis (LCA) results and prevalence data from the GAME-S, participants were categorized into four risk groups based on their gaming disorder severity scores:

1) Low-risk group: Participants with GAME-S scores ranging from 0 to 5 (child: 48.7%, parent: 42.6%), corresponding to the lowest-risk LCA group. These individuals show no significant gaming-related issues and are unlikely to fulfil the criteria for gaming disorder.

2) Moderate-risk group: Participants with GAME-S scores ranging from 6 to 12 (child: 28.8%, parent: 30.9%) represent an elevated but subclinical level of gaming behavior. While they do not meet the diagnostic criteria, they may engage in prolonged gaming that causes some functional impact.

3) High-risk group: Participants with scores ranging from 13 to 20 (child: 18.9%, parent: 20.8%), corresponding to the high-risk group identified by LCA. These individuals display problematic gaming behaviors, with a higher likelihood of functional impairment, warranting clinical attention.

4) Addicted group (gaming disorder diagnosis): Participants scoring above 20 (child: 3.6%, parent: 5.7%) closely correspond to the prevalence of gaming disorder as assessed by GAME-S (child: 3.2%, parent: 4.3%). This group is most likely to meet the diagnostic criteria for gaming disorder and may require further psychiatric evaluation and intervention.

This classification offers a structured approach to the early identification and intervention, ensuring that at-risk individuals receive appropriate monitoring and clinical care.

The study has several strengths, including a diverse, community-based sample drawn from all regions of Thailand and a broad age range of participants (6-25 years), which enhances the generalizability of the findings. The use of clinical interviews based on the ICD-11 diagnostic criteria further enhances the study's criterion validity. Additionally, it collects data from both child and parent perspectives, which improves the reliability of the responses. However, some limitations should be acknowledged. The sample consisted of individuals from non-clinical backgrounds with predominantly low socioeconomic status, which may limit the generalizability of the results to clinical populations or those with different socioeconomic backgrounds. Additionally, not all eligible participants attended clinical interviews, potentially introducing attribution bias. Interviewers were informed of the participants' screening test scores and thus were not blinded during the diagnostic assessment. Lastly, test-retest reliability was not assessed, leaving the stability of responses over time undetermined.

Future research should aim to improve specificity by refining scoring thresholds or incorporating behavioral indicators, such as gaming duration and psychosocial impact. Longitudinal studies are also needed to assess the predictive validity of GAME-S over time. Additionally, cross-cultural validation studies could expand their applicability beyond Thailand, particularly in Southeast Asian populations, where gaming disorder is an emerging public health concern.

CONCLUSION

The GAME-S, particularly when using both the child and parent versions, is an effective screening tool for gaming disorder among children and adolescents. Additionally, the GAME-S can categorize children and adolescents into four risk groups (low, moderate, high, and addicted groups) to help identify individuals and provide appropriate interventions for each group.

Data Availability Statement

The data underlying the results of this study are not accessible to the public due to ethical and confidentiality constraints. However, de-identified data can be provided upon request to the corresponding author, pending approval from the institutional ethics review board. Relevant secondary data sources are referenced in the bibliography.

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Conflict of Interest

The authors have no conflicts of interest to disclose regarding this study.

Registration Number of Clinical Trial

Not applicable.

Author Contributions

Conceptualization and methodology, W.D, C.P., and W.A.; Investigation, W.D.; Formal analysis, W.D., C.P., and W.A.; Visualization and writing – original draft, W.D. ; Writing – review and editing, C.P., and W.A.; Funding acquisition, C.P., and W.A.; Supervision, C.P., and W.A. All authors have read and agreed to the final version of the manuscript.

Use of Artificial Intelligence

Not applicable.

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