original paper Epeynhtikh εργασια

Determining an optimal cut-off point for TikTok addiction using the TikTok Addiction Scale

OBJECTIVE To identify an optimal cut-off point for the TikTok Addiction Scale (TTAS). METHOD We performed a cross-sectional study with a convenience sample. Data were collected in Greece during July 2024. We used a sample of TikTok users among the general population and employed the Receiver Operating Characteristic analysis to identify an optimal cut-off point for the TTAS by using the Bergen Social Media Addiction Scale (BSMAS) and the Patient Health Questionnaire-4 (PHQ-4) as external criterions. Also, we used the suggested cut-off points from the literature to develop dichotomous variables for BSMAS and PHQ-4. RESULTS A significant predictive power of TTAS was found for social media addiction, anxiety, and depression. We found that the best cut-off point for the TTAS was 3.23 (p-value < 0.001, Youden's index=0.72). In that case, the area under the curve (AUC) was 0.91 (95% confidence interval=0.86-0.97). Sensitivity and specificity of the TTAS were 0.76 and 0.96, respectively. Thus, the mean TTAS score \geq 3.23 suggested TikTok use disorder, while the mean score from 1.00 to 3.22 suggested healthy users. The positive predictive value of the TTAS was 0.61, while the negative predictive value was 0.98. CONCLUSIONS The best cut-off point for the TTAS was 3.23. TikTok users with a mean TTAS score \geq 3.23 should be further examined by mental health professionals. Further research should be conducted to validate our results. ARCHIVES OF HELLENIC MEDICINE 2025, 42(4):554–559 ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2025, 42(4):554–559

P. Galanis,¹ A. Katsiroumpa,¹ I. Moisoglou,² P. Gallos,¹

O. Konstantakopoulou¹

¹Laboratory of Clinical Epidemiology, Faculty of Nursing, National and Kapodistrian University of Athens, Athens ²Faculty of Nursing, University of Thessaly, Larissa

Καθορισμός διαχωριστικού ορίου για τον εθισμό στο TikTok χρησιμοποιώντας την κλίμακα εθισμού στο TikTok

Περίληψη στο τέλος του άρθρου

Key words

Addiction Bergen Social Media Addiction Scale Cut-off analysis Patient Health Questionnaire-4 TikTok Addiction Scale Users

> Submitted 13.8.2024 Accepted 24.8.2024

Social media platforms have gained immense popularity all over the world, with approximately five billion people using these platforms for connecting, communicating, and seeking information. The number of social media users has increased worldwide from 2.7 billion in 2017 to 5.2 billion in 2023, and it is projected to reach almost six billion in 2028. Furthermore, the average daily social media usage has increased to 151 minutes from 90 minutes in 2012.⁷

TikTok has emerged as one of the world's most widely used applications for short-form videos. A significant proportion of the global population (about 20%), particularly those aged 18 and above, use TikTok. In 2021, TikTok was downloaded more than 2 billion times, and most of its users are adolescents and young adults (aged 16–35).² Unlike other social media platforms, such as Facebook, Twitter, Instagram, and Snapchat, which focus primarily on images and text, TikTok emphasizes short videos.³ The excessive use of digital technology has raised concerns about the appropriate internet use. A meta-analysis of data from 64 countries found that the global pooled prevalence for social media addiction is 17.4%, for internet addiction is 14.2%, for smartphone addiction is 27.0%, for cybersex addiction is 8.2%, and for game addiction is 6.0%.⁴ There is an ongoing debate about the adverse consequences of social media usage. The overuse of social media has become a significant public health issue due to its association with various problems, such as depression, low self-esteem, impulsivity, suicide risk, work impairments, and poor sleep quality.⁵⁻¹⁰

TikTok is a platform that enables users to create short videos to record their experiences and have fun. However, it has also been identified as a potential source of social media addiction, which refers to the recurrent engagement in social media despite negative consequences.¹¹ Although

research on social media addiction has primarily focused on popular platforms like Facebook and Instagram, there is growing interest in understanding the impact of TikTok on users' behavior.¹¹

Measuring social media addiction is essential to identify individuals who are at high risk of developing problematic behaviors. A recent review found that 37 instruments are available to measure negative social networking site use.¹² The Bergen Facebook Addiction Scale (BFAS) is the most widely used tool to measure negative social media use.¹³ While there are some studies that have used simple variables like the amount of time spent on TikTok, the number of accounts followed, and the number of friends, likes, and followers to measure usage, there is a need for more comprehensive and valid measurement tools specific to TikTok.^{14–16}

Recently, a new scale has been developed and validated to measure levels of TikTok addiction among users, i.e. the TTAS.¹⁷ The aim of our study was to identify an optimal cut-off point for the TTAS.

MATERIAL AND METHOD

Study design

We performed a cross-sectional study with a convenience sample. We collected our data in Greece during July 2024. We used a sample of TikTok users among the general population. We approached our participants through social media, such as TikTok, Facebook and Instagram. We created an online version of our study questionnaire and we invited TikTok users to participate in our study. We did not collect personal data. The Ethics Committee of the Faculty of Nursing, National and Kapodistrian University of Athens (approval number: 510, June 2024) approved our study protocol. Additionally, we applied the guidelines of the Declaration of Helsinki to conduct our study.¹⁸

Tools

We used the TTAS to measure levels of TikTok addiction among our users.¹⁷ The TTAS includes 15 items, and answers are on a fivepoint Likert scale; very rarely (1), rarely (2), sometimes (3), often (4), and very often (5). Adding up the responses to the 15 items and dividing by 15 gives the total score on the scale. Total score ranges from 1 to 5. Higher scores indicate higher levels of TikTok addiction. Cronbach's alpha for the TTAS was 0.91 in our study. We used the Greek version of the TASS.¹⁷

We used the Bergen Social Media Addiction Scale (BSMAS)¹⁹ to measure levels of social media addiction. The BSMAS includes six items, and answers are on a five-point Likert scale; very rarely (1), rarely (2), sometimes (3), often (4), and very often (5). Adding

up the responses to the 6 items gives the total score on the scale. Total score ranges from 6 to 30. Higher scores indicate higher levels of BSMAS. According to literature, score on BSMAS \geq 24 suggests a social media use disorder and it is considered as an optimal clinical cut-off point. Cronbach's alpha for the BSMAS was 0.83 in our study. We used the valid Greek version of the BSMAS.²⁰

We used the Patient Health Questionnaire-4 (PHQ-4)²¹ to measure levels of anxiety and depression in our sample. The PHQ-4 includes four items, and answers are on a four-point Likert scale from 0 (not at all) to 3 (nearly every day). Two items refer to anxiety and the other two items refer to depression. Scores on anxiety and depression scales range from 0 to 6. Score \geq 3 in each scale suggests anxiety and depression. In our study, Cronbach's alpha for the anxiety and the depression scales was 0.79 and 0.73, respectively. We used the valid Greek version of the PHQ-4.²²

Statistical analysis

We present categorical variables with numbers and percentages, and continuous variables with mean and standard deviation (SD). We employed the Receiver Operating Characteristic analysis to identify an optimal cut-off point for the TTAS by using the BSMAS and the PHQ-4 as external criterions. We used the suggested cut-off points from the literature to develop dichotomous variables for BSMAS and PHQ-4. Thus, the optimal cut-off point for the BSMAS is 24, for anxiety is 3, and for depression is 3.

We calculated sensitivity, specificity, and the Youden index. These measures take values from 0 to 1 with higher values indicating better diagnostic value of the TTAS. The Youden index defines an optimal cut-off point and is calculated as sensitivity+specificity-1.²³ Additionally, we calculated the area under the curve (AUC), 95% confidence interval (Cl), and p-value.²⁴ Values for the AUC between 0.5 and 0.7 indicate low accuracy, values between 0.71 and 0.9 indicate moderate accuracy, and values greater than 0.9 indicate high accuracy.²⁵ After defining the best cut-off point for the TTAS, TikTok users with a score above this value were considered as TikTok users with a TikTok use disorder, while those below it were considered as healthy users.

P-values less than 0.05 were considered as statistically significant. We used the Statistical Package for Social Sciences (SPSS), version 21.0 (IBM Corp released 2012; Armonk, NY, IBM Corp) for the analysis.

RESULTS

Our sample included 429 TikTok users with a mean age of 26.5 years (SD: 8.5 years). Among our users, 18.2% were males and 81.8% were females.

We employed ROC analysis to define an optimal cut-off point for the TTAS. Table 1 presents the detailed results of ROC analysis. We found that the best cut-off point for the TTAS was 3.23, using the BSMAS as criterion (fig. 1). In that

Criterion	Cut-off point for criterion	Cut-off point for the TTAS	Sensitivity	Specificity	AUC	95% Cl	Significance	Youden's index
Anxiety (PHQ-4)	High level of anxiety (total score ≥3)	2.03	0.72	0.55	0.68	0.63–0.73	<0.001	0.26
Depression (PHQ-4)	High level of anxiety (total score ≥3)	2.70	0.48	0.89	0.74	0.68–0.79	<0.001	0.37
BSMAS	High level of social media addiction (total score ≥24)	3.23	0.76	0.96	0.91	0.86–0.97	<0.001	0.72

Table 1. Predictive validity of the "TikTok Addiction Scale" (TTAS).

AUC: Area under the curve, BSMAS: Bergen Social Media Addiction Scale, CI: Confidence interval, PHQ-4: Patient Health Questionnaire-4



Figure 1. ROC curve of the "TikTok Addiction Scale" for Bergen Social Media Addiction Scale (BSMAS) (total score \geq 24).

case, we found the highest values for Youden's index (0.72) and AUC (0.91). The value for the AUC indicated high accuracy for the cut-off point of 3.23. The 95% CI for the AUC ranged from 0.86 to 0.97. Sensitivity and specificity of the TTAS were 0.76 and 0.96, respectively (p<0.001). Therefore, we considered TikTok users with TTAS score \geq 3.23 as TikTok users with a TikTok use disorder, and those with TTAS score <3.23 as healthy users. Applying this cut-off point for the TTAS score in our study, 7.7% (n=33) of our users had a TikTok use disorder. The positive predictive value of the TTAS was 0.61, while the negative predictive value was 0.98.

We also found a significant predictive power of the TTAS for anxiety by the PHQ-4 with AUC=0.68, p<0.001, 95% CI=0.63-0.73, sensitivity=0.72, and specificity=0.55 (fig. 2). In that case, the positive predictive value of the TTAS was 0.12, while the negative predictive value was 0.96.



Figure 2. ROC curve of the "TikTok Addiction Scale" for anxiety (PHQ-4).

A significant predictive power of the TTAS for depression by the PHQ-4 was found (AUC=0.74, p<0.001, 95% CI=0.68–0.79, sensitivity=0.48, and specificity=0.89 (fig. 3). In that case, the positive predictive value of the TTAS was 0.27, with the negative predictive value being 0.95.

DISCUSSION

TikTok has quickly become one of the most widely used applications for short-form videos, with over 20% of adults worldwide using the platform.² Despite this widespread usage, research on social media addiction has primarily focused on established platforms like Facebook, Instagram, and others, often overlooking the influence of TikTok and related maladaptive behaviors.¹¹ Consequently, it is crucial to develop valid tools to assess TikTok addiction in order to identify high-risk individuals. A recent review identified



Figure 3. ROC curve of the "TikTok Addiction Scale" for depression (PHQ-4).

37 instruments that measure negative social networking site usage, such as the Bergen Facebook Addiction Scale (BFAS), the Social Media Disorder Scale, and the Generalized Problematic Internet Use Scale.¹² However, there are currently no valid and specific psychometric tools available to assess TikTok addiction/disorder/problematic use. Given the rapid increase in TikTok usage and the possibility that TikTok addiction may be a distinct form of social media addiction, it is important to develop a valid tool to measure TikTok addiction. Additionally, given the differences in platform design among social media platforms, it is essential to investigate the impact of TikTok usage on individuals' mental health.

Recently, the TTAS was developed in order to measure levels of TikTik addiction among users.¹⁷ Since there is not yet developed an optimal cut-off point to discriminate against TikTok users we performed a cross-sectional study to establish one. We used the BSMAS and the PHQ-4 as external criteria. In particular, we employed the Receiver Operating Characteristic analysis to identify an optimal cut-off point for the TTAS. In that case, we calculated the Youden index since the maximum value of this index corresponds to the optimal cut-off point.²⁴ Additionally, we calculated the AUC, where the optimal cut-off point is defined as the point where the AUC has the highest value.²⁶ We performed three analyses, by using the BSMAS, the anxiety factor on the PHQ-4, and the depression factor on the PHQ-4 to identify the best cut-off point for the TTAS.

After all, we found that the best cut-off point for the TTAS is 3.23. This cut-off point corresponded to a sensitivity of 0.76, and a specificity of 0.96. The positive predictive value of the TTAS was 0.61, while the negative predictive value was 0.98. Therefore, TikTok users with a mean TTAS score higher than 3.23 should be further examined by mental health professionals since a TikTok use disorder is probable.

Our study had several limitations. Although we used valid tools as external criteria to identify an optimal cut-off point for the TTAS, it is probable that these tools should not be used as gold standard criteria for the TikTok addiction. Also, we used two valid tools as external criteria, while several other tools could be used. Additionally, we performed our analysis to examine the validity and predictive ability of the TTAS, and not for diagnostic purposes. Moreover, we performed a cross-sectional study with a convenience sample, and, thus, our results cannot be generalized in other populations and settings.

In conclusion, we found an optimal cut-off point for the TTAS with significant predictive power for social media addiction, anxiety, and depression. Our cut-off point could be a quick, reliable and valid primary screening tool to identify TikTok users with high probability of TikTok use disorder. Our cut-off point should not be used for diagnostic purposes, and TikTok users with high scores on the TTAS should be further examined. Scholars should expand our research in different populations and settings to further validate our results.

.....

Καθορισμός διαχωριστικού ορίου για τον εθισμό στο TikTok χρησιμοποιώντας την κλίμακα εθισμού στο TikTok

Π. ΓΑΛΑΝΗΣ,¹ Α. ΚΑΤΣΙΡΟΥΜΠΑ,¹ Ι. ΜΩΥΣΟΓΛΟΥ,² Π. ΓΑΛΛΟΣ,¹ Ο. ΚΩΝΣΤΑΝΤΑΚΟΠΟΥΛΟΥ¹ ¹Εργαστήριο Κλινικής Επιδημιολογίας, Τμήμα Νοσηλευτικής, Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών, Αθήνα, ²Τμήμα Νοσηλευτικής, Πανεπιστήμιο Θεσσαλίας, Λάρισα

Αρχεία Ελληνικής Ιατρικής 2025, 42(4):554-559

ΣΚΟΠΟΣ Η εύρεση του κατάλληλου διαχωριστικού ορίου για την κλίμακα εθισμού στο TikTok. ΥΛΙΚΟ-ΜΕΘΟΔΟΣ Διεξήχθη μια συγχρονική μελέτη με ένα δείγμα ευκολίας. Η συλλογή των δεδομένων πραγματοποιήθηκε στην Ελλάδα τον Ιούλιο του 2024.Το δείγμα περιλάμβανε χρήστες του ΤikTok από τον γενικό πληθυσμό. Χρησιμοποιήσαμε την καμπύλη ανάλυσης των λειτουργικών χαρακτηριστικών για να βρεθεί το κατάλληλο διαχωριστικό όριο για την κλίμακα εθισμού στο TikTok. Αναλυτικότερα, χρησιμοποιήσαμε την Bergen Social Media Addiction Scale (BSMAS) και το Patient Health Questionnaire-4 (PHQ-4) ως κριτήρια για τον υπολογισμό του κατάλληλου διαχωριστικού ορίου. Χρησιμοποιήσαμε τα προτεινόμενα διαχωριστικά όρια από τη βιβλιογραφία για τη μετατροπή της BSMAS και του PHQ-4 σε διχοτόμες μεταβλητές. ΑΠΟΤΕΛΕΣΜΑΤΑ Διαπιστώθηκε ότι η κλίμακα εθισμού στο TikTok έχει σημαντική προβλεπτική ισχύ ως προς τον εθισμό στα μέσα κοινωνικής δικτύωσης, το άγχος και την κατάθλιψη. Βρήκαμε ότι το καλύτερο διαχωριστικό όριο για την κλίμακα εθισμού στο TikTok ήταν το 3,23 (p<0,001, Youden's index=0,72). Στην περίπτωση αυτή, το εμβαδό της περιοχής που καλύπτεται από την καμπύλη ανάλυσης των λειτουργικών χαρακτηριστικών ήταν 0,91 (95% διάστημα εμπιστοσύνης=0,86–0,97). Η ευαισθησία και η ειδικότητα της κλίμακας ήταν 0,76 και 0,96, αντίστοιχα. Έτσι, μέση βαθμολογία στην κλίμακα εθισμού στο TikTok ≥3,23 υποδηλώνει εθισμό στο TikTok, ενώ μέση βαθμολογία από 1–3,22 υποδηλώνει υγιή επίπεδα χρήσης του TikTok. Η θετική προγνωστική αξία της κλίμακας εθισμού στο TikTok ήταν 0,61, ενώ η αρνητική προγνωστική αξία ήταν 0,98. ΣΥΜΠΕΡΑΣΜΑΤΑ Το καλύτερο διαχωριστικό όριο για την κλίμακα εθισμού στο TikTok ήταν το 3,23. Οι χρήστες του TikTok με μέση βαθμολογία στην κλίμακα εθισμού στο TikTok ≥3,23 θα πρέπει να υποβάλλονται σε περαιτέρω έλεγχο από τους επαγγελματίες ψυχικής υγείας. Απαιτείται επί πλέον έρευνα για την επιβεβαίωση των συμπερασμάτων μας.

.....

Λέξεις ευρετηρίου: Ανάλυση διαχωριστικού ορίου, Εθισμός, Κλίμακα εθισμού στο TikTok, Bergen Social Media Addiction Scale, Patient Health Questionnaire-4, Χρήστες

References

- 1. STATISTA. Social media and user-generated content. 2024. Available at: https://www.statista.com/statistics/278414/numberof-worldwide-social-network-users/
- 2. DATAREPORTAL. Global social media statistics. 2024. Available at: https://datareportal.com/social-media-users
- MONTAG C, MARKETT S. Depressive inclinations mediate the association between personality (neuroticism/conscientiousness) and TikTok Use Disorder tendencies. *BMC Psychol* 2024, 12:81
- 4. MENG SQ, CHENG JL, LI YY, YANG XQ, ZHENG JW, CHANG XW ET AL. Global prevalence of digital addiction in general population: A systematic review and meta-analysis. *Clin Psychol Rev* 2022, 92:102128
- ARRIVILLAGA C, REY L, EXTREMERA N. A mediated path from emotional intelligence to problematic social media use in adolescents: The serial mediation of perceived stress and depressive symptoms. Addict Behav 2022, 124:107095
- BÁNYAI F, ZSILA Á, KIRÁLY O, MARAZ A, ELEKES Z, GRIFFITHS MD ET AL. Problematic social media use: Results from a large-scale

nationally representative adolescent sample. *PLoS One* 2017, 12:e0169839

- SINDERMANN C, ELHAI JD, MONTAG C. Predicting tendencies towards the disordered use of Facebook's social media platforms: On the role of personality, impulsivity, and social anxiety. *Psychiatry Res* 2020, 285:112793
- KELES B, McCRAE N, GREALISH A. A systematic review: The influence of social media on depression, anxiety and psychological distress in adolescents. *Int J Adolesc Youth* 2020, 25:79–93
- KUSS DJ, GRIFFITHS MD, KARILA L, BILLIEUX J. Internet addiction: A systematic review of epidemiological research for the last decade. *Curr Pharm Des* 2014, 20:4026–4052
- XANIDIS N, BRIGNELL CM. The association between the use of social network sites, sleep quality and cognitive function during the day. *Comput Human Behav* 2016, 55:121–126
- SMITH T, SHORT A. Needs affordance as a key factor in likelihood of problematic social media use: Validation, latent profile analysis and comparison of TikTok and Facebook problematic use measures. Addict Behav 2022, 129:107259

- 12. VARONA MN, MUELA A, MACHIMBARRENA JM. Problematic use or addiction? A scoping review on conceptual and operational definitions of negative social networking sites use in adolescents. Addict Behav 2022, 134:107400
- ANDREASSEN CS, TORSHEIM T, BRUNBORG GS, PALLESEN S. Development of a Facebook Addiction Scale. *Psychol Rep* 2012, 110:501–517
- 14. ZHU JJ, MA Y, XIA G, SALLE SM, HUANG H, SANNUSI SN. Self-perception evolution among university student TikTok users: Evidence from China. *Front Psychol* 2024, 14:1217014
- 15. ALHABASH S, SMISCHNEY TM, SUNEJA A, NIMMAGADDA A, WHITE LR. So similar, yet so different: How motivations to use Facebook, Instagram, Twitter, and TikTok predict problematic use and use continuance intentions. *Sage Open* 2024, 14:1–20
- 16. HENDRIKSE C, LIMNIOU M. The use of Instagram and TikTok in relation to problematic use and well-being. *J Technol Behav Sci* 2024 (under press)
- GALANIS P, KATSIROUMPA A, MOISOGLOU I, KONSTANTAKOPOULOU
 O. The TikTok Addiction Scale: Development and validation. Research Square preprints 2024. Available at: https://www. researchsquare.com/article/rs-4762742/v1
- WORLD MEDICAL ASSOCIATION. World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. JAMA 2013, 310:2191–2194
- 19. ANDREASSEN CS, BILLIEUX J, GRIFFITHS MD, KUSS DJ, DEMETROVICS Z, MAZZONI E ET AL. The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychol Addict*

Behav 2016, 30:252-262

- 20. DADIOTIS A, BACOPOULOU F, KOKKA I, VLACHAKIS D, CHROUSOS GP, DARVIRI C ET AL. Validation of the Greek version of the Bergen Social Media Addiction Scale in undergraduate students. *EM-Bnet J* 2021, 26:e975
- 21. KROENKE K, SPITZER RL, WILLIAMS JBW, LÖWE B. An ultra-brief screening scale for anxiety and depression: The PHQ-4. *Psy-chosomatics* 2009, 50:613–621
- KAREKLA M, PILIPENKO N, FELDMAN J. Patient Health Questionnaire: Greek language validation and subscale factor structure. *Compr Psychiatry* 2012, 53:1217–1226
- 23. FLUSS R, FARAGGI D, REISER B. Estimation of the Youden Index and its associated cutoff point. *Biom J* 2005, 47:458–472
- 24. AKOBENG AK. Understanding diagnostic tests 3: Receiver operating characteristic curves. Acta Paediatr 2007, 96:644–647
- 25. FISCHER JE, BACHMANN LM, JAESCHKE R. A readers' guide to the interpretation of diagnostic test properties: Clinical example of sepsis. *Intensive Care Med* 2003, 29:1043–1051
- PERKINS NJ, SCHISTERMAN EF. The inconsistency of "optimal" cutpoints obtained using two criteria based on the receiver operating characteristic curve. Am J Epidemiol 2006, 163:670– 675

Corresponding author:

P. Galanis, 123 Papadiamantopoulou street, 115 27 Athens, Greece

e-mail: pegalan@nurs.uoa.gr