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Posted Date: 28 January 2026

doi: 10.20944/preprints202601.2142.v1

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Article

Problematic TikTok Use Affects Anxiety, Depression and Sleep Quality: Sex and Generation Differences

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Abstract

Our aim was to examine the association between problematic TikTok use, anxiety, depression and sleep quality. Additionally, we examined differences between genders and generations. We conducted a cross-sectional study in Greece with a convenience sample. Participants were categorized into three generation groups: Generation Z (born 1997-2012), Millennials (born 1981-1996), and Generation X (born 1965-1980). We used the TikTok Addiction Scale to measure problematic TikTok use. Moreover, we measured anxiety and depression with the Patient Health Questionnaire-4. Also, we used the Sleep Quality Scale to measure sleep quality. We constructed multivariable linear regression models to eliminate confounding. We found a positive association between problematic TikTok use, anxiety and depression. We identified a stronger association between problematic TikTok use and anxiety among males and Generation X. Moreover, we found a stronger association between problematic TikTok use and depression among males and Generation Z and Millennials. Multivariable analysis showed a negative association between problematic TikTok use and sleep quality. This association was stronger among males and Millennials. In conclusion, our findings support the association between problematic TikTok use, anxiety, depression and sleep quality. Policy makers, stakeholders and healthcare professionals should develop and implement appropriate interventions to reduce negative consequences of problematic TikTok use.

Keywords: TikTok; anxiety; depression; sleep quality; TikTok addiction scale; sex; generation

1. Introduction

One of the most prominent characteristics of contemporary society is the pervasive influence of social media, which has experienced exponential growth and become deeply embedded in the daily routines of individuals worldwide—particularly among younger demographics [1]. Leveraging sophisticated and continuously evolving algorithms, social media platforms are capable of analysing users' behaviour with remarkable precision, discerning personality traits, and curating content that aligns closely with users' preferences and interests [2–4]. Current data indicate that the global number of social media users reached 5.44 billion in 2025, with projections suggesting an increase to 6.46 billion by the end of 2029. A further testament to the dominance of these platforms is the substantial amount of time users dedicate to them, with average daily usage reported at approximately 141 minutes [1].

Among contemporary social media platforms, TikTok has emerged as the most dominant. Within only nine years of its initial launch in China, its rapid expansion has surpassed all competing platforms, both in growth trajectory and user base. Whereas earlier social media networks required decades to establish their global presence, TikTok achieved comparable—and in many cases

greater—prominence in less than a decade [1,5]. Its influence is particularly evident among younger generations, who devote substantial portions of their daily screen time to viewing short-form videos on the platform. TikTok currently reports 1.5 billion active users monthly, with Generation Z (individuals aged 16–24) comprising approximately 35% of this population [1,6]. Existing literature and statistical evidence consistently indicate that TikTok use is strongly associated with addictive behaviour [7–10]. Data from the United States reveal relatively similar patterns of perceived addiction and negative mental-health impacts across generational groups. Generation Z reports the highest rate of perceived addictiveness at 77.7%, followed by Millennials at 73.5% and Generation X at 71.7% [1]. Although TikTok's short videos—lasting up to 60 seconds—are often used for light-hearted and harmless purposes, such as sharing information, promoting content, or highlighting trends, and can even serve as a creative outlet for self-expression, research points to several concerning issues. To begin with, studies estimate that users may spend from 52 to over 150 minutes on the platform each day [1]. TikTok engages the brain's dopaminergic pathways in much the same way as other addictive behaviours [11–13].

Literature has already documented the detrimental effects of social media platforms [14–18]. Increased time spent on social media indicated higher levels of engagement, emotional investment, and addictive behaviours on them, which were associated with elevated psychological distress, anxiety, and depressive symptoms [15]. Likewise, a systematic review with 67 studies found a association between problematic social media use, anxiety and depression [19]. Similarly, another systematic review including 32 studies identified a positive association between problematic social media use and anxiety-related symptoms [16].

Accordingly, a substantial body of research indicates that problematic TikTok use and TikTok-related addiction are linked to adverse mental health outcomes too, with anxiety, depression, and sleep disturbances emerging as the most frequent and severe consequences [6,20–22]. Literature supports that users consumed by TikTok tend to have worse scores in well-being and mental health even in comparison to other platform users [23,24], while mental variants such as anxiety and depression are getting improved even with a week temperance from TikTok [25,26]. According to literature, age seems to play a significant role, since younger ages, along with females, tend to display more problematic use in comparison to older age groups, [9,27,28]. A study with adolescents in China reported that individuals classified as TikTok-addicted exhibited significantly poorer mental health outcomes than both non-users and moderate users. These adolescents demonstrated elevated levels of stress, anxiety, sadness, loneliness, social anxiety, concentration difficulties, and reduced sleep quality and life satisfaction. Furthermore, TikTok-addicted participants showed lower academic achievement, greater exposure to bullying victimization, weaker family relationships, and heightened academic stress [10]. Same results are deriving from Sha and Dong's study where 3036 Chinese students with a mean age of 16.7 years showed positive relationship between TikTok addiction and variants such as anxiety, stress and depression [29].

Furthermore, a prolonged engagement to TikTok has been linked to increased body dissatisfaction and a distorted body image, particularly among women, which in turn is associated with psychological concerns such as stress, depressive symptoms, and diminished self-esteem [30–33]. Furthermore, existing research indicates that even content labelled as body-positive may fail to achieve its intended goals; the persistent circulation of idealized and often unattainable body standards can exacerbate mental health difficulties [34]. Given that a substantial proportion of TikTok users are adolescents and young adults—a population already vulnerable to social and psychological pressures—the platform's influence may contribute to adverse outcomes related to well-being, including heightened insecurity, reduced self-worth, and elevated risks of depression.

Another major issue emerging from TikTok is the correlation between excessive time on it and sleep disorder. It is found that the prolonged exposure to blue-light-emitting screens—including smartphones, tablets, and computers—which has been consistently associated with various sleep disturbances, such as insomnia, circadian rhythm dysregulation, and reduced overall sleep quality. Literature is claiming that screen time, especially at night, results to poor sleep quality [35–37]. TikTok

users devote a large portion of their day in TikTok [1]. Further studies, have appointed poor quality of sleep due to TikTok addiction along with incapability of the users to disconnect sacrificing their nighttime sleep to TikTok and experience sleeplessness in their daytime activities failing to participate adequately [6,27,38,39]. Sleep is a vital parameter both for mental and physical well-being. Especially young ages and children where sleep plays a key-role for brain and nerve system development [40–45]. The evidence suggests that TikTok addiction, particularly among younger users, disrupts multiple aspects of sleep, negatively affecting both its duration and overall quality [27,46,47].

In this context, we examined for first time in Greece the association between problematic TikTok use, anxiety, depression and sleep quality. Also, we investigated differences according to sex and generations.

2. Materials and Methods

2.1. Study Design

In Greece, we carried out a web-based cross-sectional study using an online questionnaire created with Google Forms, which we shared through TikTok. We specifically made a TikTok video to inform users about our study. Participants needed to be adults aged 18 or older. The Google Forms link was sent to interested TikTok users via direct messages. Before starting the survey, participants were shown an introductory page with key information. This page explained the study's purpose and design, gave a brief overview of the questions, estimated the time needed to complete the questionnaire, highlighted that participation was voluntary, and informed participants they could exit the survey by closing their browser. Our contact details were also provided. To maintain data integrity, we asked participants if they had previously completed the survey, and any positive responses were excluded from the dataset, resulting in a convenience sample. Data collection took place from January to March 2025. We followed the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for our study [48].

We used G*Power v.3.1.9.2 to calculate our sample size. Considering a small effect size between problematic TikTok use, and anxiety, depression and sleep quality ($f^2 = 0.02$), the number of independent variables (one predictor and five confounders), a confidence level of 95%, and a margin error of 5%, sample size was estimated at 652 participants.

2.2. Measurements

We evaluated problematic TikTok use with the TikTok Addiction Scale (TTAS), which includes 15 items assessing six dimensions: salience (two items), mood modification (two items), tolerance (three items), withdrawal symptoms (two items), conflict (four items), and relapse (two items) [49]. Salience refers to users' preoccupation with TikTok, while mood modification indicates its impact on emotional well-being. Tolerance is when users need more TikTok engagement to feel satisfied, and withdrawal is marked by negative feelings when they stop using it. Conflict arises when TikTok interferes with daily life, and relapse is when users return to previous usage patterns after abstaining. The TTAS assesses individuals' attitudes towards TikTok over the past year, with responses on a five-point Likert scale from 1 (very rarely) to 5 (very often). Scores for the TTAS and the six factors range from 1 to 5, with higher scores indicating more problematic TikTok use. A cut-off score of 3.23 is suggested to distinguish between healthy and problematic users [50]. We used the validated Greek version of the TTAS [49]. In our study, the TTAS had a Cronbach's alpha of 0.944. Cronbach's alpha for the factor "salience" was 0.689, for the factor "mood modification" was 0.706, for the factor "tolerance" was 0.891, for the factor "withdrawal symptoms" was 0.851, for the factor "conflict" was 0.911, and for the factor "relapse" was 0.898.

We assessed anxiety and depression using the Patient Health Questionnaire-4 (PHQ-4), which consists of four questions: two for anxiety and two for depression [51]. Responses are recorded on a four-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). The scores for both factors

can vary from 0 to 6, with higher scores indicating more severe anxiety and depressive symptoms. A score of 3 or above signifies elevated levels of anxiety and depression. We used the Greek version of the PHQ-4 [52]. In our study, the Cronbach's alpha for the PHQ-4 was 0.849, with 0.790 for anxiety and 0.782 for depression.

Sleep quality was evaluated using the Sleep Quality Scale (SQS) [53]. Participants were instructed to rate their overall sleep quality over the past week on a visual analogue scale, marking an integer from 0 (worst sleep quality) to 10 (excellent sleep quality). We used the valid Greek version of the SQS [54]. When assessing their sleep quality, participants were asked to consider key aspects such as the number of hours slept, ease of falling asleep, frequency of waking during the night (excluding bathroom trips), instances of waking earlier than necessary, and how refreshing their sleep felt.

We considered several potential confounding variables, including educational level (ranging from elementary school to PhD), socioeconomic status, daily TikTok usage (continuous variable), daily social media usage (continuous variable), and the total number of social media accounts (continuous variable). Socioeconomic status was measured with a straightforward question: "How do you consider your socioeconomic status?" Responses were on a scale from 0 to 10, where 0 indicated the lowest socioeconomic status and 10 the highest.

2.3. Ethical Issues

Our study was conducted in accordance with the Declaration of Helsinki guidelines [55]. The study protocol received approval from the Ethics Committee of the Faculty of Nursing, National and Kapodistrian University of Athens (approval number; 05, October 10; 2024). Participants were informed about the study design and asked to provide consent to participate. Specifically, before accessing the online questionnaire, TikTok users were asked via Google Forms if they agreed to participate. Those who consented were allowed to complete the questionnaire, thereby obtaining informed consent. Furthermore, no personal data were collected from participants, ensuring that participation was both voluntary and anonymous.

2.4. Statistical Analysis

We display categorical variables as numbers (n) and percentages (%), while continuous variables are shown with their mean, standard deviation (SD), median, interquartile range, skewness, and kurtosis. To evaluate the distribution of continuous variables, we employed the Kolmogorov-Smirnov test and Q-Q plots. Levels of problematic TikTok use were treated as the independent variable in our study. We observed moderate to strong correlations among the six factors on the TTAS, with correlation coefficients ranging from 0.554 to 0.771 (all p-values < 0.001). Consequently, to prevent multicollinearity in the multivariable regression models, we opted to use the total TTAS score as the independent variable. Our dependent variables included anxiety score, depression score and sleep quality score. We considered educational level, socioeconomic status, daily TikTok usage, daily social media usage, and the total number of social media accounts as potential confounding factors. Given that the dependent variables were continuous and normally distributed, we utilized linear regression analysis, reporting both unadjusted and adjusted beta coefficients, 95% confidence intervals (CI), and p-values. All multivariable models were adjusted for the confounders. We checked for multicollinearity in the multivariable models using variance inflation factors (VIFs), with VIFs exceeding 4 indicating multicollinearity [56]. The VIFs for the final models ranged from 1.071 to 1.614, suggesting no multicollinearity concerns. Additionally, we performed separate linear regression analyses according to sex and generation to examine potential differences between males and females, and between the three age generations. Participants were categorized into three generational groups: Generation Z (born 1997-2012), Millennials (born 1981-1996), and Generation X (born 1965-1980) [57]. We also used independent samples t-tests to assess differences in TikTok usage, social media usage, and study scales between the two sexes and the three generations. For generational analysis, we first performed an analysis of variance, followed by independent samples

t-tests between two groups with Bonferroni correction. Pearson's correlation coefficient was calculated to examine correlations between continuous variables. P-values less than 0.05 were considered statistically significant. We used the IBM SPSS 28.0 (IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp) for analysis.

3. Results

3.1. Demographic Characteristics

Our sample included 1033 individuals. In our sample, 75.4% were females, and 24.6% were males. The mean age was 31.1 years (SD; 12.4), with a median age of 26.0 years. A majority of the participants were from Generation Z (53.6%), followed by Millennials at 28.6%, and Generation X at 17.8%. Among the participants, 60.4% held a university degree, while 39.6% had completed high school. The mean score on the socioeconomic status scale indicated a moderate level. Table 1 shows the demographic data of our participants.

Table 1. Demographic data of our participants (N=1033).

Characteristics	N	%
Sex		
Females	779	75.4
Males	254	24.6
Age ^a	31.1	12.4
Age categories		
Generation Z	554	53.6
Millennials	295	28.6
Generation X	184	17.8
Educational level		
High school	409	39.6
University degree	373	36.1
MSc diploma	229	22.2
PhD diploma	22	2.1
Socioeconomic status ^a	6.2	1.5

^a mean, standard deviation.

3.2. Social Media Characteristics

On average, participants used TikTok for 1.8 hours daily (SD; 1.5), with a median of one hour, a minimum of 30 minutes, and a maximum of 8.0 hours. Females used TikTok for an average of 1.8 hours per day, while males used it for 1.7 hours (p-value = 0.238). Generation Z averaged 2.3 hours of TikTok use daily, Millennials 1.3 hours, and Generation X 0.8 hours (p-value < 0.001 for differences among all groups).

The average daily social media usage was 3.3 hours (SD; 1.9), with a median of 3.0 hours, a minimum of 30 minutes, and a maximum of 8.0 hours. Females averaged 3.4 hours of social media use per day, compared to 3.3 hours for males (p-value = 0.356). Generation Z used social media for an average of 4.0 hours daily, Millennials for 2.9 hours, and Generation X for 2.1 hours (p-value < 0.001 for differences among all groups).

Most participants (92.9%, n=960) had accounts on at least two social media platforms. Specifically, 7.1% (n=73) had only a TikTok account, 15.8% (n=163) had accounts on two platforms, 28.0% (n=289) on three platforms, 21.9% (n=226) on four platforms, 15.4% (n=159) on five platforms,

and 11.9% (n=123) on 6-8 platforms. The average number of accounts was 3.6 (SD; 1.5), with a median of 3.0, a minimum of 1, and a maximum of 8. Females had an average of 3.6 accounts, while males had 3.9 (p-value = 0.011). Generation Z averaged 3.8 accounts, Millennials 3.7, and Generation X 3.1 (p-value < 0.001 for differences between Generation Z and X, and between Millennials and Generation X).

Table 2 presents social media variables in our sample according to sex and generation.

Table 2. Social media variables in our sample according to sex and generation (N=1033).

	Sex		Generation			Total
	Females (n=779)	Males (n=254)	Generation Z (n=554)	Millennials (n=295)	Generation X (n=184)	
TikTok use per day (hours)						
Mean	1.8	1.7	2.3	1.3	0.8	1.8
Standard deviation	1.5	1.5	1.7	1.1	0.5	1.5
P-value ^a	0.238		<0.001 ^b for all comparisons between the three groups			
Social media use per day (hours)						
Mean	3.4	3.3	4.0	2.9	2.1	3.3
Standard deviation	1.9	1.8	1.8	1.7	1.4	1.9
P-value ^a	0.356		<0.001 ^b for all comparisons between the three groups			
Social media accounts						
Mean	3.6	3.9	3.8	3.7	3.1	3.6
Standard deviation	1.5	1.7	1.5	1.5	1.4	1.5
P-value ^a	0.011		<0.001 ^b for comparisons between Generation Z and X, and between Millennials and Generation X			

^a independent samples t-test ^b p-values after Bonferroni correction.

3.3. Study Scales

Among the participants, 11.3% (n=117) scored above the TTAS cut-off of 3.23, indicating problematic TikTok use, while 88.7% (n=916) scored below, indicating healthy use. Participants scored highest on "mood modification" and "tolerance" followed by "conflict" "salience", "relapse" and "withdrawal symptoms". No significant difference was found in TTAS scores between females (mean; 1.95, SD; 0.79) and males (mean; 1.98, SD; 0.84), (p-value = 0.643). Generation Z (mean; 2.30, SD; 0.83) had higher TTAS scores than Millennials (mean; 1.66, SD; 0.58) and Generation X (mean; 1.38, SD; 0.36), (p-value < 0.001 in all cases).

Mean score on PHQ-4 was 4.25 (SD; 2.95), while mean anxiety score was 2.38 (SD; 1.62), and mean depression score was 1.87 (SD; 1.61). One out of three participants (35.0%, n=362) had an anxiety

score of 3 or greater indicating considerable anxiety issues. Moreover, one out of four (24.9%, n=257) had a depression score ≥ 3 , indicating high levels of depressive symptoms.

Mean score on Sleep Quality Scale was 5.73 (SD; 2.26). Sleep quality was terrible for 1.5% (n=16) of our participants, poor for 17.1% (n=177), fair for 39.1% (n=403), good for 33.6% (n=409), and excellent for 2.7% (n=28).

Descriptive statistics for the study scales are shown in Table 3.

Table 3. Descriptive statistics for our study scales (N=1033).

Scale	Mean	Standard deviation	Median	Interquartile range	Skewness	Kurtosis
TikTok Addiction Scale	1.95	0.80	1.73	1.07	1.05	0.57
Saliency	1.70	0.82	1.50	1.00	1.36	1.61
Mood modification	2.81	1.06	3.00	1.50	-0.02	-0.74
Tolerance	2.33	1.13	2.00	1.67	0.60	-0.69
Withdrawal symptoms	1.33	0.62	1.00	0.50	2.31	6.02
Conflict	1.92	1.02	1.50	1.50	1.18	0.57
Relapse	1.48	0.82	1.00	1.00	2.10	4.59
Patient Health Questionnaire-4	4.25	2.95	4.00	4.00	0.84	0.20
Anxiety	2.38	1.62	2.00	2.00	0.72	0.11
Depression	1.87	1.61	2.00	1.00	0.90	0.30
Sleep Quality Scale	5.73	2.26	6.00	3.00	-0.32	-0.52

3.4. Correlation Between Study Scales

Our findings showed a positive correlation between TikTok addiction score and anxiety score ($r = 0.249$, p -value < 0.001). This correlation was stronger among males and Generation X. Similarly, we found a positive correlation between TikTok addiction score and depression score ($r = 0.360$, p -value < 0.001). This correlation was stronger among males and Generation Z. We found a negative correlation between TikTok addiction score and sleep quality score ($r = -0.178$, p -value < 0.001). This correlation was stronger among males, Generation Z and Millennials.

Table 4 shows correlation between TikTok addiction score, and anxiety score, depression score and sleep quality score.

Table 4. Pearson's correlation coefficients between TikTok addiction score, anxiety score, depression score and sleep quality score (N=1033).

	Anxiety score	Depression score	Sleep quality score
Full sample (n=1033)	0.249*	0.360*	-0.178*
Females (n=779)	0.207*	0.311*	-0.128*
Males (n=254)	0.391*	0.503*	-0.295*
Generation Z (n=554)	0.281*	0.400*	-0.207*
Millennials (n=295)	0.181*	0.317*	-0.218**
Generation X (n=184)	0.321*	0.212*	-0.105

Coefficients were adjusted for educational level, socioeconomic status, TikTok use per day, social media use per day, and social media accounts. * p-value < 0.001.

3.5. Association Between Problematic TikTok Use and Anxiety

We found a positive association between problematic TikTok use and anxiety in the full sample (adjusted coefficient beta = 0.582, 95% CI = 0.443 to 0.720, p-value < 0.001). Our analysis showed that the association between problematic TikTok use and anxiety was stronger among males (adjusted coefficient beta = 0.814, 95% CI = 0.574 to 1.055, p-value < 0.001) than females (adjusted coefficient beta = 0.506, 95% CI = 0.337 to 0.675, p-value < 0.001). Moreover, our analysis identified differences between generations. In particular, the association between problematic TikTok use and anxiety was stronger in Generation X (adjusted coefficient beta = 0.997, 95% CI = 0.561 to 1.433, p-value < 0.001) than Generation Z (adjusted coefficient beta = 0.604, 95% CI = 0.431 to 0.777, p-value < 0.001), and Millennials (adjusted coefficient beta = 0.536, 95% CI = 0.199 to 0.872, p-value = 0.002). Table 5 shows linear regression models with anxiety score as the dependent variable.

Table 5. Linear regression models with anxiety score as the dependent variable.

Predictor:	Univariate model			Multivariable model ^a					
	Unadjusted coefficient beta	95% CI for beta	P-value	Adjusted coefficient beta	95% CI for beta	P-value	VIF	R ² (%)	P-value for ANOVA
Full sample (n=1033)	0.774	0.660 to 0.889	<0.001	0.582	0.443 to 0.720	<0.001	1.550	18.9	<0.001
Females (n=779)	0.710	0.575 to 0.845	<0.001	0.506	0.337 to 0.675	<0.001	1.506	14.6	<0.001
Males (n=254)	0.961	0.750 to 1.171	<0.001	0.814	0.574 to 1.055	<0.001	1.444	31.3	<0.001
Generation Z (n=554)	0.648	0.490 to 0.806	<0.001	0.604	0.431 to 0.777	<0.001	1.253	14.1	<0.001
Millennials (n=295)	0.779	0.474 to 1.084	<0.001	0.536	0.199 to 0.872	0.002	1.278	12.0	<0.001
Generation X (n=184)	1.016	0.579 to 1.452	<0.001	0.997	0.561 to 1.433	<0.001	1.071	16.1	<0.001

^a Multivariable models are adjusted for educational level, socioeconomic status, TikTok use per day, social media use per day, and social media accounts CI: confidence interval, TTAS: TikTok Addiction Scale, VIF: variance inflation factor.

3.6. Association Between Problematic TikTok Use and Depression

The final multivariable linear regression model in the full sample showed a positive association between problematic TikTok use and depression (adjusted coefficient beta = 0.864, 95% CI = 0.727 to 1.002, p-value < 0.001). This positive association was stronger among males (adjusted coefficient beta = 1.123, 95% CI = 0.881 to 1.365, p-value < 0.001) than females (adjusted coefficient beta = 0.769, 95% CI = 0.603 to 0.934, p-value < 0.001). Additionally, our analysis found that the association between problematic TikTok use and depression was stronger in Millennials (adjusted coefficient beta = 0.927, 95% CI = 0.605 to 1.249, p-value < 0.001) and Generation Z (adjusted coefficient beta = 0.905, 95% CI =

0.731 to 1.079, p-value < 0.001) than Generation X (adjusted coefficient beta = 0.624, 95% CI = 0.198 to 1.051, p-value < 0.001). Table 6 shows linear regression models with depression score as the dependent variable.

Table 6. Linear regression models with depression score as the dependent variable.

Predictor:	Univariate model			Multivariable model ^a					
	Unadjusted coefficient beta	95% CI for beta	P-value	Adjusted coefficient beta	95% CI for beta	P-value	VIF	R ² (%)	P-value for ANOVA
Full sample (n=1033)	0.891	0.780 to 1.002	<0.001	0.864	0.727 to 1.002	<0.001	1.55	20.3	<0.001
Females (n=779)	0.827	0.706 to 0.967	<0.001	0.769	0.603 to 0.934	<0.001	1.61	17.0	<0.001
Males (n=254)	1.043	0.836 to 1.251	<0.001	1.123	0.881 to 1.365	<0.001	1.44	31.8	<0.001
Generation Z (n=554)	0.870	0.714 to 1.027	<0.001	0.905	0.731 to 1.079	<0.001	1.25	18.7	<0.001
Millennials (n=295)	1.048	0.761 to 1.335	<0.001	0.927	0.605 to 1.249	<0.001	1.27	16.3	<0.001
Generation X (n=184)	0.666	0.249 to 1.084	0.002	0.624	0.198 to 1.051	0.004	1.07	7.2	<0.001

^a Multivariable models are adjusted for educational level, socioeconomic status, TikTok use per day, social media use per day, and social media accounts CI: confidence interval, TTAS: TikTok Addiction Scale, VIF: variance inflation factor.

3.7. Association Between Problematic TikTok Use and Sleep Quality

After elimination of confounders, we found a negative association between problematic TikTok use and sleep quality score (adjusted coefficient beta = -0.609, 95% CI = -0.816 to -0.403, p-value < 0.001). This association was stronger among males (adjusted coefficient beta = -0.942, 95% CI = -1.325 to -0.560, p-value < 0.001) and Millennials (adjusted coefficient beta = -0.973, 95% CI = -1.478 to -0.469, p-value < 0.001). Table 7 shows linear regression models with sleep quality score as the dependent variable.

Table 7. Linear regression models with sleep quality score as the dependent variable.

Predictor:	Univariate model			Multivariable model ^a					
	Unadjusted coefficient beta	95% CI for beta	P-value	Adjusted coefficient beta	95% CI for beta	P-value	VIF	R ² (%)	P-value for ANOVA
Full sample (n=1033)	-0.679	-0.847 to -0.511	<0.001	-0.609	-0.816 to -0.403	<0.001	1.55	8.4	<0.001

Females (n=779)	-0.528	-0.724 to - 0.332	<0.00 1	-0.446	-0.690 to - 0.202	<0.00 1	1.55	6.9	<0.001
Males (n=254)	-1.087	-1.413 to - 0.760	<0.00 1	-0.942	-1.325 to - 0.560	<0.00 1	1.44	18.5	<0.001
Generation Z (n=554)	-0.542	-0.765 to - 0.320	<0.00 1	-0.619	-0.864 to - 0.373	<0.00 1	1.25	6.3	<0.001
Millennials (n=295)	-0.933	-1.396 to - 0.471	<0.00 1	-0.973	-1.478 to - 0.469	<0.00 1	1.27	11.3	<0.001
Generation X (n=184)	-0.699	-1.471 to 0.073	0.076	-0.571	-1.369 to 0.228	0.160	1.07	1.2	0.224

^a Multivariable models are adjusted for educational level, socioeconomic status, TikTok use per day, social media use per day, and social media accounts CI: confidence interval, TTAS: TikTok Addiction Scale, VIF: variance inflation factor.

4. Discussion

We conducted a cross-sectional study to examine the potential association that may exist between the problematic TikTok use and the levels of anxiety, depression, and sleep quality among TikTok users in Greece. In contrast to earlier studies that relied on non-specific measures of social media engagement or simple frequency-based questions [10,23,24,29], our study employed a validated instrument designed explicitly to assess problematic TikTok use—the TikTok Addiction Scale [49]. Furthermore, our aim was to concentrate information on problematic TikTok use by sex and age generations.

The distribution of the individuals in generation was fluctuated as followed: Generation Z, Millennials and Generation X, following the literature that younger ages around adolescence make more extensive use of TikTok in comparison to other social media platforms [1,23,58]. The mean daily time spent on TikTok was 1.8 hours per day. Gentzer et al. and Chao et al. suggest a daily use of TikTok at 2.2 and 2.9 hours respectively, which are quiet close to our findings [10,23]. Also, literature agrees with our findings that females were found to slightly taking the lead of TikTok daily use in contrast to males [1,9,23,59]. A recent systematic review also supports the lead among females [59]. According to other studies female individuals tend to devote more time on social media generally, in contrast to male participants [60,61]. Either due to body-image-related issues or due to fear of missing out, or due to factors that are still under question, female individuals seem to be more easily seduced by the digital world of TikTok [14,30,33,34,59] investing more time and effort on social media relationships [62–64]. It is also important to note that the time reported on TikTok, in our sample, spanned from of 30 minutes minimum to, even, 8.0 hours maximum which arises many concerns, especially when these results are combined to the finding that the average daily social media usage was 3.3 hours in our sample.

The fact that the 11.3% of the sample ranked a score above the cut-off point of the TikTok Addiction Scale, meaning that more than one out of 10 express addictive behaviour concerning TikTok use, aligns with previous studies indicating that social media are constantly “consuming” their users with TikTok been the strongest of all platforms concerning addictive effects [3,10,13,27,58,59,61,65]. A very interesting aspect concerning the findings of this study is that the higher scores of TikTok addiction referred to “mood modification” and “tolerance” followed by “conflict” “salience” “relapse” and “withdrawal symptoms” both for females and males and mostly among Generation Z. In other words, participants’ feelings were affected by the absence of TikTok, and the more often they used the platform, the longer they stayed connected feeling unable or unwilling to log out. Even if they tried to cut it off for a period, a relapse with worse outcomes concerning problematic use and addiction would follow, even if that came into conflict with their schedule or daily responsibilities. These findings are totally aligned with the neurotic mechanism and

the pathway of addiction. The more pleasure the user obtains from a specific substance or action, the more the mind and body craves for bigger amounts [11,12]. It is shown from previous studies that the algorithms that social media use are that strong and engaging, concluding to absolute bound of the users to the platform [2,3,13,65,66]. TikTok, among all, employs very strong and precise algorithms, achieving higher levels of engagement between its users and the platform [5,8,58,59,67].

Also, one out of three participants in our sample had an anxiety score of 3 or greater, indicating considerable anxiety issues and one out of four participants had a depression score higher than 3, indicating high levels of depressive symptoms. Finally, 1.5% of the sample had “terrible” sleep quality and 17.1% stated a poor one, meaning that almost one out four could get the essential rest from their nighttime sleep. These findings are of great importance when examined in combination with the above. More specifically, the findings concerning association between our study scales indicated a positive association between TikTok addiction, anxiety and depression, especially among male participants and Generation X, while the sleep quality depicted a negative association. Once more, the association was stronger among male participants, but this time Millennials’ sleep quality was more affected than other age groups. There is an extensive literature supporting that social media, in general, share a great role in poor mental health of their users. The more involved individuals are devoting time and effort, the higher the emotional engagement is. This constant and strong bond between the platform and spiritual world of the individual ends up in worse scores concerning anxiety and depression [13,23,46]. A recent systematic review which included cross-sectional and cohort studies, agree that the extensive use of social media is linked to poor mental health and sleep quality [46]. TikTok functions in the same way concerning mental health and sleep quality, only sharper since the engagement of the individuals is stronger. A number of findings in literature declare that the more addicted one is, the worse the mental health tends to be, affecting a number of factors such as anxiety, depression, well-being [10,27,59,62]. Furthermore, variables such as stress, cognitive and learning abilities among students have been found disordered due to the effect of TikTok addiction along with procrastination and tendency to isolation [9,10,26,28,29,59]. Motivation in school and academic activities seems to be affected as well due to the dramatic influence of TikTok on individuals’ personality and interest [10,20]. Problematic TikTok engagement is further marked by diminished attentional control and distorted perceptions of time, as individuals become deeply immersed in the platform’s digital environment, leading to reduced awareness of and detachment from offline activities [68]. Chao et al. conducted a comparative study examining mental health differences between individuals with and without problematic TikTok use, revealing significantly poorer psychological outcomes among those classified as addicted. Participants were categorized based on their level of engagement with short-video platforms. Classification of addictive use was determined using the Smartphone Addiction Scale, applying established cut-off scores. Findings indicated that individuals identified as addictive users exhibited a wide range of adverse outcomes, including heightened mental health difficulties such as depression, anxiety, stress, and loneliness, as well as social challenges including social anxiety, attention-related problems, and reduced life satisfaction. Additionally, addicted users reported elevated stress levels, poorer academic performance, and increased exposure to bullying and victimization. The study also showed that TikTok-addicted users tended to experience more strained parent–child relationships, more negative parenting practices, and lower parental education levels compared with their non-addicted peers. Finally, problematic TikTok use was associated with poorer sleep quality among those exhibiting addictive behaviours, confirming the results of our study regarding poor sleep quality due to TikTok addiction [10].

Individuals are failing to control their time on the social media platforms, including TikTok, scarifying time, not only from their daily activities, but also from their sleep and rest during nighttime [6,27,37,38,69]. This finding lurks a variety of major issues, since poor quality in sleep deriving from TikTok addiction and extensive exposure to blue-light-screens (as smartphones, tablets, laptops etc.) [35,36], conclude to a number of physical and mental issues, including insomnia, disoriented

circadian cycle, sleeplessness, migraines, bruxism, cardiovascular issues, cognitive disorders, higher risk for Alzheimer, fatigue etc. [70–72].

Several determinants have been identified as contributing to addictive or problematic engagement with short-video platforms. Broadly, these predictors fall into three overarching categories: individual characteristics (such as personality traits, expectations of use, and behavioural tendencies), the surrounding social environment, and platform-related or technological factors associated with social media itself [73]. The reason why young people, especially female individuals, indicate high levels of anxiety and depression may be attributed to the extensively bombing of false icons in TikTok. This non-realistic images of how one should look or which standards are considered eligible in order to be feminine or muscular, are pushing young people to non-realistic body-image beliefs, unable to be achieved. This chain of facts, results to self-esteem problems, deeply affecting well-being and bringing to the surface depression and anxiety to this vulnerable age groups. It is indicating that even campaigns for body-image enhancement for girls, are failing to serve their purpose, worsening the negative outcomes on young girls mental health [30,33,34,62,67].

Another major concept which may explain the findings of the study, is the fear of missing out (FOMO) young people are experiencing. The main point of this concept, is that users are not willing to log out of the platform, fearing that they will miss important updates concerning their digital relationships and social life. Although this may sound enhancing to socializing, it brings great amounts of isolation and alienation from the real human touch and relationships, ending up to depression and relevant mental issues [14,74–79].

Our study had several limitations. Firstly, since we conducted a cross-sectional study, we are unable to determine a causal link between problematic TikTok use and variables such as anxiety, depression, and sleep quality. Consequently, it remains unclear whether problematic TikTok use influences anxiety, depression, and sleep quality, or if these issues pre-exist and contribute to increased TikTok use. Longitudinal studies examining the association between problematic TikTok use and these variables could provide valuable insights. Secondly, we utilized a convenience sample of TikTok users in Greece. Although we met the sample size requirements, our sample may not accurately represent all TikTok users. For example, our study predominantly included females, which could introduce selection bias due to this gender imbalance. Future research should employ random sampling to yield more representative findings. Thirdly, while we used valid tools to assess problematic TikTok use, anxiety, depression, and sleep quality, participants' responses might be influenced by social desirability bias, leading to potential information bias in our study. Additionally, information bias could arise from the measurement of confounding factors, such as using self-reported assessments for socioeconomic status. Fourthly, exploring potential mediators in the relationship between problematic TikTok use, anxiety, depression, and sleep quality could further enhance our understanding of TikTok impact. Lastly, we accounted for several confounders in our study, including educational level, socioeconomic status, daily TikTok use, daily social media use, and social media accounts. However, other variables might still confound the relationship between problematic TikTok use, anxiety, depression, and sleep quality. Future research should consider eliminating additional confounders, such as personality traits, family relationships, and sleep patterns.

5. Conclusions

The results of this study indicate an association between TikTok use and elevated levels of anxiety, depressive symptoms, and poor sleep quality among TikTok users in Greece. Nevertheless, given the methodological constraints of the present research and the limited body of existing literature concerning sex and generation reasoning on these results, further empirical investigations are necessary to establish more definitive conclusions regarding these associations. Early detection of users exhibiting signs of problematic or addictive TikTok use is crucial for safeguarding their mental health and overall well-being. Healthcare practitioners should remain vigilant in identifying indicators of excessive or maladaptive TikTok engagement in this population. In addition,

policymakers are encouraged to design and implement evidence-based interventions aimed at mitigating overuse of the platform.

Mitigating the mental health risks associated with excessive TikTok engagement requires the development of tailored strategies. Such strategies may include public education efforts, initiatives designed to strengthen digital well-being, and access to psychological support services. Addressing problematic TikTok use is most effective when healthcare providers, educators, and families collaborate to monitor and guide young users. In addition, the creation of clear policies and usage guidelines is necessary to promote healthier patterns of interaction with the platform. Evidence from a recent systematic review of mobile-based psychological interventions for university students indicates that these tools are generally accepted by users and demonstrate strong adherence. Early findings also suggest that mobile interventions can play a meaningful role in reducing stress, anxiety, and depressive symptoms, as well as curbing risky behaviors such as alcohol and tobacco use, while contributing to improvements in sexual health knowledge.

Author Contributions: Conceptualization, A.K. Z.K., and P.G.; methodology, A.K. Z.K., E.K., P.M., and P.G.; software, I.M., P.G.; validation, E.K., P.M., I.M.; formal analysis, A.K. Z.K., and P.G.; investigation, E.K., P.M., I.M.; resources, E.K., P.M., I.M.; data curation, E.K., P.M., I.M.; writing—original draft preparation, A.K., Z.K., E.K., P.M., I.M., P.G.; writing—review and editing, A.K., Z.K., E.K., P.M., I.M., P.G.; visualization, A.K. Z.K., and P.G.; supervision, P.G.; project administration, P.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the Faculty of Nursing, National and Kapodistrian University of Athens (approval number; 05, October 10; 2024).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original data presented in this study are openly available in FigShare at doi.org/10.6084/m9.figshare.28903820.

Acknowledgments: none.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

TTAS	TikTok Addiction Scale
PHQ-4	Patient Health Questionnaire-4
SQS	Sleep Quality Scale
SD	Standard deviation
CI	Confidence interval
VIF	Variance inflation factor

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