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Abstract

Background: In recent years, the Fear of Missing Out (FoMO) construct has been the object of growing attention in digital technology research with previous studies finding support for the relationship between FoMO and problematic smartphone use (PSU) among adolescents and young adults. However, no previous studies clarified the causal link between FoMO and PSU using a longitudinal design. **Methods:** An auto-regressive, cross-lagged panel design was tested by using a longitudinal dataset with two waves of data collection (T0 and T1, one year apart). Participants included two hundred and forty-two adolescents (109 males and 133 females), with a mean age of 14.16 years, who filled out the Fear of Missing Out scale (FoMOs) and the Smartphone Addiction Scale (SAS). Moreover, participants filled out the Difficulties in Emotion Regulation Scale (DERS), at the first time-point of data collection. **Results:** The findings of the study show that FoMO (both FoMO-Fear and FoMO-Control subscales) and PSU are positively related at both time-points (i.e. at a cross-sectional level). However no cross-lagged associations between them were longitudinally supported. Females and older adolescents show higher FoMO-Fear at T1. **Conclusions:** The findings of the present study suggest caution when causal links between FoMO and PSU are inferred.

Keywords: Fear of Missing Out, Smartphone Addiction, Longitudinal modeling, Adolescents, Autoregressive cross-lagged panel, Emotional regulation.

Declaration of interest: All authors declare that they have no conflicts of interest with this study.

Examining bi-directionality between Fear of Missing Out and Problematic Smartphone Use. A two-wave panel study among adolescents

1. Introduction

Smartphones have become a fundamental part of daily life and nearly everybody, across different age groups, goes online daily and engages in browsing, communicating and gaming. Although smartphones are undoubtedly helpful (e.g. allowing continuous access to information from almost everywhere), their widespread use has lead researchers to focus attention on a maladaptive use, frequently defined as Problematic Smartphone Use (PSU; Panova & Carbonell, 2018). PSU is considered an inability to regulate one's use of the mobile phone and there is evidence that it might have detrimental effects on an individual's well-being (De-Sola Gutiérrez, Rodríguez de Fonseca, & Rubio, 2016). More specifically, high rates of PSU have been reported among adolescents (Haug et al., 2015; Firat et al., 2018), as well as a number of associations with indications of poor mental health including depression and anxiety, poor sleep, low self-esteem and lower levels of physical activity (Billieux, 2012; Emirtekin et al., 2019; Elhai, Dvorak, Levine, & Hall, 2017; Kara, Baytemir, & Inceman-Kara, 2019).

Recently, experts have drawn attention to the Fear of Missing Out (FoMO) as a variable which can play a role in PSU. FoMO is a particular kind of anxiety that arises from a person's fear of missing out on rewarding social experiences that others might be having and from which one is absent (Przybylski, Murayama, DeHaan, & Gladwell, 2013). High levels of FOMO might indicate poor social relatedness, which is linked to emotional dysregulation and poor well-being (Ryan & Deci, 2000; Przyblski et al., 2013). Specifically, higher FoMO is related to lower life satisfaction (Błachnio & Przepiórka, 2018), lower self-esteem (Buglass, Binder, Betts, & Underwood, 2017), higher anxiety (Blackwell, Leaman, Tramposch, & Liss, 2017) and fear of being evaluated negatively in a context of social anxiety (Wolnievicz, Tiamiyu, Weeks, & Elhai, 2018). The FOMO construct can be especially important within the online context in which adolescents live. For

example, social media activities via smartphones are attractive for adolescents because they serve as instruments to build up their social identities and express their desired self-presentation, without the supervision of adults (Panova & Carbonell, 2018). Thus, it is likely that the adolescent's extensive social media activity via smartphone might trigger more stressful feelings of not being connected often enough, as well as the need to check up on others more frequently via social media (Buglass et al., 2017; Elhai et al., 2018). Previous research has shown that greater FoMO is related to higher engagement with social media use (Blackwell et al., 2017; Franchina, Vanden Abeele, Van Rooij, Lo Coco, & De Marez, 2018) and to PSU (Abel, Buff, & Burr, 2016; Elhai, Levine, Dvorak, & Hall, 2016; Elhai, Yang, Fang, Bai, & Hall, 2020; Kuss et al., 2018). It is also worth noting that FOMO is still being widely investigated, and there is an ongoing debate regarding its characteristics. A recent study (Casale & Fioravanti, 2020) identified two components of FoMO with adolescents and young adults: the first one (FoMO-Fear) reflects the original conceptualization of FoMO (i.e. people's fears and worries about being out of touch with experiences across their extended social environment); whereas the second (FoMO-Control) reflects a cognitive/behavioral dimension of the FoMO construct (i.e. ruminative thoughts and strategies to address the fears associated with decreasing levels of social connectedness), by suggesting that some maladaptive cognitions could sustain high levels of FoMO.

1.1 The link between FoMO and PSU

Although there have been several studies investigating the link between FoMO and PSU, the direction of this association is still unclear, because the vast majority of existing research on this topic is cross-sectional. A large body of research suggested that FoMO can result in PSU (Chotpitayasunondh & Douglas, 2016; Elhai et al., 2016, 2018), rather than the other way around. Thus, the unmet social relatedness needs that are entailed in FOMO (Przybylski et al., 2013) could drive one towards greater engagement with a PSU. For example, adolescents with high FoMO might feel compelled to check their smartphone in order to keep up to date on their friends'

activities. However, the opposite direction is also possible, with PSU resulting in an increased tendency towards FoMO. For example, there is evidence that habitual smartphone use and certain privileged applications can trigger addictive smartphone behavior (van Deursen, Bolle, Hegner, & Kommers, 2015; Giordano et al., 2019). The automatic and continuous notifications from social media delivered to the smartphone, could heighten the need to check on what friends are doing more often, as well as the FoMO. Thus, extensive social media use could exacerbate the adolescent's perception of missing out on online social relationships (Oberst, Wegmann, Stodt, Brand, & Chamarro, 2017). These two paths (FoMo vs PSU, and PSU vs FoMO) are not mutually exclusive. According to the Compensatory Internet Use Theory (Kardefelt-Winther, 2014), the problematic use of technological devices could be conceptualized as a way in which people regulate negative emotions associated with FoMO. At the same time, there is also research suggesting a path from PSU to FoMO: the use of smartphones may increase FoMO in a kind of vicious circe (Oberst et al., 2017) and some recent findings have shown that limiting the time spent on social media can decrease FoMO anxiety (Hunt, Marx, Lipson, & Young, 2018). Thus, it is possible that we may find support for both the prospective associations between FoMO and PSU.

1.2. Aims and Hypotheses of the current study

To the best of our knowledge, previous research failed to test causal links between PSU and FoMO among adolescents. The aim of the current study is to build upon prior cross-sectional findings by examining cross-lagged relationships between FoMO and PSU with a two-wave panel model. The first hypothesis purported to show that the levels of FoMO and PSU at Time 0 would be linked to the same factors at Time 1. Secondly, we hypothesized that FoMO would be positively related to PSU in both waves, in line with prior research showing moderate to great associations between FoMO and PSU (e.g., Chotpitayasunondh & Douglas, 2016; Elhai et al., 2016, 2018; Wolniewicz et al., 2018). The third research question explored the longitudinal direction of the

association between FoMO and PSU, given that both their prospective associations could be supported.

Moreover, previous studies which evaluated the relationship between FoMO and PSU conceptualized FoMO as a mono-dimensional construct. Given that no previous research had examined the relationship between PSU and both the FoMO-Fear and FoMO-Control dimensions (Casale & Fioravanti, 2020), in the present study we have explored the relationships between these variables in both waves.

Relevant covariates were also controlled. Specifically, since research suggests that age (e.g. FoMO is highest at a younger age; Elhai et al., 2018), gender (e.g. FoMO is highest among women; Elhai et al., 2018) and emotion dysregulation (i.e. individuals who exhibit higher emotion dysregulation are more likely to use smartphones in order to manage negative emotions; Elhai et al., 2016, 2018; Kim, Seo, & David, 2015) all affect associations between study variables, these were included as covariates.

2. Materials and Methods

2.1 Participants

The study included 242 participants, assessed in two waves. At Time 0 data were collected from 700 adolescents, as part of a larger study on the potentially negative consequences of PSU on Italian adolescents. From this initial sample, 263 adolescents were invited to participate in the second assessment. Thirteen adolescents declined to take part in the study, thus 250 adolescents were initially considered for this study. Eight adolescents (37% males) were subsequently excluded due to missing data. The final sample comprised 242 adolescents (45% males), ranging in age from 12 to 16 years (M = 14.16±.99). The majority of them (78.5%) had attended school for 9 years with the remaining adolescents completing eight (7.0%), eleven (12.8%), twelve (0.4%) and thirteen (1.2%) years of school.

2.2 Measures

The Fear of Missing Out scale (FoMOs; Przybylski et al., 2013) is a 10-item self-report measure of the apprehension that others might be having rewarding experiences from which one is absent. The Italian version of the FoMO (Casale & Fioravanti, 2020) covers two domains: FoMO-Fear and FoMO-Control. The FoMOs has shown good reliability in previous research (α = .79 and .70 for FoMO-Fear and FoMO-Control, respectively; Casale & Fioravanti, 2020), as well as in the current study (T0: α = .79 and .75, T1: α = .83 and .78 for FoMO-Fear and FoMO-Control, respectively).

The Smartphone Addiction Scale-short version (SAS-SV; Kwon, Kim, Cho, & Yang, 2013) is a 10-item self-report measure of PSU. The Italian version of the SAS-SV has shown good reliability in previous research (α = .79; De Pasquale, Sciacca, & Hichy, 2017), as well as in the current study (T0α = .77 and T1α = .81).

The Difficulties in Emotion Regulation Scale-Short Form (DERS-SF; Gratz & Roemer 2004; Kaufman et al., 2016; Giromini, Velotti, de Campora, Bonalume, & Zavattini, 2012) is a 18-item self-report measure of emotion dysregulation. The reliability of the DERS-SF has been well demonstrated (α = .89-.91, Kaufman et al., 2016). In the present study, the DERS-SF showed good internal consistency (α = .88).

2.3 Procedures

Two waves of data were collected from participants in five middle and high schools in Italy at two time-points (T0 and T1, one year apart). Information about the study and consent forms were sent to the parents of all adolescents. Participants received no compensation. Surveys were completed by students within their classrooms under the supervision of trained research assistants. The study was conducted in accordance with the ethical standards of the Italian Psychological Association (AIP), as well as the Declaration of Helsinki.

2.4 Plan of Data Analysis

Descriptive statistics and correlations between variables were examined. Differences in FoMO (both dimensions) and PSU levels between T0 and T1 were tested using a paired samples t-test. Cohen's d effect sizes were also reported.

A longitudinal auto-regressive, cross-lagged model was used to examine the associations between FoMO (both dimensions) and SAS over the two time points of data collection. The auto-regressive, cross-lagged model (Figure 1) was estimated with within-time relations (i.e. concurrent associations; e.g. correlation between both T0 FoMO subscales and T0 SAS), autoregressive paths (i.e. stability of the constructs across time; e.g. T1 FoMO-Fear on T0 FoMO-Fear), and cross-lagged paths (i.e. longitudinal relationships between the variables investigated; e.g., T1 SAS on T0 FoMO-Fear). The overall goodness of model-fit was assessed using the Satorra-Bentler robust χ^2 test statistics (S-Bχ^2/df ratios < 3 indicate reasonable fitting models), the robust comparative fit index (CFI; values >.95 indicate a good fit; Schermelleh-Engel, Moosbrugger, & Müller, 2003), and the root-mean-square error of approximation (RMSEA; values <.05 indicate a good fit; Hu & Bentler, 1999). The longitudinal auto-regressive, cross-lagged model was conducted using EQS 6.1 (Bentler, 2006). The model tested used robust Maximum Likelihood estimation (MLR). Multivariate non-normality was evaluated using Mardia's index (2.67) and robust statistics were used. Age, gender (0 = males, 1 = females) and emotion dysregulation were considered as control variables. Finally, the same model was tested in a subgroup of participants with high levels of PSU (i.e. adolescents with SAS-SV scores above the cut-offs for high risk of PSU - males: 22-31; females: 22-33) or PSU (males: > 31; females: > 33) (Kwon et al., 2013).

3. Results

3.1 Preliminary Analyses

At T1 adolescents reported significantly higher scores both for FoMO-Fear (t(df) = -3.788 (241), p <.001; Cohen 's d = 0.243) and FoMO-Control (t(df) = -3.672 (241), p < .001; Cohen 's d =

0.236). Moreover, there was a trend toward higher SAS at T1 (t(df) = -1.941 (241), p = .053; Cohen's d = 0.125). Descriptive analyses and correlations for DERS at T0 and for FoMO and SAS at T0 and T1 are presented in Table 1. Both at T0 and T1 SAS was positively related to both FoMO subscales. Moreover, almost all correlations between T0 and T1 variables were significant. FoMO-Fear at T0 was positively related to FoMO-Fear and SAS at T1; FoMO-Control at T0 was positively related to FoMO-Control and SAS at T1; and SAS at T0 was positively related to FoMO-Control and SAS at T1. Higher DERS scores were related to both higher SAS and FoMO subscales at T0 and to SAS and FoMO-Fear at T1.

3.2 Auto-Regressive, Cross-Lagged Model

The model provided a modest fit to the data (S-Bχ^2 = 66.6163, df = 12, S-Bχ^2/df = 5.55, Robust CFI = .851, RMSEA = .137, RMSEA 90% C.I. = .106 - .170) so the modification indices were used to improve the fit. More specifically, the model was modified by adding three covariances (i.e. DERS/FoMO-Fear, DERS/FoMO-Control and DERS/SAS at T0). These modifications improved the model fit: S-Bχ^2 = 5.9531, df = 9, χ^2/df = .66, Robust CFI = 1.000, RMSEA = .000, RMSEA 90% C.I. = .000 - .052, largest absolute standardized residuals = .109. The model accounted for 18%, 12% and 12% of the variance in SAS, FoMO-Fear and FoMO-Control at T1, respectively. See Figure 1 and Table 2 for full model results.

As hypothesized, there were statistically significant concurrent positive associations between FoMO (both dimensions) and SAS at both time points (T0: FoMO-Fear/SAS, β = .383, p < .001, FoMO-Control/SAS, β = .435, p < .001; T1: FoMO-Fear/SAS, β = .414, p <.001, FoMO-Control/SAS, β = .381, p < .001).

Across time, both for FoMO and SAS the stability paths at T0 to T1 were confirmed: T1 FoMO-Fear was positively related to T0 FoMO-Fear, T1 FoMO-Control was positively related to T0 FoMO-Control, T1 SAS was positively related to T0 SAS. However, contrary to hypotheses, no significant longitudinal cross-lagged associations were found between FoMO and SAS over time.

Regarding control variables, girls and older adolescents show higher FoMO-Fear scores at T1. Finally, to further test the specificity of this cross-lagged panel, in the sample with problematic users who scored above the SAS cut-off, the same model was run in a subgroup of 108 participants (44.6% of the total sample; 40% males; mean age = 24.23±1.02). The model provided a good fit to the data (by adding also an additional covariance between age and T0 FoMO-Control; S-Bχ^2 = 9.1914, df = 8, S-Bχ^2/df = 1.15, Robust CFI = .988, RMSEA = .037, RMSEA 90% C.I. = .000 - .123). No significant longitudinal cross-lagged associations were found between FoMO (both dimensions) and SAS over time (T0 FoMO-Fear →T1 SAS: β = -.064, p = .522; T0 FoMO-Control → T1 SAS: β = -.041, p = .653; T0 SAS → T1 FoMO-Fear: β = -.119, p = .246; T0 SAS → T1 FoMO-Control: β = .108, p = .298).

4. Discussion

The current study examined longitudinal, bi-directional relationships between FoMO and PSU among adolescents. The first hypothesis of the study was supported by the significant autoregressive paths for FoMO and PSU. Thus, results suggested that adolescents who report higher FoMO and/or PSU at a given time point are more likely to report higher levels of FoMO and/or PSU from one year to the next, consistently with studies supporting a stability of PSU through developmental stages (Coyne, Stockdale, & Summers, 2019). Moreover, consistent with previous cross-sectional research focusing on the link between FoMO and PSU (Chotpitayasunondh & Douglas, 2016; Elhai et al., 2018; Wolniewicz et al., 2018), our findings suggest the interplay between higher FoMO (both FoMO-Fear and FoMO-Control) and PSU at both time points. The current study adds that both dimensions of FoMO are linked to PSU, consistently with the study by Casale and Fioravanti (2020), which reported positive associations between FoMO subscales and social media addiction. Further research is necessary to examine the role that the FoMO-Control dimension, involving ruminative thoughts and the need for control, may play in predicting adolescents' PSU.

Contrary to our hypotheses, results indicated no longitudinal cross-lagged relationships between FoMO and PSU, impairing the likelihood that there is a causal link between FoMO and subsequent PSU, or vice versa. This pattern of results was also confirmed in the sub-analysis with adolescents who scored above the SAS cut-off. Overall, these cross-lagged findings are in contrast with most prior cross-sectional research (Blackwell et al., 2017; Elhai et al., 2018) and may paint a different picture about the relationship between these two constructs. However, these findings are in line with those from recent studies, which found weak longitudinal associations between constructs that are generally related at a cross-sectional level. For example, an extensive study with 10- to 15-year old participants showed that the longitudinal relationship between social media use and life satisfaction is nuanced and varied, depending on how the data are analyzed (Orben, Dienlin, & Przybylsky, 2019). Moreover, when adolescents' data were analyzed with an autoregressive and cross-lagged panel at a within-person level (Coyne, Rogers, Zurcher, Stockdale, & Booth, 2020), results showed that the cross-sectional associations between time spent using social media and mental health problems did not hold when examining the longitudinal paths among variables.

Our findings suggest that the association between FoMO and PSU might not be due to the causal effects of either, but due to the effects of different variables. Previous research suggested the role of anxiety as a predisposing factor of FoMO (Elhai et al., 2017), consistent with the I-PACE model (Brand, Young, Laier, Wölfling and Potenza, 2016) which examined FoMO as a mediator between psychological symptoms and negative consequences of PSU (Elhai et al., 2020; Oberst et al., 2017; Przybylsky et al., 2013). Furthermore, negative affectivity (i.e. rumination, boredom proneness) can mediate the relationship between FoMO and PSU (Elhai et al., 2018). However, on the contrary, depression, anxiety and self-regulation did not predict PSU during the transition from adolescence to emerging adulthood (Coyne et al., 2019). Overall, these mixed findings suggest that future research should examine the longitudinal link between FoMO, negative affectivity and PSU through different stages of development.

Of note, in this study the effect of smartphone use frequency on features such as social networking or instant messaging was not controlled, and prior research suggested that higher smartphone frequency of use might mediate the relationship between FoMO and PSU among students (Elhai et al., 2020). The experience of social media use via smartphones may be particularly relevant, given that it seems embedded into FoMO in a kind of vicious circle (Casale, Rugai, & Fioravanti, 2018), because the more often adolescents check their social media, the more often they find events on which they are missing out (Franchina et al., 2018; Oberst et al., 2017).

Building on these prior findings, future research could also take into account the distinction between a process smartphone use (i.e. which involves primarily non-social purposes) and social one (i.e. which involves social purposes such as social networking and communication) (van Deursen et al., 2015), in order to examine whether adolescents with high FoMO might perceive new notifications from social media as a rewarding experience, which increases addictive behavior with their smartphones.

Regarding the longitudinal design, future studies with data from a short-term framework could examine whether FoMO may cause short-term changes in PSU or vice versa. For example, recent evidence suggests that higher FOMO levels are related to increasingly negative effects over the week (Elhai, Rozgonjuk, Liu, & Yang, 2020) and that FoMO predicted negative outcomes (i.e. physical symptoms, stress, fatigue) on a daily basis (Milyavskaya, Saffran, Hope, & Koestner, 2018). However, these studies focused on college students and more research is needed on this topic among adolescents. Results from the present study suggest that FoMO may not act as a risk factor for long-term increases in PSU among adolescents, but FoMO is associated with the increased likelihood of this behavior one year later. The high cross-sectional correlations between FoMO and PSU suggest an interplay between them, and their reciprocal influences by repeated assessments over a short time-lag need to be examined. The cross-lagged model also included relevant covariates. Emotion regulation is worth noting and despite being cross-sectionally associated with both PSU and FoMO, in line with existing literature (Casale, Caplan, & Fioravanti, 2016; Van

Deursen et al., 2015), its role in predicting these variables over time was not significant. Attempts to further examine the role of emotion regulation on FoMO and PSU should take into account different time lags.

Finally, in this study both females and older adolescents reported higher levels of FoMO-Fear at T1, contrary to the previous study, which found no significant gender and age differences in FoMO-Fear (Casale & Fioravanti, 2020). This latter result has to be taken with caution, due to the limited age variance in our homogeneous sample. On the other hand, prior research on the association between gender and FoMO resulted in mixed findings (Elhai et al., 2018; Stead & Bibby, 2017). It could be speculated that a stronger female engagement on social media use during adolescence (Oberst et al., 2017) may negatively reinforce their FoMO, but further prospective research is needed on this topic.

4.1 Strengths and limitations of the study

While our study has a number of strengths, including the investigation of longitudinal directionality between FoMO and PSU, as opposed to mere cross-sectional assessment among a sample of adolescents, several limitations should also be noted. Firstly, in this study, only two time-points of data collection were considered. Future studies should include large-scale panel datasets in order to separate the proportional change (changes that are dependent on immediately preceding levels of each variable) from the continuous developmental processes (mean-level changes) in each variable over the entire available time period (Hounkpatin, Boyce, Dunn, & Wood, 2018). Also, more assessment time is needed to disentangle the between-person from the within-person effects (Berry & Willoughby, 2017). Moreover, given the low power of the cross-lagged panel, further research should be repeated across different time lags and with different groups of subjects. Finally, recruitment occurred within a community context using a convenience sample. Although this provides important information regarding the reciprocal influence between FoMO and PSU, it would be important to repeat this study with larger and more representative samples.

4.2 Conclusion

Smartphones with permanent internet access may represent catalysts of FoMO. However, the nature of the link between PSU and FoMO is still unclear because research on bidirectional relationships among these constructs has so far received limited attention. The current study provides initial evidence on the lack of cross-lagged effects for FoMO and PSU over time. Based upon these results, future research needs to focus on the understanding of variables that may better account for the relationship between FoMO and PSU.

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Table 1 – Descriptive analyses and correlations for DERS at T0 and for FoMO (both subscales) and SAS at T0 and T1.

	M	DS	1	2	3	4	5	6
Time 0								
1. SAS	20.78	6.86	-					
2. FoMO-Fear	1.76	.81	.383**	-				
3. FoMO-Control	2.72	.79	.435**	.472**	-			
4. DERS	37.44	11.81	.392**	.383**	.346**	-		
Time 1								
5. SAS	21.77	7.69	.408**	.138*	.212**	.236**	-	
6. FoMO-Fear	2.02	.93	.058	.219**	.106	.171**	.389**	-
7. FoMO-Control	2.95	.84	.166*	.071	.320**	.096	.409**	.433**

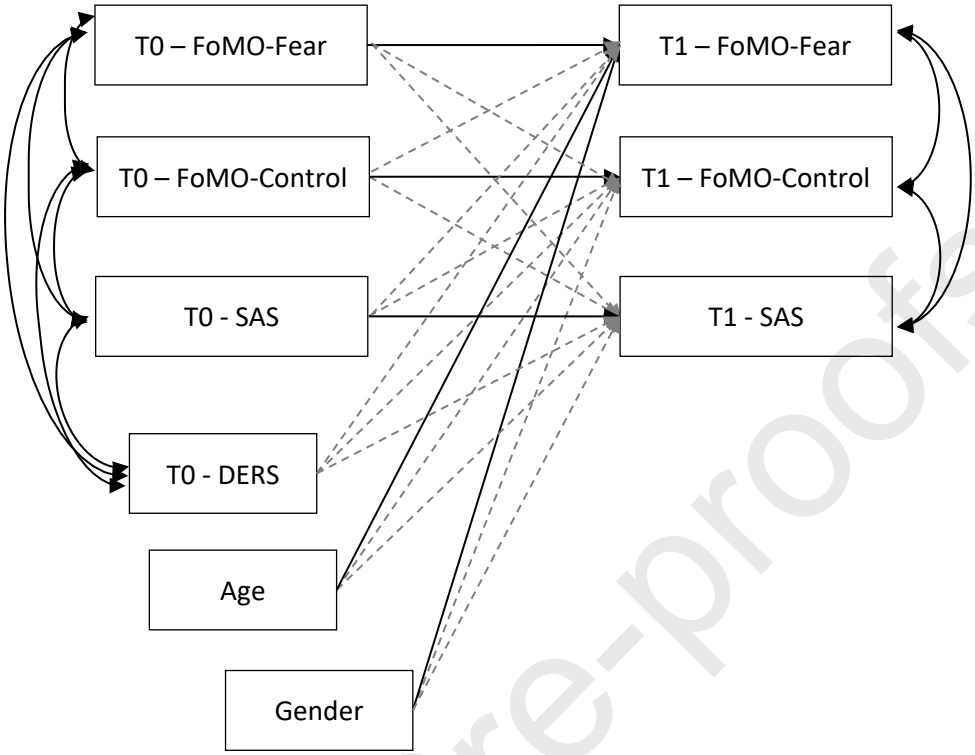
*Note: SAS = Smartphone Addiction Scale; FoMO = Fear of Missing Out scale; DERS = Difficulties in Emotion Regulation Scale; * $p < .05$, ** $p < .01$.*

Table 2 – Auto-Regressive, Cross-Lagged Model Results (n = 242)

	DV: T1 FOMO-Fear				DV: T1 FOMO-Control				DV: T1 SAS			
	B	β	p	R^2	B	β	p	R^2	B	β	p	R^2
				.115				.116				.176
T0 – FoMO-Fear	.221	.193	<.05		-.124	-.120	.080		-.653	-.069	.327	
T0 – FoMO-Control	-.009	-.007	.920		.368	.349	<.001		.427	.044	.503	
T0 – SAS	-.011	-.085	.246		.007	.057	.435		.416	.372	<.001	
Gender	.312	.168	<.01		.114	.068	.258		.872	.057	.337	
Age	.178	.191	<.01		-.019	-.023	.704		.015	.002	.976	
DERS	.008	.107	.131		-.000	-.005	.936		.063	.098	.211	

Note: Gender is coded 0 for males and 1 for females; FoMO = Fear of Missing Out; SAS = Smartphone Addiction Scale; DERS = Difficulties in Emotion Regulation Scale.

Figure 1 - Auto-Regressive, Cross-Lagged Model



Note: Slid black lines represent significant paths. Dotted grey lines represent non-significant paths. Gender is coded 0 for males and 1 for females; FoMO = Fear of Missing Out; SAS = Smartphone Addiction Scale; DERS = Difficulties in Emotion Regulation Scale.

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Contributors

G.L.C, C.G. and M.D.B. designed the study and wrote the protocol. M.D.B. conducted literature searches and provided summaries of previous research studies. A.L.T. and V.F. collected the data.

L.S. conducted the statistical analysis. L.S. and G.L.C. wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest with this study.

Highlights

- A two-wave cross-lagged panel design was tested with 242 adolescents
- FoMO and problematic smartphone use (PSU) were related at cross-sectional level
- No cross-lagged associations between FoMO and PSU were longitudinally supported
- Causal links between FoMO and PSU need to be examined across different time lags