

# Mobile internet technologies, ecological momentary assessment, and intervention—p...

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## Introduction

Technological advancements often present new challenges to mental health and well-being while, at the same time, creating the possibility for new, effective interventions for its preservation, improvement, and recovery ( [1](#) ). In the current commentary, on one hand, we discuss the category of problematic behaviors for which mobile internet technologies have created an outlet. We also consider research challenges related to the conceptualization of these problems, as proposed by the World Health Organization (WHO) for the upcoming 11<sup>th</sup> revision of International Classification of Disorders ( [2](#) ). On the other hand, we discuss what the development of mobile and online technologies offers for solving or mitigating these problems. Specifically, we focus on ecological momentary assessment (EMA) and intervention (EMI) methodologies ( [3](#), [4](#) ) and how they can help in overcoming difficulties currently faced in problematic online behavior research, diagnosis, and therapy.

## New Arenas for Problematic and Addictive Behavior

High-speed internet that can be accessed cheaply, at whim, using convenient pocket-sized portable devices and through a multitude of entertaining applications have created a new environment in which gratifying behavior can be easily engaged in and repeated, leading in some cases to the development of detrimental habits. In this way, some online-mediated activities, like cybersex and pornography use, gambling, gaming, buying, social networking, video streaming, or general internet use, can become problematic and—for a subset of users—constitute a mental health

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problem ( [5](#) - [7](#) ). Although some of these behaviors were potentially problematic before the Internet era, the advent of high-speed Internet and widespread use of mobile technology has dramatically increased their addictive potential, making them more significant mental-health threats both on a personal and societal level ( [8](#) , [9](#) ).

## **ICD-11 and Problematic Online Behaviors**

To address clinical concerns on growing societal significance of new behavioral problems related to the development of technology, WHO recently classified some of them as new diagnostic entities in the ICD-11 ( [2](#) ). Pathological gambling, as well as pathological gaming were described in the “ Disorders due to substance use and addictive behaviors” category, while Compulsive Sexual Behavior Disorder (CSBD) was deemed a member of “ Impulse Control Disorders” ( [2](#) , [10](#) ), although the discussion on the addictive, compulsive, and/or impulsive roots of the disorder is still ongoing ( [11](#) - [13](#) ). An alike debate for some of the other problematic behavior types, e. g., gambling ( [14](#) , [15](#) ), gaming ( [16](#) ) or buying ( [17](#) , [18](#) ) is still in progress.

In our opinion, this discussion raises important questions on determinants for the classification of problematic behavior. Why are some of them classified as addiction-type disorders while others as impulse control disorders? It is worth mentioning that in the Diagnostic and Statistical Manual IV-TR ( [19](#) ) gambling disorder was classified as an impulse control disorder and in the 5<sup>th</sup> edition ( [20](#) ) as an addiction. A similar change occurred between ICD-10 ( [21](#) ) and ICD-11 ( [3](#) ) for pathological gambling. It raises further important

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questions: what are the main mechanisms underlying problematic gaming, gambling, or CSBD, and are they homogeneous within each unit?

Recognizing these pathological behaviors as psychiatric conditions naturally require further research on their accurate conceptualization and development of effective treatments. Here, another significant question emerges: how do we examine the effectiveness of the treatment? In the case of substance use disorders, there is plenty of objective measures of abstinence such as urinal, saliva, or blood tests ( [22](#), [23](#) ). In contrast, there is no such objective and retrospective method of assessment for problematic behaviors. However, if the behavior is engaged in online, reliable tracking of activity can be made possible by using EMA.

## **Ecological Momentary Assessment: A Way to Better Understand New Problematic Behaviors**

EMA is a method delivered through mobile devices aimed to collect and record a person's activities and inner states in real time as they occur, by periodically prompting the user to fill-out short assessment questionnaires ( [3](#), [24](#), [25](#) ). Among the most appreciated benefits of EMA are: (a) minimization of recall bias by assessing the current, instead of retrospective data; (b) maximization of ecological validity through data collection in a real-world setting, as opposed to data collection in controlled laboratory environments; (c) enabling to gather a large amount of quantitative data from individuals across time and different contexts ( [3](#) ); as well as (d) to identify the dynamic interplay between the variables, thereby helping (e) to infer causal relationships between them ( [26](#) ). Most recent versions of EMA running on new mobile devices equipped with sophisticated sensors and

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features allow for real-time geolocation, active tracking, objective inferring on stress or arousal level based on biosensors (e. g., heart rate and temperature measurements with smartwatches) and tracking of actual online behavior (e. g., on smartphone or tablet) ( [3](#), [24](#), [25](#) ). Recent advances in the research have transformed EMA from an initially a valuable data collection method into real-time intervention tool - EMI ( [5](#) ), providing not only the assessment but also the management of momentary variables ( [22](#), [27](#), [28](#) ). In our opinion research involving EMA may help (a) to solve the etiological debate on the correct conceptualization and behavioral phenotyping of gambling, gaming, CSBD, and not-yet classified behaviors such as problematic social media use of video bingeing. (b) It provides a more reliable and objective measure of frequency and severity, progression, or improvement of actual behaviors; and in combination with EMI (c) can offer new scientifically verified treatments.

## **Addictive, Impulsive, and Compulsive Models: Solving the Puzzle**

To illustrate the benefits of using EMA in advancing the debate between addictive, impulsive, and compulsive models of online problematic behaviour, we will use the example of CSBD, for which the discussion is especially lively ( [11](#) ). The validity of each model is based on the presence and relative importance of symptoms predicted by each of the three models ( [29](#) ). The presence of obsessions driving sexual behavior, as well as its relative rigidity and ritualism, can indicate its kinship to obsessive-compulsive disorders and support the validity of the compulsive model. The presence of withdrawal symptoms and tolerance lends support to the

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addictive model, while impulsive sexual behavior-driven mainly by pleasure-seeking with associated general impulse control deficits indicates the validity of the impulsive model ( [12](#), [13](#), [29](#), [30](#) ). Compared to a standard self-report method, EMA can be better suited to investigate these predictions and the concurrent validity of these models because: (a) it enables ecologically valid measurements of symptom feature predicted by the three models, which is especially important as addictive behavior have a highly contextual character; (b) phenomena-like obsessions, withdrawal symptoms and cravings are transient states and the adopted method of measurement should be able to reflect their fluctuation (which is hard to achieve with retrospective, aggregate measurements); (c) frequency of a targeted problematic behavior can be assessed with higher accuracy, using ecological declarative measurements or objective indicators (see the section below); (d) multiple points of measurement over time allow for directional relationships between variables to be investigated; (e) Lastly, the most valid solution to the debate on etiology may not rely on singling out the model that is the best universal descriptor of symptoms for all subjects, but on investigating possible subtypes or profiles of the disorder that pertain to the three described models and the prevalence of these subtypes (allowed due to the possibility for gathering large amounts of data with EMA) ( [31](#) ). In this way, EMA can provide unique contributions to an accurate classification of gambling, gaming, CSBD, as well as problematic behavior not yet classified (e. g., problematic buying, social networking), which are harder to obtain using more traditional approaches.

## **For Online Problematic Behavior, Accurate Behavior Tracking Is Crucial**

Self-reports are associated with numerous errors, related to faulty memory, memory bias, or social desirability bias ( [32](#) ). We have evidence of inaccuracies of self-reports regarding problematic behaviors like gambling ( [33](#) ) or gaming ( [34](#) ). Moreover, these biases can be the strongest for the most active/problematic users ( [33](#) ). This is especially important, as for online problematic behavior the frequency of the behavior is one of the main factors contributing to the severity of experienced negative symptoms ( [35](#) ). With respect to this, EMA delivered on smartphones offers unique advantages, as the methodology allows for more accurate tracking of frequencies of a target behavior, thoughts or moods, with higher compliance and lower data loss compared to standard paper-pencil or computer-based questionnaires or diaries ( [36](#) ). Additionally, in conjunction with biosensors and specific software solutions, it enables objective data collection continuously and passively, with little or no burden to participants (heart rate, temperature, location, smartphone use, or social media and online engagement gathered through data mining), which provide reliable diagnostic and predictive biomarkers of examined constructs ( [25](#) , [28](#) , [37](#) ). Future studies in online problematic behaviors may combine both subjective and objective measurements that help to accurately assess behavioral and psychological changes over time and between contexts as well as to better monitor progression, recovery, and possible relapses in problematic behavior treatment ( [28](#) , [37](#) , [38](#) ). Although objective tracking of problematic behavior in its offline form is harder, EMA can still provide more accurate

assessments based on subjective indicators ( [36](#) ). Additionally, as (a) offline vs online forms of problematic activities can have differing features, patterns of use, as well as risk and protective factors; (b) subjects engaging in online vs offline problematic behaviors can have different characteristics; (c) similar differences can potentially appear depending on the used device [e. g., computer vs mobile mediated form of problematic behavior, see examples for problematic gambling ( [39](#) - [42](#) )], EMA/EMI can be employed as a useful tool for investigating these differences.

## **EMI as a Promising Method for Addictive Behavior Intervention**

A significant gap between the number of people that need or could benefit from treatment and the number of people actually receiving it is one of the most urgent problems in therapy ( [43](#) ). Due to its high cost-effectiveness, EMI offers the possibility to improve access to evidence-based treatment for various populations, democratizing it ( [1](#), [5](#) ). EMI seems to be promising owing the possibility of identifying contextual (social interaction, location) and intra-individual (craving, mood, physiological responses) precipitating factors of lapses through the employment of machine learning algorithms and data mining ( [44](#), [45](#) ). EMI has the potential to tailor the intervention to the demographic, psychological, and behavioral characteristics of a person and specific symptoms experienced ( [46](#) ), meta-analytic evidence shows that such adaptive features increase the effectiveness of the interventions ( [47](#) ). As online problematic behavior can be induced by external cues, delivering just-in-time adaptive interventions ( [46](#) ) can contribute to

successful behavioral management in many cases. Recent research has  
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shown that physiological information gathered with EMA can be positively used for EMI (e. g., when the stress indicators exceed a threshold value, relaxation exercises can be prompted) ( [48](#) ). Moreover, EMI allows for the preservation of anonymity, therefore helping to overcome the fear of social-stigmatization ( [49](#) ). Lastly, EMI is well suited for the group of people manifesting online problematic behavior as a barrier to entry does not exist: members of this group are used to smartphones and mobile applications.

Additionally, it is worth underlying that the discussed methodology has already proven to be useful in assessment and therapy of substance addictions and related behavior: aiding recovery from alcoholism by reducing risky drinking episodes ( [50](#) ), helping to limit binge drinking among young people ( [51](#) ), supporting smoking cessation ( [52](#) ), reducing marijuana cravings ( [53](#) ), and significantly predicting substance use relapse after treatment ( [54](#) ).

Despite these factors, to the best of our knowledge, and recent-meta-analytic work ( [55](#) ), no randomized controlled trials for interventions delivered *via* smartphones are available for online problematic behavior. Supplementing this lack in the near future is key for further advancements.

## **New Ethical Issues**

Although tracking objective indicators of online behavior and offering tailored interventions are possible with mobile devices, it raises ethical issues connected to gathering, managing, and storing sensitive, personal data ( [56](#) ). Also, using mobile applications as the method of delivery of interventions

can potentially result in increasing, not decreasing, the reliance of a person on technology ( [2](#) ). Researchers and commentators now point to the fact that in order to attract users and extend time online, application creators often make them, in fact, more addictive ( [57](#) ), which results in a dangerous possibility of exchanging one addiction to another in the process of treatment ( [3](#) ). Repetitive assessment of problematic behavior and associated variables can make the behavior itself more salient and increase the risk of relapse or increase craving, which has to be monitored and taken into account by researchers and developers ( [58](#) ). Overall, there is an existing need to improve the evidence base behind mobile app products through careful evaluation of their safety and effectiveness before the public distribution or clinical use ( [59](#) ).

## **Conclusion**

The development of mobile and online technologies has allowed for the proliferation of online problematic behavior, but can also be harnessed for more effective intervention and therapy, as well as effective tackling of remaining theoretical questions. Although challenges exist (e. g., ethical issues), EMA and EMI methodologies seem to have huge potential for online problematic behavior research and therapy, which is—as yet—untapped.

## **Author Contributions**

Review of the literature was conducted by KL and MG. The manuscript draft was developed by KL, MG, and MKG. All authors contributed to the article and approved the submitted version.

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## Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## References

1. Aboujaoude E, Gega L. From Digital Mental Health Interventions to Digital “Addiction”: Where the Two Fields Converge. *Front Psychiatry* (2019) 10: 2019. 01017. doi: 10. 3389/fpsy. 2019. 01017
2. *World Health Organization. International Classification of Diseases 11th Revision* (2020). Available at: <https://icd.who.int/dev11/l-m/en> (Accessed Access: June 2020).
3. Shiffman S, Stone AA, Hufford MR. Ecological momentary assessment. *Annu Rev Clin Psychol* (2008) 4: 1–32. doi: 10. 1146/annurev. clinpsy. 3. 022806. 091415

4. McDevitt-Murphy ME, Luciano MT, Zakarian RJ. Use of Ecological Momentary Assessment and Intervention in Treatment With Adults. *Focus Am Psychiatr Publ* (2018) 16(4): 370–5. doi: 10. 1176/appi. focus. 20180017
5. Fineberg NA, Demetrovics Z, Stein DJ, Ioannidis K, Potenza MN, Grunblatt E, et al. Manifesto for a European research network into Problematic Usage of the Internet. *Eur Neuropsychopharm* (2018) 28(11): 1232–46. doi: 10. 1016/j. euroneuro. 2018. 08. 004
6. Holden C. “ Behavioral” addictions: Do they exists? *Science* (2001) 294(5544): 980–2. doi: 10. 1126/science. 294. 5544. 980
7. Kuss DJ, Griffiths MD. Internet gaming addiction: A systematic review of empirical research. *Int J Ment Health Ad* (2012) 10(2): 278–96. doi: 10. 3390/brainsci2030347
8. Cooper A. Sexuality and the Internet: Surfing into the new millennium. *Cyberpsychol Behav* (1998) 1(2): 187–93. doi: 10. 1089/cpb. 1998. 1. 187
9. Young KS. What makes the Internet addictive: Potential explanations for pathological Internet use. In: *105th annual conference of the American Psychological Association Annual convention* . Chicago, IL, USA. (1997). vol. 15. p. 12–30.
10. Kraus SW, Krueger RB, Briken P, First MB, Stein DJ, Kaplan MS, et al. Compulsive sexual behaviour disorder in the ICD-11. *World Psychiatry* (2019) 17(1): 109–10. doi: 10. 1002/wps. 20635

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11. Fuss J, Lemay K, Steinet DJ, Briken P, Jakob R, Reed GM, et al. Public stakeholders' comments on ICD-11 chapters related to mental and sexual health. *World Psychiatry* (2019) 18(2): 233–5. doi: 10. 1002/wps. 20635
12. Bancroft J, Vukadinovic Z. Sexual addiction, sexual compulsivity, sexual impulsivity, or what? *Toward Theor Model J Sex Res* (2004) 41(3): 225–34. doi: 10. 1080/00224490409552230
13. Stein DJ. Classifying hypersexual disorders: compulsive, impulsive, and addictive models. *Psychiatr Clin* (2008) 31(4): 587–91. doi: 10. 1016/j. psc. 2008. 06. 007
14. Blanco C, Moreyra P, Nunes EV, Saiz-Ruiz J, Ibanez A. Pathological gambling: addiction or compulsion? *Semin Clin Neuropsychiatry* (2001) 6(3): 167–76. doi: 10. 1053/scnp. 2001. 22921
15. Fauth-Bühler M, Mann K, Potenza MN. Pathological gambling: a review of the neurobiological evidence relevant for its classification as an addictive disorder. *Addict Biol* (2017) 22(4): 885–97. doi: 10. 1111/adb. 12378
16. Aarseth E, Bean AM, Boonen H, Coulson C M, Coulson M, Das D, et al. Scholars' open debate paper on the World Health Organization ICD-11 Gaming Disorder proposal. *J Behav Addict* (2006) 6(3): 267–70. doi: 10. 1556/2006. 5. 2016. 088
17. Hartston H. The case for compulsive shopping as an addiction. *J Psychoact Drugs* (2012) 44(1): 64–7. doi: 10. 1080/02791072. 2012. 660110

18. Müller A, Brand M, Claes L, Demetrovics Z. Buying-shopping disorder—Is there enough evidence to support its inclusion in ICD-11. *CNS Spectr* (2019) 24(4): 374–9. doi: 10.1017/S1092852918001323

19. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders 4th Edition Text Revision*. Washington, DC: Author (2000). doi: 10.1176/appi.books.9780890423349

20. American Psychiatric Association. Anxiety Disorders. In: *Diagnostic and statistical manual of mental disorders*, 5th Edition. Washington, DC: Author (2013). doi: 10.1176/appi.books.9780890425596.dsm05

21. World Health Organization. *The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines*. Geneva: Author (1992). Available at: <https://www.who.int/classifications/icd/en/bluebook.pdf>

22. Cone EJ. Testing human hair for drugs of abuse. i. individual dose and time profiles of morphine and codeine in plasma, saliva, urine, and beard compared to drug-induced effects on pupils and behavior. *J Anal Toxicol* (1990) 14(1): 1–7. doi: 10.1093/jat/14.1.1

23. Schramm W, Smith RH, Craig PA, Kidwell DA. Drugs of abuse in saliva: a review. *J Anal Toxicol* (1992) 16(1): 1–9. doi: 10.1093/jat/16.1.1

24. Shiffman S. Ecological momentary assessment (EMA) in studies of substance use. *Psychol Assess* (2009) 21(4): 486–97. doi: 10.1037/a0017074

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25. Serre F, Fatseas M, Swendsen J, Auriacombe M. Ecological momentary assessment in the investigation of craving and substance use in daily life: A systematic review. *Drug Alcohol Depend* (2015) 148: 1–20. doi: 10.1016/j.drugalcdep.2014.12.024
  26. Borsboom D. A network theory of mental disorders. *World Psychiatry* (2017) 16(1): 5–13. doi: 10.1002/wps.20375
  27. Witkiewitz K, Desai SA, Bowen S, Leigh BC, Kirouac M, Larimer ME. Development and evaluation of a mobile intervention for heavy drinking and smoking among college students. *Psychol Addict Behav* (2014) 28(3): 639–50. doi: 10.1037/a0034747
  28. Ruwaard J, Kooistra L, Thong M. *Ecological Momentary Assessment in Mental Health Research: A Practical Introduction, with Examples in R (1st edition - build 2018-11-26)*. Amsterdam: APH Ment Health (2018).
  29. Walton MT, Cantor JM, Bhullar N, Lykins AD. Hypersexuality: A critical review and introduction to the “sexbehavior cycle”. *Arch Sex Behav* (2017) 46(8): 2231–51. doi: 10.1007/s10508-017-0991-8
  30. Kraus SW, Voon V, Potenza MN. Should compulsive sexual behavior be considered an addiction? *Addiction* (2016) 111(12): 2097–106. doi: 10.1111/add.13297
  31. Knight RA, Graham FJ. Hypersexuality: Equifinal, cohesive, clinical presentation or symptom cluster with multiple underlying mechanisms? *Arch Sex Behav* (2017) 46(8): 2261–4. doi: 10.1007/s10508-017-1089-z
- <https://assignbuster.com/mobile-internet-technologies-ecological-momentary-assessment-and-interventionpoison-and-remedy-for-new-online-problematic-behaviors-in-icd-11/>

32. Fisher RJ. Social desirability bias and the validity of indirect questioning. *J Consum Res* (1993) 20(2): 303–15. doi: 10. 1086/209351
33. Auer M, Griffiths MD. Self-reported losses versus actual losses in online gambling: An empirical study. *J Gambli Stud* (2017) 33(3): 795–806. doi: 10. 1007/s10899-016-9648-0
34. Kahn AS, Ratan R, Williams D. Why we distort in self-report: Predictors of self-report errors in video game play. *JCMC* (2014) 19(4): 1010–23. doi: 10. 1111/jcc4. 12056
35. Lewczuk K, et al. Moral incongruence and religiosity as predictors of self-perceived behavioral addictions (pornography, internet, social media and gaming addiction). Preregistered study based on a nationally representative sample. Under review.
36. Faurholt-Jepsen M, Frost M, Vinberg M, Christensen EM, Bardram JE, Kessing LV. Smartphone data as objective measures of bipolar disorder symptoms. *Psychiatry Res* (2014) 217(1-2): 124–7. doi: 10. 1016/j. psychres. 2014. 03. 009
37. Dogan E, Sander C, Wagner X, Hegerl U, Kohls E. Smartphone-based monitoring of objective and subjective data in affective disorders: Where are we and where are we going? Systematic Review. *J Med Internet Res* (2017) 19(7): e262. doi: 10. 2196/jmir. 7006
38. Young JJ, Silber T, Bruno D, Galatzer-Levy IR, Pomara N, Marmar CR. Is there progress? An overview of selecting biomarker candidates for major  
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depressive disorder. *Front Psychiatry* (2016) 7: 72. doi: 10. 3389/fpsy. 2016. 00072

39. Hubert P, Griffiths MD. A comparison of online versus offline gambling harm in Portuguese pathological gamblers: An empirical study. *Int J Ment Health AD* (2018) 16(5): 1219–37. doi: 10. 1007/s11469-017-9846-8

40. Montes KS, Weatherly JN. Differences in the gambling behavior of online and non-online student gamblers in a controlled laboratory environment. *J Gamb Stud* (2017) 33(1): 85–97. doi: 10. 1007/s10899-016-9613-y

41. Estévez A, Rodríguez R, Díaz N, Granero R, Mestre-Bach G, Steward T, et al. How do online sports gambling disorder patients compare with land-based patients? *J Behav Addict* (2017) 6(4): 639–47. doi: 10. 1556/2006. 6. 2017. 067

42. Gainsbury SM, Liu Y, Russell AM, Teichert T. Is all Internet gambling equally problematic? Considering the relationship between mode of access and gambling problems. *Comput Hum Behav* (2016) 55: 717–28. doi: 10. 1016/j. chb. 2015. 10. 006

43. World Health Organization. *Fact Sheet on Mental disorders* . Geneva: Author (2017). Available at: <https://www.who.int/campaigns/world-health-day/2017/fact-sheets/en>

44. Bolman C, Verboon P, Thewissen V, Boonen V, Soons K, Jacobs N. Predicting smoking lapses in the first week of quitting: An ecological

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momentary assessment study. *J Addict Med* (2018) 12(1): 65–71. doi: 10.1097/ADM.0000000000000365

45. Kim H, Lee S, Lee S, Hong S, Kang H, Kim N. Depression Prediction by Using Ecological Momentary Assessment, Actiwatch Data, and Machine Learning: Observational Study on Older Adults Living Alone. *JMIR Mhealth Uhealth* (2019) 7(10): e14149. doi: 10.2196/14149

46. Nahum-Shani I, Smith SN, Spring BJ, Collins LM, Witkiewitz K, Tewari A, et al. Just-in-Time Adaptive Interventions (JITAs) in Mobile Health: Key Components and Design Principles for Ongoing Health Behavior Support. *Ann Behav Med* (2018) 52(6): 446–62. doi: 10.1007/s12160-016-9830-8

47. Head KJ, Noar SM, Iannarino NT, Harrington NG. Efficacy of text messaging-based interventions for health promotion: a meta-analysis. *Soc Sci Med* (2013) 97: 41–8. doi: 10.1016/j.socscimed.2013.08.003

48. Raugh IM, Chapman HC, Bartolomeo LA, Gonzalez C, Strauss GP. A comprehensive review of psychophysiological applications for ecological momentary assessment in psychiatric populations. *Psychol Assess* (2019) 31(3): 304–17. doi: 10.1037/pas0000651

49. Heron KE, Smyth JM. Ecological momentary interventions: incorporating mobile technology into psychosocial and health behaviour treatments. *Br J Health Psychol* (2010) 15(Pt 1): 1–39. doi: 10.1348/135910709X466063

50. Gustafson DH, McTavish FM, Chih MY, Atwood AK, Johnson RA, Boyle MG, et al. A smartphone application to support recovery from alcoholism: a <https://assignbuster.com/mobile-internet-technologies-ecological-momentary-assessment-and-interventionpoison-and-remedy-for-new-online-problematic-behaviors-in-icd-11/>

randomized clinical trial. *JAMA Psychiatry* (2014) 71(5): 566–72. doi: 10.1001/jamapsychiatry. 2013. 4642

51. Carrà G, Crocamo C, Bartoli F, Carretta D, Schivalocchi A, Bebbington PE, et al. Impact of a mobile E-Health intervention on binge drinking in young people: The digital-alcohol risk alertness notifying network for adolescents and young adults project. *J Adolesc Health* (2016) 58(5): 520–6. doi: 10.1016/j.jadohealth. 2016. 01. 008

52. Businelle MS, Ma P, Kendzor DE, Frank SG, Vidrine DJ, Wetter DW. An ecological momentary intervention for smoking cessation: evaluation of feasibility and effectiveness. *J Med Internet Res* (2016) 18(12): e321. doi: 10.2196/jmir. 6058

53. Shrier LA, Burke PJ, Kells M, Scherer EA, Sarda V, Jonestrask C, et al. Pilot randomized trial of MOMENT, a motivational counseling-plus-ecological momentary intervention to reduce marijuana use in youth. *Mhealth* (2018) 4: 29. doi: 10.21037/mhealth. 2018. 07. 04

54. Scott CK, Dennis ML, Gustafson DH. Reprint of Using ecological momentary assessments to predict relapse after adult substance use treatment. *Addict Behav* (2018) 82: 72–8. doi: 10.1016/j.addbeh. 2018. 02. 025

55. Tønning ML, Kessing LV, Bardram JE, Faurholt-Jepsen M. Methodological Challenges in Randomized Controlled Trials on Smartphone-Based Treatment

in Psychiatry: Systematic Review. *J Med Internet Res* (2019) 21(10): e15362. doi: 10. 2196/15362

56. Huckvale K, Prieto JT, Tilney M, Benghozi P-J, Car J. Unaddressed privacy risks in accredited health and wellness apps: a cross-sectional systematic assessment. *BMC Med* (2015) 13: 2014. doi: 10. 1186/s12916-015-0444-y

57. Ding X, Xu J, Chen G, Xu C. Beyond smartphone overuse: identifying addictive mobile apps. In: *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* . San Jose, CA: CHI'16 Extended Abstracts (2016). p. 2821–8. doi: 10. 1145/2851581. 2892415

58. Roth AM, Rossi J, Goldshear JL. Potential risks of ecological momentary assessment among persons who inject drugs. *Subst Use Misuse* (2016) 52(7): 840–7. doi: 10. 1080/10826084. 2016. 1264969

59. Capon H, Hall W, Fry C, Carter A. Realizing the technological promise of smartphones in addiction research and treatment: an ethical review. *Int J Drug Policy* (2016) 36: 47–57. doi: 10. 1016/j. drugpo. 2016. 05. 013