

**ENVIRONMENTAL-RISK (E-RISK) LONGITUDINAL TWIN STUDY
CONCEPT PAPER FORM**

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Provisional Paper Title: Problematic Media Use and Sleep Quality: Novel Insights from a Twin Study

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Objective of the study and its significance:

Good sleep quality is important for optimal development and health. Sleep disturbances have been related to a plethora of problems, including psychopathology (e.g. anxiety and depression) (Alvaro, Roberts, & Harris, 2013), increased BMI (Madrid-Valero, Martínez-Selva, & Ordoñana, 2017) and poor cognitive functioning (Alhola & Polo-Kantola, 2007).

There are multiple reasons as to why people differ in terms of their sleep quality – and both genetic and environmental reasons have been highlighted (Madrid-Valero, Sanchez-Romera, Gregory, Martinez-Selva, & Ordonana, 2018). One variable that has received particular recent attention concerns technology use. Available technology and the way in which we consume technology, has changed over recent years (Shochat, 2012) – and its associations with different aspects of our well-being is an important topic of investigation. The problematic use of technology can have a negative impact upon sleep (Gradisar et al., 2013).

The relationship between sleep disturbances and the use of technology has been addressed in different studies. For example, Carter et al.,(2016) conducted a meta-analysis finding that bedtime access and use of media was significantly associated with poor sleep quality and excessive sleepiness. Longitudinal studies have also addressed this relationship. For example, it has been found that time spent using technology predicts shorter subsequent sleep duration (Mazzer, Bauducco, Linton, & Boersma, 2018). Although the links between technology use and sleep disturbances are well-established, work now needs to further address the complex nature of these associations, including the role of associated variables. One construct that might be relevant is loneliness. This has been found to be associated with both disturbed sleep (Matthews et al., 2017) and also technology use (Carter, 2018). Here we will assess whether loneliness (assessed over development) might moderate the association between technology use and sleep. We will also seek to understand whether adjusting for other covariates (such as levels of anxiety, depression (assessed over development), neighbourhood and SES have an influence on the magnitude of the associations reported). These variables have been selected as they have been associated with both problematic media use and sleep quality previously (Gregory et al., 2011; Hussain, Griffiths, & Sheffield, 2017; Lai & Kwan, 2017; Troxel et al., 2018).

Technology use is likely to be associated with sleep in adolescence for multiple reasons. For example, certain devices emit 'blue light' – which can disrupt the 'darkness hormone' melatonin and result in a lost cue for the body that it is time to fall asleep. Conversely disrupted sleep can result in greater opportunities to use technology. Other possibilities, that have received less research attention are that there are shared genetic or environmental influences on disturbed sleep may be shared with those for problematic

technology use.

In this study, we will examine problematic use of technology in adolescence and its associations with sleep quality. Using three different methodologies, we will test: 1) the association between problematic use of technology and sleep problems (and separately with its subscales) – with and without controlling for neighbourhood, sex, SES, anxiety and depression (assessed over development) and mother's insomnia when the participants were 12 years of age, 2) whether the association between problematic use of technology and sleep problems remain after controlling for familial factors (by taking a twin difference design), 3) consider that loneliness may moderate the association between media use and sleep quality and 4) Quantitative genetic models (which will allow us to assess the overlap between genes and environmental influences on both variables).

These questions will be addressed primarily using cross sectional data at 18 years of age (this is the only age at which participants sleep quality and problematic use of technology has been addressed). Nonetheless, we shall capitalize on the longitudinal design of the E-Risk study by considering covariates, and moderators over multiple waves of assessments and earlier time-points as available. For example, we shall look to see whether loneliness (assessed over development) moderates the association between sleep and technology use. We shall look to see whether controlling for anxiety and depression symptoms (assessed over development) reduces the association between problematic media use and sleep quality.

Statistical analyses:

Descriptive statistics

Descriptive statistics for the key variables will be run (i.e., sleep quality and problematic use of technology). Results will be stratified in order to check levels of poor sleep quality in those subjects with high levels of problematic use of technology.

Regression analyses

We will use regression analyses to examine the association between sleep quality and problematic use of technology. Regression analyses will be performed using problematic use of technology and poor sleep quality at 18y. Additionally, sub-scales of Pittsburgh Sleep Quality Index (e.g. sleep length, sleep disturbances) will be analysed. We shall include a further model adjusting for sex, SES, anxiety and depression over development, neighbourhood and mother's insomnia when the participants were 12 years of age.

Co-Twin design

A Co-Twin design will be applied to further test the robustness of the association between problematic use of technology and sleep quality (Vitaro, Brendgen, & Arseneault, 2009). We shall use the different scores between twins within a pair for both variables and use regressions to examine the association between the difference score in one variable and another.

Quantitative genetics analyses

If a significant association between problematic use of technology and sleep quality is found, quantitative genetic models will be fitted in order to examine the nature of this association. This model will include problematic use of technology and sleep quality at 18y. This model will allow us to disentangle the role of genetic and environmental factors on the etiology of this relationship. In other words, both sources of variance and covariance between problematic use of technology and sleep quality will be examined.

Variables Needed at Which Ages (names and labels):

Study:

Age 5:

FAMILYID Unique family identifier
FAMIDCK Family ID (inc chkdig)
FCHECK Check Digit for FamilyID
TWINAID Twin A ID (inc chkdig)
ATWINID Twin A ID (ex chkdig)
TACHECK Check Digit for AtwinID
TWINBID Twin B ID (inc chkdig)
BTWINID Twin B ID (ex chkdig)
TBCHECK Check Digit for BtwinID

Age 7:

Age 10:

Age 12:

MATINSOMM12 Maternal Insomnia - Phase 12

Age 18:

TECHE18 Technology Use - P18 - Elder
TECHY18 Technology Use - P18
PSQIC1E18 PSQI - Subjective sleep quality - P18 - Elder
PSQIC1Y18 PSQI - Subjective sleep quality - P18 - Younger
PSQIC2E18 PSQI - Sleep latency - P18 - Elder
PSQIC2Y18 PSQI - Sleep latency - P18 - Younger
PSQIC3E18 PSQI - Sleep duration - P18 - Elder
PSQIC3Y18 PSQI - Sleep duration - P18 - Younger
PSQIC4E18 PSQI - Habitual sleep efficiency - P18 - Elder
PSQIC4Y18 PSQI - Habitual sleep efficiency - P18 - Younger
PSQIC5E18 PSQI - Sleep disturbances - P18 - Elder
PSQIC5Y18 PSQI - Sleep disturbances - P18 - Younger
PSQIC6E18 PSQI - Use of sleep meds - P18 - Elder
PSQIC6Y18 PSQI - Use of sleep meds - P18 - Younger
PSQIC7E18 PSQI - Daytime dysfunction - P18 - Elder
PSQIC7Y18 PSQI - Daytime dysfunction - P18 - Younger
PSQIE18 PSQI - Global Score - P18 - Elder
PSQIY18 PSQI - Global Score - P18 - Younger- Younger
LONELYE18 Loneliness scale - P18 - Elder
LONELY18 Loneliness scale - P18 - Younger
MDESXE18 MDE - Symptom scale - P18 - Elder
MDESXY18 MDE - Symptom scale - P18 - Younger
GADSXE18 GAD - Symptom scale - P18 - Elder
GADSXY18 GAD - Symptom scale - P18 - Younger
COLLEFE18 Collective efficacy - Elder
COLLEFY18 Collective efficacy - Younger
NDSRDE18 Neighbourhood disorder - Elder
NDSRDY18 Neighbourhood disorder - Elder

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Data Security Agreement

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Proposing Author	Juan J Madrid-Valero
Today's Date	15/05/19

Please keep one copy for your records
(Please initial your agreement)

JJMV I am familiar with the King's College London research ethics guidelines (<https://www.kcl.ac.uk/innovation/research/support/ethics/about/index.aspx>) and the MRC good research practice guidelines (<https://www.mrc.ac.uk/research/policies-and-guidance-for-researchers/good-research-practice/>).

_____ My project has ethical approval from my institution.

JJMV I am familiar with the EU General Data Protection Regulation (<https://mrc.ukri.org/documents/pdf/gdpr-guidance-note-3-consent-in-research-and-confidentiality/>), and will use the data in a manner compliant with its requirements.

JJMV My computer is (a) encrypted at the hard drive level, (b) password-protected, (c) configured to lock after 15 minutes of inactivity, AND (d) has an antivirus client which is updated regularly.

JJMV I will treat all data as "restricted" and store in a secure fashion.

JJMV I will not share the data with anyone, including students or other collaborators not specifically listed on this concept paper.

JJMV I will not merge data from different files or sources, except where approval has been given by the PI.

JJMV I will not post data online or submit the data file to a journal for them to post. Some journals are now requesting the data file as part of the manuscript submission process. The E-Risk Study cannot be shared because the Study Members have not given informed consent for unrestricted open access. Speak to the study PI for strategies for dealing with data sharing requests from Journals.

JJMV Before submitting my paper to a journal, I will submit my draft manuscript and scripts for data checking, and my draft manuscript for co-author mock review, allowing three weeks.

JJMV I will submit analysis scripts and new variable documentation to project data manager after the manuscript gets accepted for publication.

JJMV I will delete the data after the project is complete.

JJMV **For projects using location data:** I will ensure geographical location information, including postcodes or geographical coordinates for the E-Risk study member's homes or schools, is never combined or stored with any other E-Risk data (family or twin-level data)

JJMV **For projects using genomic data:** I will only use the SNP and/or 450K data in conjunction with the phenotypes that have been approved for use in this project at the concept paper stage.



Signature:

CONCEPT PAPER RESPONSE FORM

A. To be completed by the proposing author

Proposing Author: Juan J Madrid-Valero

X I have read the E-Risk data-sharing policy guidelines and agree to follow them

Provisional Paper Title: Problematic Media Use and Sleep Quality: Novel Insights from a Twin Study

Potential co-authors: Louise Arseneault, Alice M Gregory, Tim Matthews, Candice Odgers, Avshalom Caspi, Terrie Moffitt, Ben carter

Potential Journals:

Intended Submission Date (month/year):
May 2020

Please keep one copy for your records and return one to Louise (louise.arseneault@kcl.ac.uk)

B. To be completed by potential co-authors:

Approved Not Approved Let's discuss, I have concerns

Comments:

Please check your contribution(s) for authorship:

- Conceptualizing and designing the longitudinal study
- Conceptualizing and collecting one or more variables
- Data collection
- Conceptualizing and designing this specific paper project
- Statistical analyses
- Writing
- Reviewing manuscript drafts
- Final approval before submission for publication
- Acknowledgment only, I will not be a co-author

Signature: