
Supplementary Methods

Participants

Participants were 398 young adults ($M = 21$ years of age, $SD = 1.9$, 74% female). Participants were recruited between March 2024 and March 2025 via Instagram and ResearchMatch, a national electronic, web-based recruitment tool. Of the 417 participants who enrolled in the study, 19 were disqualified.

Procedure

The study consisted of a 2-week observational period, where participants used social media as normal, and a week-long optional detox period, where participants were asked to refrain from social media use. Participants attended 2 or 3 study visits, as follows:

Visit 1

Participants were instructed to download and login to mindLAMP by a research assistant, enabling all location settings; this allowed the app to track their passive data (GPS, accelerometer, steps, phone use) for the duration of the study. Participants were also asked to complete a battery of assessments via REDCap, including the Patient Health Questionnaire (PHQ-9), GAD-7, ISI, UCLAQ, PUSNS, BSMAS and MSMCS. Participants were also asked to complete their daily surveys on mindLAMP (see ‘Materials’).

In between Visit 1 and Visit 2

Participants were asked to complete their daily surveys every day. One week after Visit 1, participants were sent the battery of surveys to complete again. Passive data was monitored continuously. Summarized trends in participants’ data were shared in the form of a data report (see ‘Patient Data Report Template’ below).

Visit 2

The Visit 2 session occurred 2 weeks after Visit 1. At this visit, the Research Assistant recorded the participant’s screen time and social media use data for Instagram, TikTok, Snapchat, Twitter and Facebook for the past 2 weeks, gathered via screen sharing. Participants were asked to complete the same battery of assessments for the third time. The Research Assistant would share a data report generated using the participant’s individual phenotyping data, visualizing their smartphone use, behavioral data and mental health outcomes. This report reviewed the materials and trajectory of patient symptoms, including plots of their mood, anxiety and difficulty functioning against their passive data, such as home time, entropy, screen time and steps. Participants were asked if they wanted to participate in the detox. If they opted-out, they were thanked for their participation and compensated \$100. If they opted-in, they were asked to continue completing daily surveys for the next week, but to refrain as much as possible from using social media.

Visit 3

One week after Visit 2, participants met with the Research Assistant, who recorded social media usage from the detox week. Participants were asked to complete the battery of assessments for the fourth and final time.

Data Collection

The mindLAMP app collects active data in the form of surveys, and passive data, which is stored on one's phone - such as GPS, accelerometer, phone use and step count. Time spent on social media was collected for Instagram, TikTok, Twitter, Snapchat and Facebook using Apple and Android's screen time feature in the settings app.

Compensation

Participants were compensated based on mindLAMP survey completion, at \$2.00 for each daily survey completed, and \$6.00 for each weekly survey completed. As such, participants could earn up to \$100 for completing two weeks, and \$150 for three. Participants were compensated via Clinicard, a prepaid debit card.

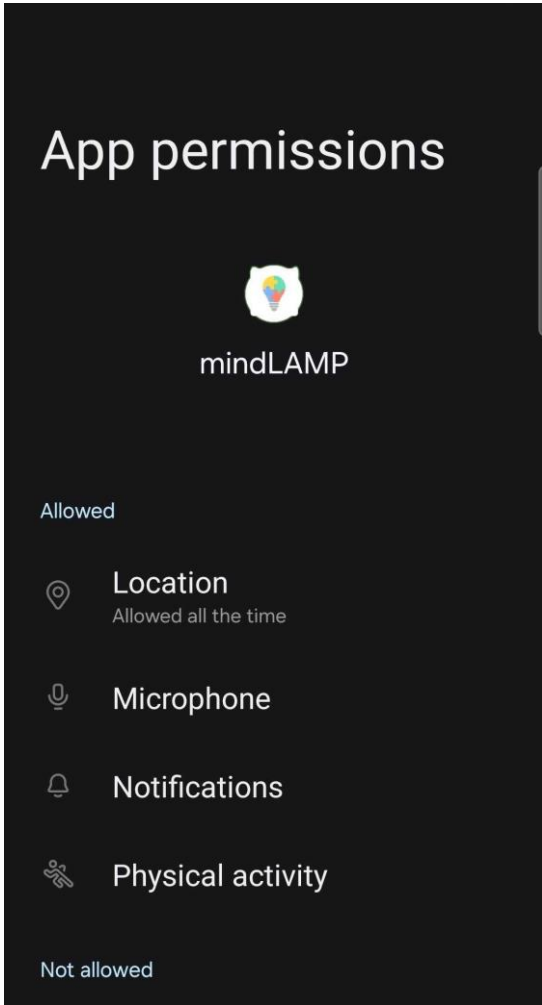

Onboarding Configuration Checklist

Have the participant configure permissions required for passive sensing collection by:

- ☐ Verify that the participant device has hardware and software that is compatible with the passive sensing platform.
- ☐ Ensure that the permissions the participant has enabled match those available for their device type and operating system. Example, when collecting steps data via mindLAMP on Android devices, participants who have not configured Google Fit must connect it to an existing Gmail account, then connect it to mindLAMP in order for steps data to be collected.
 - ☐ Ensure that permissions are not only enabled, but are set to operate even when the data collection system is not open, i.e. enable “Always Allow”.
- ☐ Ensure that participants disable low power mode in their device settings.
- ☐ Support configuration with screenshots of the appropriate permissions configured for the participant’s device type and operating system.
- ☐ If feasible, ask the participant to show you the settings configured on their device per instructions provided, to ensure no miscommunication.
- ☐ Provide guidance to:
 - ☐ Avoid entering low power mode.
 - ☐ Avoid allowing the device to die.
 - ☐ And force quitting the app.
 - ☐ Warn participants that the device may prompt them to disable permissions with prompts such as “Are you sure you want mindLAMP to continue collecting GPS data”, and that they should not disable permissions.

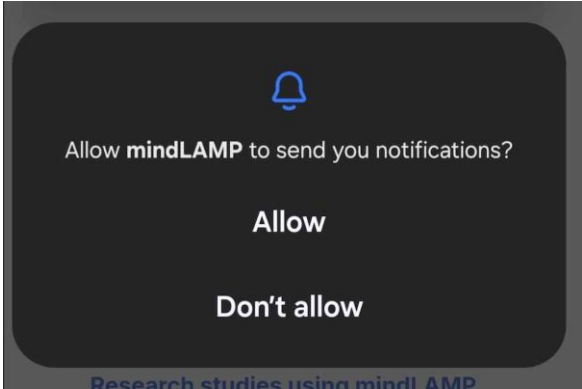
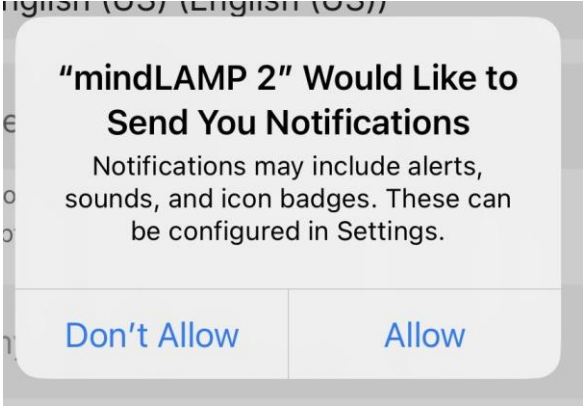
For examples of required permissions to enable during onboarding, please see the ‘**Participant Annotated Permissions Configuration**’ section.

Participant Annotated Permissions Configuration

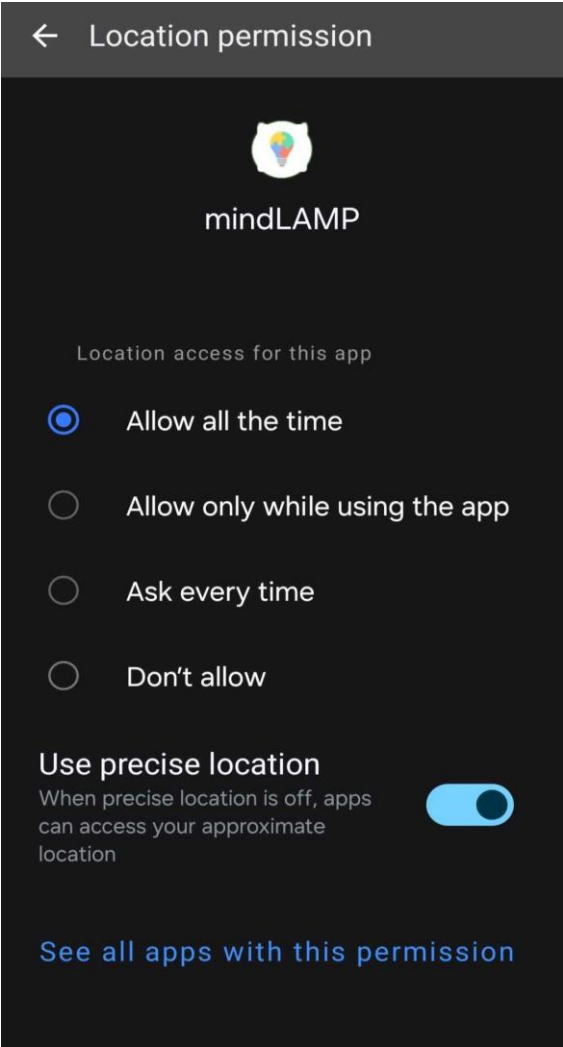
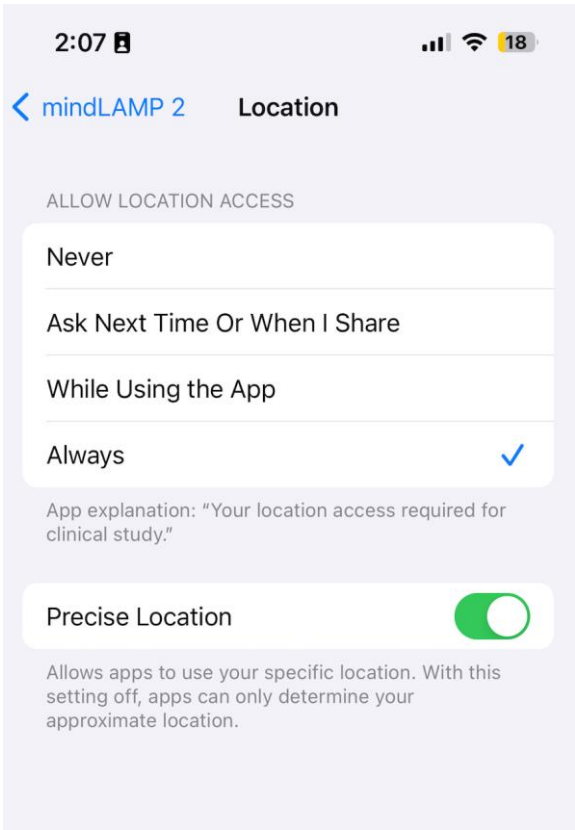
Android	iPhone
<p>Settings → Apps → mindLAMP 2</p> 	<p>Settings → mindLAMP 2</p> 

Please note that all Android devices will not have the same interface

A. If notification for permission settings is prompted.

Notification Permissions Android	Notification Permissions iPhone
<p>Settings Apps → mindLAMP 2</p>  <p>The image shows an Android notification permission dialog for the app 'mindLAMP 2'. It features a blue bell icon at the top. The text asks 'Allow mindLAMP to send you notifications?'. Below this, there are two buttons: 'Allow' and 'Don't allow'. At the bottom, there is a small link that says 'Research studies using mindLAMP'.</p>	<p>This will appear as a pop up when logging in</p>  <p>The image shows an iPhone notification permission pop-up for the app 'mindLAMP 2'. The title is '"mindLAMP 2" Would Like to Send You Notifications'. Below the title, it says 'Notifications may include alerts, sounds, and icon badges. These can be configured in Settings.' At the bottom, there are two buttons: 'Don't Allow' and 'Allow'.</p>

B. Checking notification permission

Location Permissions Android	Notification Permissions iPhone
<p>This will appear as a pop up when logging in</p> 	<p>Settings → mindLAMP 2 → Location</p> 

C. Disabling low battery mode

Battery Mode Android	Battery Mode iPhone
<div>Settings → Battery</div> <div><div>Power saving</div><div>Background usage limits</div></div>	<div>Settings → Battery</div> <div><div>2:15</div><div>Signal icons</div><div>18</div></div> <div><div>Settings</div><div>Battery</div></div> <div><div>Battery Percentage</div><div>Low Power Mode</div><div>Low Power Mode temporarily reduces background activity like downloads and mail fetch until you can fully charge your iPhone.</div><div>Battery Health & Charging</div></div>

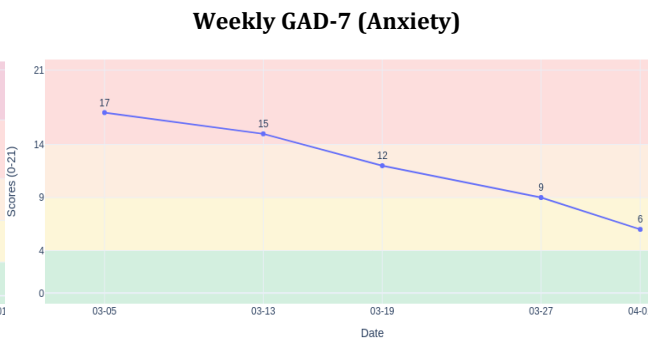
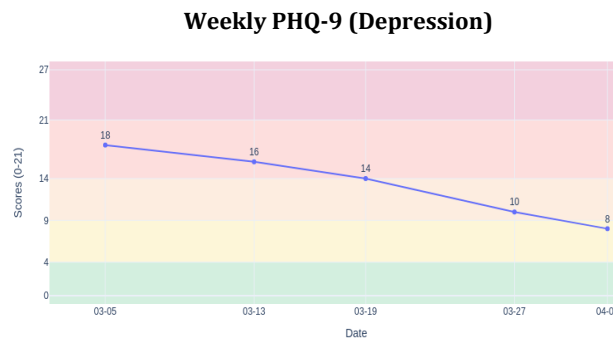
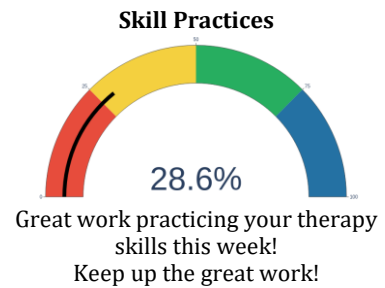
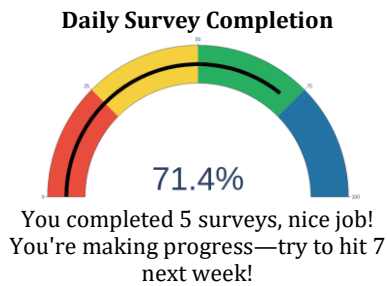
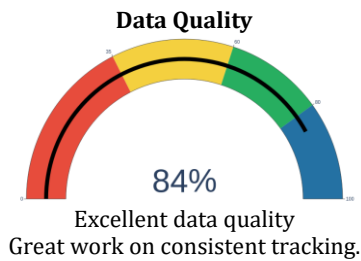
Python Script Implementing Digital Data Reports



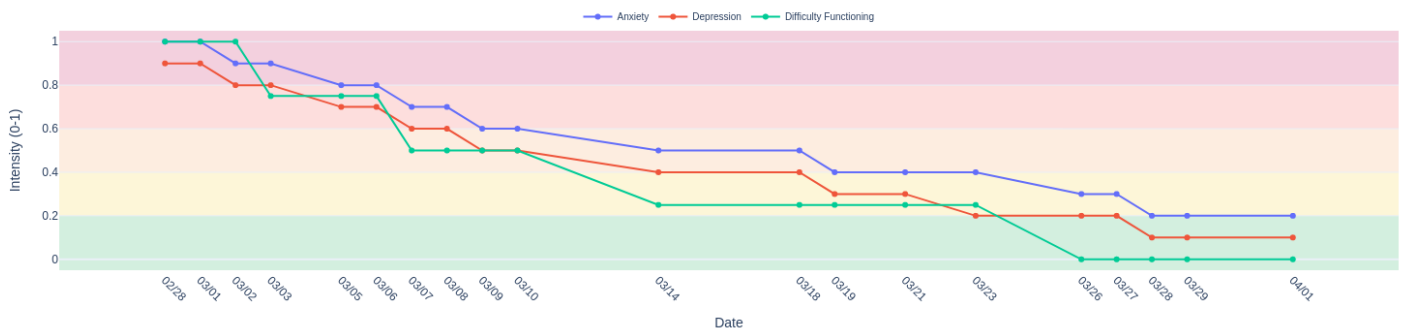
Scanning this QR code will take you to a website that contains the code needed to run participant data reports. Once properly set up, the only fields that need to be changed are the **part** and **start** variables within the initialization code block. For more information regarding the inner workings of the code and general troubleshooting, visit: <https://www.jmir.org/2024/1/e58502/>

TEMPLATE DIGITAL DATA REPORT

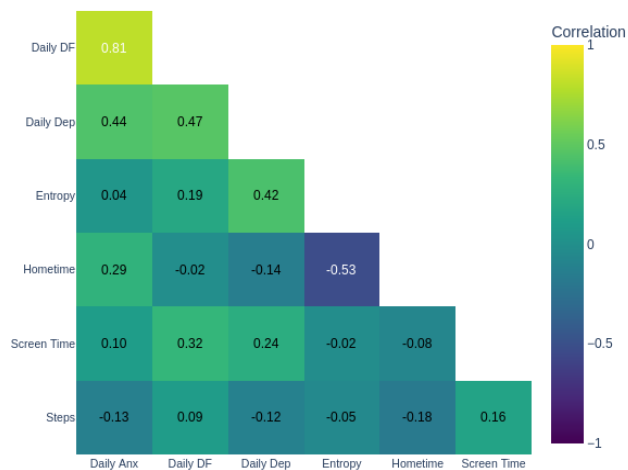
Age: XX, Sex: XX, Gender: XXX, Education: XXX, Race: XXX (Sample Data)



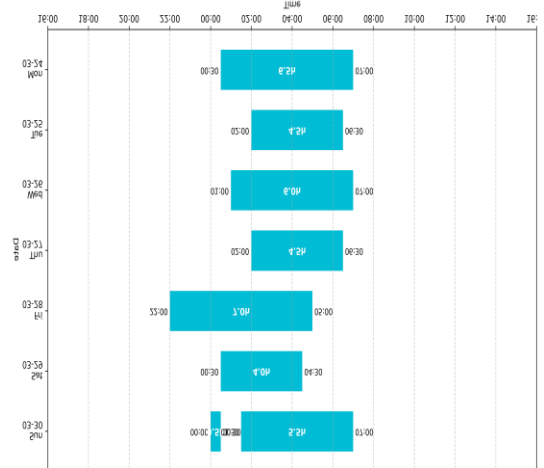
Daily Surveys (Higher Score = More Symptomatic)



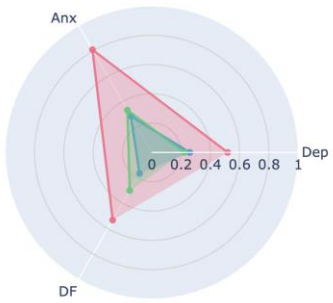
Correlation Matrix



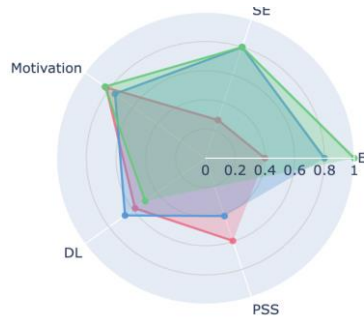
Last Week's Sleeping Patterns



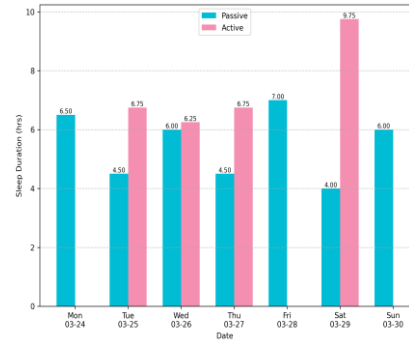
Baseline Metrics



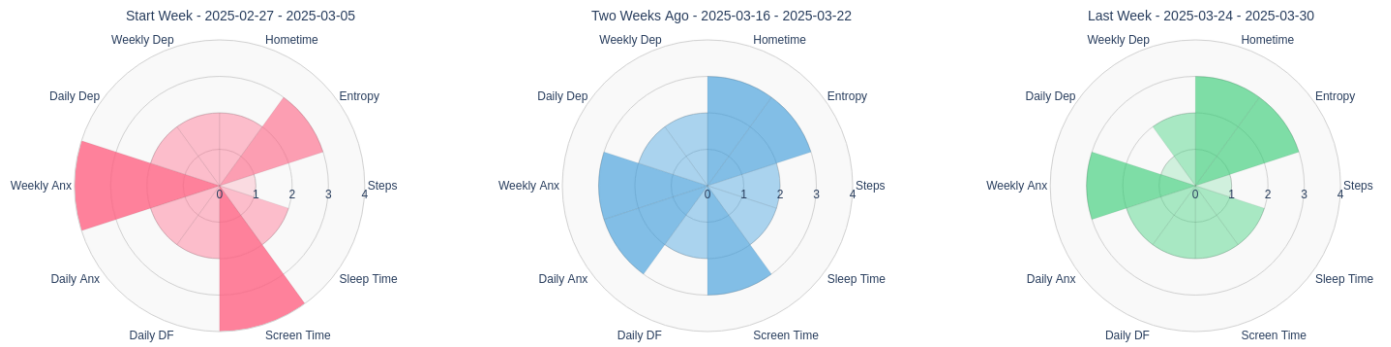
Positive Valence Metrics



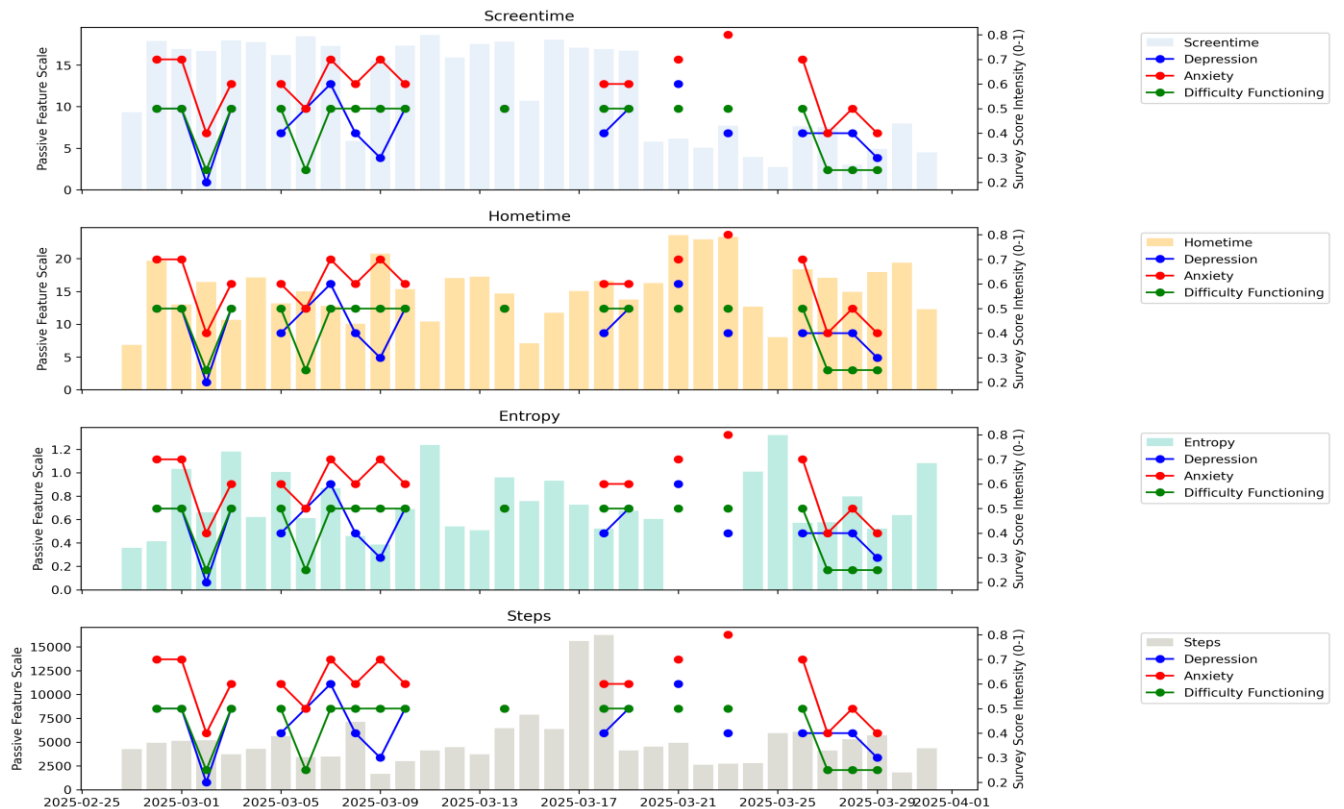
Passive vs. Active Sleep Duration (Last Week)



Visualization of Patients' Daily, Weekly Psychopathology and Phenotyping Features



Passive vs. Active Data



Python Scripts Generating Monitoring Dashboard



Scanning this QR code will forward you to the ‘LAMP-dashboard’ GitHub repository, where you can find detailed instructions on how to implement the Python scripts available in order to generate the dashboard for viewing and monitoring participants’ passive data collected. If questions arise during implementation, please contact us at: jtorous@bidmc.harvard.edu.

Portal

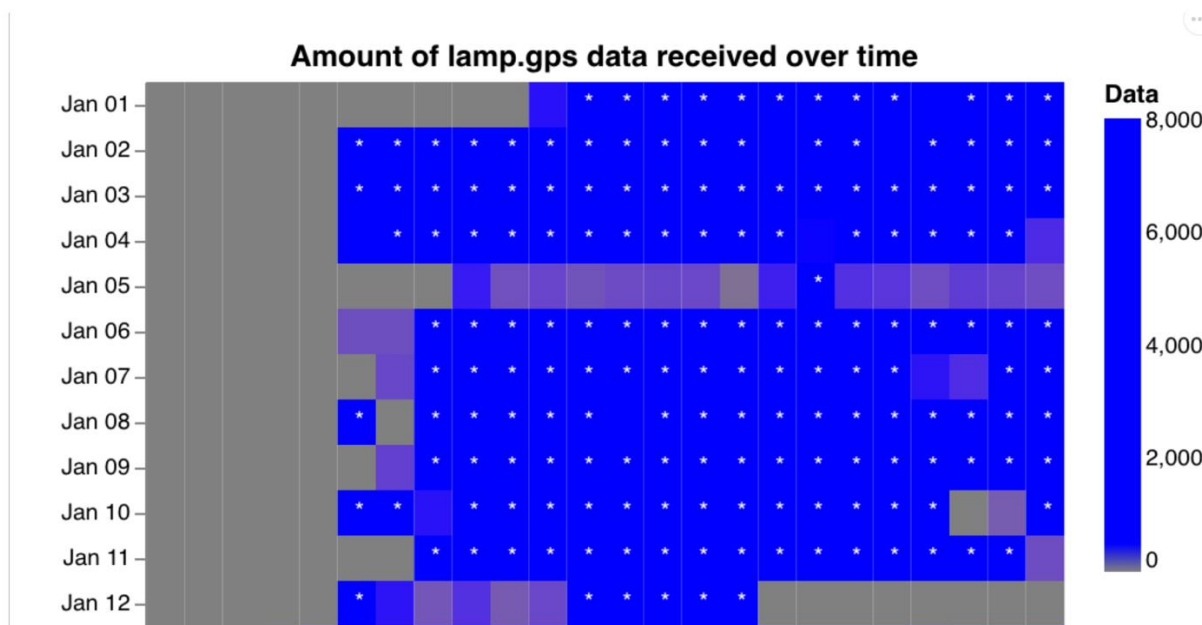


Fig. S1. Dashboard data quality heat map. This figure displays hourly GPS data quality, with x-axis represents the very start of the day, 12 AM or 00:00 in 24-hour time. Each hour is represented as a square and given a gradient of blue, with the deeper blues representing more data points collected. Each row represents 1 day and starts at the top.

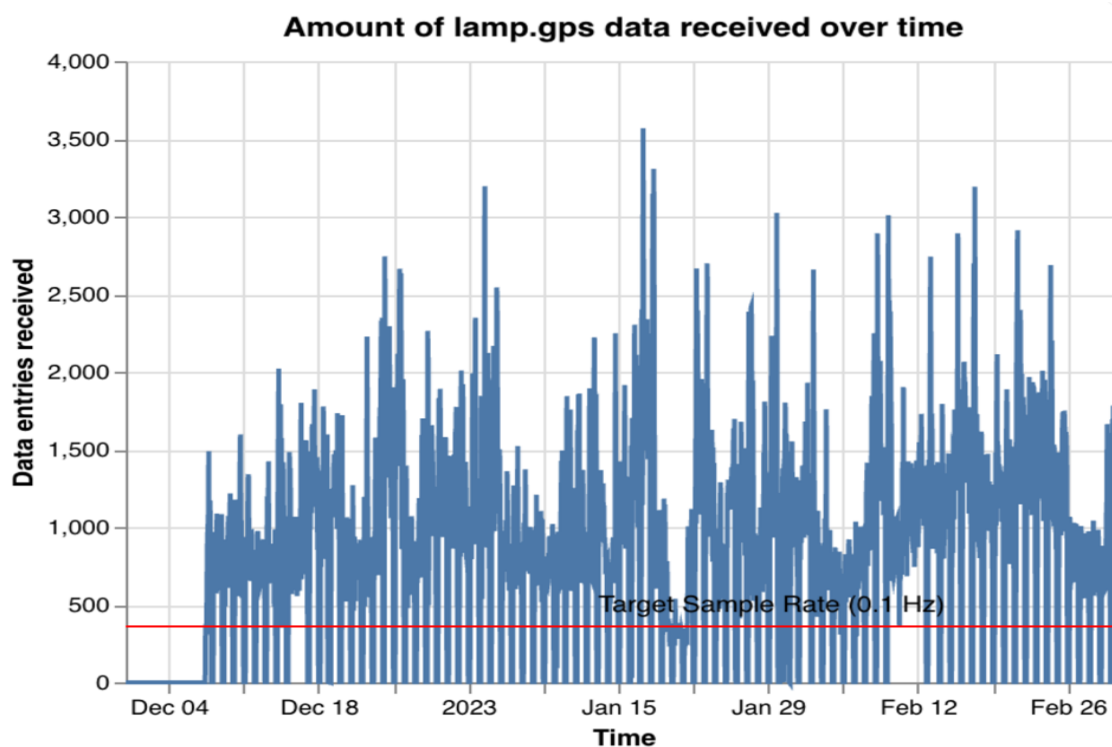


Fig. S2. Dashboard data quality line graph. This figure displays daily GPS data quality, with the x axis representing time of collection and the y axis representing volume of data points that day. The red line running along the x axis represents the set sampling rate.

Troubleshooting Outreach Email Template

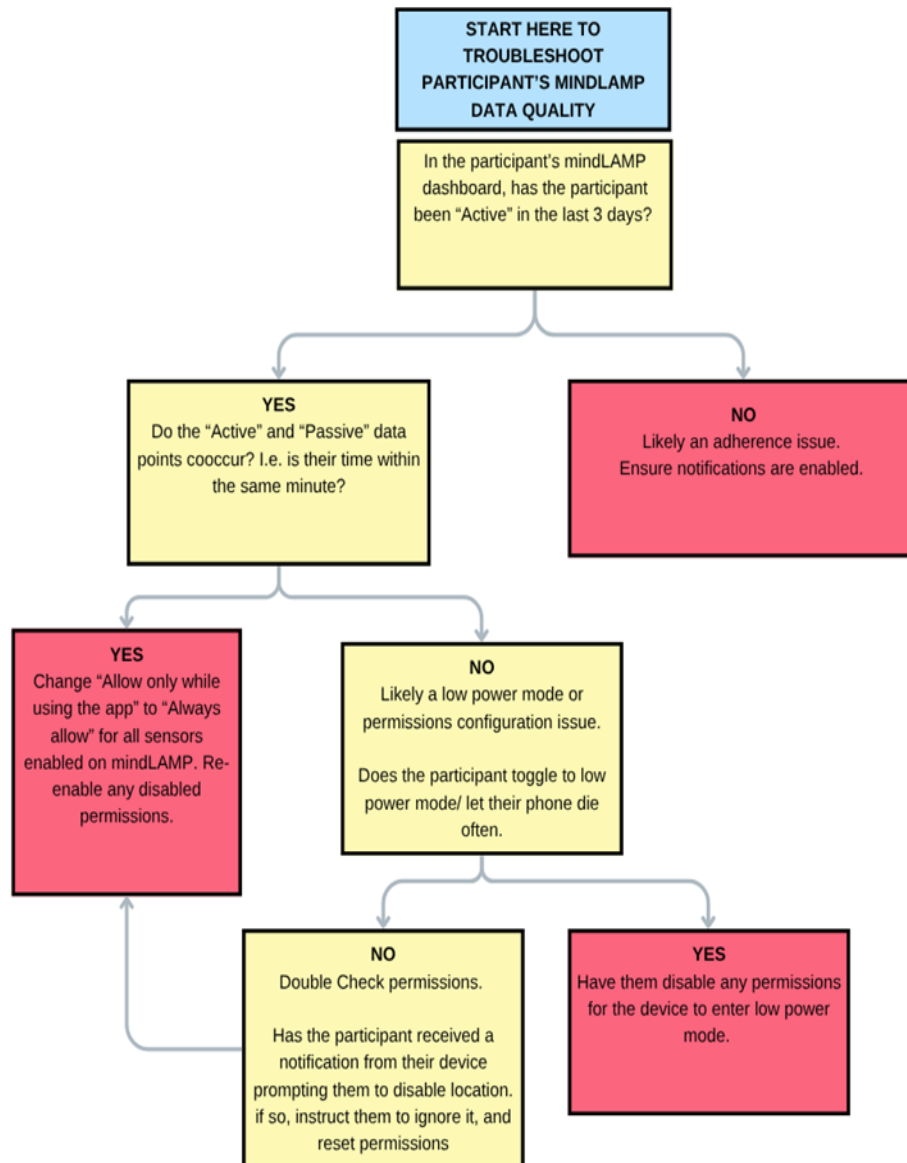
Good Morning!

My name is [insert name] and I work within the [insert lab/organization] that runs the [investigation] that you are currently participating in.

The reason I am emailing you is because I have noticed that the quality of data we are gathering from your device has been low. Particularly passive data, which includes GPS and accelerometer data. Due to this, I wanted to check in and see if we can solve this issue. Common reasons this can happen include putting your phone in low power mode or turning off location sharing with the app itself. Please refer to the attached screenshots showing the correct settings for both Apple and Android devices. If low power mode is the issue we ask that you please refrain from using the setting as this interferes with data collection! If you have any questions or concerns, please don't hesitate to reach out and I would be happy to help.

Very Respectfully,
[name]

Data Quality Intervention Workflow



Troubleshooting Checklist

a) Is the patient currently logged in?	Ask them to open the app and log in. This will also catch if they have accidentally deleted the app.
b) Are the required permissions granted correctly in Settings?	Allow mindLAMP app to access GPS as “always allow.” See bottom of form for permission screenshots.
c) Is the phone operating on low power or battery saver mode?	Ask them to open Settings. Low power or low battery mode will prevent the app from collecting sensor data. Remind them to disable “low battery mode” whenever the phone is charged. If their phone has battery optimization features, they must be deactivated. If they have gone into low power mode, turned off low power mode, and passive data is not flowing, the participant must uninstall and reinstall the app during the visit.

If the above are not enough to resolve the issue, here are other possibilities.

d) Has the participant encountered a bug in the app (white screen, app not loading etc.)?	Try reinstalling the app and re-log in with the same ID and password.
e) Is the phone’s device storage/memory full?	<p>a) If your device's storage is very close to full, this may interfere with passive data collection. Ask if freeing up storage on the device is possible.</p> <p>b) Clear data (android users). For android users go to settings, proceed to click on mindLAMP, then storage & cache, and clear cache to clean data. Sometimes this can help and it will clear stored data on your phone, allowing LAMP to run better.</p>

f) Is airplane mode turned off?	Ask them to verify this from their home screen or Settings. If airplane mode was turned on and then off at some point, this action will not compromise data quality.
g) Is the device consistently connected to Wi-Fi?	Data can be locally stored in mindLAMP but won't be uploaded to the server without Wi-Fi.
h) Is the device powered on most of the times of the day?	Data cannot be collected when the phone is off.
The best general way to troubleshoot missing data is to delete the app and reinstall mindLAMP app and re-log in with the existing mindLAMP ID. This serves as a catch all fix for many miscellaneous issues. Then remember to set all permissions accordingly including:	
1) Allowing mindLAMP app to access GPS as "always allow."	
2) "Battery save mode" is NOT enabled.	



Fig. S3. Accelerometer and GPS data quality correlation. This figure illustrates the correlation between average accelerometer and GPS data quality for a sub-sample of participants from the study sample, demonstrating the capacity of GPS to operate as a proxy for accelerometer data quality.

Table S1. Baseline Clinical Characteristics (Median, IQR, Minimum, Maximum)

	PHQ-9	GAD-7	ISI	UCLAQ	RSES	NSMCS	PUSNS	BSMAS
median	4	4	6	50	23	27	48	13
IQR	6	6	7	9	2	10	18	7
min	0	0	0	0	10	6	18	6
max	25	21	26	80	29	42	85	28

Abbreviations: Depression as assessed by the Patient Health Questionnaire-9 (PHQ-9); Anxiety as assessed by the General Anxiety Disorder-7 (GAD-7); Insomnia as assessed by the Insomnia Severity Index (ISI); Loneliness as assessed by the UCLA Loneliness Scale (UCLAQ); Self-esteem as assessed by the Rosenberg Self-Esteem Scale (RSES); Social comparison as assessed by the Negative Social Media Comparison Scale (NSMCS); Problematic use as assessed by the Problematic Use of Social Networks Scale (PUSNS); Social media dependence as assessed by the Bergen Social Media Addiction Scale (BSMAS).