

# Geographic and behavioural diversity in the optical radiation exposome

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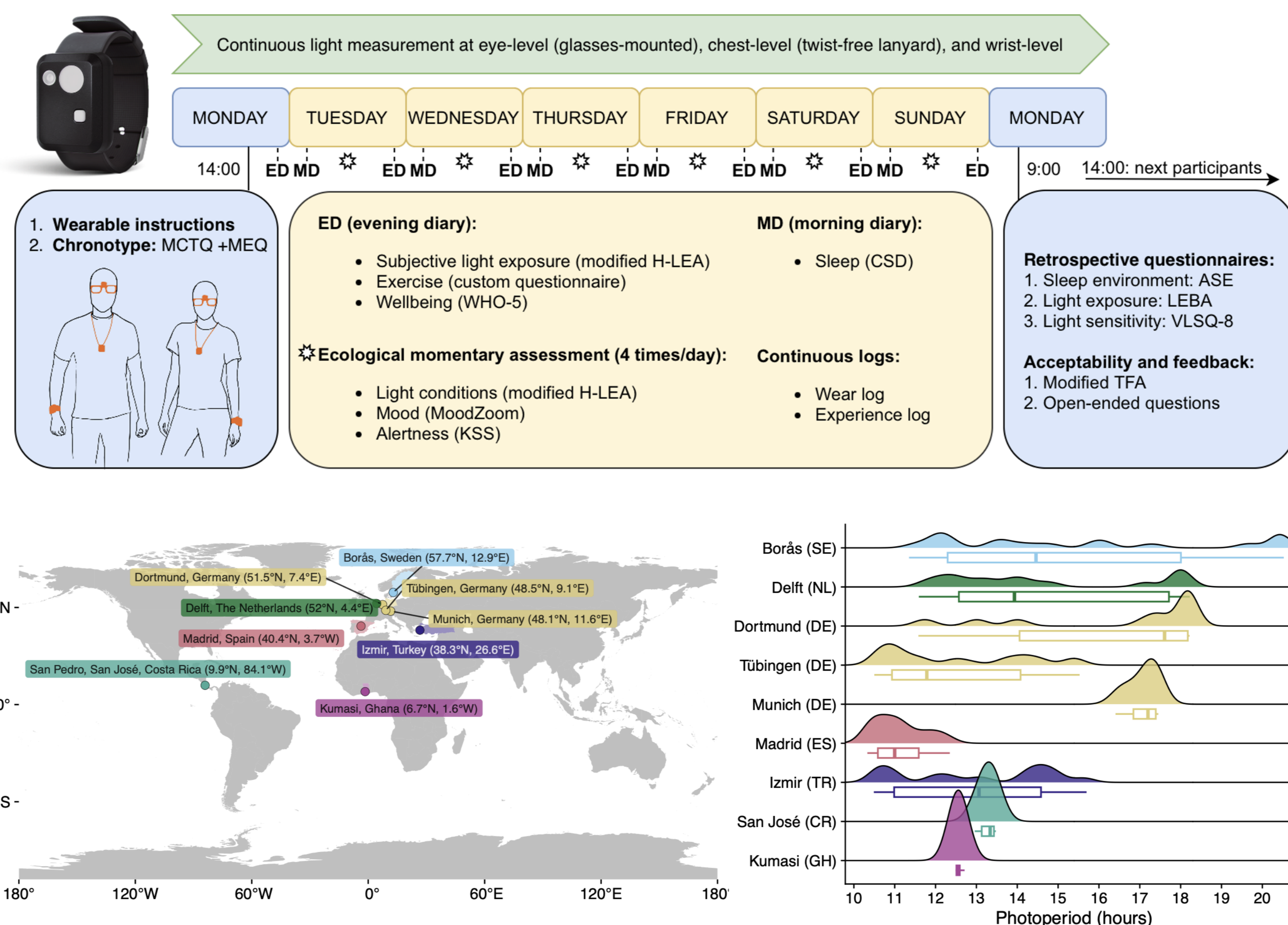
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## Why measure light?

**Personal light exposure is a major determinant of health and well-being.** Beyond vision, light directly influences melatonin regulation, circadian timing, alertness, mood, and sleep. Too little daytime light and too much light at night can impair performance in the short term and increase long-term mental and cardiometabolic health risks.

**Quantifying personal light exposure across populations has been limited by a lack of harmonised, high-resolution multicentre field data.**

Here, we present a standardised, open protocol to characterise the optical radiation exposome across diverse latitudes and sociocultural contexts.



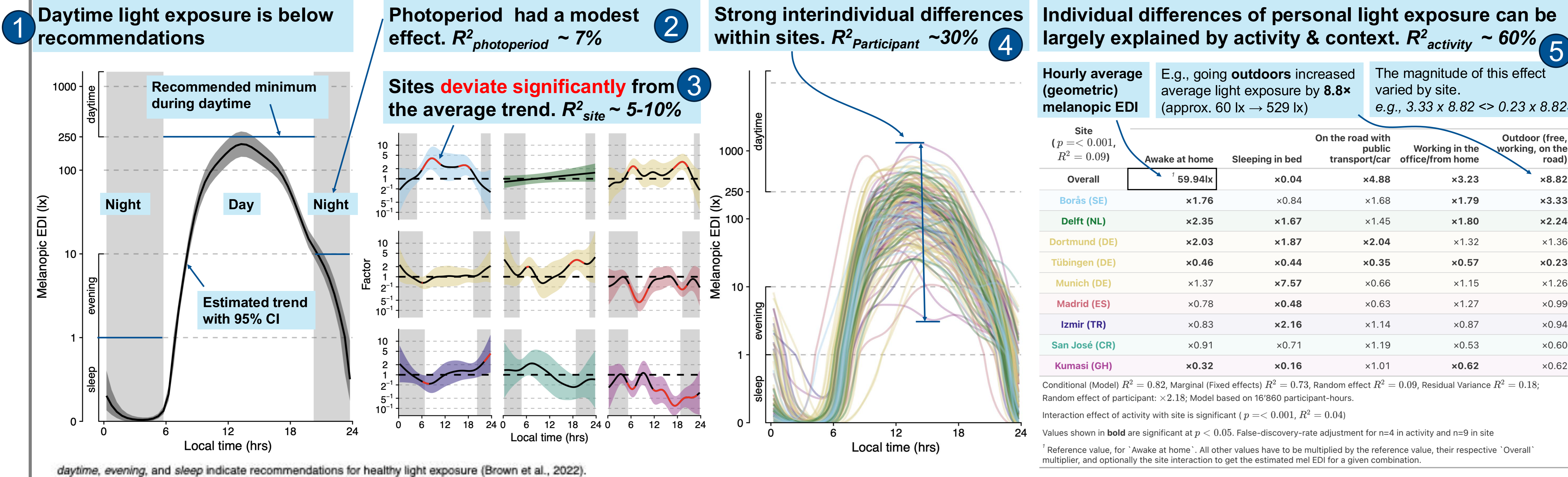
## Methods

- **191 adults across 9 sites 7 countries**
- **7 consecutive days** of monitoring
- Wearable light loggers at **3 body locations**:
  - spectacles (corneal plane)
  - chest pendant
  - wrist
- Measurements every **10 s**
- Smartphone surveys captured:
  - sleep
  - activity
  - perceived light environment
- **1,480 participant-days** of annotated data

| MeLiDos sites and demographics |           |            |            |               |               |             |             |            |               |             |
|--------------------------------|-----------|------------|------------|---------------|---------------|-------------|-------------|------------|---------------|-------------|
| Variable                       | Overall   | Borås (SE) | Delft (NL) | Dortmund (DE) | Tübingen (DE) | Munich (DE) | Madrid (ES) | Izmir (TR) | San José (CR) | Kumasi (GH) |
| Participants                   | 191       | 17         | 20         | 24            | 26            | 10          | 23          | 17         | 39            | 15          |
| Female                         | 105 (55%) | 6 (35%)    | 8 (40%)    | 13 (54%)      | 14 (54%)      | 6 (60%)     | 15 (65%)    | 11 (65%)   | 24 (62%)      | 8 (53%)     |
| Age                            | 32 ± 10   | 40 ± 14    | 33 ± 12    | 36 ± 13       | 28 ± 5        | 27 ± 3      | 35 ± 11     | 25 ± 3     | 32 ± 9        | 23 ± 2      |

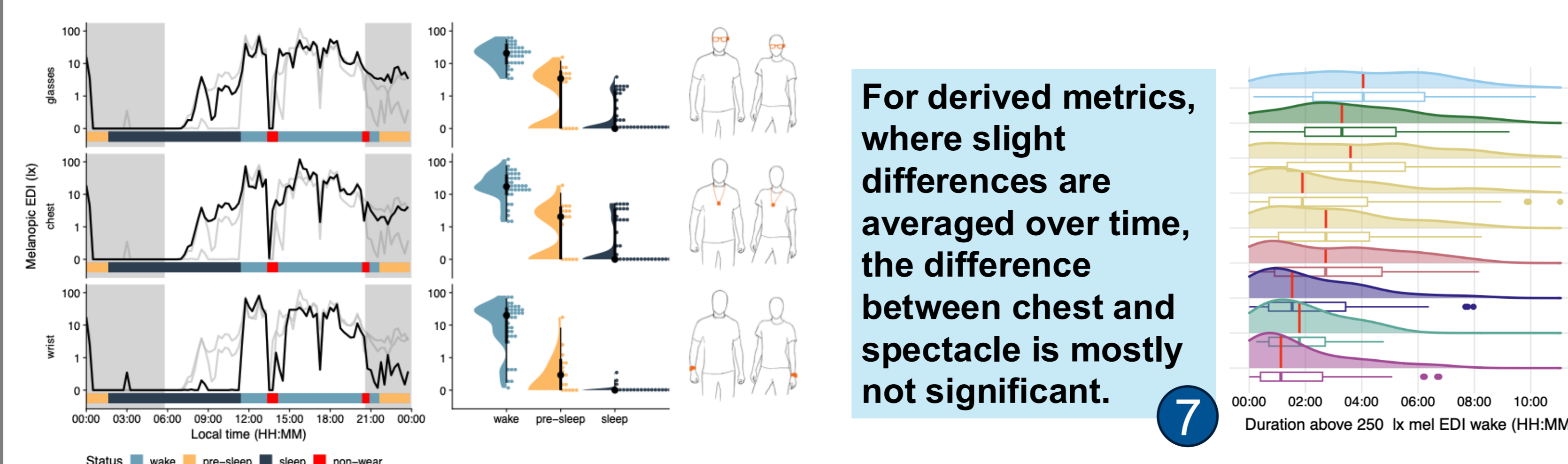
**Outcome metrics:** melanopic equivalent daylight illuminance (lux) – referred to as **melanopic EDI** and derived exposure metrics.

## Behaviour matters more than macro-location or photoperiod



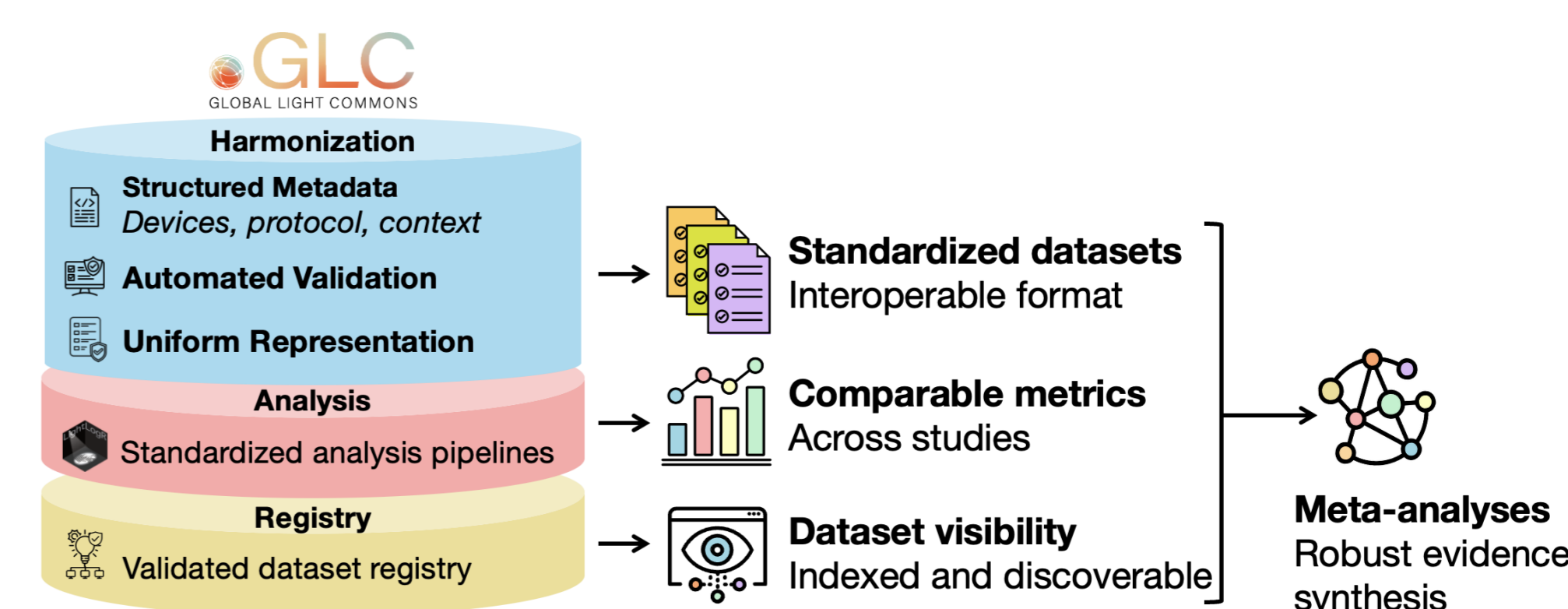
## Sensor placement matters: keep it close to the eye

- **Corneal-level measurements best approximate retinal exposure.**
- **Spectacle-mounted sensors provide highest fidelity, but participant acceptability is lower.**
- **Chest-mounted sensors offer the best practical trade-off.**
- **Wrist-worn devices are convenient but substantially less accurate.**



## Open Science and reusable data

**This is the first multi-site personal light exposure dataset of this scale and fidelity.** The resulting dataset supports future analyses of the global light exposome. The **Global Light Commons (GLC)** provides a framework and tools to harmonise data across studies and facilitate analysis and data reuse.



## Things that don't fit on a Poster



Inspect the analysis  
Quarto-documentation  
of the full analysis



Get the data  
Github project with documented  
data repositories



Join the **Global Light Commons**  
Subscribe for updates or contribute  
and validate your own datasets

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## References

1. Spitschan, M., et al., F. Illuminating the future of wearable light metrology: Overview of the MeLiDos Project. Measurement 235, 114909 (2024).
2. Guidolin, C., et al. Protocol for a prospective, multicentre, cross-sectional cohort study to assess personal light exposure. BMC Public Health 24, 3285 (2024).
3. Zauner J, Hartmeyer S, Spitschan M. *LightLogR: Reproducible analysis of personal light exposure data*. Journal of Open Source Software. 2025 Mar 13;10(107):7601.

