



Quality of Life Technologies Lab
University of Geneva & University of Copenhagen
qol.unige.ch



Co-calibrating Short Term, Mixed-Methods Based Momentary Assessments for Physical and Psychological Outcomes with Long Term Quality of Life Outcomes in Older Adults: The **coQoL** Method

Vlad Manea, Igor Matias, Katarzyna Wac
manea@di.ku.dk, igor.matias@unige.ch, katarzyna.wac@unige.ch



UNIVERSITÉ
DE GENÈVE

UNIVERSITY OF
COPENHAGEN



STANFORD
SCHOOL OF MEDICINE

Stanford University Medical Center



EUROPEAN
COMMISSION
AAL
ADVANCED ASSISTED LIVING



EUROPEAN
COMMISSION



HORIZON 2020
AAL
ADVANCED ASSISTED LIVING



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra



FONDS NATIONAL SUISSE
SCHWEIZERISCHER NATIONALFONDS
FONDO NAZIONALE SVIZZERO
SWISS NATIONAL SCIENCE FOUNDATION



Research
at Google

Motivation

Research Problem: Co-Calibration

Sleep Quality Assessment (PSQI)

INSTRUCTIONS:

During the past month,

| | Good | Fair | Poor | Total |
|--|------|------|------|-------|
| 1. Sleep disturbance due to trouble falling asleep | | | | |
| 2. Sleep disturbance due to frequent awakenings | | | | |
| 3. Sleep disturbance due to waking up too early | | | | |
| 4. Sleep disturbance due to difficulty re-falling asleep | | | | |
| 5. Sleep disturbance due to sleeping too long | | | | |
| 6. Sleep disturbance due to waking up too often | | | | |
| 7. Sleep disturbance due to waking up too late | | | | |
| 8. Sleep disturbance due to waking up too soon | | | | |
| 9. Sleep disturbance due to waking up too early | | | | |
| 10. Sleep disturbance due to waking up too often | | | | |
| 11. Sleep disturbance due to waking up too late | | | | |
| 12. Sleep disturbance due to waking up too soon | | | | |
| 13. Sleep disturbance due to waking up too often | | | | |
| 14. Sleep disturbance due to waking up too late | | | | |
| 15. Sleep disturbance due to waking up too soon | | | | |
| 16. Sleep disturbance due to waking up too often | | | | |
| 17. Sleep disturbance due to waking up too late | | | | |
| 18. Sleep disturbance due to waking up too soon | | | | |
| 19. Sleep disturbance due to waking up too often | | | | |
| 20. Sleep disturbance due to waking up too late | | | | |
| 21. Sleep disturbance due to waking up too soon | | | | |
| 22. Sleep disturbance due to waking up too often | | | | |
| 23. Sleep disturbance due to waking up too late | | | | |
| 24. Sleep disturbance due to waking up too soon | | | | |
| 25. Sleep disturbance due to waking up too often | | | | |
| 26. Sleep disturbance due to waking up too late | | | | |
| 27. Sleep disturbance due to waking up too soon | | | | |
| 28. Sleep disturbance due to waking up too often | | | | |
| 29. Sleep disturbance due to waking up too late | | | | |
| 30. Sleep disturbance due to waking up too soon | | | | |



PROs

Gold Standard

TechROs

Emerging



Method

Measured Outcomes (PROs)

Self-Reported Measures (PROs)

- Filled during subsequent group visits (3 waves)
- N = 39 (age 70.0 ± 7.2), up to 2,5 years

Measures (Validated Scale)

- Physical Activity (**IPAQ**)
- Social Support (**MSPSS**)
- Anxiety/Depression (**GADS**)
- Mediterranean Diet (**PREDIMED**)
- Nutrition (**SelfMNA**)
- Memory (**MFE**)
- Sleep Quality (**PSQI**)
- Health-Related Quality of Life (**EQ5D3L**)



The document is a 'Sleep Quality' questionnaire. It includes a title 'Sleep Quality', a subtitle 'What is it?', and a brief description: 'The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire that assesses sleep quality and disturbance over a 1-month period. It is a validated and widely used measure of sleep quality. It consists of 19 self-rated items and a 5-item clinician rating scale. The total score ranges from 0 to 21, with higher scores indicating poorer sleep quality. The PSQI is a validated and widely used measure of sleep quality. It consists of 19 self-rated items and a 5-item clinician rating scale. The total score ranges from 0 to 21, with higher scores indicating poorer sleep quality.' Below this is the 'INSTRUCTIONS' section, which reads: 'The following questions refer to your usual sleep habits. For each item, mark the frequency of their occurrence during the past month.' This is followed by a table with columns for 'Frequency' and 'Score'. The 'Frequency' column has options: 'None at all', 'Rarely', 'Sometimes', 'Often', and 'Very often'. The 'Score' column has options: '0', '1', '2', '3', '4', and '5'. The table contains 19 rows of questions related to sleep habits. At the bottom, there is a 'Scoring' section with instructions on how to calculate the total score and a 'Global PFSQ' section.

Measured Outcomes (TechROs)

Devices (TechROs)

- Fitbit Charge 2

Measures (Daily)

- Energy expenditure
- Steps
- Distance
- Sedentary duration
- Physical activity durations (light, moderate, vigorous)
- Sleep duration
- Heart rate



Name: _____

Sleep Quality

What is your sleep quality like? (Please check the box that best describes your sleep quality. You may check more than one box.)

INSTRUCTIONS:
The following questions relate to your sleep during the past month. You are asked to indicate the frequency of sleep and light activities.

During the past month,

| 1 | 2 | 3 | 4 | 5 |
|--|---|---|---|---|
| 1. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 2. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 3. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 4. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 5. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 6. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 7. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 8. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 9. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 10. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 11. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 12. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 13. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 14. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 15. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 16. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 17. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 18. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 19. How often do you wake up during the night? | 1 | 2 | 3 | 4 |
| 20. How often do you wake up during the night? | 1 | 2 | 3 | 4 |

Scoring

| Component | 1 | 2 | 3 | 4 | 5 |
|--------------|---|---|---|---|---|
| Component 1 | 1 | 2 | 3 | 4 | 5 |
| Component 2 | 1 | 2 | 3 | 4 | 5 |
| Component 3 | 1 | 2 | 3 | 4 | 5 |
| Component 4 | 1 | 2 | 3 | 4 | 5 |
| Component 5 | 1 | 2 | 3 | 4 | 5 |
| Component 6 | 1 | 2 | 3 | 4 | 5 |
| Component 7 | 1 | 2 | 3 | 4 | 5 |
| Component 8 | 1 | 2 | 3 | 4 | 5 |
| Component 9 | 1 | 2 | 3 | 4 | 5 |
| Component 10 | 1 | 2 | 3 | 4 | 5 |
| Component 11 | 1 | 2 | 3 | 4 | 5 |
| Component 12 | 1 | 2 | 3 | 4 | 5 |
| Component 13 | 1 | 2 | 3 | 4 | 5 |
| Component 14 | 1 | 2 | 3 | 4 | 5 |
| Component 15 | 1 | 2 | 3 | 4 | 5 |
| Component 16 | 1 | 2 | 3 | 4 | 5 |
| Component 17 | 1 | 2 | 3 | 4 | 5 |
| Component 18 | 1 | 2 | 3 | 4 | 5 |
| Component 19 | 1 | 2 | 3 | 4 | 5 |
| Component 20 | 1 | 2 | 3 | 4 | 5 |

Add all scores together. Global PPG

If score is not 100% or greater, indicate if your sleep quality is poor.

If your score is 100% or greater, indicate if your sleep quality is excellent.

Results

Anxiety / Depression (GADS): Co-Calibrations

Notable PROs (contours of correlations 0.8+)



- All participants
 - Q5A Sleeping poorly
- Healthy participants
 - Q7A Trembling

| Health | PRO | | TechRO | | | Correlation/Contour | | | |
|---------|------------|---------------------------------------|----------|-----------|------------|---------------------|-------|--------|------|
| | Outcome | Variable | Amount | Family | Variable | Lower | r_s | Higher | |
| All | Anxiety | Q3A: irritable | Relative | CLR PA | Vigorous | × | +0.8 | | |
| All | Anxiety | Q5A: sleeping poorly | Relative | CLR PA+S | Light | +0.5 | +0.8 | +0.5 | +0.3 |
| All | Anxiety | Q7A: trembling | Absolute | Processed | Active | | -0.8 | | |
| All | Depression | Q1D: lacking energy | Relative | CLR PA+S | Vigorous | × | -0.8 | | |
| All | Depression | Q6D: lost weight due to poor appetite | Relative | CLR PA+S | Light | × | +0.8 | × | |
| All | Both | Numeric score | Relative | CLR PA+S | Sleep | | +0.8 | | |
| Healthy | Anxiety | Q3A: irritable | Absolute | Processed | Active | | -0.8 | | |
| Healthy | Anxiety | Q7A: trembling | Absolute | Processed | Light+fair | -0.5 | -0.8 | -0.5 | |
| Healthy | Anxiety | Q7A: trembling | Absolute | Processed | Vigorous | × | +0.8 | | |
| Healthy | Anxiety | Q7A: trembling | Absolute | Processed | Active | | -0.8 | | |
| Healthy | Anxiety | Q7A: trembling | Relative | CLR PA | Light | × | -0.8 | × | |
| Healthy | Anxiety | Q7A: trembling | Relative | CLR PA+S | Vigorous | × | +0.8 | | |
| Healthy | Depression | Q2D: lost interest in things | Relative | CLR PA | Light | × | -0.8 | × | |
| Healthy | Depression | Q6D: lost weight due to poor appetite | Relative | CLR PA+S | Sleep | | +0.8 | | |
| Healthy | Depression | Q9D: worse in the morning | Relative | CLR PA+S | Sedentary | | +0.8 | × | |

Color coding: from orange (weak correlation) to green (strong correlation). × depicts an absent significant correlation of the same sign next to the strong correlation.

Memory (MFE): Co-Calibrations

Notable PROs (contours of correlations 0.8+)

- All participants
 - Q24 Forgetting where things are kept
- Healthy participants
 - Q14 Forgetting to do planned things
- Participants with mild disease
 - Q18 Forgetting to tell somebody something important

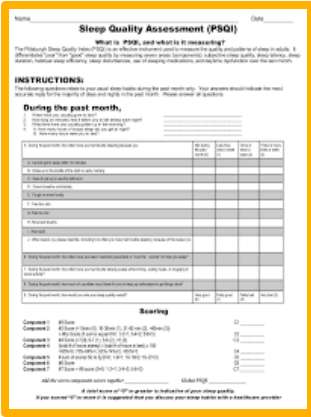


| Health | PRO Variable | TechRO | | Correlation/Contour | | | |
|----------|--|----------|-----------|---------------------|-------|-------|-----------|
| | | Amount | Family | Variable | Lower | r_s | Higher |
| All | Q7: completely forgetting to take things | Relative | CLR PA+S | Sleep | | +0.8 | |
| All | Q12: having difficulty picking up a new skill | Relative | CLR PA+S | Light | × | -0.8 | × |
| All | Q13: finding a word on the tip of the tongue | Relative | CLR PA+S | Sleep | | +0.8 | |
| All | Q24: forgetting where things are normally kept | Relative | CLR PA | Fair | × | +0.8 | × |
| All | Q24: forgetting where things are normally kept | Relative | CLR PA+S | Fair | × | -0.8 | -0.3 |
| All | Numeric score | Absolute | Processed | Active | | -0.8 | |
| Healthy | Q7: completely forgetting to take things | Relative | CLR PA+S | Sleep | | +0.8 | |
| Healthy | Q10: letting ramble about unimportant things | Absolute | Processed | Light+fair | × | -0.8 | × |
| Healthy | Q14: forgetting to do planned things | Absolute | Processed | Fair+vigorous | × | +0.8 | +0.8 |
| Healthy | Q14: forgetting to do planned things | Absolute | Processed | Vigorous | +0.8 | +0.8 | |
| Healthy | Q16: forgetting the topic of an ongoing conversation | Absolute | Processed | Fair | × | -0.8 | -0.4 |
| Healthy | Q24: forgetting where things are normally kept | Relative | CLR PA+S | Fair | × | -0.8 | × |
| Healthy | Numeric score | Relative | CLR PA | Fair | × | -0.8 | × |
| Diseased | Q1: forgetting objects put | Relative | CLR PA+S | Vigorous | -0.7 | -0.8 | |
| Diseased | Q6: forgetting the time of events | Absolute | Raw | Heart rate | | +0.8 | |
| Diseased | Q6: forgetting the time of events | Absolute | Processed | Light | +0.7 | +0.8 | × |
| Diseased | Q6: forgetting the time of events | Absolute | Processed | Sleep | | -0.8 | |
| Diseased | Q8: being reminded about things | Absolute | Processed | Light+fair | +0.6 | +0.8 | × |
| Diseased | Q9: reading anew something already read | Absolute | Processed | Sleep | | -0.8 | |
| Diseased | Q13: finding a word on the tip of the tongue | Absolute | Processed | Active | | -0.8 | |
| Diseased | Q13: finding a word on the tip of the tongue | Relative | CLR PA+S | Sedentary | | +0.8 | +0.7 |
| Diseased | Q18: forgetting to tell somebody something important | Absolute | Processed | Fair | × | -0.8 | -0.8 -0.8 |
| Diseased | Q18: forgetting to tell somebody something important | Absolute | Processed | Fair+vigorous | -0.8 | -0.8 | -0.8 |
| Diseased | Q18: forgetting to tell somebody something important | Absolute | Processed | Vigorous | -0.8 | -0.8 | -0.8 |
| Diseased | Numeric score | Absolute | Processed | Active | | -0.8 | |

Color coding: from orange (weak correlation) to green (strong correlation). × depicts an absent significant correlation of the same sign next to the strong correlation.

Applicability

Applicability: Behavior Changes for Dementia screening



Form: Sleep Quality Assessment (PSQI)

What is PSQI, and what is it measuring?

INSTRUCTIONS:

During the past month,

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |

Scoring

Component 1: 0-5
Component 2: 0-5
Component 3: 0-5
Component 4: 0-5
Component 5: 0-5
Component 6: 0-5
Component 7: 0-5
Component 8: 0-5
Component 9: 0-5
Component 10: 0-5
Component 11: 0-5
Component 12: 0-5
Component 13: 0-5
Component 14: 0-5
Component 15: 0-5
Component 16: 0-5
Component 17: 0-5
Component 18: 0-5
Component 19: 0-5
Component 20: 0-5
Component 21: 0-5
Component 22: 0-5
Component 23: 0-5
Component 24: 0-5
Component 25: 0-5
Component 26: 0-5
Component 27: 0-5
Component 28: 0-5
Component 29: 0-5
Component 30: 0-5



PROs

Gold Standard

TechROs

Emerging

?



Quality of Life Technologies Lab
University of Geneva & University of Copenhagen
qol.unige.ch



Co-calibrating Physical and Psychological Outcomes and Consumer Wearable Activity Outcomes in Older Adults: An Evaluation of the coQoL Method

Vlad Manea, Katarzyna Wac

manea@di.ku.dk, katarzyna.wac@unige.ch

Manea V., Wac K. Co-Calibrating Physical and Psychological Outcomes and Consumer Wearable Activity Outcomes in Older Adults: An Evaluation of the coQoL Method, MDPI Journal of Personalized Medicine, 2020



UNIVERSITÉ
DE GENÈVE

UNIVERSITY OF
COPENHAGEN



STANFORD
SCHOOL OF MEDICINE

Stanford University Medical Center



EUROPEAN
COMMISSION



EUROPEAN
COMMISSION



AAL
AGENCY FOR ALZHEIMER ASSISTANCE



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra



FONDS NATIONAL SUISSE
SCHWEIZERISCHER NATIONALFONDS
FONDO NAZIONALE SVIZZERO
SWISS NATIONAL SCIENCE FOUNDATION



Research
at Google



Quality of Life Technologies Lab
University of Geneva & University of Copenhagen
qol.unige.ch

European
Network of
Living Labs

Thank You



Igor Matias and the QoL Team

Quality of Life, Center for Informatics, University of Geneva, Switzerland

igormatias.com | igor.matias@unige.ch



UNIVERSITÉ
DE GENÈVE

UNIVERSITY OF
COPENHAGEN



STANFORD
SCHOOL OF MEDICINE

Stanford University Medical Center



EUROPEAN
COMMISSION



EUROPEAN
COMMISSION



AAL
ASSISTED ASSISTANCE LIVING



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra



FONDS NATIONAL SUISSE
SCHWEIZERISCHER NATIONALFONDS
FONDO NAZIONALE SVIZZERO
SWISS NATIONAL SCIENCE FOUNDATION



Research
at Google