

UNRAVELLING THE EFFECTS OF ACUTE STRESS OUTCOMES ON OCCUPATIONAL EXPERIENCES: PILOTING OF THE STRESS AT WORK (STRAW) PROJECT IN THE AUSTRALIAN WORKFORCE

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In partial fulfilment of Master of Ergonomics, Safety and Health

INTRODUCTION

- **High work-related stress in office-based workers** (Alberdi et al., 2016; Hadgraft et al., 2016)
- **Limited unobtrusive and continuous early stress detection models available** (Cassar et al., 2020; Orneck & Esin, 2020)
- **STress at Work (STRAW) protocol established to address limitations** (Bolliger et al., 2020)
- **Not previously explored in Australia**
- **Research aim**
 - To investigate the feasibility and acceptability of the protocol in examining acute occupational stress in Australian workers in sedentary roles.

Occupational stress

- Imbalance between perceived ability to cope with demands in working environment (Béjean & Sultan-Taïeb, 2003; Jay et al., 2015)
- Negative effects on employee physical and psychological health (Crosswell & Lockwood, 2020)
- Changing work patterns, e.g., increased cognitive demands, work intensification, declining work efficiency
- Increased focus on acute stress and sedentary work
- 81% of workers reporting some exposure to sedentary work (Straker et al., 2016)



An integrated approach

- Significant gaps in data collection methods
- Multiple modalities required in real-world settings (Alberdi et al., 2016)
- Increase in novel approaches for acute stress detection models
- STress at Work (STRAW) protocol (Bolliger et al., 2020)
- Explore day-to-day stress among academic staff
- Wearable technology, ecological momentary assessments (EMAs), smartphone sensor and usage data
- Novel combination requiring further investigation

Fig 1. *Bolliger et al. (2020) study.*



International Journal of
*Environmental Research
and Public Health*



Study Protocol

Protocol of the STress at Work (STRAW) Project: How to Disentangle Day-to-Day Occupational Stress among Academics Based on EMA, Physiological Data, and Smartphone Sensor and Usage Data

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Received: 30 September 2020; Accepted: 25 November 2020; Published: 27 November 2020



Note. From “Protocol of the STress at Work (STRAW) Project: How to Disentangle Day-to-Day Occupational Stress among Academics Based on EMA, Physiological Data, and Smartphone Sensor and Usage Data,” by L. Bolliger, J. Lukan, M. Luštrek, D. De Bacquer and E. Clays, 2020, *International Journal of Environmental Research and Public Health*, 17, p. 1

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METHODS

- Pilot study of prospective observational design
- Research aim:
 - 1) To investigate the feasibility of Bolliger et al.'s (2020) STRESS at Work (STRAW) protocol in examining occupational stress in Australian workers in sedentary roles, and
 - 2) To understand the acceptability of the protocol to workers.
- Replicate existing protocol
- Repeated measurements of EMAs and wristband data over 15 working days
- Eight participants from project engineering firm
- Inclusion criteria:
 - Work at least 80% of working week
 - Agree to use Android smartphone (install app)
 - Wear Empatica E4 wristband continuously
 - Access to computer to transfer data
 - Permission from supervisor to participate

Fig 2. STRAW protocol for the Australian pilot study.



Ecological Momentary Assessment (EMA) 

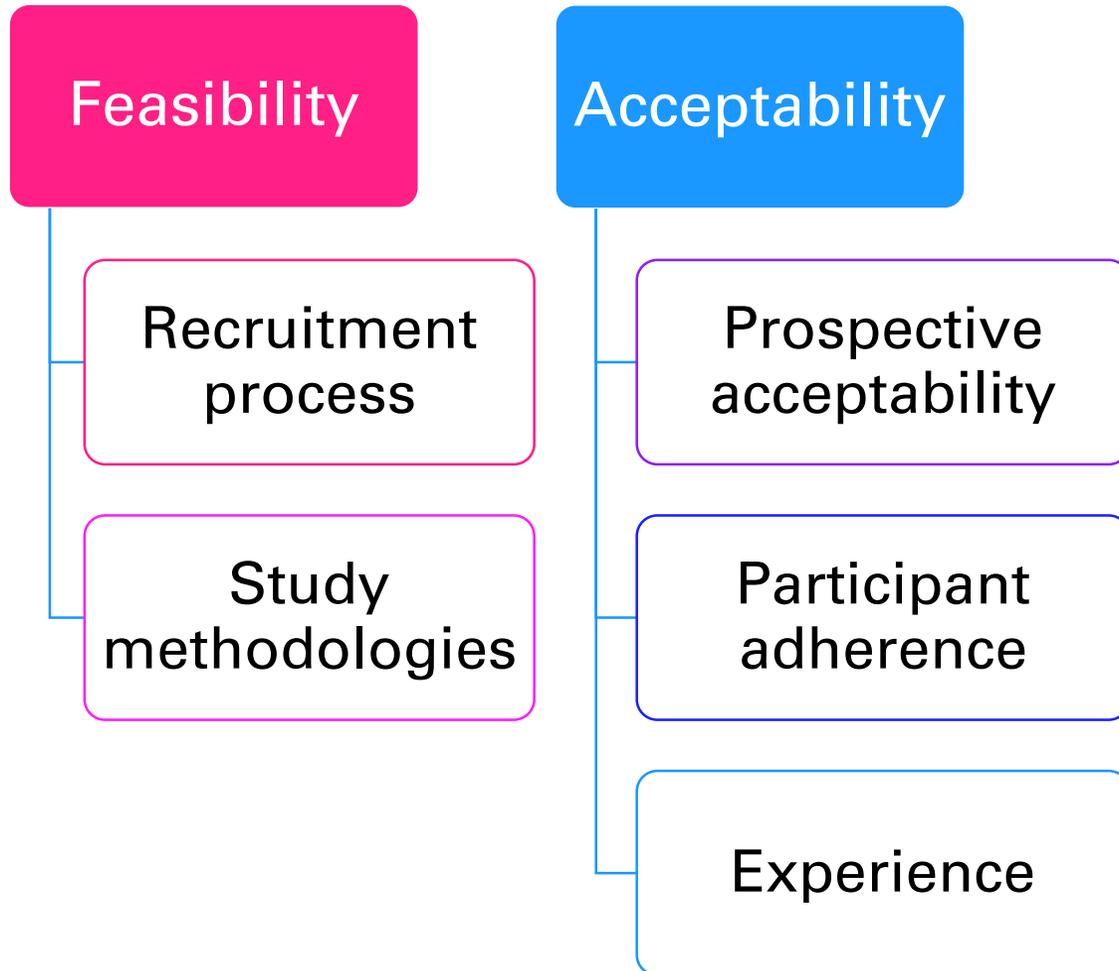
-  After every 90 minute-interval during working hours of weekdays, and 1x/day in the morning and evening
- 
 - Work environment risk factors
 - Self-perceived stress outcomes
 - Activities: current task, coffee consumption, smoking and breaks
 - Working hours each day

Wristband-based Measures 

-  Continuously during all waking hours of weekdays (and 1 night during the week)
- 
 - Acceleration
 - Electrodermal activity
 - Heart rate
 - Heart rate variability
 - Skin temperature

Note. Adapted from “Protocol of the STress at Work (STRAW) Project: How to Disentangle Day-to-Day Occupational Stress among Academics Based on EMA, Physiological Data, and Smartphone Sensor and Usage Data,” by L. Bolliger, J. Lukan, M. Luštrek, D. De Bacquer and E. Clays, 2020, *International Journal of Environmental Research and Public Health*, 17, p. 4 (<https://doi.org/10.3390/ijerph17238835>). Copyright 2020 by the authors.

Study outcomes



Successful depending on:

- Percentage of participants completing the full data collection period
- Percentage completion rate of daily EMAs
- Percentage completion rate of baseline survey

RESULTS

The background features a color gradient from light purple on the left to a darker blue on the right. It is decorated with various abstract patterns: wavy lines, a circular area with a dashed border, a grid of small white crosses, and a grid of small white dots. In the upper left, there are three small white symbols: a plus sign, an open circle, and a solid dot. In the lower right, there are three more symbols: a solid dot, a plus sign, and an open circle. A thin white vertical line is positioned on the left side of the page.

Feasibility

% completion of full-data collection

- 87.5% retention rate
- Mean daily recording length: 9-hours and 11-minutes
- Mean 10.7 days
- Incomplete recordings, i.e. <8-hours (15.2%), and missing recordings (13.3%)



% completed EMAs

- 361 EMAs completed
- Mean completion 51.57 EMAs per participant (SD 35.73).
- Missing data due to technical difficulties (56.1%), skipped/incomplete surveys (36.3%), removed (4.3%), and scheduled day off (3.3%)



% completed baseline survey

- Mean completion time 62.63 minutes (SD 32.08)
- Two required greater than 100 minutes to complete
- 100% completion rate



Acceptability

Prospective acceptability



Burden reported by all participants

Connectivity issues with wristband and E4 Manager (n = 7)
EMAs too frequent (n = 6)
EMAs triggering at incorrect times (n = 5)



Barriers to participation

Baseline survey too long (n = 7)
EMA frequency (n = 4)
Wording of EMAs not clear (n = 4)
Forgetting smartphone (n = 3)
Ongoing technical issues (n = 2)

Acceptability

Participant adherence

EMAs

- 49.1% completion rate
- Low due to high perceived burden
- 50.9% skipped or incomplete EMAs
- Adherence decreased to 31.02% between Day 11 and Day 15

Wristbands

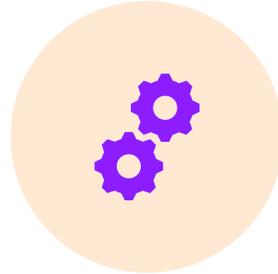
- 71.4% completion rate
- Low adherence due to daily transfers
- 60% transferred once a week
- Perceptions of time

Acceptability

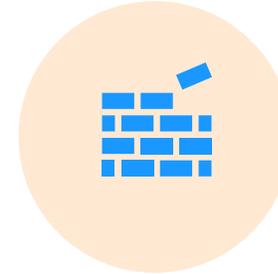
Experience



POSITIVE
SATISFACTION



SIMPLE AND
STRAIGHTFORWARD
(71.42%)



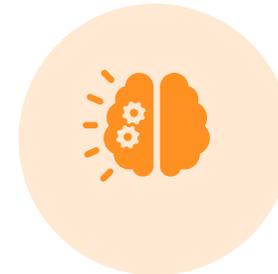
EMA 'BURDENSOME'



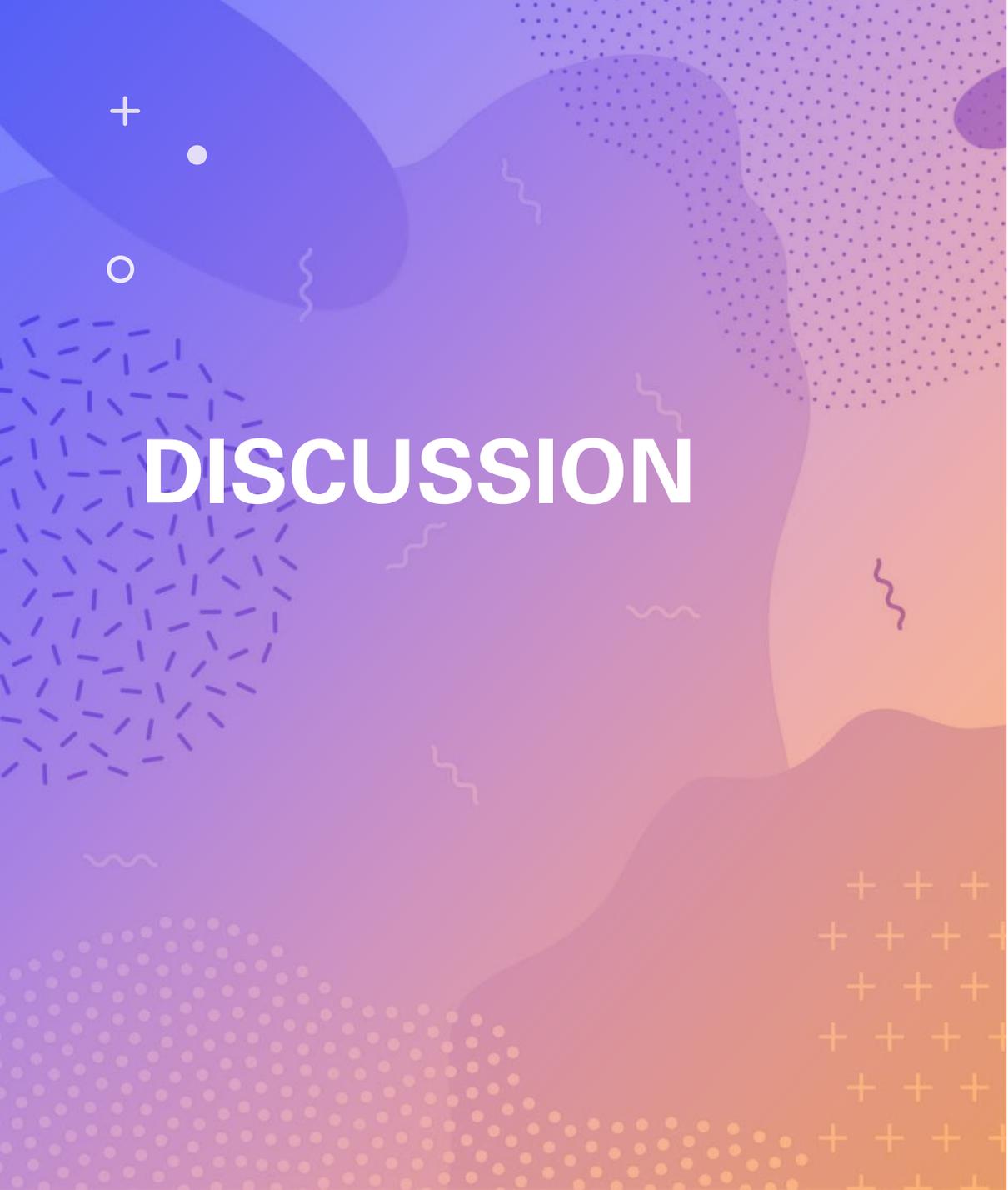
WOULD NOT PARTICIPATE
IN SIMILAR STUDY
(28.57%)



UNABLE TO IDENTIFY
EMOTION (N = 2)



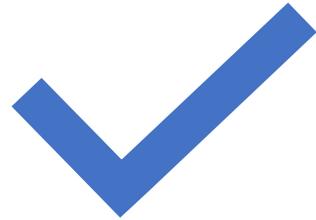
MORE AWARE OF
FEELINGS (N = 1)



DISCUSSION

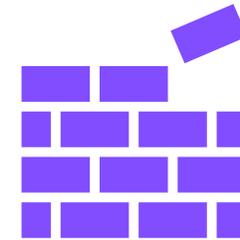
- Moderate feasibility and low acceptability
 - Requires modifications for future studies
 - Key findings:
 - Additional resourcing required
 - Protocol modifications
 - Time and resource requirements high
 - Significant participant demand
- 

Strengths and limitations



Strengths

- Replicated existing protocol
- Implemented in real-world setting
- Analysed feasibility and acceptability



Limitations

- Limited time and resources
- Small sample size (under-powered)
- Single organisation and workforce

Future considerations



Protocol modifications



Additional resourcing



Smartphone sensor and usage data

CONCLUSION

- Pilot study to investigate feasibility and acceptability of STRAW protocol to workers in Australia
- Findings
 - Moderate feasibility
 - Low acceptability
- Requires reasonable modifications to be suitable
- Study contributions
 - 1) Applied into a different contextual environment
 - 2) Enabled refinement of the protocol
 - 3) Enhance meaning and implications, provides opportunity to trial analysis methods

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