

# My PhD and Post-Doctoral Research

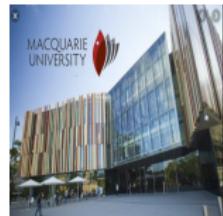
Jing Xu

kenny.xu@duke-nus.edu.sg  
Centre for Quantitative Medicine, Duke-NUS Medical School, Singapore

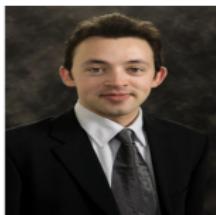
- Proportional hazard model estimation under dependent censoring using maximum penalized likelihood
  - Brodaty, et al. (2014). Predictors of Institutionalization in Dementia: A three Year Longitudinal Study. *Journal of Alzheimer's Disease.*
  - Xu, et al. (2018). Proportional hazard model estimation under dependent censoring using copulas and penalized likelihood. *Statistics in Medicine.*
  - Xu, J., Ma, J. and Fung, T. (2020). *survivalMPLdc*: Survival Analysis under Dependent Right Censoring using Maximum Penalised Likelihood. R package version 0.1.0.

# Team-PhD

- **Statistic:** Dr Jing Xu, A/Prof Jun Ma, Dr Thomas Fung



- **Medicine:** Dr Michael Connors, Prof Henry Brodaty



- Multi-Level Micro-Randomized Trial : Detecting the Proximal Effect of Messages on Physical Activity
  - Xu, et al. (2020). Multi-Level Micro-Randomized Trial for Detecting the Proximal Effect of a Mobile Application Messages on Physical Activity in Diabetes and Depression. arXiv.
  - Aguilera, et al. (2020). An mHealth app using machine learning to increase physical activity in diabetes and depression: clinical trial protocol for the DIAMANTE Study. BMJ Open.

# Team-Postdoc

- **Statistician:** Dr Jing Xu, A/Prof Bibhas Chackraborty, Miss Xiaoxi Yan



- **Social Welfare:** A/Prof Adrian Aguilera, Dr Caroline Figueroa



- **Computer Scientist:** Dr Joseph Williams



# DIAMANTE Study

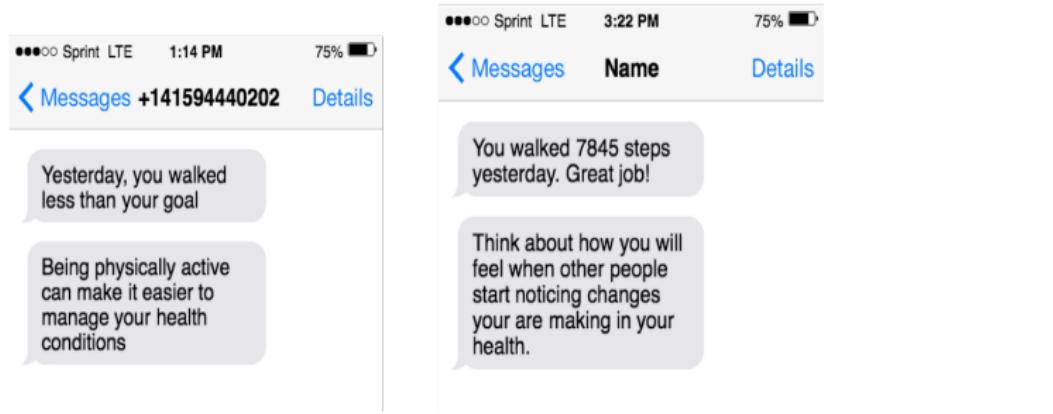
DIAbetes and Mental Health Adaptive Notification Tracking and Evaluation:  
adaptive-learning and clinic-integrated mobile intervention targeting physical activity  
to manage co-morbid diabetes and depression in low-income, ethnic minority patients  
served in the San Francisco Health Network



Source: <https://diamante.healthysms.org/>

# Developmental Goal of DIAMANTE Study

2 different messages every day, 1 minute apart



- Learn to send better messages to patients to encourage them to walk more
- Messages are multi-component interventions, with varying levels of: (a) Time Window (when to send the message), (b) Feedback Message, and (c) Motivational Message

# Design for DIAMANTE study

- The proposed design is called “Multi-Level Micro Randomized Trial”.
  - It involves multiple message components with more than 2 levels.
  - For each message component, new levels can be added through the study period.
  - The possible message levels for each participant are randomized at each sequential decision point.
  - It captures the “just-in-time” adaptive intervention purpose of mobile intervention.
  - Proximal outcome is the walking steps in next 24-hour after a message level sent.

# Analysis Plan

- Data structure: longitudinal dataset with time varied interventions
- Hypothesis test: no proximal effect vs proximal effect exists
- Analysis type: generalized estimating equations
- Parameter estimator: least square
- Test statistics: Chi-squared (Large sample) or Hotelling  $t^2$  (small sample)

# Sample Size Calculation

- Power-based:
  - Number of sequential randomization
  - Effect size
    - Initial standardized effect
    - Average standardized effect
    - Trend of standardized effect over time
  - Desired power (80%)
  - Significance level (5%)
- Precision-based: desired power is replaced by desired coverage probability while effect size is replaced by margin of error.