Leveraging Natural Language Processing and Thematic Analysis to Understand Personal Sensing Acceptability in Opioid Use Disorder Patients

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Opioid Use Disorder (OUD)

- The chronic use of opioids for non-medical reasons that causes clinically significant distress or impairment.
- Affects over 2.1 million people in the United States.
- In 2021, over 80,000 people in the United States died from an opioid overdose.
- Very few people seek treatment.

Dydik, Jain, and Gupta 2024; NIDA 2023

Individual

- Stigma
- Lack of social support
- Cost of care

McLean, Murphy, and Kruis 2024

Individual

- Stigma
- Lack of social support
- Cost of care

Provider/Institutional

- Low treatment availability in rural areas
- Low variety of treatment options
- System navigation

McLean, Murphy, and Kruis 2024

Individual

- Stigma
- Lack of social support
- Cost of care

Provider/Institutional

- Low treatment availability in rural areas
- Low variety of treatment options
- System navigation

Societal/Systematic

- Laws surrounding treatment
- Flawed justice system
- Lack of education about addiction

McLean, Murphy, and Kruis 2024

Digital Therapeutics

- Accessible 24/7 and can be used in conjunction with traditional care or by itself.
- These personalized treatments use personal sensing and machine learning to predict and recommend.
- While the potential for reaching a largely underserved population is high, it requires individuals find personal sensing acceptable.

Acceptability of Personal Sensing

- People with alcohol use disorder using sensing methods for three months found methods to be acceptable.
- There are reasons to suspect this could be different among those with other substance use disorders, particularly opioid use disorder.

Wyant et. al, 2023

Demographic Differences

- In urban populations, such as Philadelphia, PA, distrust of the police may result in bystanders not intervening when someone is experiencing an overdose.
- In rural areas, limited availability of medication treatment has led to overdose-related deaths surpassing urban overdose-related deaths in 2015.
- African Americans and other historically marginalized groups are less likely than White people to receive medication, live near a provider of such medications, or continue treatment for opioid use disorder.
- Women have higher rates of comorbid depression and anxiety, poorer quality of life, and face more stigma.
- Individuals of a lower SES are less likely to be treated or be referred for treatment for opioid use disorder.

Marcu et al. 2019; Lister et al. 2020; Barnett et al. 2023; Di Paola et al. 2022; Siddiqui and Urman, 2022

Aims of Study

- Assess if individuals with opioid use disorder from a national sample find personal sensing methods to be acceptable.
- Identify important themes from qualitative data to identify strengths, challenges, and barriers for applying sensing-based treatments to people with OUD.


sharing
helps
bother
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app
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bit
issue
takes
positive
data
bad
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private
locations
survey
answer
matter
everyday
knowing
personal
track
focus
deal
lot
text
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hard
call
star
past
feel
video
reminds
forget
helped
affect
texts
drug
battery
comment
research
answers
love
hate
nice
guys
feels
opioid
accurate
days
cool
holds
sober
explain
beneficial
money
months
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invasion
forward
indifferent
constant
hindsight
intrusive
moment
burden
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behaviors
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complaints
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relapse
upset
reality
options
process
glitches
usage
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talking
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quickly
passcode
forefront
grocery
detailed
tedious
leaving
content
abuse
future
pays
pick
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categories
shorter
literally
analyze
worry
wrong
necessity
submit
reminders
restaurant
solution
compensated
experience
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meaningful
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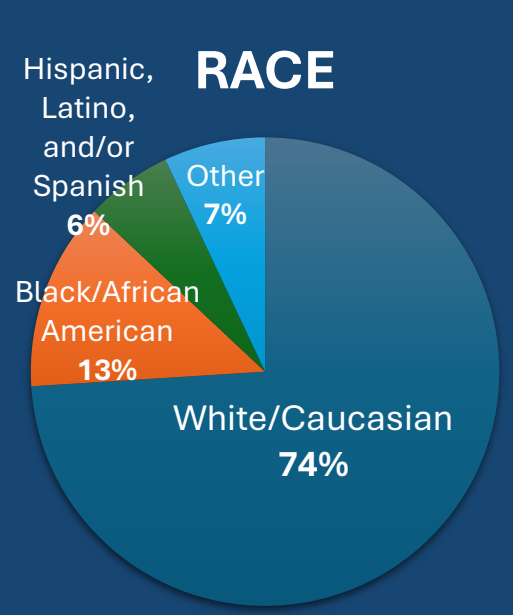
continue

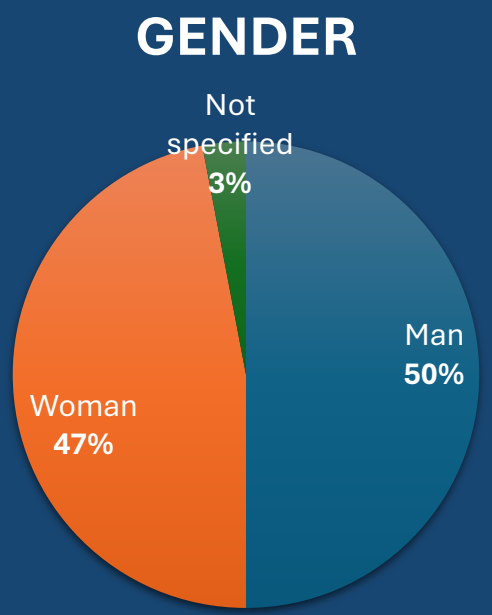
Procedure




“Please share any positive or negative comments you have about [Sensing Method].”

Study Demographics





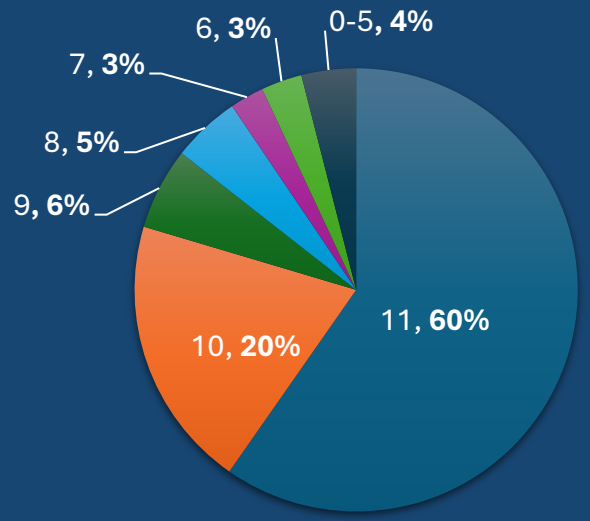
Age ranged from 22-65+
90% of our sample fell between 26 – 55 years old

Participants reside in 38 states across the US

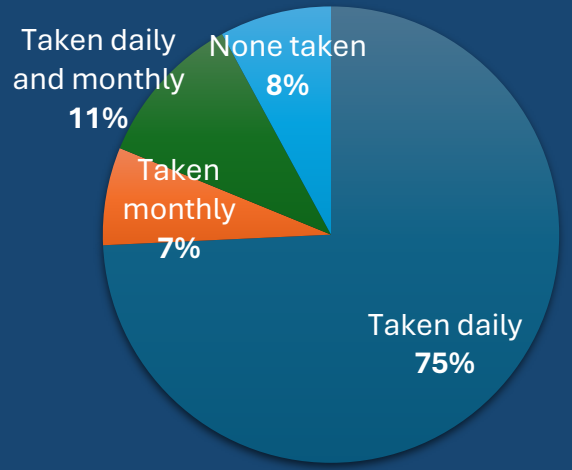
N = 200

Clinical Characteristics

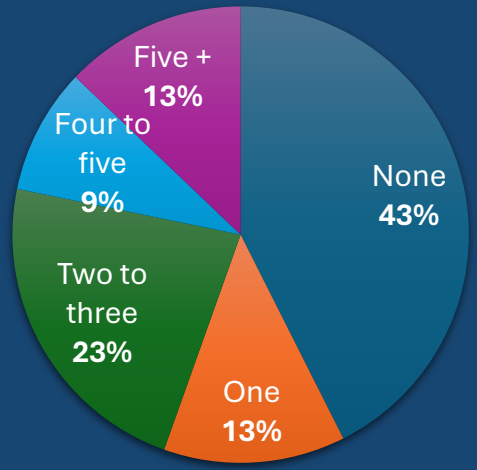
DSM 5 SYMPTOM SCORE



MEDICATION STATUS

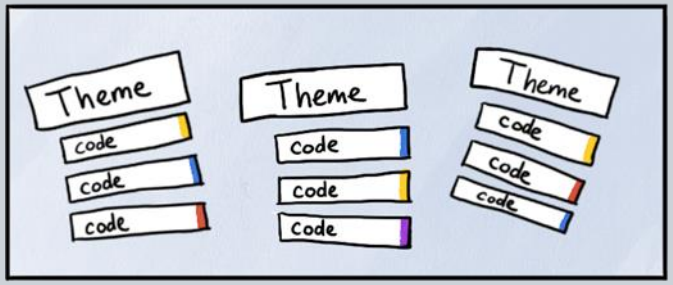


LIFETIME OVERDOSES



N = 200

Methods

Thematic Analysis	Topic Modeling
• Top-down approach • Driven by research aims and questions • Deductive codes informed by prior research • Inductive codes iteratively created	• Bottom-up approach • Driven by data • Identifies clusters of words that co-occur frequently together. • Allows new and unexpected categories to emerge as being important
	

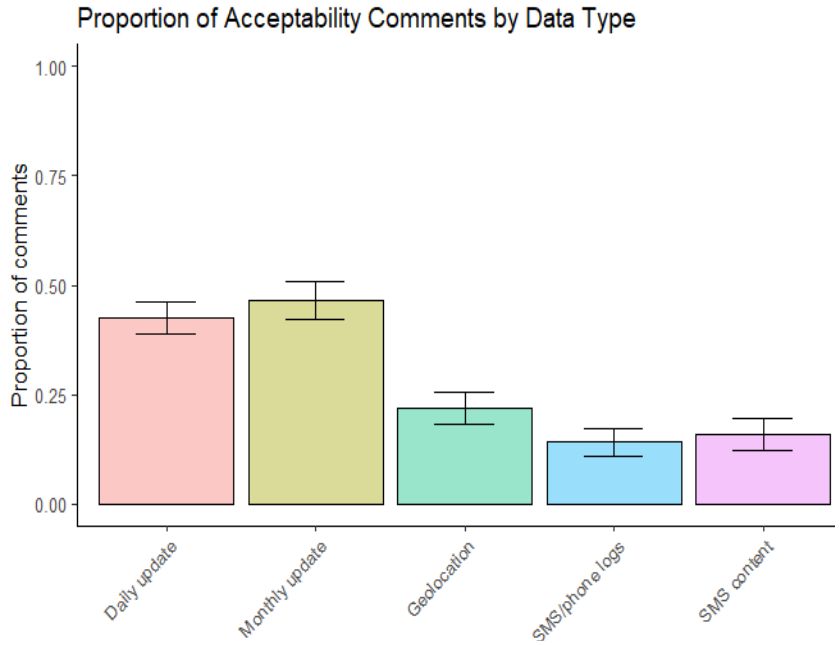
Thematic Analysis

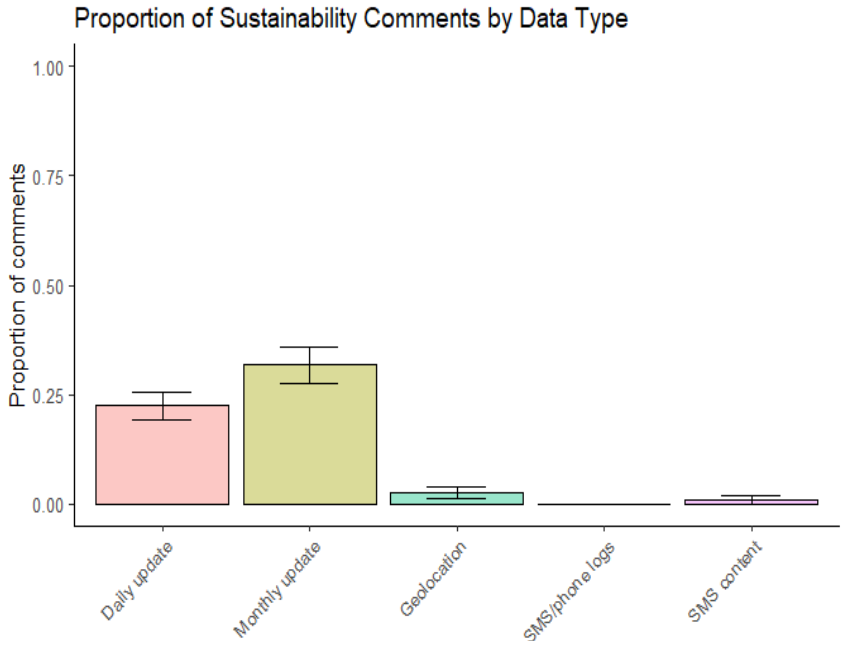
- Total comments: 1,356
- Total comments coded: 647
- Discrepancies were found using R and resolved by coder #1
- Report the overall percentage of comments in each theme and separately by data type
- We then report percentage of comments by data type and demographic characteristic (race/ethnicity, gender, and income)

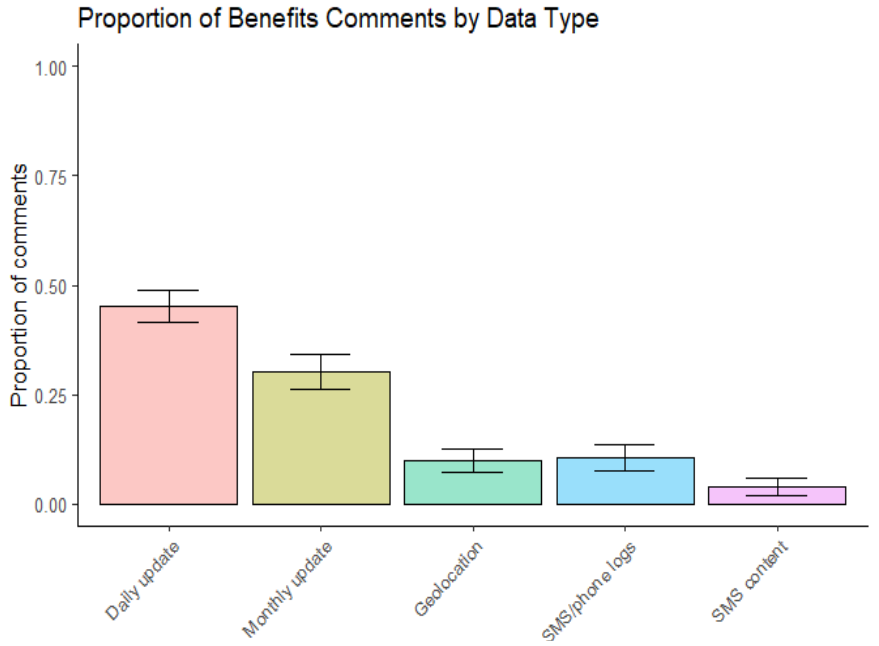
Thematic Analysis - Themes

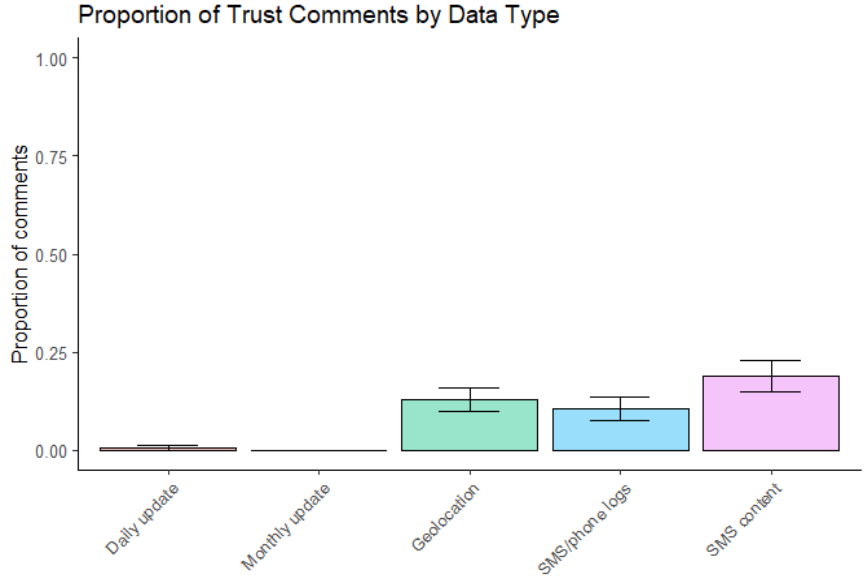
Theme	Comment	% of comments, (n)
Acceptability	“It’s a good tool that makes me look back and reflect on how I’m doing in my recovery.”	30.14%, (195)
Sustainability	“I have worked this daily update into my routine.”	13.14%, (85)
Benefits	“It helps me stay sober.”	22.87%, (148)
Trust/Privacy	“It’s a bit of an invasion of privacy but I understand why it’s needed for the study.”	15.45%, (100)
Usability	“I think it’s great and very precise about the information you asked.”	15.76%, (102)
Feedback	“It would be nice to explain certain things that caused me to use.”	51.93%, (336)

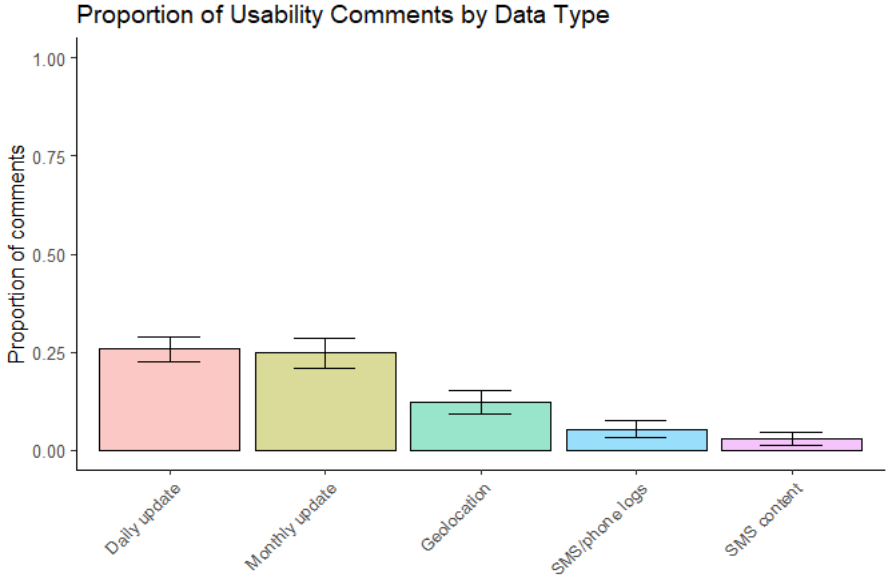
Proportion of Comments by Data Type - Themes







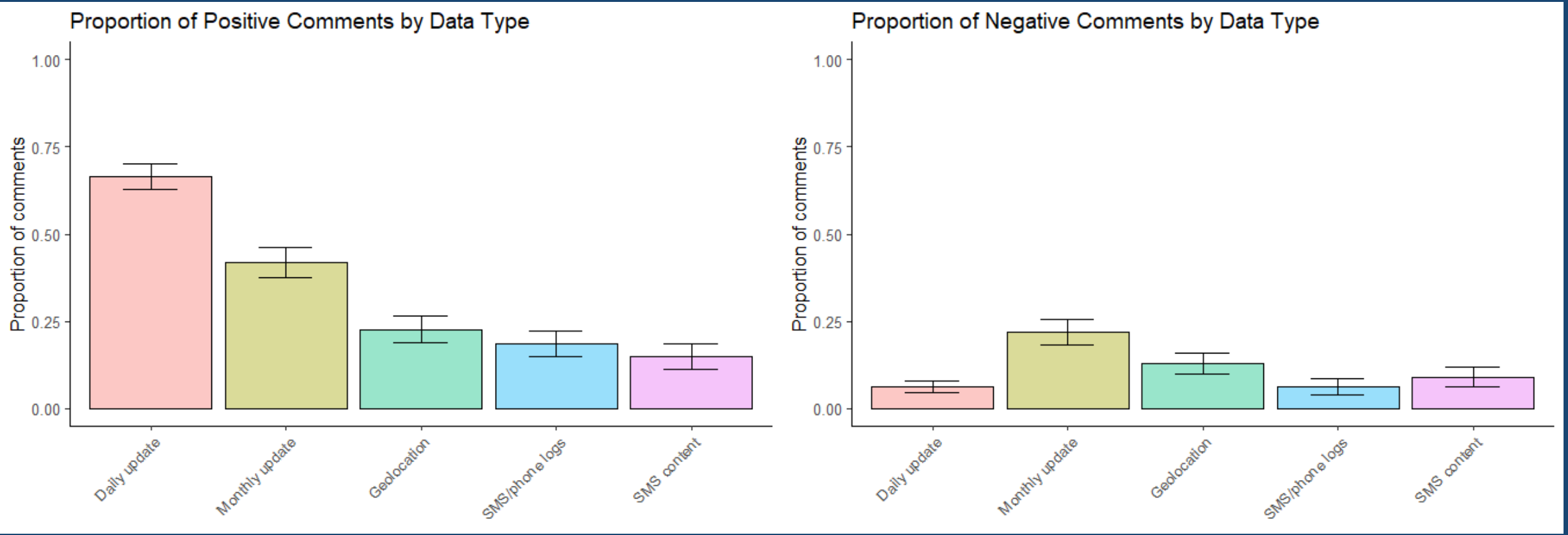




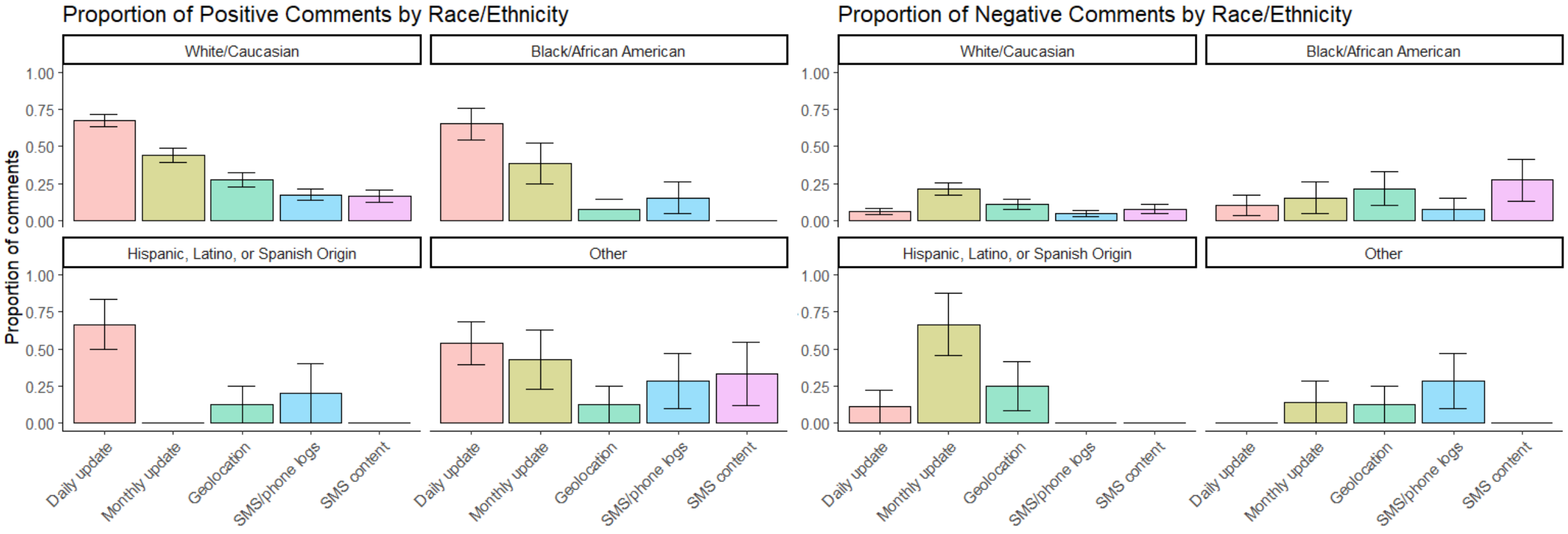
Thematic Analysis - Affect

Affect	Comment	% of comments, (n)
Positive 	"The program and daily updates have helped my recovery and helped me to evaluate my emotions and actions."	36.63%, (237)
Negative	"I just disliked how it drained the battery on my phone so quickly."	10.97%, (71)
Neutral/mixed	"I don't mind providing this information."	52.24%, (338)

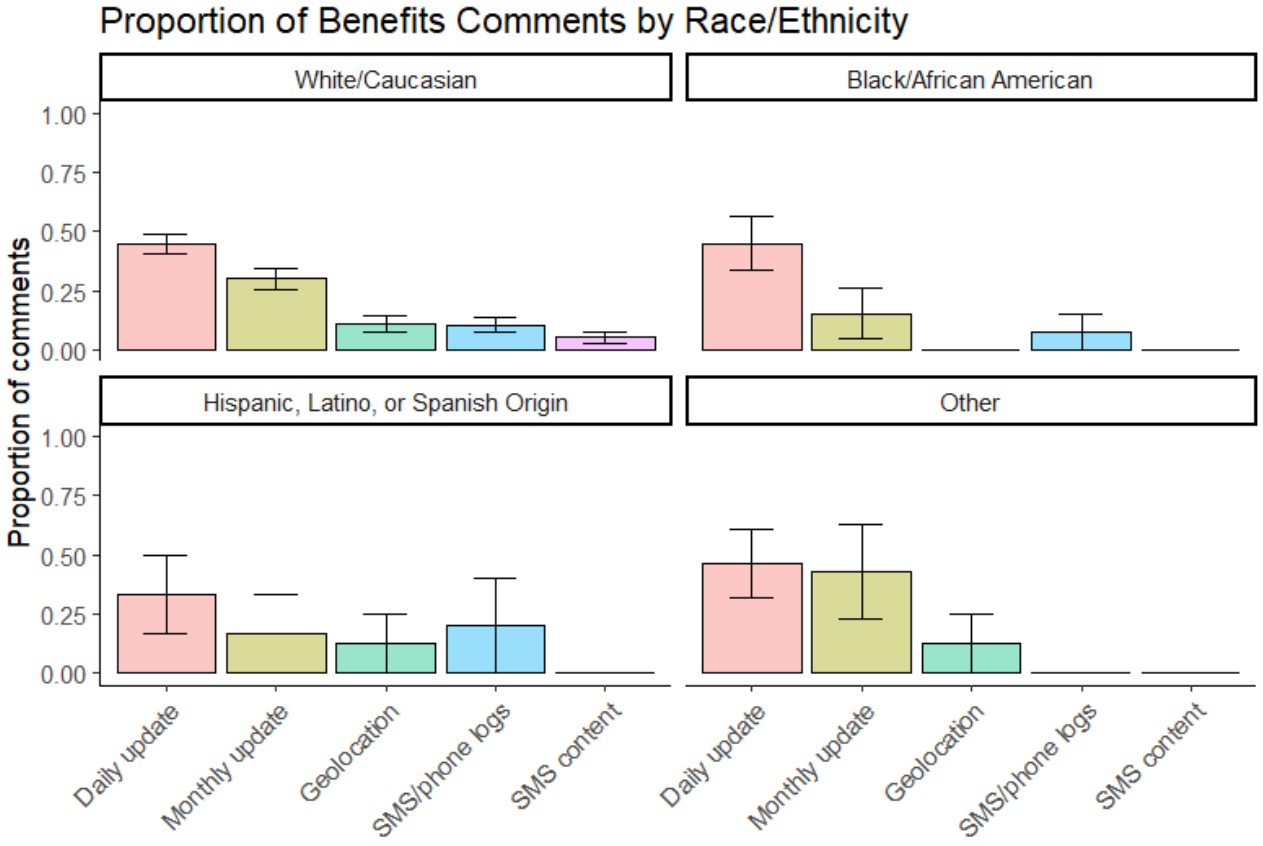
Proportion of Comments by Data Type - Affect

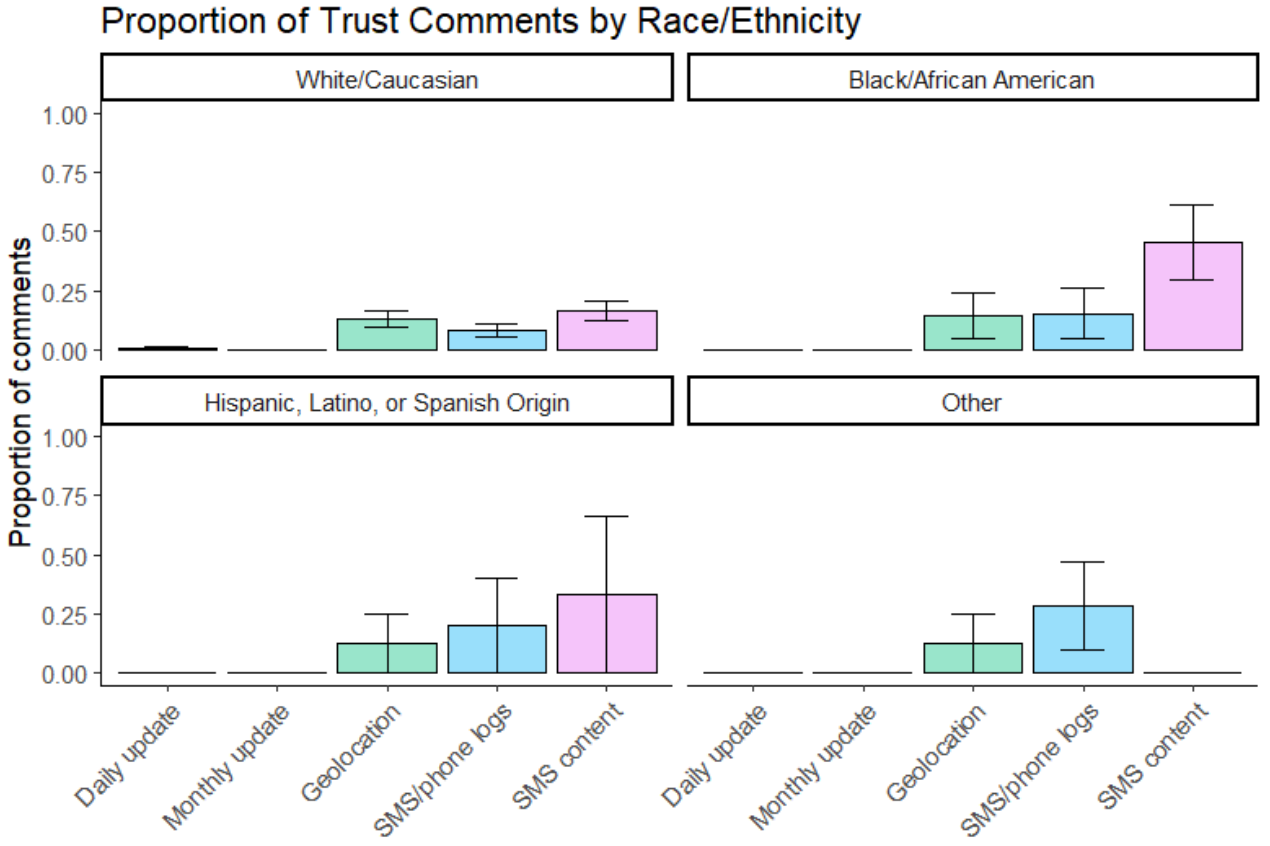


Demographic Differences in Themes - Race



Demographic Differences in Themes - Race





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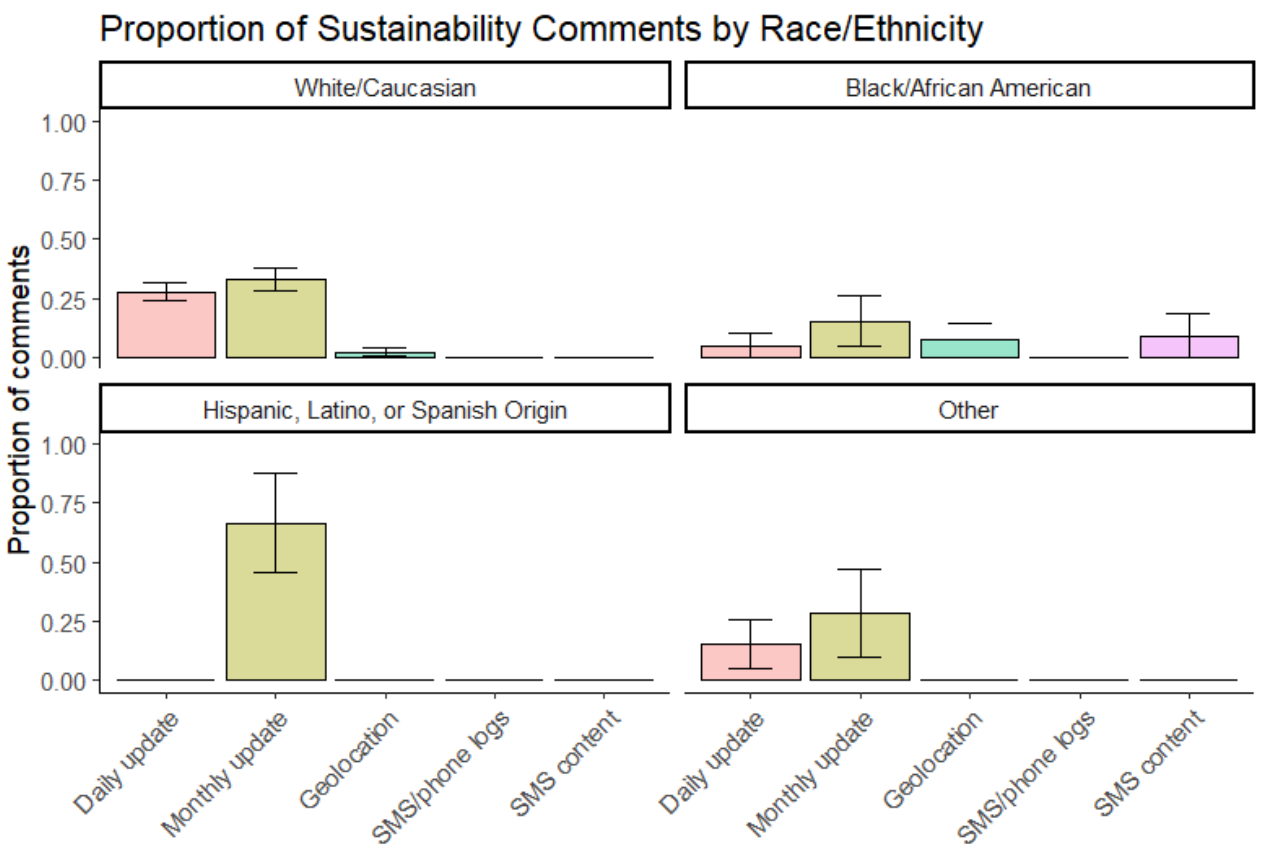
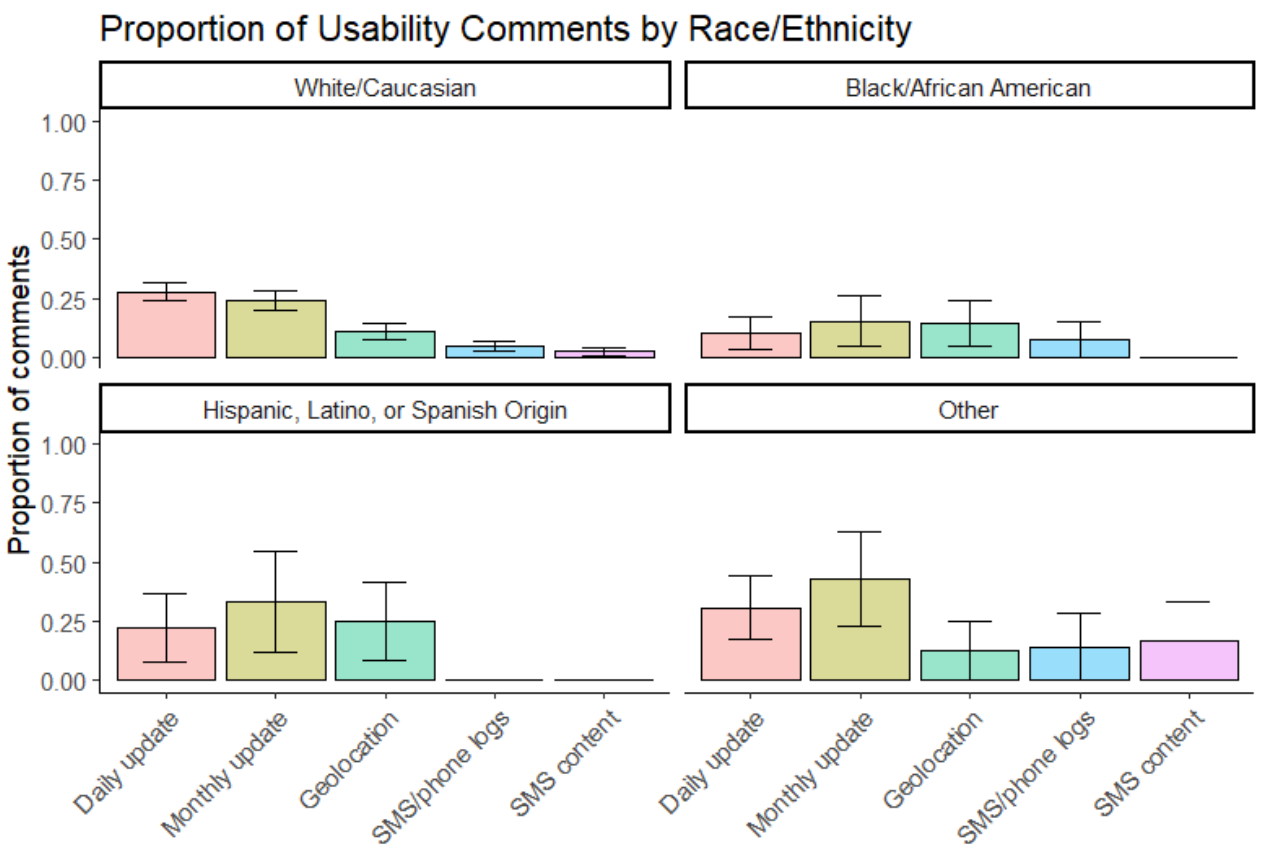
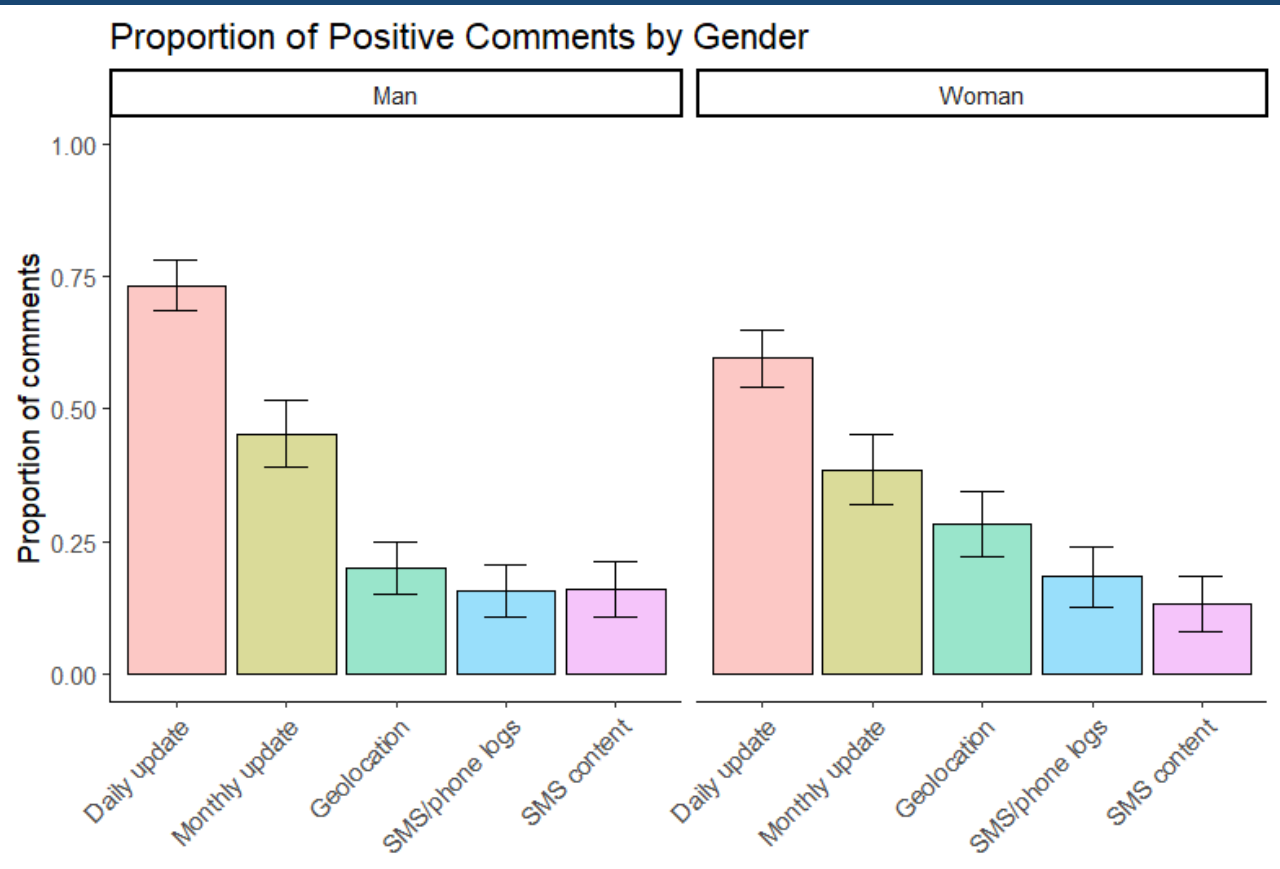
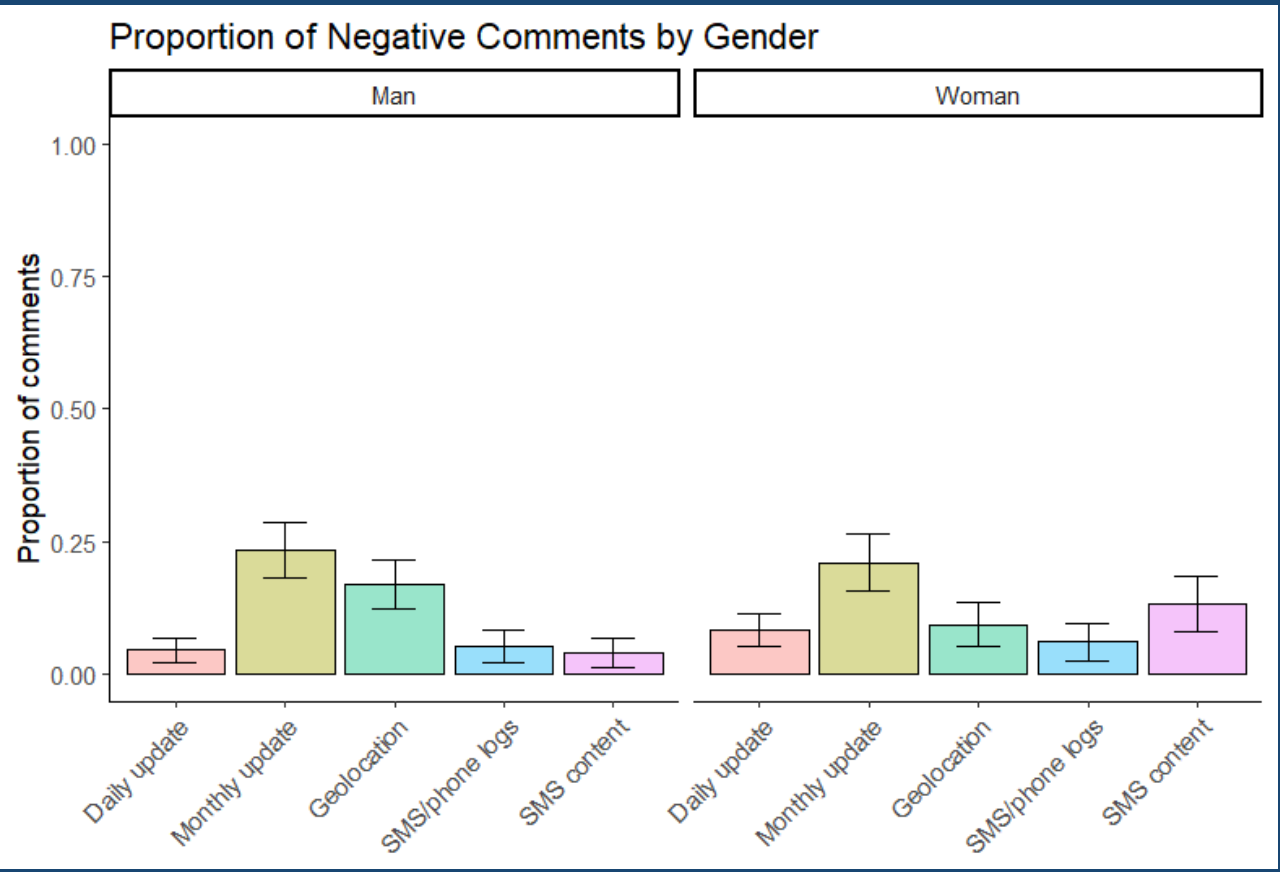


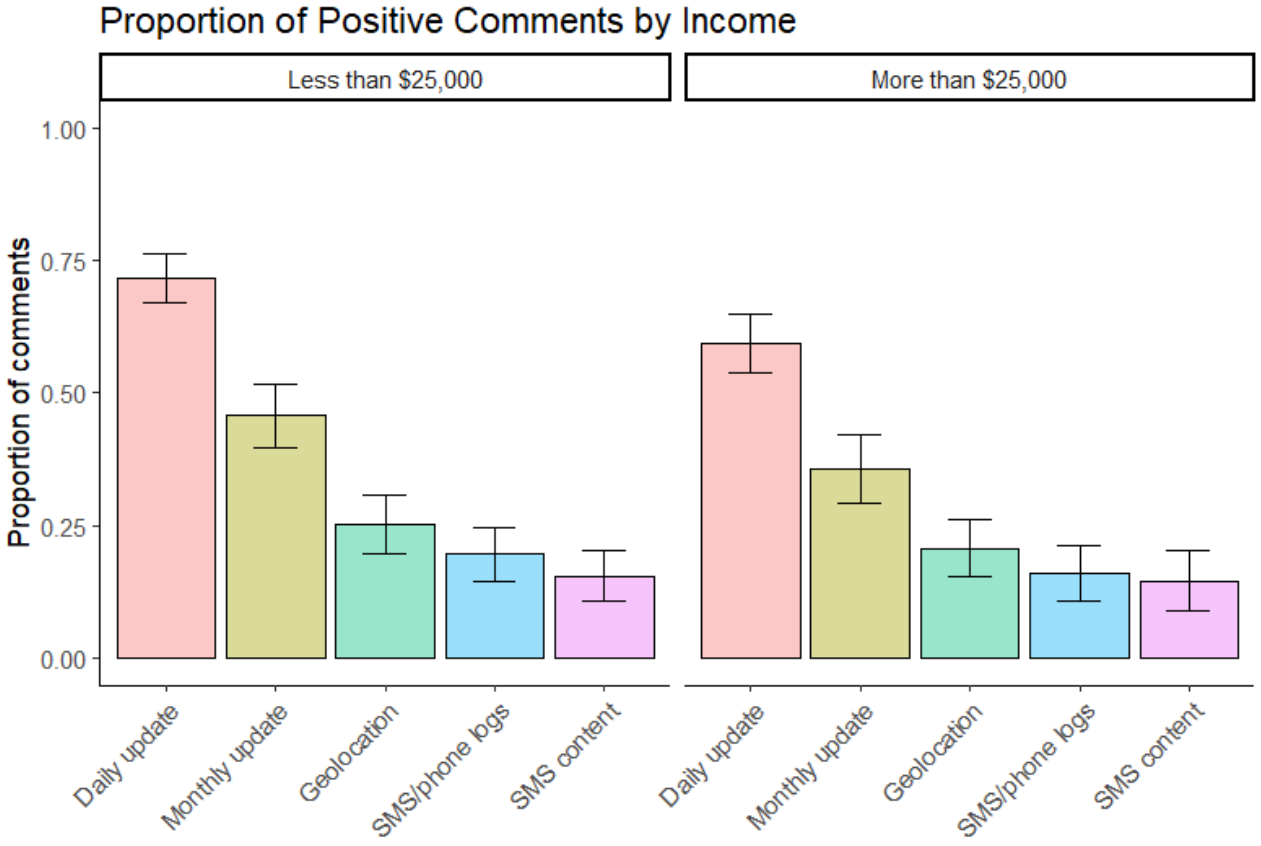


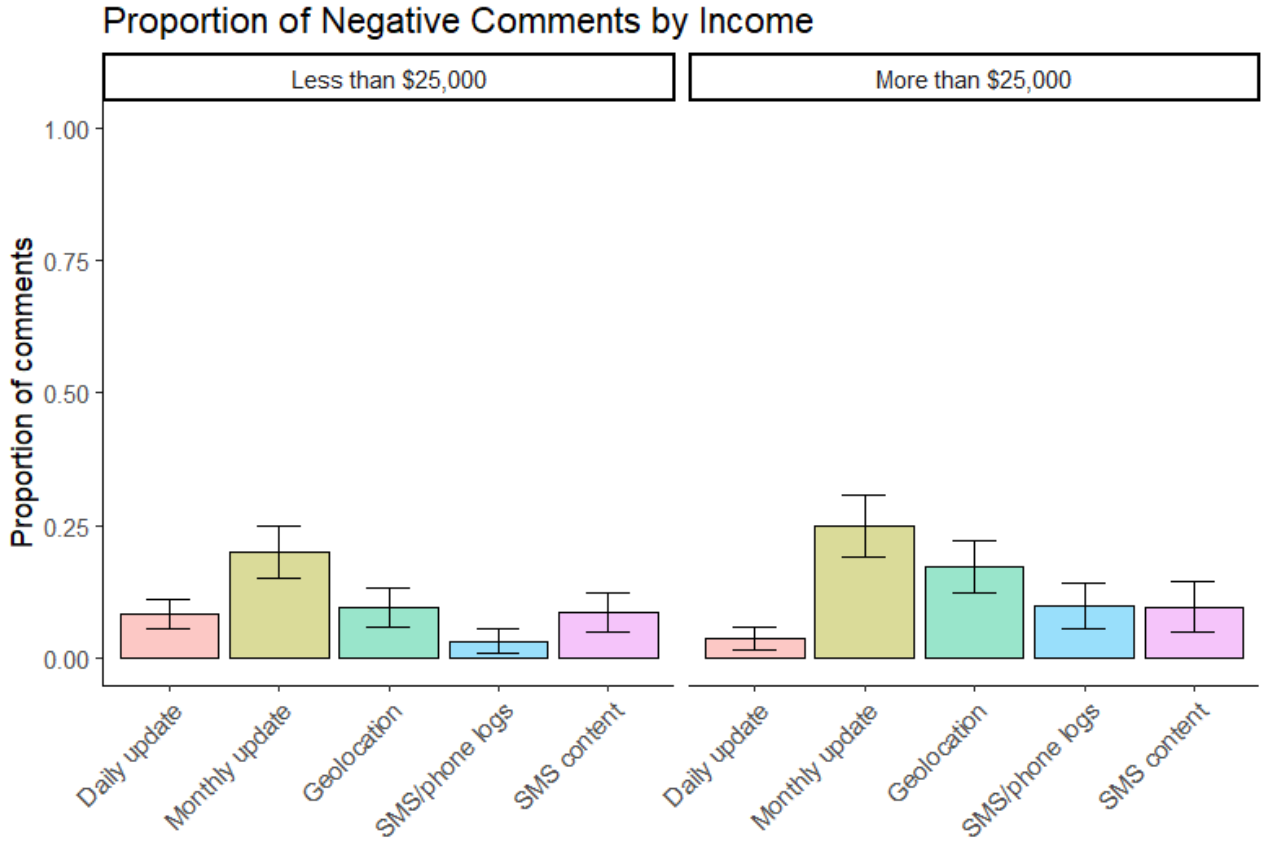
Demographic Differences in Themes - Gender





Demographic Differences in Themes - Income

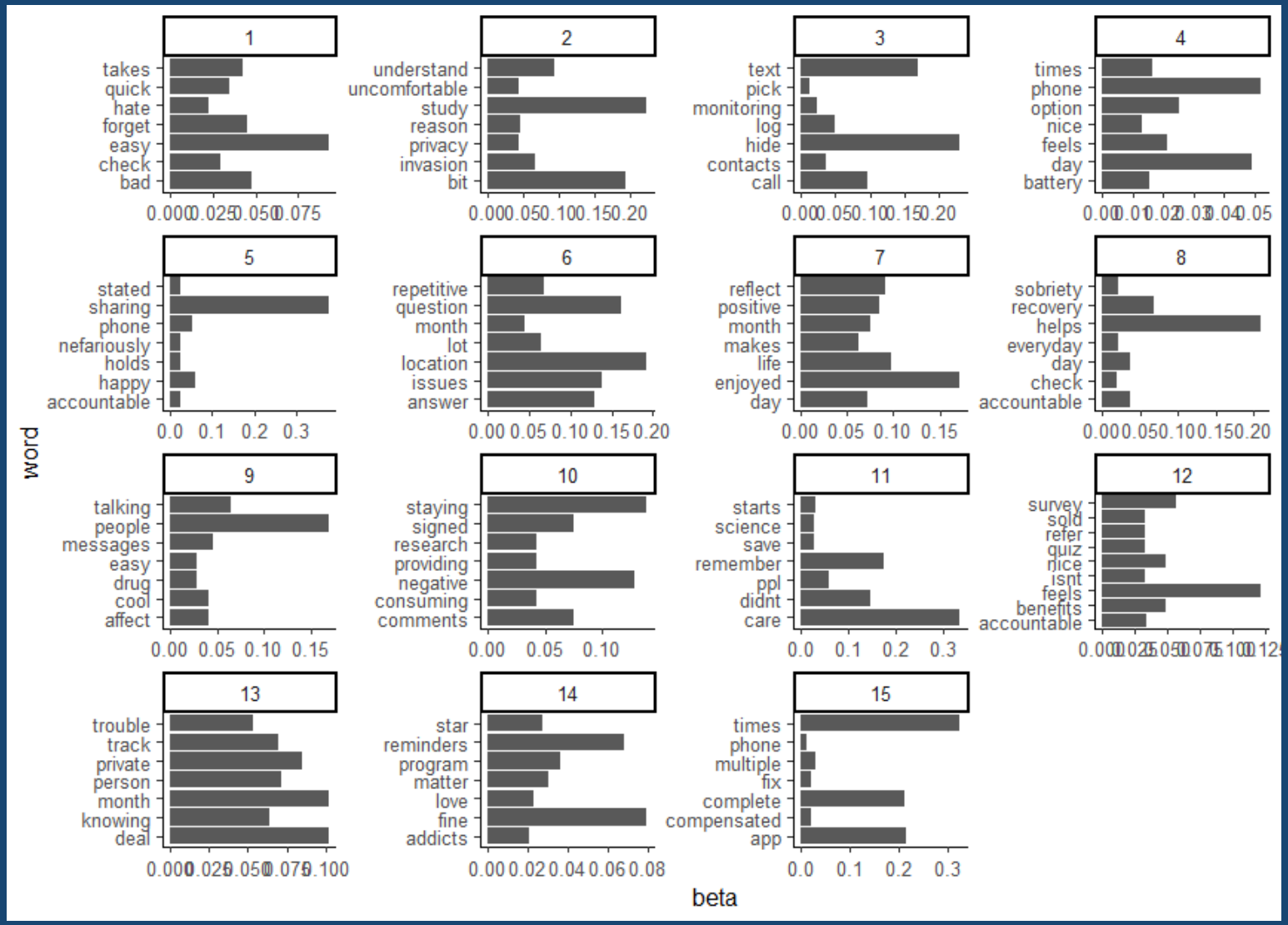




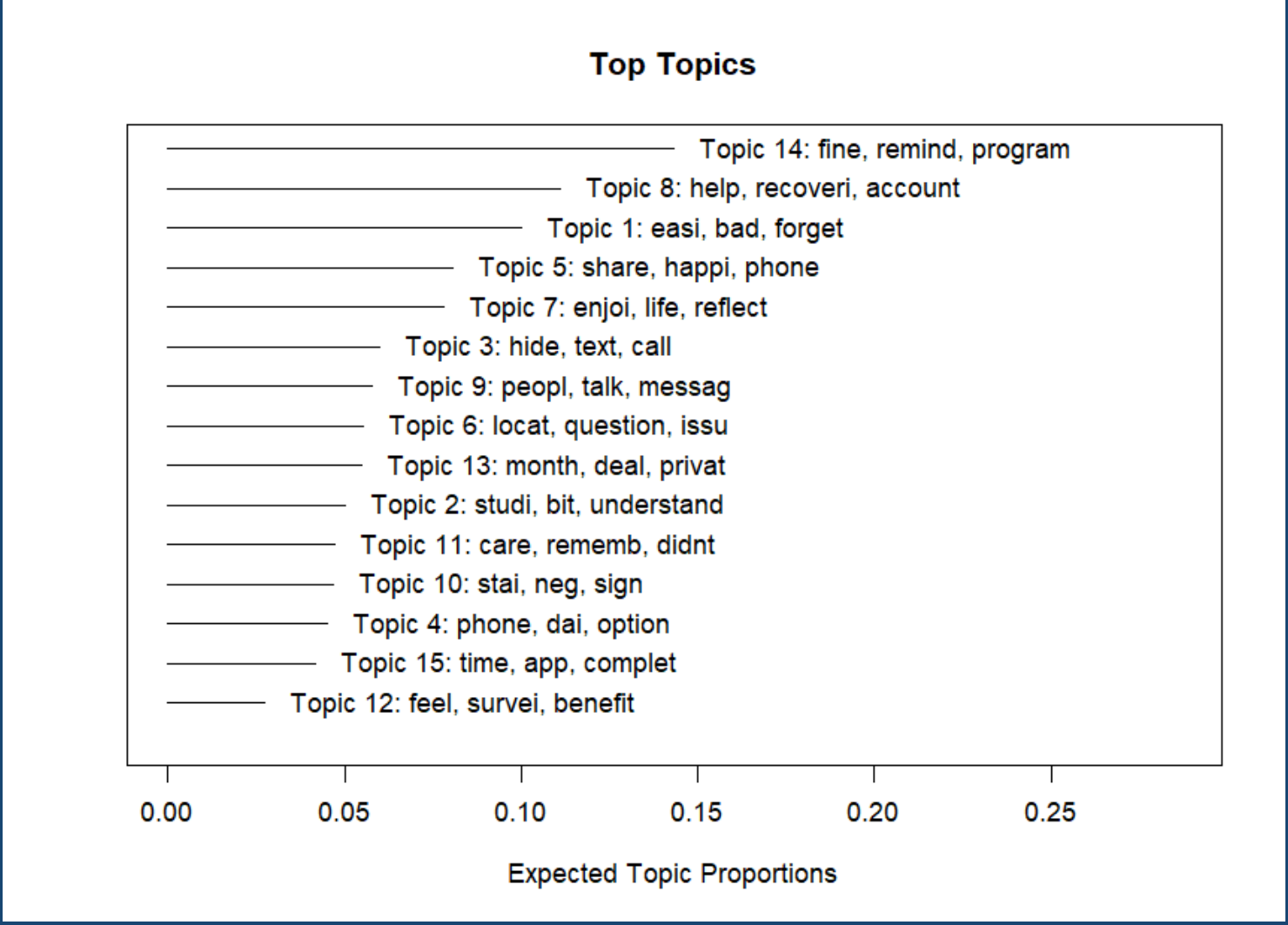
Topic Modeling

- Fit a structural topic modeling controlling for covariates of race and data type
- We looked at the top words defined by FREX, a metric that evaluates word frequency and exclusivity to a topic
- We found that there were 15 unique topics

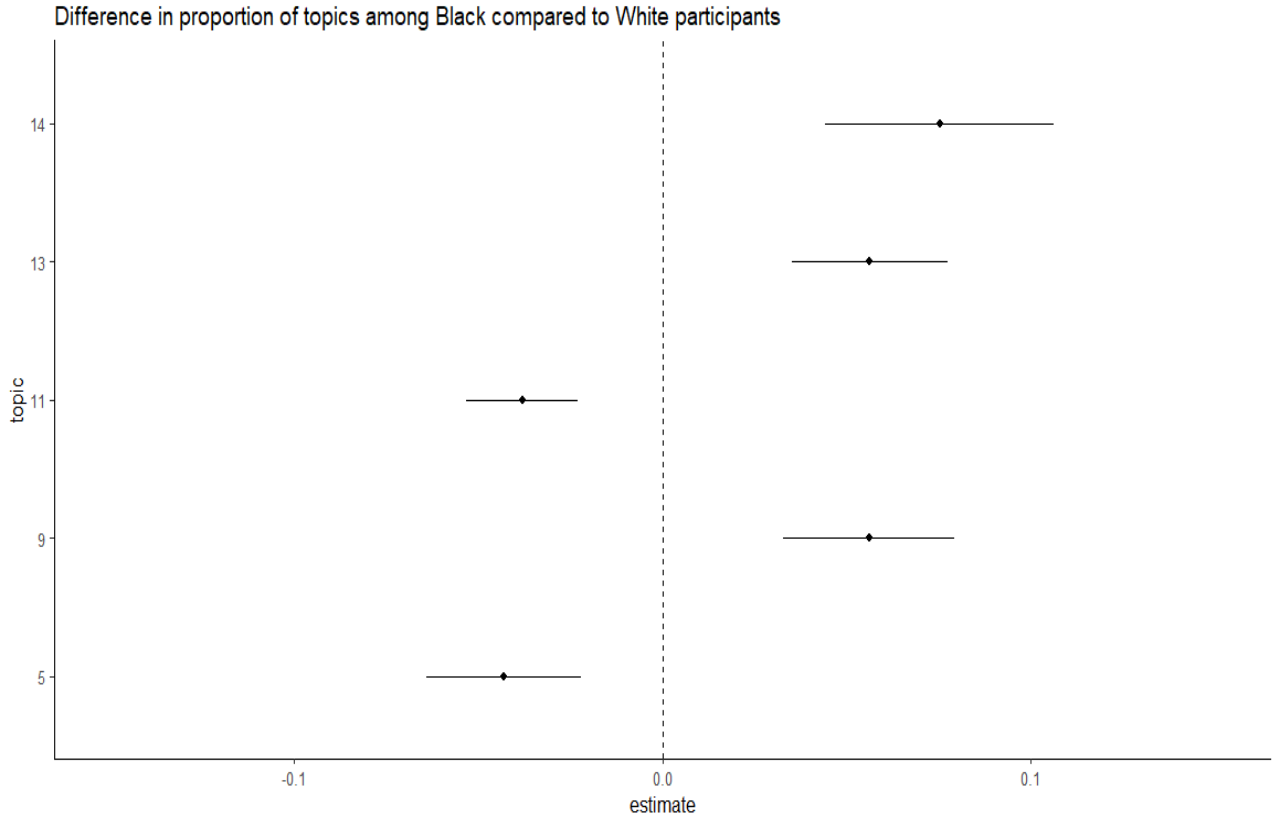
Identified Topics

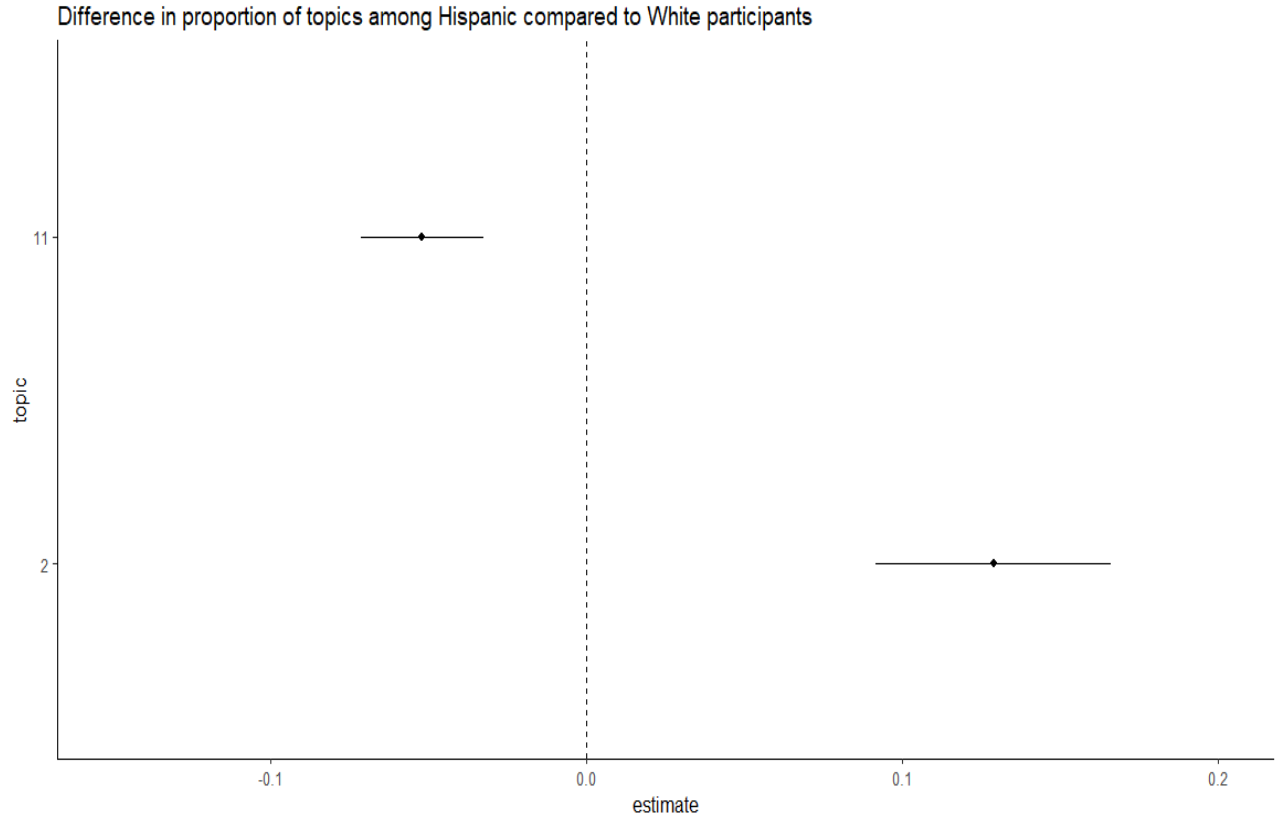


Proportion of Topics



Demographic Differences in Themes - Race





Implications

- Participants found these methods to be acceptable and saw benefits from using them
- Participants largely reported positively about these methods
- Acceptability of personal sensing types varies across racial/ethnic groups, but is relatively the same across gender and income
- Digital therapeutics could be a viable treatment method for those with opioid use disorder

Future Directions

- End-of-study survey
  - Gauging participant reactions after using personal sensing methods for a full year
- Location data
  - Looking at if participants live in a rural, suburban, or urban setting
- Linguistic Inventory and Word Count (LIWC)
  - Top-down approach that analyzes text based on predefined linguistic categories

Thank You!

John Curtin and Kendra Wyant

Addiction Research Center

Brad Postle and Sarah Sant'ana

PREP Faculty and Mentors

Questions?

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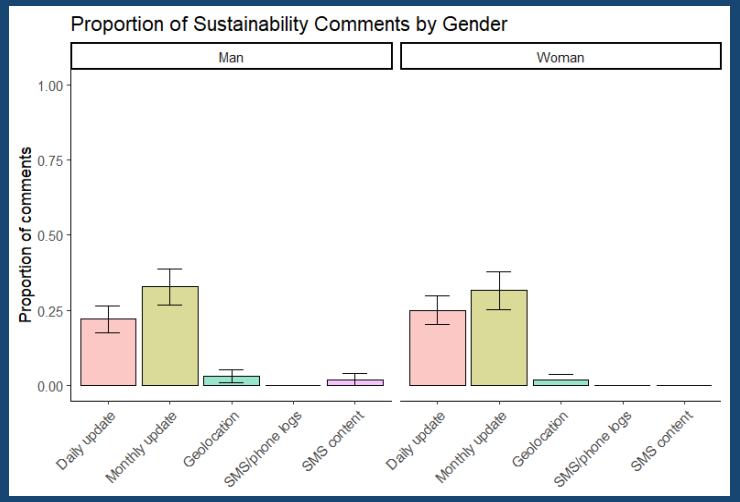
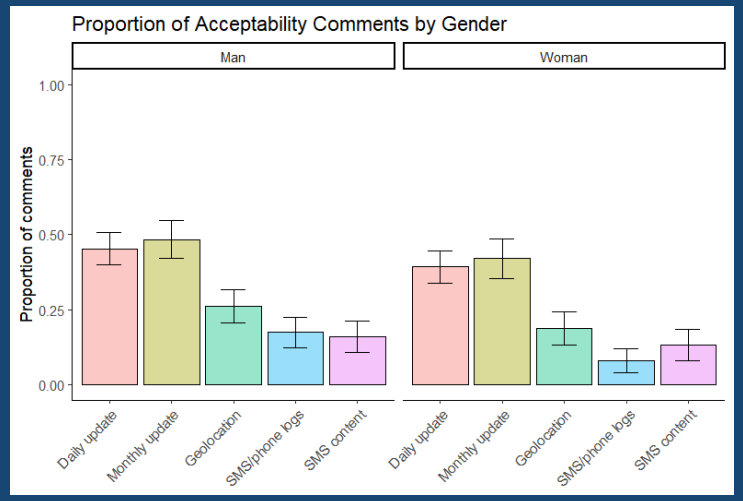
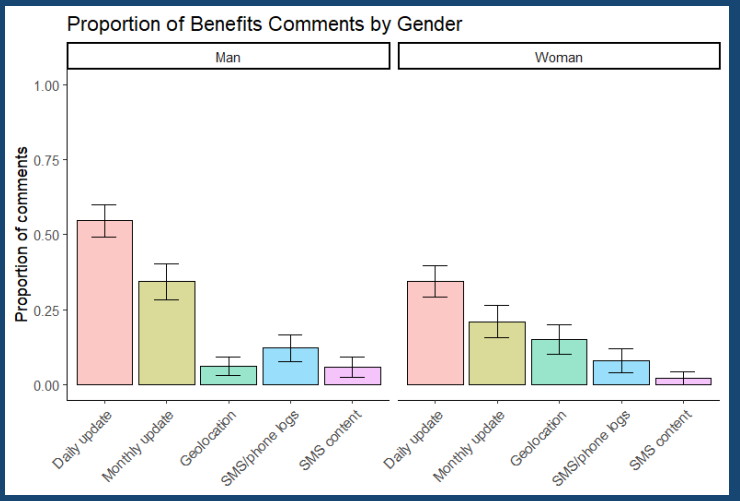
Thematic Analysis – Additional Themes

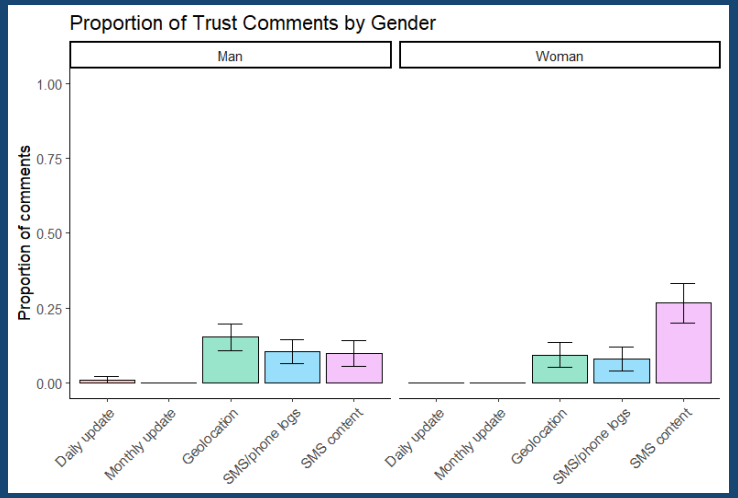
Theme	Comment	% of comments, (n)
Getting in trouble	“Idk. Don't wish to get anyone in trouble.”	0.77%, (5)
Data already tracked	“Everyone is being tracked.”	1.08%, (7)
Research/Study/Science	“Nothing to say its part of the program its not hard to do.”	5.87%, (38)
Honesty	“Nothing to hide here.”	4.79%, (31)

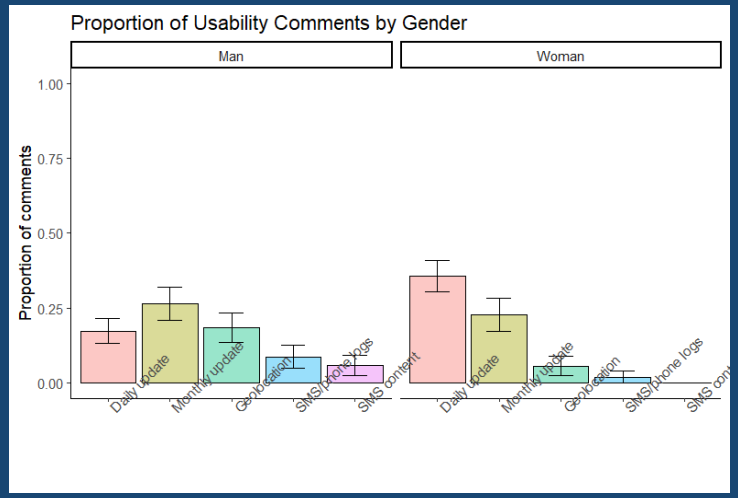
Demographic Differences in Themes - Gender



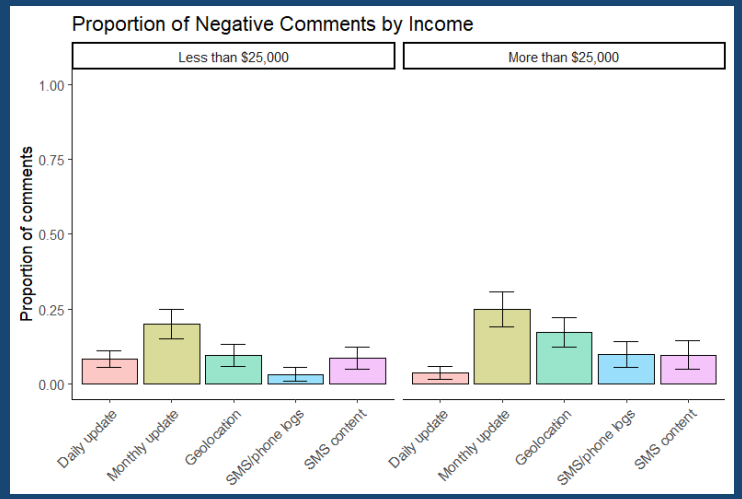


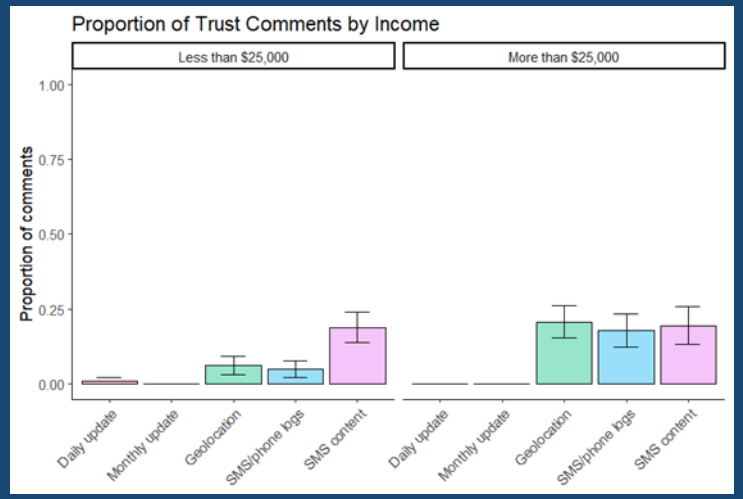


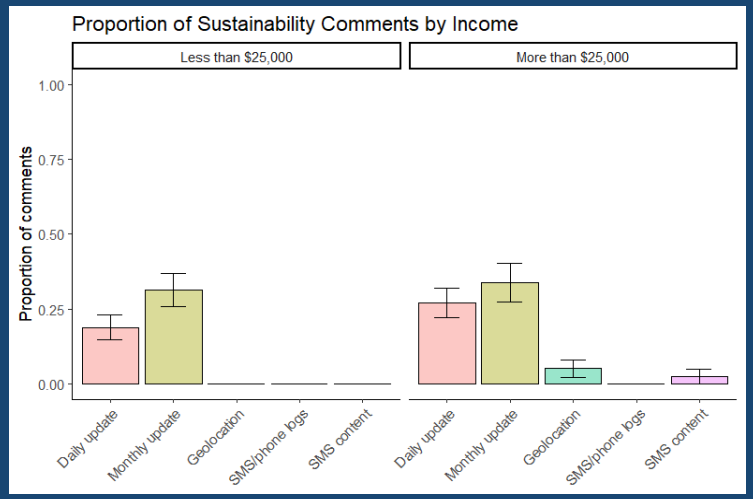


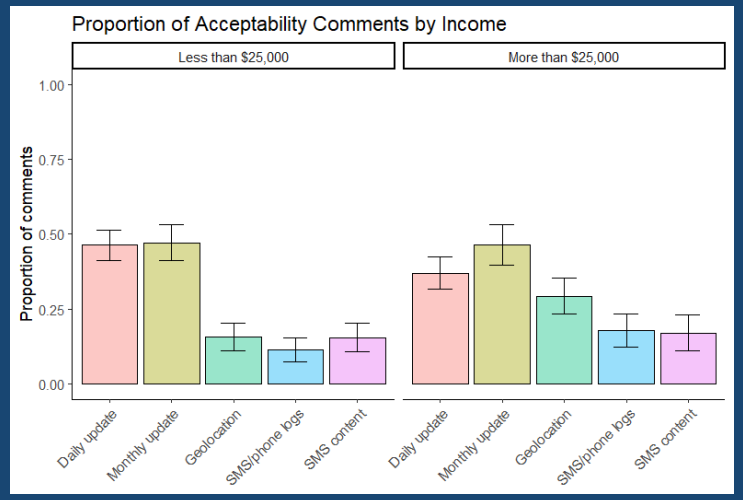


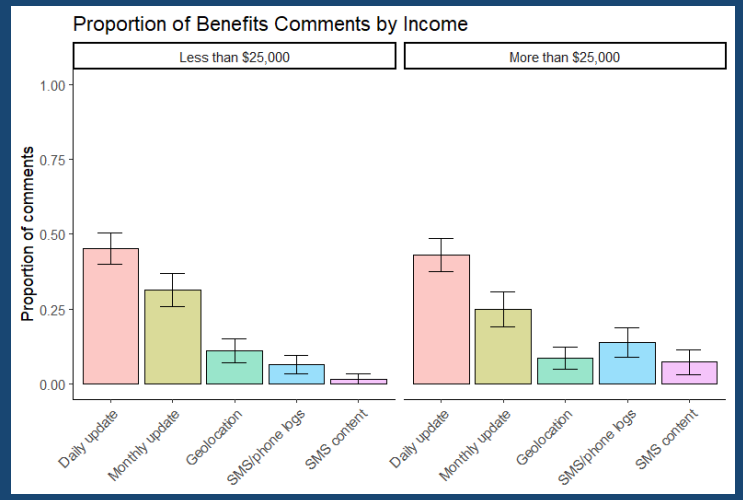
Demographic Differences in Themes - Income











Feedback Notes