A Motivational-Interviewing Chatbot with Generative Reflections for Increasing Readiness to Quit Among Smokers

Andrew Brown, Ash Kumar, Osnat Melamed, Angus Wang, Marta Maslej, Nadia Minian, Jodi Wolff, Matt Ratto, Peter Selby, Jonathan Rose

University of Toronto and CAMH
Disclosures

Disclosures of Financial Support
• This program has received financial support from NFRF/Candian Government in the form of research grant.
• Potential for conflict(s) of interest: n/a

Faculty/Presenter Disclosure
• Faculty: Jonathan Rose
• Relationships with financial sponsors: n/a
Addiction to Smoking Kills

- 1.3 billion worldwide smokers
  - 7 million die each year; 45K in Canada alone

Clinician-based Talk Therapy using Motivational Interviewing (MI) has shown success in:

1. Moving smokers towards the decision to quit smoking
2. Helping them actually quit
Clinicians are Hard to Access

- Clinician-based talk therapy is expensive
  - not accessible, applied too late

- If we could **automate** MI talk therapy
  - would be more accessible to many more people
  - available where & when it is needed

- A **population-level** intervention
Most Smokers are Ambivalent

- Know smoking is bad, but positives keeps them smoking
  - 70% of all smokers are in this state of ambivalence

Goal:
- Create chatbot to guide smokers towards decision to quit
- using Motivational Interviewing approach
Research Project is a Collaboration

Between:
- MI Clinician/Researchers
- Computer Engineers
- Social Scientists
Methods
Method – Conversation Design

- Conversation is 5 Open-Ended Questions
  - Uses MI “Running head start” approach:

1. What is the thing you like **most** about smoking?
2. What is the thing you like **least** about smoking?
3. What is one thing about your smoking habit that you would like to **change**?
4. What will it **look like** when you have made this change in your smoking habit?
5. What are the **steps** you need to take to make this change?
Conversation Design, cont’d

- After each question, client responds  
  - All through a textual interface

- Chabot responds with a *reflection*  
  - which restates the client statement (*simple* reflection)  
  - connects response to guess of motivation (*complex* reflection)

- Purpose of reflection: to encourage contemplation
Example Interaction

MIBot: To start, what is the thing you like most about smoking?  

Client: stress relief

MIBot: You enjoy smoking because it helps you cope with stressful situations.
Reflections Use Generative AI

- Have been working on automatic reflections for 4 years.
  - during the incredible progress on generative AI

- Use a fine-tuned version of GPT-2 to generate both simple and complex reflections
  - Roughly 55% of the reflection deemed acceptable
  - Also built a classifier to filter out bad reflections

- Can also hit 98% with GPT-4 (not reported in this work)
Two Forms of Conversation

Form 1: Just asks the 5 questions
- No reflection, just respond with ‘thank you’

Form 2: For each of the 5 questions:
- Respond with generative reflection
- Ask, ‘Did that make sense?’
- If yes, thank, if no, apologize.

- some extra branches, see: JMIR Mental Health in press
  https://preprints.jmir.org/preprint/49132
Recruitment

- Used **Prolific.com** online recruitment platform
  - Inclusion: smokers, English speaking, age 18+

- Enables higher number of subjects

- Less control/guarantee of quality of subjects
  - Addressed through double filter of subjects
Outcome Metric

■ Readiness Ruler:
  – Survey taken before conversation and 1 week later

On scale from 0 to 10, how confident are you that you can quit?
  – Also, how ready, how important
  – Confidence is the most predictive of cessation success
Other Metrics

- The CARE Survey
  - Measures empathy of a care giver; validated for clinicians
    
    How was MIBot at ...

    1. Making you feel at ease...
    (being friendly and warm towards you, treating you with respect; not cold or abrupt)

    - Poor
    - Fair
    - Good
    - Very Good
    - Excellent
    - Does Not Apply

- Quit Attempts
  - Did you attempt to quit smoking during the week

- Written feedback on bot experience
Results
# Change in Confidence to Quit

On a scale from 0 to 10, how confident are you that you would succeed at stopping smoking if you start now?

<table>
<thead>
<tr>
<th>Conversation</th>
<th>N</th>
<th>Average Confidence Before</th>
<th>Average Confidence 1 Week Later</th>
<th>Average Change</th>
<th>Signif</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Conversation</td>
<td>100</td>
<td>3.3</td>
<td>4.7</td>
<td>+1.3</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Only Questions</td>
<td>52</td>
<td>3.6</td>
<td>4.7</td>
<td>+1.0</td>
<td>P = 0.0001</td>
</tr>
</tbody>
</table>

- Get most of the impact just by asking the questions

17
Effect on Importance and Readiness

- Full conversation does better:
  - Importance scale +.7, P<.001
  - Readiness scale +.4, P=.01
CARE – Empathy Scale (/50)

<table>
<thead>
<tr>
<th>Conversation</th>
<th>N</th>
<th>Average CARE</th>
<th>St. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Conversation</td>
<td>100</td>
<td>36</td>
<td>9.1</td>
</tr>
<tr>
<td>Only Questions</td>
<td>52</td>
<td>32</td>
<td>9.6</td>
</tr>
</tbody>
</table>

- Significantly higher CARE score with reflections (P=.004)
  - generative reflections respond to what the person said

- But: Human clinicians do much better, near perfect 50
Resolution of Ambivalence

- Also classified outcome into three categories
  - Moving towards quitting
  - Moving towards smoking
  - Stayed the same

- Manual classification based on
  - change in confidence and feedback 1 week later:
  - “Did the conversation help you realize anything about your smoking behavior? Why or why not?”
### Direction of Resolution of Ambivalence

<table>
<thead>
<tr>
<th>Conversation</th>
<th>Towards Quitting</th>
<th>Towards Smoking</th>
<th>Stayed Same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Conversation</td>
<td>30%</td>
<td>6%</td>
<td>64%</td>
</tr>
</tbody>
</table>

- Promising impact; needs RCT to really see
  - No significant difference between the two conversations
## Quit Attempts

- “Consciously Not Smoking for 24 hours or more”

<table>
<thead>
<tr>
<th>Conversation</th>
<th>% with Quit Attempt Week Before Conversation</th>
<th>Quit Attempt Week After Conversation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Conversation</td>
<td>40%</td>
<td>38%</td>
</tr>
</tbody>
</table>

- Not significantly different
- Relatively high fraction,
  - is a younger cohort average age 30
Summary

- Conversation has significant impact on confidence to quit
- Most of the impact comes from asking the questions
- Generative reflection appears to have more impact
  - Improves perceived empathy
  - Improves readiness and importance
Next Steps in “MIBot” Project

- Have already used GPT-4 for reflections
  - Much more reliable and better

- Big decision: choose between
  1. Evolving the ‘engineered’ conversation
  2. Using a prompted GPT-4 and guiding it
  3. Some mixture of the above.