Chatbot MARVIN: Development study of an Intelligent Conversational Agent to Promote HIV Patients’ Engagement in Care and Management of ART Adherence Barriers

Yuanchao MA*1,4,5, David SANMIGUEL2,5, David LESSARD1,5, Lévis THÉRIAULT3, Sofiane ACHICHE4,5, Anish ARORA2,5, Kedar MATE1,5, Benoît LEMIRE6,7, Tarek HIJAL9, Tibor SCHUSTER1,5, John KILDEA10, Alexandra de POKOMANDY1,2,6, Joseph COX1,6,8, Nadine KRONFL1,6, Marina KLEIN1,6, Bertrand LÉBOUCHE*1,5,6

1. Research Institute McGill University Health Centre, Montréal, QC, Canada
2. Department of Family Medicine - McGill University, Montréal, QC, Canada
3. Department of Computer Engineering and Software Engineering, Polytechnique Montréal, Université de Montréal, Montréal, QC, Canada
4. Department of Mechanical Engineering, Polytechnique Montréal, Université de Montréal, Montréal, QC, Canada
5. CIHR SPOR Mentorship Chair in Innovative Clinical Trials in HIV, Montréal, QC, Canada
6. Chronic Viral Illness Service - McGill University Health Centre, Montréal, QC, Canada
7. Department of Pharmacy - McGill University Health Centre, Montréal, QC, Canada
8. Department of Epidemiology - McGill University, Montréal, QC, Canada
9. Department of Radiation Oncology, Cedars Cancer Centre, McGill University Health Centre, Montréal, QC, Canada
10. Medical Physics Unit, Gerald Bronfman Dept of Oncology, McGill University, Montréal, QC, Canada

*If you have any questions about the project, feel free to contact us: yuanchao.ma@much.mcgill.ca or bertrand.lebouche@mcgill.ca

Conflict of Interest Disclosure: I have no conflicts of interest. This project benefits from the support of the PIHVO, a ViiV Healthcare project.
Intelligent conversational agents (ICA) can mimic human interaction using machine learning technology to analyze user inputs and respond appropriately using human language.

Patients play an increasingly important role in self-managing chronic conditions like HIV infection.

Lack of quick access to reliable answers to patients’ questions can cause anxiety or jeopardize patients’ ability to follow their treatment as prescribed.

ICAs have been shown in several studies to be cost-effective, to improve adherence-related barriers, and to promote patient empowerment, collaborative goal settings, and problem-solving skills.  

Objective: Design, develop and test MARVIN*, an ICA implemented in HIV infection to promote Patient’s Engagement and self-management on perceived potential ART adherence barriers

---


MARVIN: Minimal ARV Interference
Methods

• Using a co-design methodology, a multidisciplinary group of physicians, patients, pharmacists, engineers guided the development of MARVIN:

  • Q&A Corpus development:
    • Patients and communities → Questions (Figure 1) and preferred expression of answers to ensure the understanding of user’s input
    • Physicians and pharmacists → Qualified and creditable answers to guarantee MARVIN respond with the appropriate output
    • Engineers → Corpus data processing (Figure 1) to train MARVIN with Natural Language Understanding algorithm (Figure 3)
  
  • Decision tree development: accomplish Dialogue Management (Figure 3) by instructing MARVIN to understand how to response in the corresponding topic (Figure 2)
    • Patients’ colloquial expression
    • Healthcare giver’s working method
    • Software development method

Figure 1. Q&A Corpus example: different questions collected for sub-scenario LATE on Atripla

Figure 2. Decision tree example: sub-scenario LATE

Figure 3. Structure of MARVIN
Results

• MARVIN, a virtual assistant available in English, trained in communicating with patients by both voice and text message, 24H/7

• Perform two case scenarios considered for the first stage
  • Advice for taking ART (time management, with or without food, difficulties with pill recognition, etc.) (Figure 4, 5 and 6)
  • Travel with HIV (time management, country restrictions, medication packaging, etc.) (Figure 7)

• while ensuring satisfaction such as
  • Sensitivity and confidentiality
  • Regularity and chronicity of taking medications
  • Desire for help and support

Figure 4. Conversation example: sub-scenario LATE

Figure 5. Conversation example: sub-scenario IDENTIFICATION

Figure 6. Conversation example: sub-scenario REMINDER

Figure 7. Conversation example: Scenario Travel with HIV
Conclusions

Strengths

- Patient-centered care by increasing the patients’ involvement
- Automating functions that previously required face-to-face interaction
- Provide personalized medicine
- Data collection for ICA improvement and research study (e.g., ICA training with conversation histories, identification of new barriers with users’ questions)

Limitations

- Scenario *Side effects* not considered due to potential medico-legal issues
- Require large datasets for ICA training
- Does not always recognize or respond appropriately (Figure 8)
- More features and functions to be added (medication interactions, support information, French version, etc.)