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MERLION: Culturally-Responsive Patient Engagement for Population Health

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Background

Healthier SG aims to shift care upstream by encouraging proactive participation in screenings, chronic reviews, and vaccinations. But effective engagement at scale demands more than reminders. It requires behavioural strategies that address patients' beliefs, barriers, and motivations. This is not yet possible: manual outreach is resource-intensive, while population health campaigns are too generic to be effective.

This study aims to build on the Health Belief Model (Rosenstock, 1972) for culturally adapted, scalable WhatsApp engagement for preventive and chronic care in Singapore.

MERLION Framework

The Health Belief Model (HBM) is a well-established framework for shaping health messages, but it does not provide practical guidance for how to deliver those messages in Singapore's diverse, multilingual population.

To bridge this gap, we developed the MERLION Framework, which builds on HBM by adding three key layers to support safe, personalised, and scalable messaging for preventive and chronic care engagement.



MERLION Framework
Multi-Ethnic Responsive Linguistic
Outreach & Intervention Nudges

1. Integrate HBM into Messages

HBM constructs (e.g. susceptibility, benefits, barriers) are translated into short-form, template-compatible messages suitable for WhatsApp

2. Make Messages Culturally Responsive

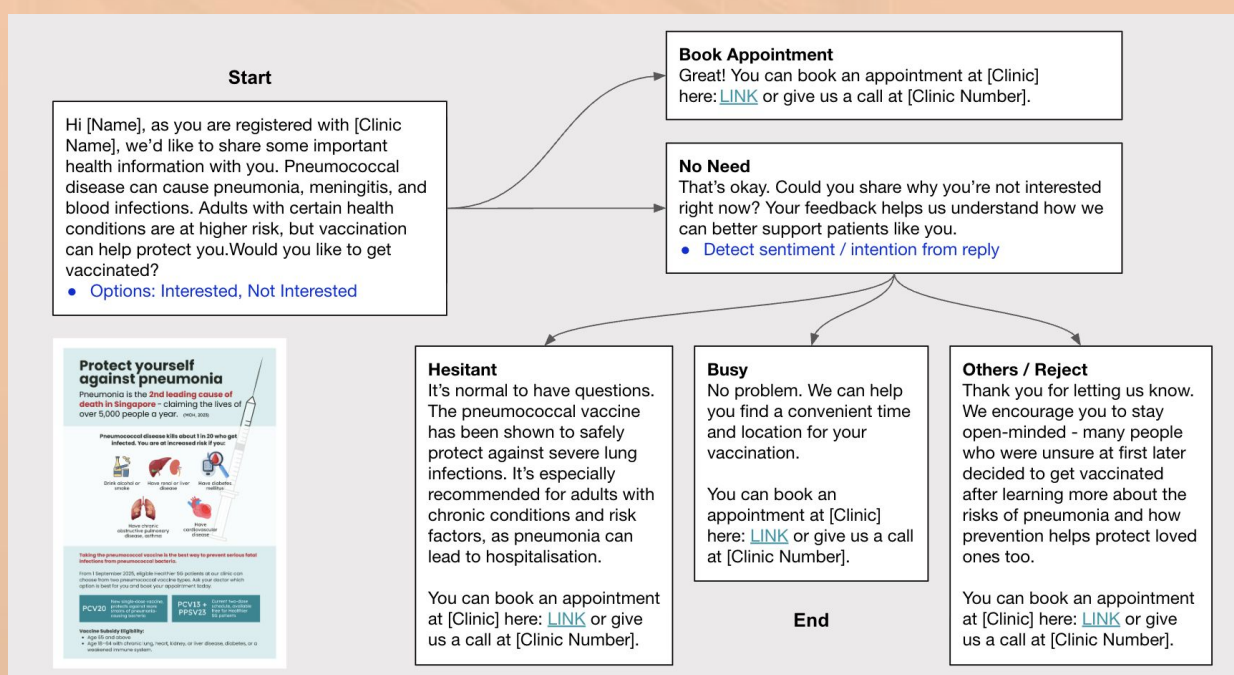
Messages are templated in English, Mandarin, and Malay, and localised to reflect tone and phrasing appropriate to common belief patterns among major ethnic groups

3. Use AI to Orchestrate Smart Replies

An AI engine selects message variants in real time based on each patient's profile (e.g. language, age group) and reply behaviour.

Campaign Development

We developed population health campaigns based on the MERLION Framework. Message templates were co-developed with primary care coordinators, then translated into Mandarin and Malay to preserve intent, emotional tone, and cultural nuance. Templates were structured into multi-turn conversational flows with branching logic. These flows are executed by a proprietary AI orchestrator, which dynamically selects and sequences messages based on patient replies, which enables personalised, automated engagement at scale.



Example of a multi-turn pneumococcal vaccination campaign developed with MERLION framework, building on HBM constructs

Pilot Evaluation

MERLION-based campaigns were deployed on our AI-enabled messaging platform ("Broadcast") and evaluated with three GP clinics (n = 1,012 patients) across clinical use cases. Care coordinators reported a significant reduction in manual recall workload, allowing more time to focus on complex or high-need patients. The key results are as follows:

1. Health Plan Appointments

15% of previously unresponsive seniors booked a care review within 24 hours of a single WhatsApp message.

2. Diabetic Eye and Foot Screening (DRP/DFS)

27% of patients completed the chat flow, and 14% booked an appointment after receiving personalised nudges.

3. Smoking History Assessment

46% of patients completed the full questionnaire entirely within WhatsApp, without the need for clinic follow-up.

Conclusion. By combining message science, multilingual design, and AI orchestration, the MERLION framework achieved high response rates and measurable improvements in care uptake with minimal staff burden. These early results demonstrate that behavioural frameworks can be operationalised at scale. We are now expanding MERLION beyond the pilot phase and welcome partnerships with healthcare providers, public agencies, and researchers to scale its impact across more care settings and conditions.