

## A. Current State

Artificial Intelligence (AI) agents are transforming healthcare operations by enhancing productivity and expanding capacity. These intelligent assistants support administrative tasks, facilitate patient engagement by enabling seamless multi-model communications such as voice and text. For this Call for Innovation, it will primarily focus on patient and community management and healthcare operations optimisation for a start. The agentic AI tasks could be varied, but they mainly assist healthcare professionals in engaging and educating patients or residents by conducting appointment (procedure) reminders, medication counselling, pre- and post-procedure follow-up care, and educating/enrolling residents in specific programs or activities.

Key considerations involve the extent of parameters and guardrails to ensure optimal data privacy and security, ethical implications for addressing clinical risks associated with AI-generated recommendations and responses, and seamless integration into existing workflows and backend source systems, such as Next-Generation Electronic Medical Records (NGEMR), for patient safety, minimise disruption, improve compliance, and enhance overall continuity of care.

## B. Challenge Statement

How might we leverage on the current agentic AI technology to support Singapore healthcare professionals in effectively managing routine voice-driven outreach tasks in a timely, safe, autonomous and engaging manner?

## C. What are we looking for? (To-be State)

The proposed Agentic AI technology solution for this Proof-of-Concept (POC) trial should cover the following 3 types of use cases (refer to Table 1 below):

| Types of Use Cases    | Type A  | Type B  | Type C   |
|-----------------------|---|---|--|
| Use cases             | Medication counselling  | Pre- and post-procedure counselling   | Population health outreach and community nursing   |
| Technology            | Agentic AI (voice-based/voice-driven automation)  |   |  |
| Specific Requirements | i. Educate and guide patients (e.g., medication adherence and understanding)<br>ii. Provide follow-up care      | i. Address patient concerns (e.g., appointment management, urgent enquiries)<br>ii. Offer directions to patients (e.g., procedure-specific instructions)<br>iii. Provide follow-up care (e.g., reassurance to caregivers) | i. Appropriately nudge (offer reminders) based on profile and enrolled programs<br>ii. Adapts messaging based on demographics, language preference, and cultural considerations<br>iii. Educate and guide local resident |
| Capability            | i. Convert audio conversation into text transcriptions (call logs)<br>ii. Call escalation and routing abilities |   |  |

|                                      |  |   |  |
|--------------------------------------|--|---|--|
|                                      | iii. Low-code/no-code self-help interface for AI agent management (i.e., create new AI agents, edit/manage/configure workflows)<br>iv. Feedback opportunity – to identify patterns and address emerging concerns (i.e., health-related, operational-related e.g., satisfaction levels) |   |  |
| <b>Types of Users</b>                | Pharmacists  | Nurses  | Nurses/Allied Health   |
| <b>Target Audience</b>               | Patients (i.e., inpatient discharge and home delivery)   | Patients undergoing/completed procedures [e.g., Ear, Nose & Throat (ENT), Ophthalmology, Endoscopy, Obstetrics and Gynaecology (O&G)] | Adult (aged 18 and above) Singapore (local) residents who can benefit from preventive health interventions (e.g., at risk of chronic diseases - hypertension, diabetes, cardiovascular conditions or eligible for national screening programs like cancer screening) |
| <b>Language Support Requirements</b> | Multilingual<br>i. Mandatory: English and Mandarin<br>ii. Optional: Tamil and/or Malay   |   |  |

Table 1: Use Case Types - For detail of the use cases, please refer to Annex A: Use Cases Summary.

**Join us on this discovery and collaborative journey through HealthX to explore and build newer, valuable, technology-enabled solutions to:**

- i. **Boost productivity:** Automating routine and repetitive tasks (e.g., medication, pre- and post-procedure counselling, and educating Singapore residents about preventive health programs and measures) can lighten healthcare professionals' burden and allow them to handle more complex cases or other essential duties.
- ii. **Improve the quality of patient care:** Standardising patient-provider conversations, i.e., medication counselling, pre- and post-procedure counselling, nudging, and educating, enables patients, caregivers, and local residents to receive information at a time convenient to them (e.g., at the comfort of their homes) preferable in a local context that are familiar to them.

**The proposed solution for this POC shall fulfil the following capabilities to be considered as a suitable candidate:**

- i. **Multi-language support:** Ability to support multi-languages (both English and Mandarin at the minimum). Added advantage if the solution could support other mixed languages (e.g. Malay, Tamil, etc.) for Singapore context within the same conversation (task) log.
- ii. **User friendliness:** The proposed solution should be intuitive for users to use (low-complexity and user-friendly) with minimal guidance and support (without elaborate setup or configurations).

- iii. **Interactive conversational AI:** The proposed agentic AI solution should possess multimodal literacy capabilities, emotional intelligence, proactive engagement abilities, personalisation and contextual awareness via Natural Language Understanding (NLU) and Natural Language Processing (NLP), reasoning and contextual reply, and can handle interruption to fulfil following scenarios:
  - a. A voice assistant for real-time counselling with the ability to answer patients' questions on medication use and identification, possible risks and procedure-related complications and precautions.
  - b. Any reminders or follow-up calls that can boost compliance will be an added advantage. Incorporation of the solution with any existing patient fronting platform, interactive videos, or visual aids will also be an added advantage.
  - c. A voice assistant that can accurately and empathetically answer patients'/residents' questions while providing the relevant guidance and encouragement to complete the assigned actions (e.g., enrol in a program, share about their condition, assist with vaccination appointment scheduling). Any reminders or follow-up calls that boost compliance will be an added advantage. Incorporating the solution with any existing patient fronting platform or interactive videos or visual aids will also be an added advantage.
- iv. **Personalised guidance:** The proposed solution should be able to provide specific information, for example:
  - a. Automated pre-procedure check in, reminders for fasting instructions, medication adjustments, procedure specific instructions and arrival times.
  - b. Automated post-procedure check in via voice or chat to assess pain, complication or adherence to post-procedure treatment plan. Counsel on common signs and symptoms of post procedure related complications and when to seek medical attention.
- v. **Escalation protocols:** The proposed solution must be able to transfer queries to a clinician when not able to answer or if a high-risk scenario is identified. The AI solution should be able to summarise the unresolved queries to the human operator before handing over the call.
- vi. **Platform-level enabler:** A self-service, low-code/no-code interface to enable users to easily create new AI agents to meet their specific requirements (i.e., use cases/workflows) without requiring extensive technical expertise.

## 2. The proposed solution for this Proof-of-Concept (POC) shall fulfil the following technical requirements:

- i. **Data residency:** For solutions that leverage their proprietary Large Language Model (LLM) hosted at their native location for the processing of audio to text and summarising capabilities, the solution provider may have to demonstrate that the audio and transcript text file do not reside at their native location.

- ii. **Data security and infrastructure requirements:** The solution must adhere to privacy standards (i.e., PDPA) to safeguard patients' information and the Security and Infrastructure Requirements on Controls for Trial & Pilot Environment (Refer to **Annex B** for more details).
- iii. **AI-Safety:** Added advantage if there is AI-safety services/features to detect and block sensitive health information and personal identifiable information.
- iv. **Natural Language Processing (NLP):** The solution must be able to handle Singapore's diverse languages, dialects, and accents in Singapore.
- v. **Integration with other health systems and applications:** The solution needs to be able to integrate with other healthcare systems and applications, especially to receive the latest medication list. It should be able to tailor counselling based on different procedure preparation, patient history, allergies, and concurrent medications. Once of such core backend system is with the **Next-Generation Electronic Medical Records (Epic)**. Solution providers need to have either proven track records in Epic integration or express explicit commitment to establish Epic integration by the time of actual implementation of the solution after the trial. For the latter, it is the sole responsibility of the solution provider to work directly with Epic to get their integration endorsed by Epic.
- vi. **Leverage on Synapse Tandem platform infrastructure:** Tandem is a Generative AI platform developed by Synapse specifically for public healthcare professionals. The proposed solution can explore leveraging on Tandem platform infrastructure for basic security hygiene such as active directory authentication for public healthcare users, AI safety features, AI models hosting or secure access to cloud service provider (CSP) LLM. Refer to **Annex C** on Tandem platform a high-level architectural design.

### 3. Overall collaboration requirements:

- i. **Scalable:** The proposed solutions should consider a broader plan to scale across other healthcare institutions and settings and consider the need to integrate and interface with the various relevant systems.
- ii. **Cost-effectiveness:** The proposed solutions must be cost-effective and beneficial to the public healthcare in Singapore. To support time motion study (if needed) to justify/support the business case and return on investment (ROI).
- iii. **Implementation Timeline:** This POC collaboration is scoped to address the challenge statement, and the trial completion period is to be capped at not more than 3 months (including the setup of the trial).

- iv. **Cost:** The proposed solution should include indicative cost (business model) for the short-term implementation and long-term scaling prospects.

## **ANNEX**

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## Annex A: Use Cases Summary

### I. MEDICATION COUNSELLING

#### a. IN-PATIENT DISCHARGE MEDICATION COUNSELLING

##### A. CURRENT STATE

Studies have demonstrated the positive benefits of active patient participation and tailoring discharge information to patient's needs. This improved adherence to revised treatment plans, reduced hospital re-admission from medication-related events and overall patient satisfaction. However, the provision of personalised discharge medication counselling is hampered by the increasing complexity of medication discharge plans and a critical shortage of qualified healthcare professionals, including pharmacists.

There is a lack of clinical flow standardisation for discharge medication counselling across different healthcare institutions. Some institutions practice one-on-one (one pharmacist to one patient) bedside medication counselling and dispensing, while others front a centralised pharmacy for patients or caregivers to receive medication counselling after hospital discharge. The counselling modality is also varied: some pharmacies practice face-to-face counselling with patients while others deliver via phone counselling. These counselling sessions can occur prior to or a few days after hospital discharge. The duration of these discharge counselling sessions is usually kept short due to mounting time pressures, with basic levels of information tailored to the patient.

Various initiatives for load levelling have been done to enhance the quality and personalisation of discharge medication counselling, including identifying low-risk groups of patients who can go home without visiting the pharmacy and will have a follow up call on their medication orders. In certain clinical cases such as Obstetrics, Gynae or even Surgical cases where medication education can be delivered remotely without making a stop to the pharmacy is restricted by the limitation in available resources.

Currently, the challenges faced for discharge medication counselling are as follows:

##### a. High Patient Discharge to Pharmacist Ratio:

Delivery of quality discharge medication counselling is heavily reliant on trained pharmacy staff, including pharmacists and pharmacy technicians. However, significant time is spent in providing in-person counselling, even for routine prescriptions, which limits their capacity for more critical or complex cases and can cause bottlenecks during peak hours, leading to longer wait times.

##### b. Inefficiencies in the collection process:

Patients may arrive at unpredictable times, disrupting workflows in the pharmacy. Medication might also sit in the pharmacy for an extended period if the patient delays collection or coming down from wards, and this increases storage issues in the pharmacy.

##### c. Lack of Prioritisation:

Regardless of risk or complexity, all patients are treated with the same process. This can result in a lack of focus on high-risk cases that need more attention.

##### d. Delay in service

Patients must wait for the counselling even if their prescriptions are straightforward, potentially reducing satisfaction.

**e. Accessibility Issues**

Patients with mobility or time constraints may find it challenging to visit the pharmacy for in-person counselling.

**f. Language Barriers**

Staff with a similar language as the patient must be identified for a seamless discharge counselling. In the event the staff is not available, the patient will need to wait until a suitable staff is around.

**B. CHALLENGE STATEMENT**

How might we deliver timely, tailored and effective remote medication counselling for discharged patients while maintaining clarity, engagement, and safety in the communication process to ensure adherence to discharge medication plans?

**C. WHAT ARE WE LOOKING FOR (TO-BE STATE):**

**Improve bed management process in the hospital:** Low-risk patients can be discharged earlier and sent to the discharge lounge for medications collection or receive their medication at home through medication delivery. Counselling can be delivered to the patient at their own convenience. This will also mean the released bed can be used for other another patient who are is acutely waiting for hospital beds.

## **b. REMOTE MEDICATION EDUCATION**

### **A. CURRENT STATE**

Contactless medication dispensing has become increasingly prevalent, especially since the COVID pandemic. This includes methods such as home delivery, locker systems, and self-collection at partnering retail or community pharmacies.

These options offer patients the advantage of receiving their medications without visiting pharmacies, thereby reducing their footprint and wait time at the pharmacies. Secondly, these modes of contactless dispensing offer flexible medication pick-up times, creating convenience for our patients.

Contactless dispensing is also envisioned as a future state for workload levelling, reducing waiting times in pharmacies while delivering seamless service from healthcare providers across Singapore.

While this service model offers advantages to both patients and healthcare providers, the process may require additional manpower to contact patients for medication counselling and to arrange for medication collection details.

Currently, the challenges faced when counselling these patients are as follow:

#### **1. Limited Counselling time:**

Currently, the options to counsel patients will be: (1) when orders are taken, or (2) a separate tele-consult will be conducted.

The limitations for option (1):

- a. The available counselling time is too short;
- b. The patient may not be able to listen attentively, which results in the patient not focusing on the conversation or information given to them; and/or
- c. Sometimes, efficiency may be prioritised over-explanation, leading to inadequate counselling.

The limitations for option (2):

- a. Phone calls may not be picked up by the caregiver/patient, resulting in delayed home delivery arrangements.
- b. Counselling over the phone typically takes longer, as patient/caregiver are unable to sight the medications physically. This, in turn, results in cost ineffectiveness for the pharmacy department.

#### **2. Potential delay in service**

Patients must wait for the counselling to be conducted before home delivery is arranged.

#### **3. Accessibility Issues**

Patients with mobility or time constraints may find it challenging to visit the pharmacy for in-person counselling.

#### **4. Confidentiality Issue**

Ensuring patient privacy during remote counselling can be difficult, especially if personal details need to be shared.



**5. Language Barriers**

Remote counselling may lead to communication challenges, especially if there is a mismatch of the spoken language between the tasked caller and the patient.

**6. Inefficient workflow due to lack of system integration**

Currently, patient can place request for home delivery or other forms of contactless dispensing on HealthHub Application Programming Interface (API). However, the subsequent steps are manual and outside of the HealthHub API. Pharmacy staff will conduct medication reconciliation and clinical checks on the NGEMR, Epic, take note of the request from HealthHub, and conduct counselling by calling the patient or caregiver.

**B. CHALLENGE STATEMENT**

How might we deliver timely, smooth and effective remote medication counselling for patients who prefers contactless mode of medication collection while maintaining clarity, engagement, and safety in the communication process?

## II. PRE- AND POST-PROCEDURE COUNSELLING

### A. CURRENT STATE

Pre- and post-procedure calls are key elements to ensuring patients are well-prepared and supported throughout their surgical journey. Pre-procedure education has been shown to improve patient satisfaction and surgical outcomes by enhancing understanding and adherence to preoperative instructions. For example, proper preoperative preparation, such as guidance on omitting certain medications, can reduce surgical risks and complications. Similarly, post-procedure calls play a crucial role in monitoring recovery, addressing concerns, and reinforcing post-operative care instructions. This proactive approach helps improve patient compliance, reduces complications, and enhances overall care continuity.

Nurses handle a high volume of phone calls daily for pre- and post-procedure counselling across various medical disciplines. For instances, Ear, Nose & Throat (ENT), Ophthalmology, Endoscopy, Obstetrics and Gynaecology, etc. These phone calls can be either be scheduled (outbound – hospital calling patients) or unscheduled (inbound – patients calling hospitals). With an ageing population, there has been an increase in patients undergoing various procedures, further contributing to the demand for nursing support in surgical care.

At present, the number of phone calls managed is approximately 45,000 per year in an acute hospital and 15,000 per year in specialty centres (based on data from one cluster). These calls, which can range from 5 to 30 minutes per call, are essential in addressing patient concerns, confirming, or cancelling appointments, and giving directions to patients for an upcoming visit, and clarifying follow-up care. However, these calls often involve repetitive explanations, scheduling adjustments, and reassurance to patients and/or caregivers, further contributing to a significant workload.

Currently, the challenges faced when counselling these patients are as follows:

1. **Overwhelming call volume:** High patient call volumes. Limited staff resources to handle surges, leading to increased hold times and patient frustration. Patients may not respond during office hours due to work and other commitments. Delays in responding to inquiries may result in missed appointments, unaddressed concerns, and negative patient experiences.
2. **Supporting multilingual and diverse patient populations:** Language barriers can cause miscommunication, leading to misunderstanding of instructions. Lack of multilingual support can delay care and decrease patient satisfaction.
3. **Long wait and hold times:** Patients and referring clinicians often experience long hold times due to high call volumes. Operator queue buildup causes delays in patient care and insufficient time for high-risk complex cases. Extended wait times may lead to frustration for patients and providers, resulting in delayed care, increased provider workflow and potentially missed follow-ups, and disruption in the continuity of care for patients.
4. **Staff burnout and job dissatisfaction:** Overburdened staff handling continuous calls can experience fatigue, stress, and burnout. High-pressure environments can lead to errors, missed calls, or inconsistent information delivery.
5. **Documentation burden:** Nurses must document patient conversations for legal and communication purposes. Manual documentation is time-consuming and diverts

attention from patient interaction. Incomplete or delayed documentation may impact care continuity and compliance.

- 6. Managing urgent patient enquiries and high-risk complex patients:** Patients with urgent concerns may not receive immediate assistance due to call backlog and after office hours insufficient staffing. Besides that, inadequate triaging can delay the escalation of high-risk complex cases to the appropriate healthcare provider.
- 7. Regular updates of clinical guidelines and protocol:** Nurses and call centre staff require specialised training on medical procedures, policies, and patient communication. In addition, regular updates of clinical guidelines (e.g., new procedures, updated discharge instructions) require frequent retraining, which can be resource intensive.
- 8. Variations in quality of information provided:** As the nurses calling the patients have different years of knowledge and experience, this can lead to variations in the quality of information and answers to queries provided to the patients, especially if they are new to the department. The inconsistency can lead to errors, reworks and inconveniences.

## **B. CHALLENGE STATEMENT:**

How might we deliver timely, tailored and effective pre- and post-procedure counselling for patients while maintaining clarity, engagement, and safety in the communication process to ensure patients are well-prepared and supported throughout their surgical journey?

## **C. WHAT ARE WE LOOKING FOR (TO-BE STATE)**

We are seeking an automated voice calling solution with natural language processing capabilities that can replace manual pre- and post-procedure patient calls currently conducted by nurses. The solution should be able to understand various languages and accents and different phrases, conduct patient assessments, and generate comprehensive reports including call completion status, pass/fail lists, and reasons for failed assessments. The system should automatically send summaries to patients and provide nurses with actionable insights, ultimately aiming to save significant nursing manpower while maintaining the quality of patient care and surgical readiness assessments.

### **Here are some of the expected outcomes:**

1. Reduced reliance on skilled manpower for routine & repetitive tasks of calling
2. Enhanced productivity and optimised saved manpower time for more value-adding tasks
3. Provision of accurate, timely and consistent information for patients
4. Timely feedback from patients on conditions and timely interventions from nurses
5. Increased patient acceptance and experience in receiving information
6. Increased job satisfaction for staff

### III. POPULATION HEALTH OUREACH AND COMMUNITY NURSING

#### A. CURRENT STATE:

Population health programs aim to improve community health outcomes through preventive care and health promotion but often encounter challenges like low engagement, limited resources, and difficulty personalising health messages. This is particularly relevant for elderly individuals who may live alone and face issues such as social isolation, challenges in managing their health, and concerns about safety at home.

Agentic artificial intelligence (AI) technology can play a vital role in various scenarios such as:

1. Providing health advice during phone calls by delivering personalised information tailored to the needs of individual patients or residents.
2. Assisting healthcare providers in responding to patient or resident inquiries more efficiently, ensuring that they receive accurate and relevant information about their health conditions, treatment options, and preventive measures proactively and compassionately.
3. Encourage timely screenings and vaccinations among the target population.
4. Help foster social connections and track patients' or residents' understanding and engagement. This enables follow-up and reinforcement of key educational points.

Leveraging such manpower augmentation enablers presents opportunities for better health outcomes and improved quality of life for communities in need. Furthermore, it can lead to increased patient or resident satisfaction and significantly lower the amount of manpower needed for routine tasks, which allows healthcare professionals to focus on delivering higher-value care interventions.

Although this technology has brought convenience, it also poses some challenges in the adoption and utilisation of this technology, which are cited below:

1. **Accuracy and reliability:** Ensuring that AI systems provide accurate and reliable health information is crucial. Misdiagnoses or incorrect advice can lead to serious health consequences.
2. **Data privacy and security:** Handling sensitive health information raises concerns about data privacy and security. Compliance with regulations like Health Insurance Portability and Accountability Act (HIPAA) is essential to protect patient data.
3. **User trust and acceptance:** Patients may be sceptical about receiving health advice from AI agents. Building trust in AI systems is necessary for widespread adoption.
4. **Integration with existing systems:** A need to be integrated with existing healthcare systems, e.g., Next Generation Electronic Medical Record (NGEMR, Epic) and databases, which can be complex and resource intensive.
5. **Ethical considerations:** There are ethical implications regarding the use of AI in healthcare, including accountability for decisions made by AI agents.
6. **Technical limitations:** AI technology may face limitations in understanding natural language nuances, leading to misinterpretations during phone calls.

#### B. CHALLENGE STATEMENT:

How might we effectively leverage technology to support healthcare professionals and community health workers in engaging patients and residents in providing timely, individualised, empathetic health advice, check-ins and enrolments while implementing wide-scale outreach initiatives for population health to enhance overall well-being in our communities?

**C. WHAT ARE WE LOOKING FOR (TO-BE STATE):**

A configurable, scalable and intelligent agentic AI-driven solution offering personalised, evidence-based, and proactive follow-ups. This solution will primarily provide companionship, regular check-ins, and guidance on essential health and social resources through voice calls and can handle potentially multi-channel outreach programs and differing workflows. The goal is to prevent potential health emergencies, significantly reduce healthcare professionals' need for manual outreach efforts and efficiently deploy community health workers for high-priority cases.

**Here are some of the expected outcomes based on different use cases:**

1. Increased participation in preventive screenings and vaccinations.
2. Increased uptake of healthy lifestyle activities, including physical activity and healthy eating.
3. Improved health indicators, including body mass index (BMI) and waist circumference.
4. Enhanced efficiency of community health resources through AI-assisted engagement.
5. Data-driven policymaking and intervention planning.
6. Reduced social isolation and improved emotional well-being among seniors.
7. Enhanced safety and timely intervention in case of medical or social emergencies.
8. Strengthened community and caregiver support networks.
9. Increase confidence to live well and age well in the community.

## Annex B: Table of Security and Infrastructure Requirements and Controls for Trial & Pilot Environment

|                                 | A. Overseas hosting solution  | B. Singapore (local) hosting solution   |
|---------------------------------|---|---|
| 1. Pilot Trial                  | (a) <b>Added advantage</b> to provide System and Organisation Controls 2 (SOC2) Type 2 certification and other relevant reports*.   |   |
| 2. Production                   | <p>(a) <b>Mandatory</b> to provide SOC2 Type 2 certification and other relevant reports*.</p> <p>(b) <b>Mandatory</b> to have certification and management practices for safeguarding and securing data [e.g., International Organization for Standardisation (ISO)/ International Electrotechnical Commission (IEC) 27001, 27017, and 27018].</p> <p>(c) <b>Added advantage</b> to reduce data risk [e.g., by removing non-necessary data fields from use; or de-identify Personally identifiable information (PII) info].</p> <p>(d) <b>Added advantage</b> to have Confidential Computing~ as part of the solution design.</p> | <p>(a) <b>Added advantage</b> to provide SOC2 Type 2 certification and other relevant reports*.</p> <p>(b) <b>Added advantage</b> to have certification and management practices for safeguarding and securing data (e.g., ISO/IEC 27001, 27017, and 27018).</p> <p>(c) <b>Optional</b> to reduce data risk (e.g., by removing non-necessary data fields from use; or de-identify PII info).</p> <p>(d) <b>Optional</b> to have Confidential Computing~ as part of the solution design.</p> |
| 3. Applicable for Pilot & Trial | <p><b>Additional risk controls such as:</b></p> <p>(a) All data stores are logically partitioned per-customer and no sharing of data.</p> <p>(b) Provision of security logs and to be made available to subscriber.</p> <p>(c) Activity logfiles are expected to be monitored and alerts sent to Service management team.</p>   |   |
|                                 | (d) Evidence to show and ensure conversation history is not logged or cached at overseas location/ storage.   |   |

\* Secure Code Review; Penetration Test; Vulnerability Assessment (VA) Scan reports.

~ encrypting data-in-use, transient data encrypted in memory during processing.

## Annex C: High Level Tandem Platform Architecture

