

The Baby Bear Bot – Improving the work experience of new Paediatric doctors through an interactive chatbot

David Chian, Sharon Goh, Catrin Kong, Stella Zhang, Tan Oon Kent, Benny Loo, Pearly Chang
Department of Paediatric Medicine, KK Women's and Children's Hospital, Singapore

Background

With the increasing ubiquity of mobile devices and wearable technology, there has been a plethora of applications and services designed to aid with clinical decision making and management. Mobile technology has the benefit of increasing data accessibility, enabling it to facilitate rapid response in critical care settings and help prevent errors.

Problems or Opportunities

The practice of Paediatric Medicine is heavily dependent on age, anthropometric measurements, and associated gender-nomograms. Many of these values require further calculation or formula application before they can be applied to the care of the paediatric patient. Doctors must frequently reference nomogram tables and charts to accurately evaluate paediatric patients during their everyday practice. In addition, many clinical guidelines and workflows are cumbersome to access as they are text-based and stored solely on hospital intranets which are internet-separated. Preliminary surveys indicated that 73% of house officers found it challenging to retrieve documents and guidelines from the hospital intranet.

In combination, these factors significantly add to the mental load of an already-stretched junior hospital staff, increasing the risk of mental fatigue and potential for clinical errors. The root causes were assessed to be inflexibility of the electronic medical record, lack of proper integration with the local hospital guidelines and suboptimal presentation of data. The extent of the problem largely involved junior hospital staff (namely house officers and medical officers) tasked to chart data, interpret nomograms and convey granular instructions to nursing staff.

In bid to increase the confidence and efficiency of House Officers (HOs) to facilitate better provision of care, a chatbot named "The Baby Bear Bot" (also referred to as the "Bot") targeting HOs as its main users was designed using the popular free instant messaging platform Telegram.

Aim

The main aim of this project is to improve work efficiency, work confidence and perceived improved provision of patient care by $\geq 50\%$ through the usage of @KKBearBot. Our secondary aim is to study the receptiveness, feasibility and challenges in implementing this ground-up solution within our hospital.

Solutions

The team comprised 7 individuals (1 Senior HO/Programmer, 4 Junior Residents, 2 Consultants). The interventions took the form of an interactive Telegram chatbot which provided several key features: (1) Easy access to clinical guidelines (2) Easy access to telephone numbers (3) Paediatric specific clinical calculators. These were designed to target several key pain points for HOs that were elicited prior. All clinical guidelines and functions were verified by appropriate specialists within KKH prior to implementation.

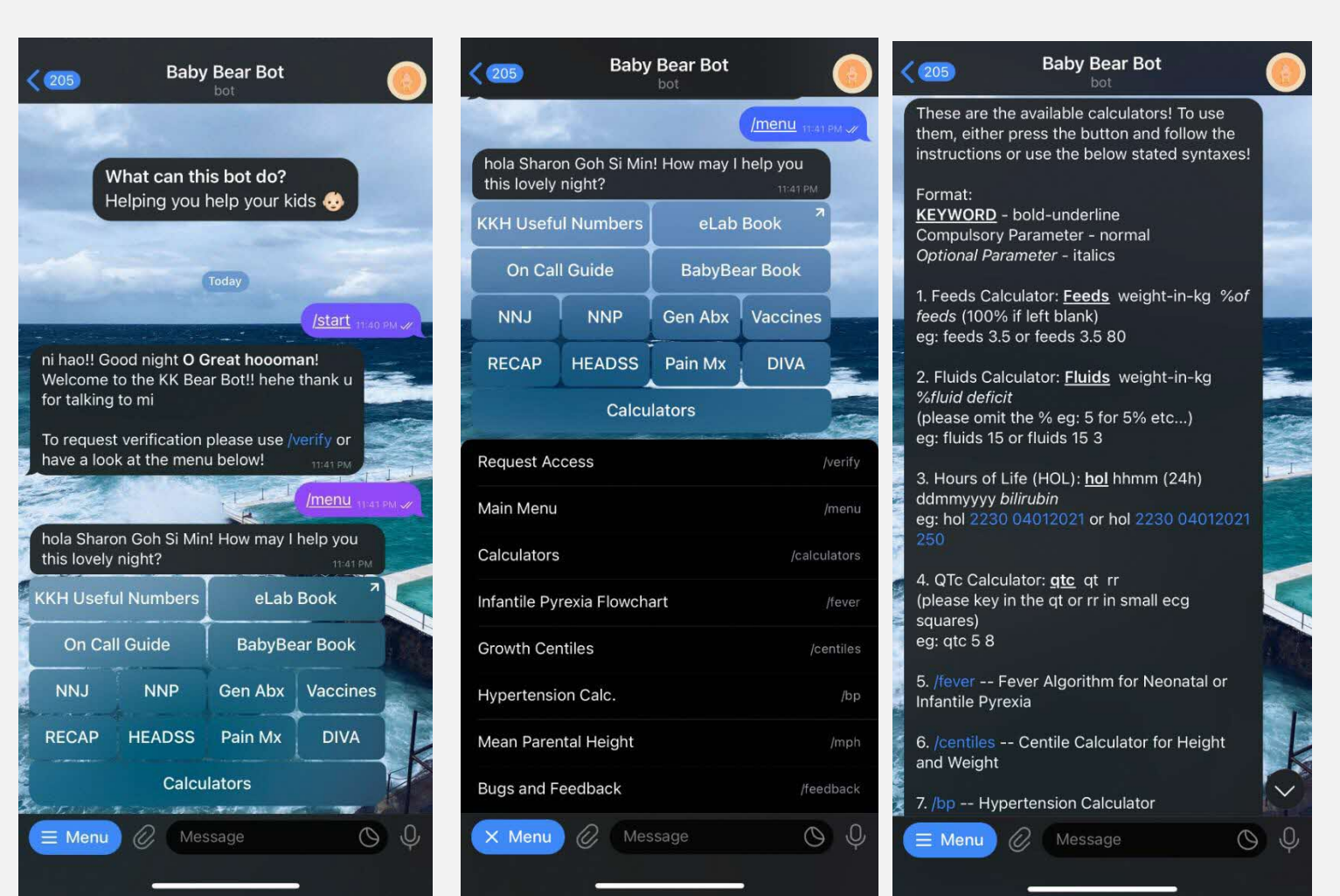
Gantt Chart for the Baby Bear Bot

Item	Jan-21	May-21	Sep-21	Jan-22	May-22	Sep-22	Jun-24	Current (Feb 25)
Quality Improvement Project								
Initial Version Released (Command-line style syntax)								
Clinical Calculator: Neonatal Feed Volume								
Clinical Calculator: Paediatric Feed Volume								
Clinical Calculator: Hours of Life Calculator								
Clinical Calculator: QTc Interval								
Total 3 Clinical Guidelines								
Telephone Directory								
Integration into initial hospital orientation								
Version 2 release (Interactive User Interface)								
Clinical Calculator: Growth and Blood Pressure Centiles								
Total 7 Clinical Guidelines (additional 4)								
Data Logging Established								
Clinical Calculator: Hours of Life (Enhancements)								
Total 11 Clinical Guidelines (Additional 4)								
Total 14 Clinical Guidelines (Additional 3)								
Project Maintenance								

The Quality Improvement component comprised 5 PDSA cycles, each comprising an independent batch of HOs and data was collected via surveys using a Likert scale at the start and at the end of the posting. Due to fairly significant changes to the @KKBearBot between PDSA cycles 2 and 3, we have grouped PDSA cycles 1 and 2 as "Version 1" of the Bot and PDSA cycles 3 to 5 as "Version 2" of the bot. After the conclusion of the Quality Improvement component, the Bot went into project maintenance from September 2022 onwards. The Bot is self-hosted and developed solely by the team.

Bot User Interface

The Bot contained several functions as well as had support for in-line text commands and buttons with hyperlinks to relevant clinical documents.



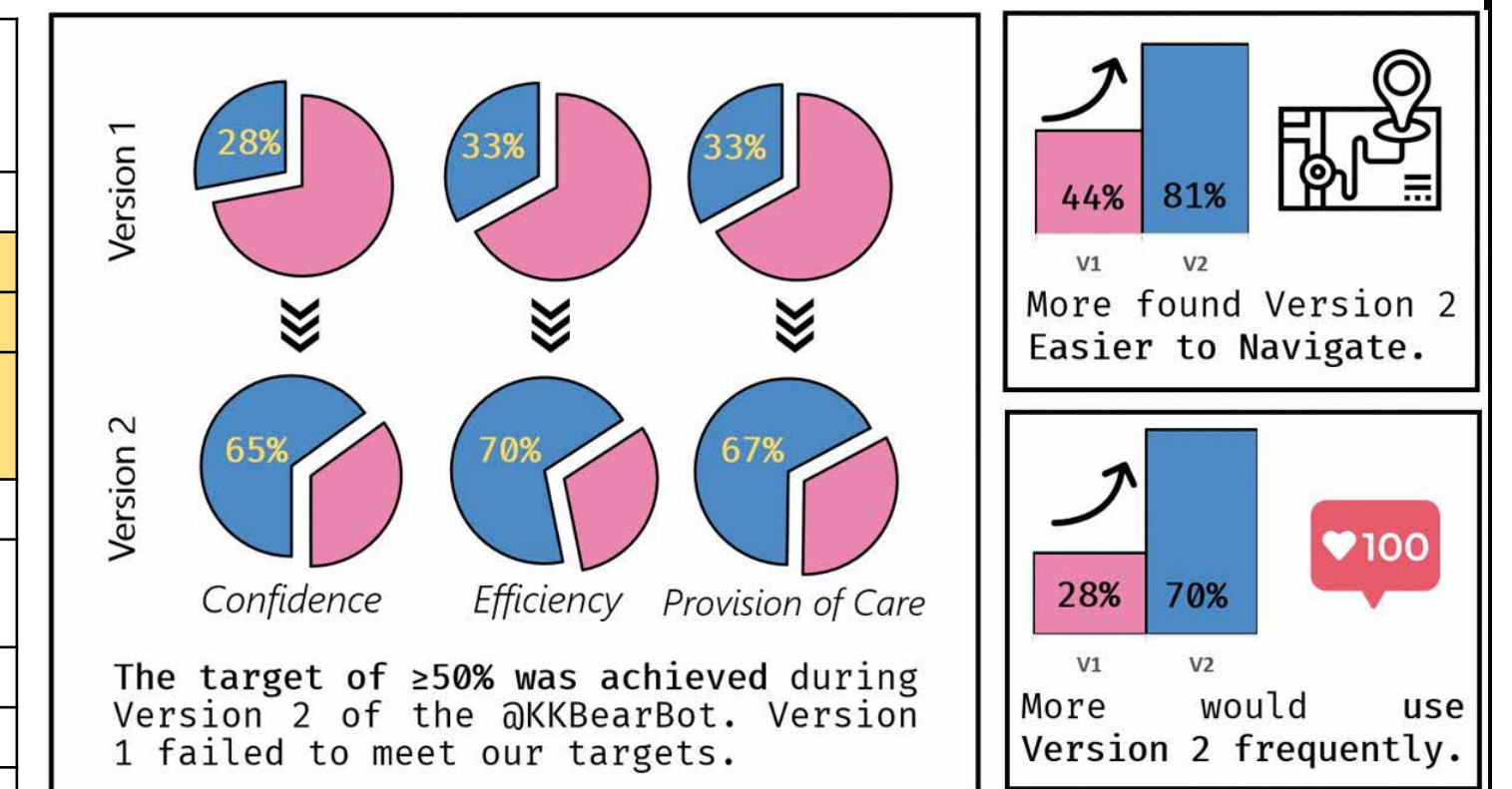
Outcomes

All three primary targets were reached, with other secondary findings in the table and figures below:

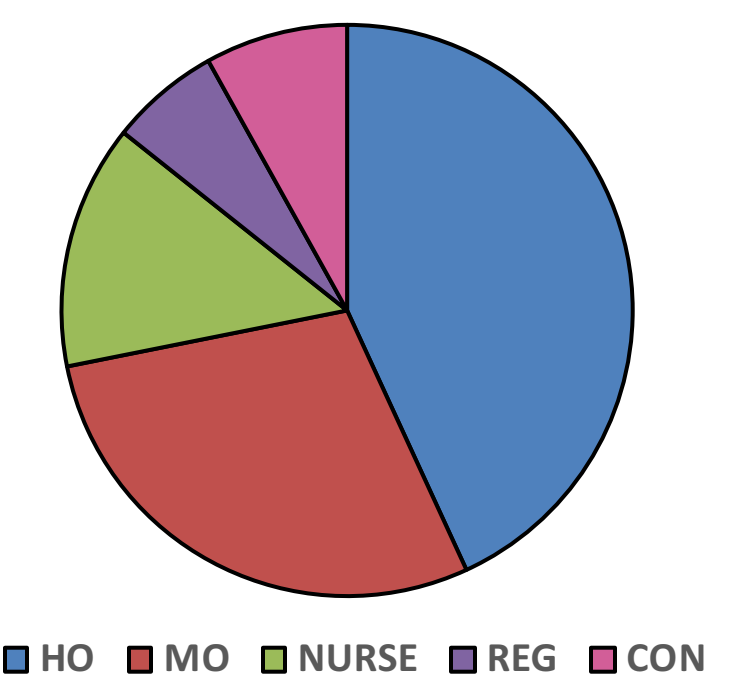
Post-Implementation Survey Results

Question	Mean (%) (PDSA 1 – 2) n = 18	Mean (%) (PDSA 3 – 5) n = 43	Mean Percentage change (%)	P-Value
User feedback of chatbot				
It increased confidence at work.	27.8	65.1	134.2	.011*
It increased efficiency at work.	33.3	69.8	109.6	.011*
It allowed better provision of patient care.	33.3	67.4	102.4	.022*
Usage Instructions were clear.	50.0	81.4	62.8	.026*
Commands were easy to remember	33.3	69.8	109.6	.011*
Commands were easy to use.	44.4	83.7	88.5	.004**
It was easy to navigate.	44.4	81.4	83.3	.006**
It would be frequently used.	27.8	69.8	151.1	.004**
I would recommend it to others	55.6	76.4	37.4	.123
Function Usage				
Hours-of-Life Calc.	17.0	46.5	173.5	.042*
Feeds Calc.	17.0	46.5	173.5	.042*
QTc Calc.	28.0	51.2	82.9	.156
Antimicrobial Guidelines	17.0	30.2	77.7	.350
Telephone Numbers	17.0	23.3	37.0	.737
Function Speed / Accuracy				
Telephone Numbers (Speed)	5.6	30.2	439.2	.047*
Antimicrobial Guidelines (Speed)	16.7	37.2	122.7	.134
QTc (Accuracy)	44.4	58.1	30.8	.403
Hours-of-Life (Speed)	44.4	55.8	25.6	.575

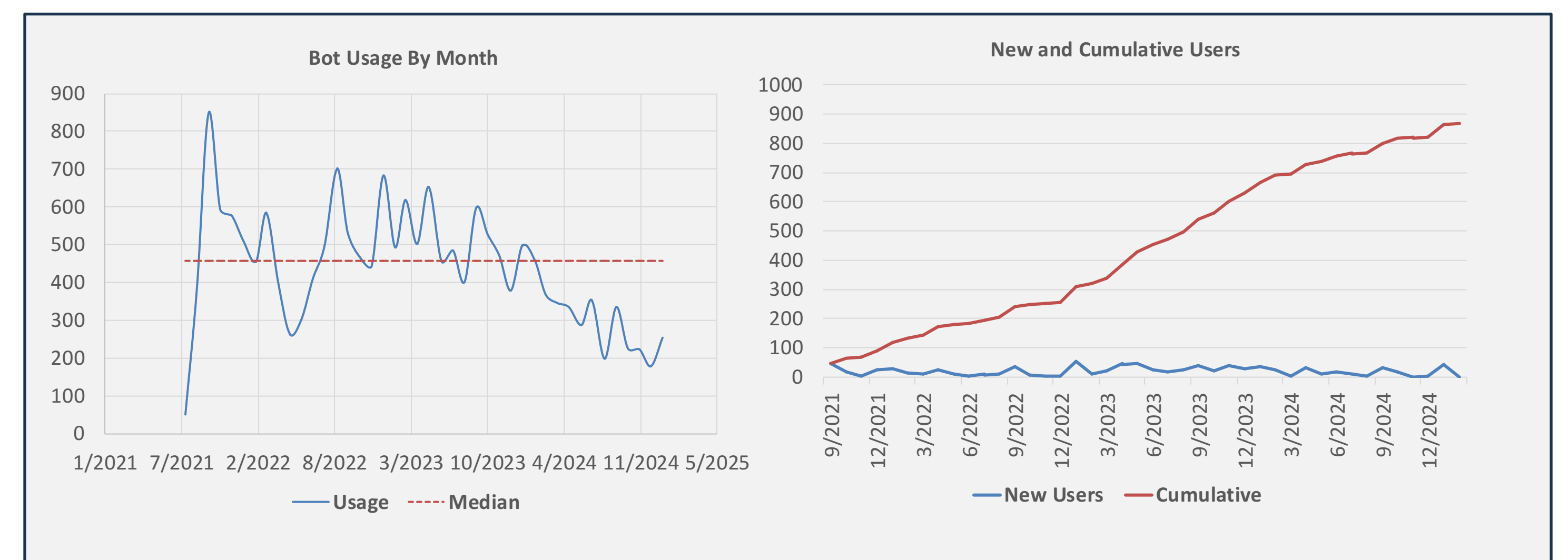
*where n represents number of respondents



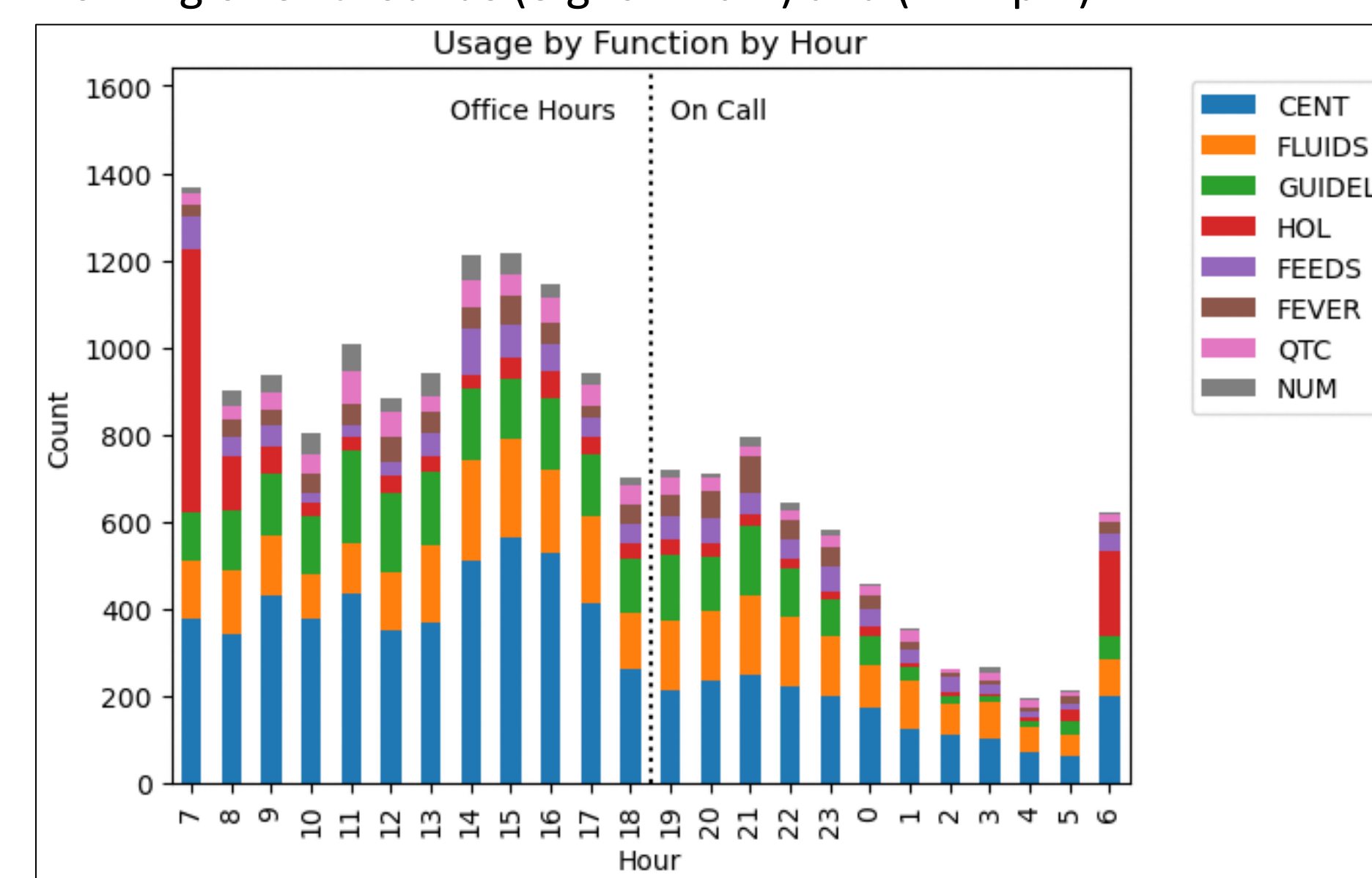
Breakdown of User Roles



The Bot also showed continued growth of users and continued usage over the years, with a cumulative total of 866 users (as of January 2025) and a median usage of 456 per month since usage tracking was implemented (version 2)



The bot also saw modest use throughout the day, especially in the on-call hours where manpower is minimal (>6pm to <8am). The usage pattern also coincides with when doctors are preparing for their morning or exit rounds (e.g. 6 – 7am) and (1 – 4pm).



Conclusion and Sustainability

Development of a healthcare-context specific mobile application or program to aid with clinical work can improve the work efficiency, confidence and perceived provision of care amongst junior doctors, despite the plethora of generic applications available for use. Care needs to be taken to consider the medium as well as the interface of such applications to encourage user uptake and maximize outcomes.

End-user feedback has been extremely positive. Usage and knowledge of the bot has spread to other departments and even other institutions. The bot is currently incorporated into the onboarding briefing for junior doctors in the KKH paediatric medicine department. Many have given feedback that the bot has been crucial in aiding their management of patients by providing quick and accurate information, particularly after office hours. All feedback and bug reports are collated via a feedback link in the bot and are rectified in a timely manner, usually within a few days.

The Baby Bear Bot project continues to run, incurring only minimal electricity costs. No funding is required for server maintenance, domain hosting, upkeep or databasing given its self-hosted nature. Features of the bot have been incorporated into the Singhealth AM Buddy Application which was co-funded by the OBGYN ACP, PAEDS ACP and Singhealth CIOO. Plans are underway to dovetail features of the Bot and AM Buddy into existing solutions offered by the Microsoft 365 suite of programs once they are whitelisted by Synapse for use. This will further save on costs and is the most sustainable long-term solution.