

# Ethics of AI in global health research

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## Case study

### Adherence vs agency: AI for behaviour change in health

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#### Background

International evidence suggests that health workers are not as diligent about handwashing as they should be given how crucial it is in preventing hospital-acquired infection (HAI)<sup>1</sup>. The global average compliance rate for handwashing is only about 38.7% with some countries falling below an acceptable threshold<sup>2</sup>. Direct supervision and feedback are usually used to improve staff habits but these methods are resource-intensive, prone to bias, and the Hawthorne effect<sup>3-6</sup>. Some studies suggest that new technologies like artificial intelligence (AI) can be used instead<sup>7-10</sup> but there is a dearth of information on their implementation in low- and middle-income countries (LMICs). Through this project we therefore employed human-centred design (HCD) to explore how AI may be deployed for the quality improvement of hand hygiene in India's public health system. The team consisted of partners and advisors from the social and commercial sectors of which Jhpiego (for ground support),<sup>11</sup> Quicksand (for HCD), and Datakalp (for technology) were main.

#### Brief description of the project

An AI system called *Vajrahands* was installed in the labour ward of seven district and sub-district hospitals across three states to cover a broad range of work environments<sup>12</sup>. It functioned in two parts: (1) A camera was set up at a selected basin to capture people's hand movements in real time — with no other identifiable information — for the algorithm to check if they had performed the nine steps of handwashing as recommended by the World Health Organization (WHO). This was supported by a display monitor where the staff got live feedback for each episode. (A green tick for the steps they got right, a red cross for the ones they didn't.) (2) All the data captured at the basin was aggregated day-wise and made available to the management on a dashboard for better monitoring and evaluation. We applied the HCD process to understand the hospital's experience of both these components.

HCD can be described as a creative process of problem solving with co-creation as its cornerstone. It begins with ethnography where designers learn about the needs, preferences, social context and constraints of their end users. This research is translated into rough solutions that are tested on the ground early on and often to come up with a final product, service, system or strategy that is truly people-centred. In recent years, this hands-on approach has gained a special significance in the development sector for it allows projects to fail and learn at a smaller scale before growing into a clinical trial. HCD can therefore be applied as 'an ingredient' to a larger study or from 'end to end' as our project demonstrates<sup>12</sup>.

#### Main activities of the project

**I. Foundational Research:** We conducted field visits, in-depth interviews, and focussed group discussions at all the project sites with 30+ stakeholders across all staff categories to learn about their handwashing practices and their initial experience of the AI system.

**II. Ideation & Prototyping:** We used the Manoff Group's *Toolkit for Behaviour Integration* to isolate the factors that influenced the uptake of *Vajrahands* from other research findings. These behavioural levers became the linchpin of our brainstorming sessions, where the most promising ideas were refined through multiple cycles of feedback from our end users until we arrived at a final set of interventions to make the AI system more friendly and useful in improving hand hygiene.

**III.Delivery:** In the last phase of the project, we introduced a new user interface for the display monitor and summary reports for the dashboard, as described in the next section. These product changes (collectively called Vajrahands 2.0) were supported by a bundle of non-digital interventions to encourage different forms of motivation and accountability (like staff meetings, self-driven targets, rewards, and feedback on hygiene from patients) along with team cohesion.

**IV.End Assessment:** The acceptability and the impact of the new interface, the summary reports, and the supporting interventions were evaluated in the following ways -

- Usage and performance data from Vajrahands (All sites)
- Staff surveys (95 respondents, all sites)
- Management surveys (21 respondents, all sites)
- In-depth interviews and group discussions with the staff, management, and ground team (30 respondents, all sites)

### **Ethical issues with a brief commentary on each issue**

A. Vajrahands was programmed according to the handwashing technique recommended by the WHO to align with global standards but this was not well-received by the staff because they were used to another protocol called SUMAN-K. They had to un-learn it and perform each step of the WHO sequence in a very specific way to be marked right by the algorithm. In addition to that they found the display monitor confusing. Its graphics were too small, and the red crosses for the missed or incorrect steps only appeared at the end of a hand wash so people would inadvertently linger on the same movement wondering why the AI had not acknowledged it. We worked on these challenges amongst others to improve the user experience and make it more engaging. Our new version almost worked like a video tutorial<sup>13</sup>. The staff simply had to follow a series of GIFs on the handwashing steps by the timer to get a perfect score. This, coupled with the supporting interventions, greatly improved the practice of handwashing — the average compliance rate at our weakest site jumped from 2.7% to 20.1% — but in making the interface more directive, we felt we had further reduced the room for variations that people naturally practise when WHO's recommendations are just that: they are not meant to be rigidly enforced.

**> How might we tread the line between adherence and agency as AI is increasingly deployed for behaviour change?**

B. Through our foundational research, we learned that the hospitals wanted an easier alternative to the dashboard. We therefore created PDF reports with data visualisation to give them a high-level summary of the ward's performance every fortnight. The reports were shared with the management on Whatsapp with a nudge to circulate them further amongst the staff. In the end evaluation, most respondents felt this intervention was crucial to behaviour change: for the first time, they could quantify and track their adherence to the handwashing protocol. But it also led to top-down supervision, where the higher-ups at some sites used fear to motivate their staff. They told the non-medical workers (who have the lowest status in the staff hierarchy) that the ward's performance was being watched by the government, leaving them anxious to comply with the algorithm. Some of the staff members were scared of making a mistake at the basin.

**> How might we protect public health employees against soft coercion as computer visioning and AI are increasingly used to monitor their adherence at work?**

C. The staff often de-prioritized the handwashing protocol because there is no incentive to follow it. We therefore introduced a short competition cycle with rewards but some sites had a blinkered view of it: they were bent on getting their scores right instead of using the intervention to inspire learning. They asked their senior staff to use Vajrahands more often to balance out the day's compliance rate if it dropped. We even had instances where the access to the project basin was altogether curtailed for those

who accompanied the expectant mother to the labour room because they did not know the WHO sequence, which leads us to ask:

**> How might we encourage a more honest relationship with numbers and data as AI is increasingly used in public health?**

### Conclusions and recommendations

The data generated by Vajrahands was analysed using an interrupted time series segmented regression analysis across a total period of seven months (Dec 2021 - June 2022) that was divided into two phases for (1) the original AI system, and (2) Vajrahands 2.0 + supporting interventions. This analysis confirmed that AI can be used to improve micro-behaviours like handwashing that are imperative to infection control and prevention. The average compliance rate at our best performing site touched 50.1% after the second iteration of Vajrahands was introduced with its retinue of non-digital interventions. But we need to pay more attention to the challenges at the adoption phase. There is a soft link between the ethical issues outlined above if we take a bird's eye view.

The Indian health system is highly hierarchical where development projects such as ours may be sanctioned by the state without consulting the implementation sites in a meaningful way. This leads to lower buy-in, and severe teething issues where the technology in question may not click with its end users [Issue A]. Which in turn creates a fertile ground for soft coercion [Issue B] and number play [Issue C] as the middle rung of decisionmakers (between the state and staff) feel the pressure to meet programme outcomes.

1. A social understanding of AI is therefore crucial to ensure that it does not exacerbate the structural disadvantages against the subaltern. HCD has the skills and mindset to closely work with people and tip the power relations by including a wide range of stakeholders from the margins to the mainstream in its participatory approach.
2. Regulatory frameworks like the Department of Health & Human Services, USA also need to account for this political reality. For example, our project was granted a non-research determination and exempted from ethical oversight because we were (i) collecting non-identifiable information from the ground (ii) investigating a trend of public importance (iii) under the aegis of the state when its decisions are not always consensual<sup>14</sup>.
3. There is also an urgent need to develop checks and balances against tech solutionism from within. This can be done by creating an evaluation tool for policymakers to measure the need for AI in their jurisdiction from a rights perspective, in a democratic way.

### References

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11. Jhpiego is a nonprofit associated with Johns Hopkins University. It was initially called the Johns Hopkins Program for International Education in Gynecology and Obstetrics, but is now simply referred to as Jhpiego.
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