## Describe your solution.

Program intelligent and personalized robots with comprehensive information on targeted clinical trials in multimedia form and with ability of direct communication. Deploy them to interact with patients in natural voice conversation to answer questions, provide information, and facilitate communications with clinical trial sites, all in a goal to build a trust and comfortable relationship between them. These robots can further be used to facilitate registration logistics and collect real time data during the trial period for big data analysis.

## How will you do it?

Partnering with healthcare robot company Catalia Health, we have built robots with artificial intelligence that interact with people in natural voice conversation. They can understand precise queries and supply matching answers but also can interpret nuances and fuzzy questions to probe and guide people in getting not just pure information but also to address emotional states. So for example, a person may ask “how will I be assigned to a treatment group?”, the robot will answer not only the methodology of randomization but also will probe the person if he/she is concerned about placebo group and may go on to explain the safety and ethics of placebo. They will be more than just machines to relay information, but agents to build relationship with the patients to make them feel comfortable about enrolling in clinical trials. These robots are designed to educate, empower, engage, and enable patients, so they are called E4 robots.

## How does it work?

Clinical trial recruitment is in essence a relationship building process. Patients’ concerns about and reluctance to enrollment mostly stem from a lack of accurate understanding of what a clinical trial is, what it entails, how benefits and risks are balanced, how patients are protected from safety and ethics aspects, etc. This lack of understanding often results into misconceptions among both referring physicians and patients. Direct interaction of physicians and clinical trial staff with patients can alleviate concerns and guide them in making the right decisions. But this resource is impractical and impossible to be made available for all potential participants. E4 robots provide humanized interaction with potential participants and to a certain degree become this resource that can be scaled up and be made available for all potential participants.

We will first in partnership with a clinical trial site develop information content on targeted clinical trials to contain text, audios, and videos. This content will go beyond what’s registered on clinicaltrials.gov to enrich with audiovisuals and in lay people language. This will also be translated into other languages like Spanish and Chinese. The content will be hosted on a secure server and be reviewed and approved by the Institutional Review Board. It will then be loaded to E4 robots. We will then customize prebuilt algorithms in E4 robots to take in the new parameters and specifications from the targeted clinical trials and rebuild the artificial intelligence to make E4 robots versed in these newly loaded clinical trials. These robots are light and sturdy enough so they can be shipped directly to patients’ homes and referring physicians’ offices where they will be in operation. For most of its operation, it will act autonomously with what’s stored in its content. For communication with clinical trial sites, it will connect to the Internet and either initiate a real time conversation similar to Apple’s Facetime or facilitate email communications by composing emails through dictation and reading emails back to patients. When patients become ready to enroll, they will already be very familiar with the content on Informed Consent Form and robots can further assist to input their registration information to make the process expeditious. A robot can be returned and be redeployed to the next patient and the cycle restarts. Robots can also stay with patients for the whole duration of trial and collect real time data on patient status such as medication adherence.

## What does it look like?

The E4 robot is in a dimension of about 20”x10”x5”(HxWxD), can easily fit in a household or an office. See accompanying photo for details.

## How will you implement it?

We will find an institutional partner of clinical trials to select one or more cancer open trials to build the robots described as above, we will then deploy the E4 robots to potential participants in 3 different and complimentary ways: 1). Place E4 robots in patient waiting rooms in the cancer clinics and set up a tradeshow like stage for it. This generates novelty and hopefully creates interests, but the interaction here with patients will be limited to general information to protect patient privacy. Interested patients can then either check out E4 robots in clinic or be put on a list to receive shipment of E4 robots. 2). Place E4 robots in referring physicians’ offices and patient advocacy communities offices and implement the same check out or shipping systems. 3). Directly reach out to patients to make them aware of availability of such robots and what they can do, then ship to them when interested.

## Where will you implement it?

We will reach out to Stanford Cancer Center and/or UCSF Cancer Center.

## Who will be involved (stakeholders)?

Jack Zeng, George Zhao, Cory Kidd from Catalia Health, and an institutional partner.

## How much will it cost to create the solution (an estimation)?

The cost of robot is $200 per unit. For a hypothetical 100 patient enrollment with 5% success rate, we would start with 2000 patients. We further estimate a patient to keep a robot for a week to interact and decide, we would need 100 robots to complete the enrollment in 20 weeks (100 x 20 = 2000). The cost would be $20000 ($200 x 100).

## How much will it cost to implement the solution (an estimation)?

The implementation cost would include content development, placement to locations, reaching out to patients, shipments of robots. We estimate the total cost at about $40,000.

## How many people will be impacted?

For the pilot, 2000 patients and many clinical trial staff members will be impacted, but if successful and broadly accepted, this solution could affect thousands and thousands, if not millions, both patients as well as clinical trial staff.

## How long will it take to create the proposed solution?

The generic robots have been built, information content will need to be developed in partnership with institution and be reviewed and approved by IRB, loaded robots will then be reprogrammed to gain new artificial intelligence. We estimate 3 to 6 months timeframe to create the solution.

## Why will it work? Why is it viable?

Majority of cancer patients are willing to participate in clinical trials, but barriers listed above prevent them. Most of those barriers can be lowered when direct interaction with clinicians became available, but that is not easily obtainable and scalable. We designed E4 robots to augment this capability to make it available to all patients, and because E4 robots can be built at low cost, can be easily deployed at home and in clinics, this is a viable solution that we believe can bring paradigm shift in patient recruitment as well as in retention.