Region Zealand, Denmark

AI Hospital Assistance

A successful case study using digital humans in Healthcare

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The Patients – COPD

COPD (Chronic Obstructive Pulmonary Disease) is a terrible chronic lung disease characterized by long-term respiratory symptoms and airflow limitation. Patients experience problems breathing, shortness of breath and severe coughing. COPD progressively worsens and patients deteriorate, severely affecting the daily lives of patients.

COPD is incurable, and eventually patients will die from the disease.

This fact affects the patients severely. Over one-in-three have severe depression. In addition, many suffer from anxiety and fear of leaving their homes, secluding themselves and stepping back from society. This has severe personal consequences to the patients, leaving them alone with their worst fear: Dying alone from suffocation.

Patients are typically elderly (+60 years old) and NOT strong with IT skills!

The Pre-care Clinic

In an experimental setting, Region Zealand has been running a Pre-care Clinic together with the Municipality of Odsherred. Their goal is to minimize hospitalization of COPD patients and give them better life quality, and in the five years that the project has run, they have shown, that hospitalization may be cut in half by collecting data of patients, measuring their respiratory capacity and monitoring it.

By doing this, the doctors and nurses of the pre-care Clinic are able to detect when a patient's condition start to deteriorate, and they may take precautionary steps to keep them from becoming full-blown exorbitations (respiratory failures) in need of hospitalization.

This is a HUGE benefit for patients!

They feel safer, become more social (because they feel safer leaving their homes), they are reminded of doing their exercises and they can see for themselves how this improves their measured conditions.

The Problem

The Pre-care Clinique still runs in an experimental stage, dependent on large-scale funding from Danish innovation pools, and today all measurements are collected through a mobile tablet app (developed by Appinux). The app is quite simple, and its main purpose is the collection of measurements (pulse, temperature and lung capacity). The tablet connects external devices like a spirometer (measuring lung capacity) via Bluetooth.

The problem is that the tablet/peripherals are still quite technical to use and requires a bit of technical expertise. Hence, the project is only able to include 1/3 of all COPD patients since the other 2/3 are not capable of handling the equipment.

And with this project, Region Zealand is looking for ways to include more people into the pre-care setting.

With the addition of a digital human to the app, how would that improve the utility of the app and the ability of the patients to perform measurements themselves?

Enter: The digital human

With our COPD project we wanted to explore the potential of allowing a digital human to interact with COPD patients of varying severity. Together with Region Zealand doctors and nurses, the following scope of exploration was identified:

New feature: Condition measurement

- How are you feeling today?
- Measurements + dialog with user
- Tell the results!

New feature: Open-ended questions/dialog – LLM-based AI model

- Ask question
- Answer with response from LLM

Preventive exercises

- PEP flute

Guidance videos

- Sleep video

Deliverable #0:

COPD Prototype – Design of Digital Human

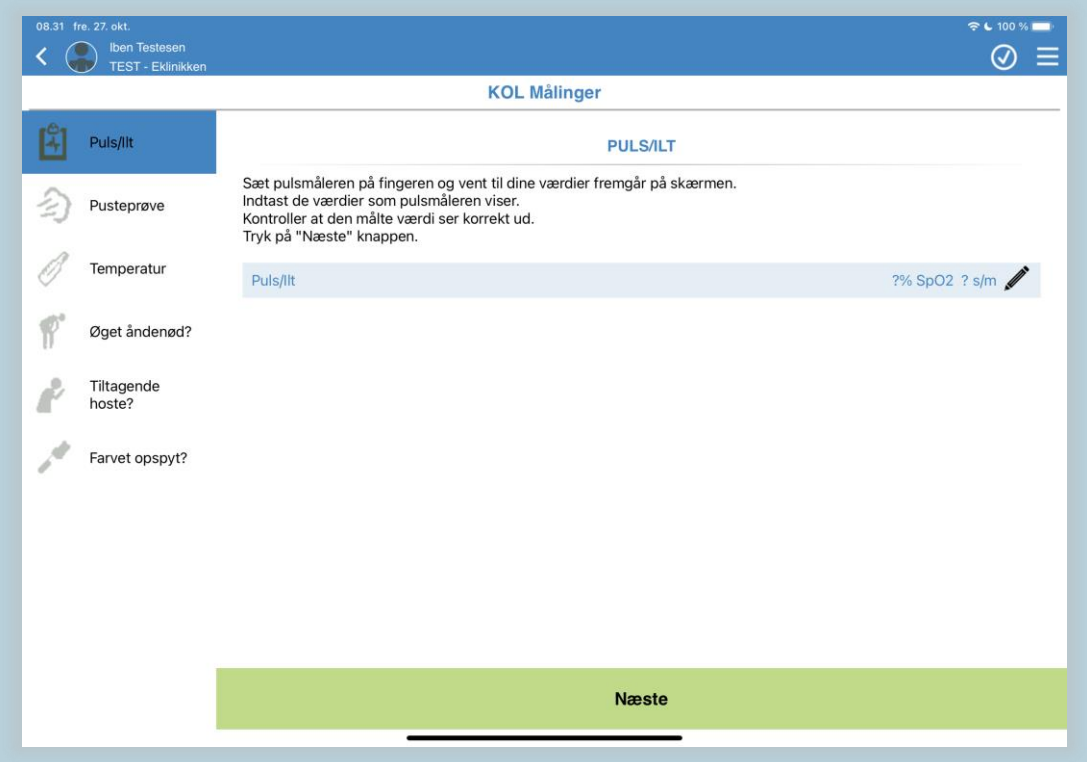
When designing the digital human, the patients expect a caring and patient healthcare professional, like the nurses they usually communicate with. Therefore, we designed a woman who was quite average looking. Not too pretty, with very little makeup and ordinary clothing, since that's what the nurses look like – nothing fancy!

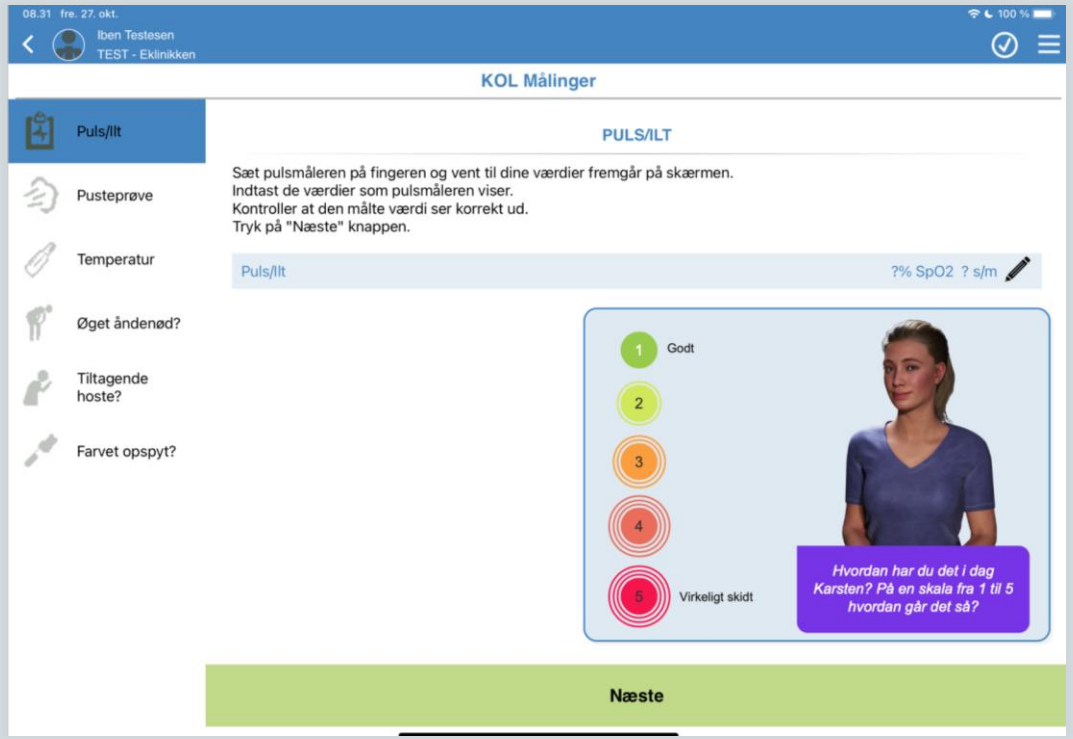
The nurses describe themselves as "average and usually with a little heavier-set frame". So, for the avatar, average features, medium blonde hair, soft chin, rounder cheeks and smaller eyes were used.

She must still look **kind, approachable, trustworthy and professional** so we added focus on her lips by sizing them a little bigger with a healthy – no lipstick – color and a smile. Having her hair tied back adds to professionalism since a healthcare professional wouldn't work with their hair loose – and she also needs to reflect the culture of the job.

Mockup: Digital Human in COPD Tablet app

- Pulse/Oxygen





Deliverable #1:

User Test with COPD Patients

Setting:

The user test was held on December 19, 2023, with three COPD patients aged 65-72 and one nurse. Plans had been made with five test subjects but two cancellations on the day resulted in only three tests and one for the nurse.

Location was Højby Town Hall in a meeting room. The nurse was present through-out all three patient tests. Tests were conducted by Emily with Rasmus as observer.

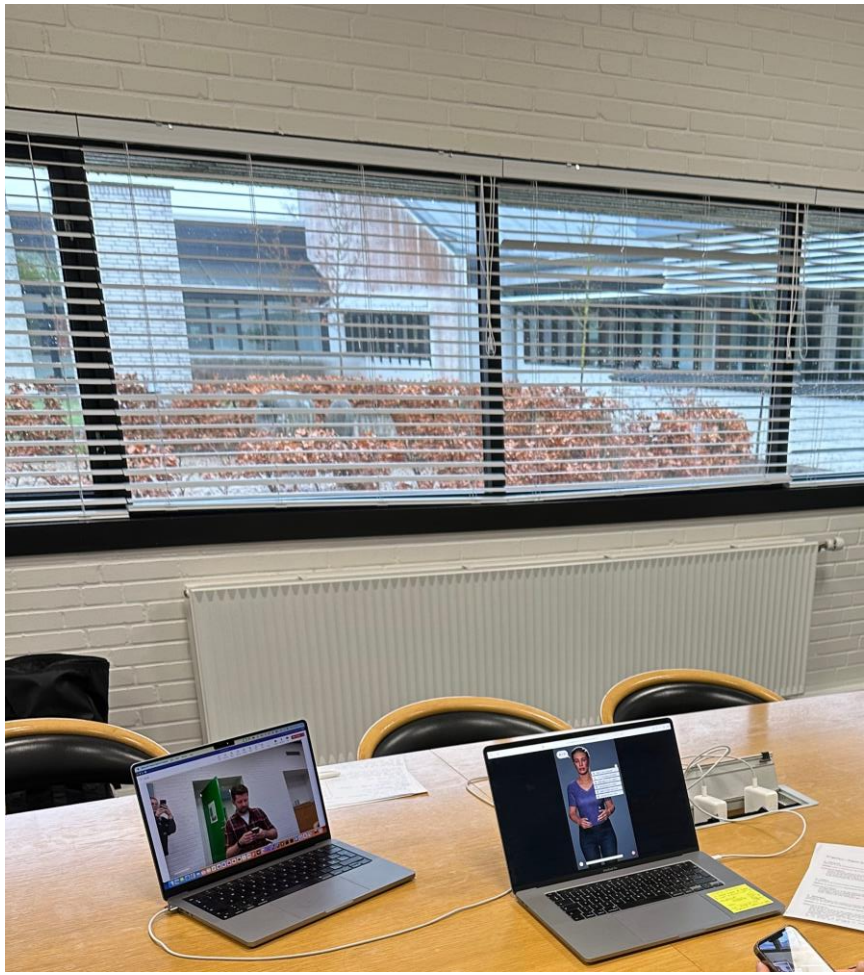
Setup was a laptop with the digital human in a **standalone feed**, meaning not integrated with the Appinux tablet app. The focus of the test was to test the digital human and the interaction between patients and avatar.

Special attention was paid to the facial expressions and non-verbal reactions of the test subject along with their verbal response and their ability to fulfill the test script.

Attachment: Spørgeguide - Brugertest - RegionSjælland 2.docx shows the Danish test script.

Attachments Brugertest_..._.mp4 shows video material from the test (except from the nurse).

Attachment: Brugertest - Region Sjælland - Opsamling.docx shows the test report made from the user test (in Danish).



Deliverable #1:

User Test with COPD Patients – Overall

Look of avatar:

Overall results showed that the patients found it quite normal to talk to the digital avatar to begin with.

Two out of three also liked the way she looked and felt that she fit their expectation of what a “digital avatar health assistant” could look like.

One patient said she would feel more comfortable talking to a “older and less healthy looking” avatar and associated that with more knowledge, experience and professionalism.

Contemplations for future work include making her older, giving her a “uniform” or some equipment to signal her profession, as well as the technical considerations on the following pages.

This may, however, contradict the official intention from Region Zealand project group: That the digital avatar should not look like a health professional because they are worried about the connection to health-related questions. This is a fine line to walk..

Deliverable #1:

User Test with COPD Patients – Overall

Overall interaction with the avatar:

All of them did, however, felt comfortable talking to the digital human. They immediately caught on to the concept and did not express insecurities interacting with the technology.

Furthermore, all patients managed to interact with selected parts of the prototype, and it was clear that when the interaction was problem-free, the technology worked by keeping interactions verbal and a sense of flow was found.

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Conclusion and Next Steps

Conclusion & Next Steps (1)

Due to events outside the control of our project, Bispebjerg and/or Hvidovre has not been able to participate in the project as intended by the SoW. Instead, we followed a lead from Spring 2023 with Region Zealand which actually turned out even better! It gave us direct patient access in a controlled setting where Region Zealand already had both patient group, nurses, doctors and tablet-based solution in place.

And this provided us with a unique opportunity to do qualitative user tests with patients! And the feedback and results (i.e. necessary changes to the platform and interaction form with the digital human for healthcare scenarios) gave us unique insights that we would have never found with the project intended by the SoW. We knew this would be difficult - to do end-user testing with senior patients – but it was clear that the technology of digital humans shows great promise with few barriers of acceptance, and designed the right way, the potential is enormous.

While pursuing the project with Region Zealand, attempts were still made with Bispebjerg/Hvidovre to get them involved and setup a kiosk in either of their emergency rooms. But attempts were unsuccessful, and this was reported to the global committee in January 2024.

Conclusion & Next Steps (2)

- Bispebjerg

After this reporting in January 2024, however, Bispebjerg finally got back to us with interest in three upcoming projects:

- **Wayfinding:** They are running an internal PoC project to evaluate wayfinding solutions and wants to include us and our Round 1 wayfinding solution as part of this evaluation. As of this report, considerations are still being made and we are yet to have a final agreement with them.
- **Receptionist solution:** They are very much interested in the digital human technology and wants to pursue a more basic receptionist solution.
- **Nutrition project:** Bispebjerg is working on a project with Innovation Fund Denmark (‘Innovationsfonden’) and one of the major vendors of administrative healthcare solution in Denmark, Systematic, for following patient food consumption and nutrition intake while in hospitals. They’re looking into adding us to the project to handle patient dialog with our it.human platform.

Conclusion & Next Steps (3)

- Region Zealand

With Region Zealand, their Pre-care Clinic has unfortunately been closed due to missing funding from January 1st 2024. They see enormous potential with our technology and are pursuing the following cases to extend our cooperation:

- **Receptionist:** A digital receptionist for internal use in their Digitization reception – to expose their own employees to the future of digital humans.
- **Path-finder-helper:** Also interested in the Wayfinding functionality from Round 1 of the project. Pursuing details here for trials.
- **Guiding counselor for other clinical projects:** Other departments than the COPD project are looking into digital communication with patients for reference material and conversational engine on specific illness/condition.

Commercializing the project

The Round 2 project of the AI Hospital Assistance shows great promise for future opportunities. Already both Region Zealand and Bispebjerg are discussing future projects with us.

Still, the field of digital humans is completely new so the next projects within healthcare will surely also have an explorative character and there is still some way to go, maturing the technology, use of microphones, tweaking of the conversational flow, design of the avatar and integration into the existing tools and platforms within healthcare.

But the project shows that patients are positive about the technology, does not fear speaking to a digital human, are able to grasp the experience and actually find it interesting and safe.

And with this **documented finding** of the Round 2 project, we are able to pursue even more projects and expand our world of digital humans into the healthcare industry but also other citizen-based areas like municipality and government level.

Service for multiple roles – the future

Relatives

- Wayfinding to the patient
- Practical information about parking, kiosk/food, toilets, ..
- Info about patient care (GDPR)
- Guidance for operation/treatment – support for the patient
- Support for rehabilitation – what can you do as a relative?
- Conversational partner when things get tough in-between nurse visits
- Update waiting time (e.g. in the ER)

Patient

- Information about care/ operation
- Instructions for rehabilitation
- Pre-op questionnaire spoken, incl pre-op abstain from food
- Directions/way-finding at hospital
- Info about course of illness
  - ”What happens next?”
  - ”What can I do myself?”
- Rehabilitation
- Proposal for clinical trial?
- Conversational partner in-between nurse visits + relatives
- Update waiting time (e.g. in the ER)

Nurses

- Dictation of notes/patient observations through speech
- In general: Make it possible to access spoken information while doing stuff, e.g. care for patients – no need to ‘pause’
- Reference for patient info
- Assist in patient care/medicine dosing – show notes
- Info about points for attention for specific patient, e.g. medicine schedule
- Remembering patient info (allergens, food preferences)
- Other stuff asked by patients..

Doctors

- Administer appointments
- Sum up patient history verbally, no requirement for reading + potential to ask questions
- Reference about specific patient - verbal
- Dictate observations (verbally)
- Proposal for clinical trials?

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