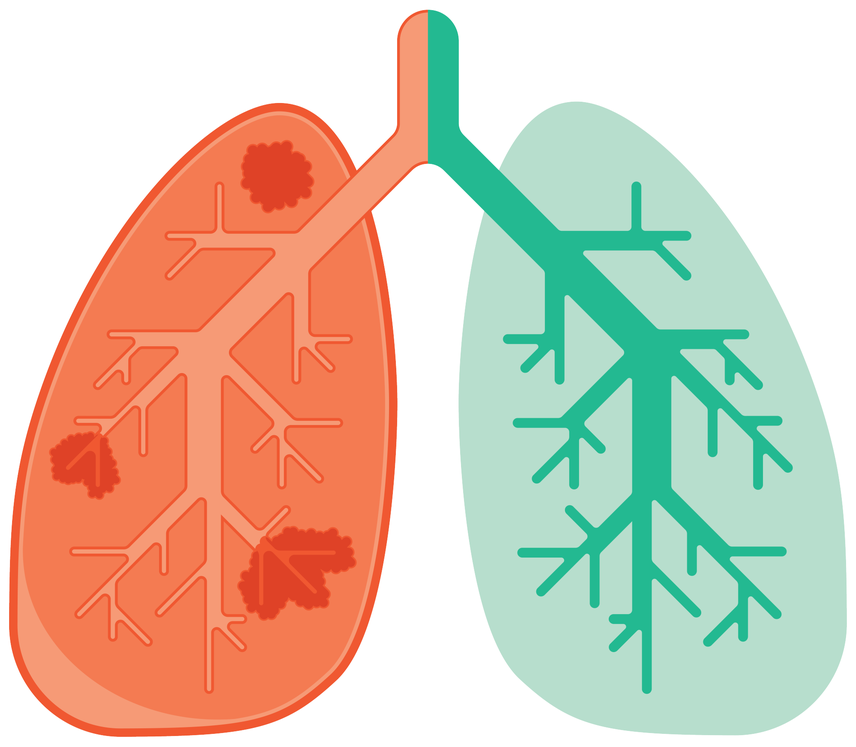
SIEMENS Healthineers

Innovation Think Tank
Proactively drive innovation to improve human life

LUNG CANCER

FACTS & FIGURES

PAIN
CAUGHING WITH BLOOD
NIGHT SWEAT
SHORTNESS OF BREATH
WEIGHT LOSS



COVID-19

IN CHINA, 1% COVID-19 CASES
HAD CANCER HISTORY
28% OF THEM LUNG CANCER

COVID-19

LUNG CANCER SYMPTOMS
FEVER (96%) AND COUGH (47%)
ARE THE MOST COMMON SYMPTOMS OF COVID-19

MOST COMMON
CANCER

2.09 MLN
CASES 2018

1.76 MLN DEATHS

1

$12.1 BILLION
LUNG CANCER CARE

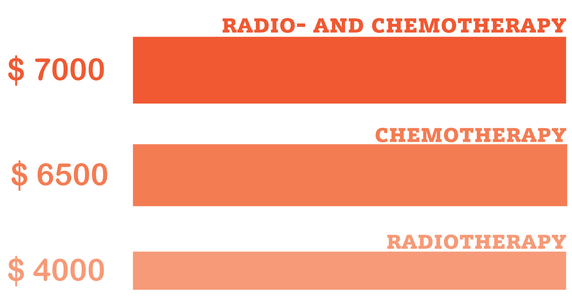
$8.8 BILLION
TOBACCO MARKETING

$1.9 BILLION
LUNG CANCER SCREENING

$460 MILLION
ANTI-TOBACCO PROGRAMMES

2

CANCER ATTRIBUTIBLE MONTHLY COST



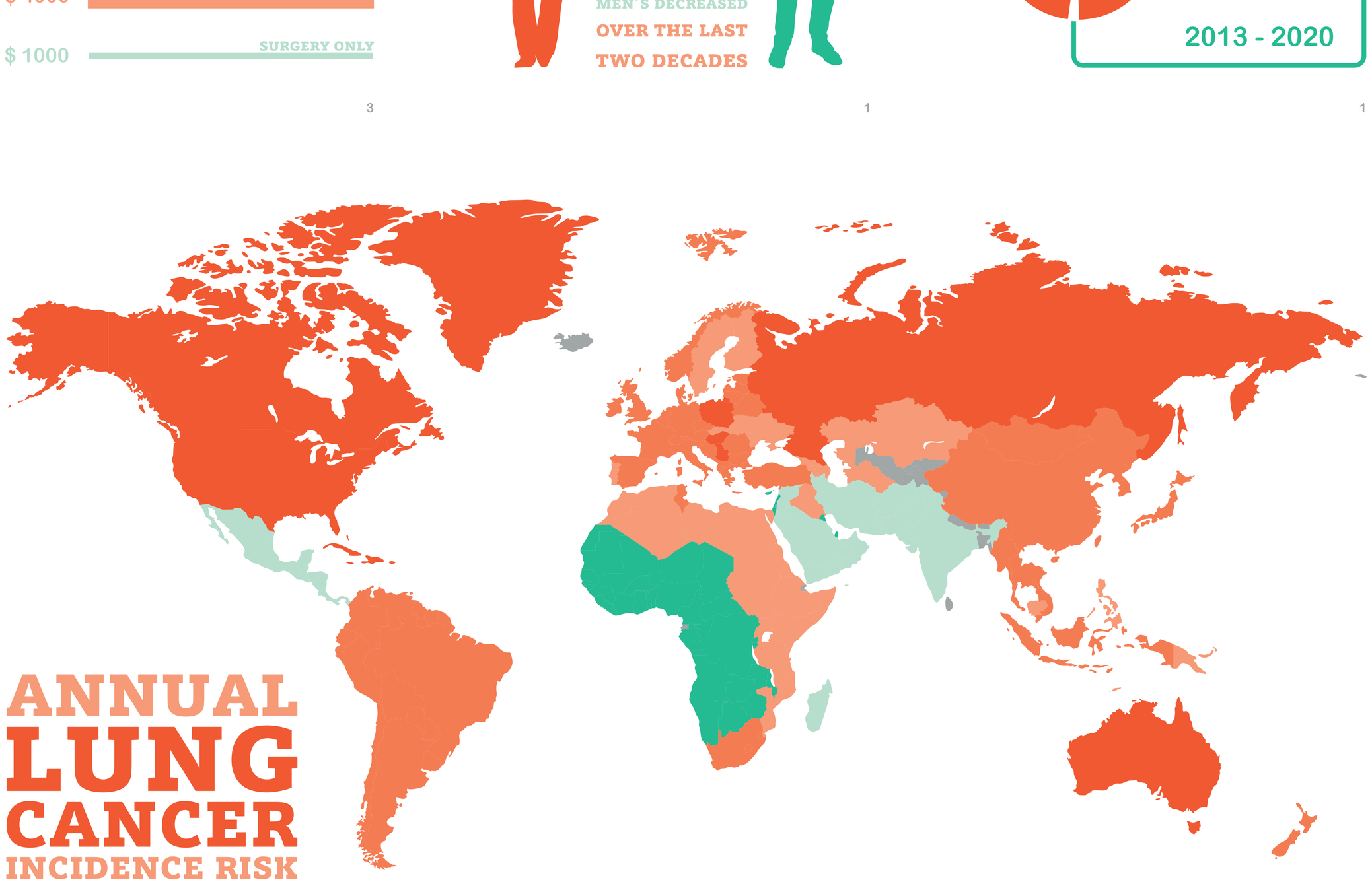
3

LUNG CANCER INCIDENCE INCREASED IN WOMEN
MEN'S DECREASED OVER THE LAST TWO DECADES

1

WHO POSITION ABOUT LUNG CANCER

1



ANNUAL
LUNG
CANCER
INCIDENCE RISK
PER 100 000
2018

0 - 8
8 - 16
16 - 24
24 - 32
40 +
NOT APPLICABLE

2

1. World Health Organization, 2018, September 12. Cancer. Retrieved from https://www.who.int/news-room/fact-sheets/detail/cancer
2. Bender, E. (2014). Epidemiology: The dominant malignancy. Nature, 513 (7517), S2-S3.
3. Sheehan, D.F. et al. 2018. Lung cancer costs by treatment strategy and phase of care among patients enrolled in Medicare. Cancer Medicine, 8 (1), 94-103.

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LUNG CANCER

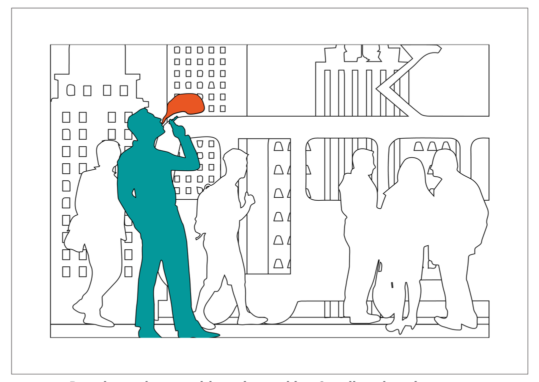
Overview of lung cancer in healthcare: present and future

1 PRENATAL

PUBLIC AREA
In the street

STAKEHOLDERS

- **The Patient** – People who are exposed to smoking & air pollution
- **Medical Device Companies** – Produce smart detector & smart masks



People get lung problems in smoking & polluted environment

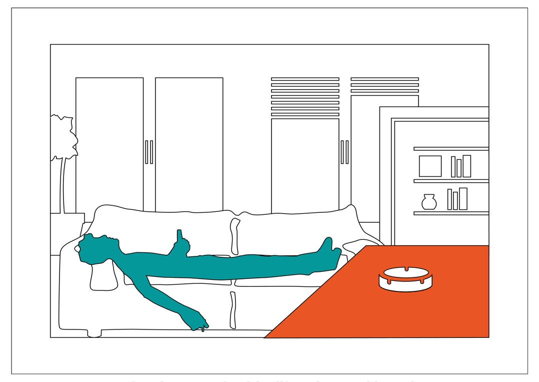
1. PAINPOINT: Polluted environment may be a risk factor for the pregnant woman to develop lung cancer (also for the baby)
   SOLUTION *digitalization*
   Smart Detector – Smart detector for smoking areas with color coding to identify the radon levels on public areas
2. PAINPOINT: The polluted air in smoking area may lead to lung cancer for pregnant woman and the baby
   SOLUTION *clinical innovation*
   Antioxidant Chemo Preventive Agent – Prenatal antioxidant chemo preventive agent like N-acetylcysteine prevents cigarette smoke-induced lung cancer
3. PAINPOINT: Secondhand smoking is harmful to the lung and may lead to lung cancer for pregnant women
   SOLUTION *digitalization*
   Smart Mask – Smart mask to filter the impurities in the air
4. PAINPOINT: Smoking pregnant women may cause lung cancer for the baby or themselves
   SOLUTION *clinical innovation*
   Nicotine Replacement – Use nicotine replacement therapy including adhesive patch, chewing gum, lozenges, nose spray, and inhaler to help quit smoking
5. PAINPOINT: Unhealthy diet & living habit may increase the possibility of lung cancer for pregnant women
   SOLUTION *clinical innovation*
   Prevention Diet – Follow a healthy diet including more of a variety of vegetables, fruits, whole grains, and legumes such as beans, limit consumption of red meats and alcoholic drinks, etc.

2 PREVENTION

HOME
Living room

STAKEHOLDERS

- **The Patient** – People who are more possible to get lung cancer
- **The Family** – Contact & take care of the potential patient
- **Medical Device Companies** – Produce smart devices



Patient have a unhealthy lifestyle (Smoking a lot)

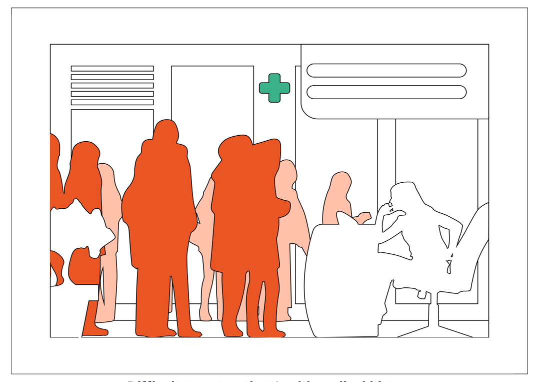
1. PAINPOINT: Unhealthy lifestyle of patient ineffective prevention
   SOLUTION *digitalization*
   Smoking-Stopping Device – Wearable device with daily challenges to encourage the person to stop smoking
2. PAINPOINT: Elderly patient who is not capable to frequently make check-ups with his geriatrician (or don't have a geriatrician)
   SOLUTION *digitalization*
   Smart AI Breathalyzer – Smart AI breathalyzer device with questionnaire of how the patient feels today, and helps by Telemedicine for geriatrician
3. PAINPOINT: People like a widower who stays alone in an apartment
   SOLUTION *digitalization*
   Home Care System – Care home for elderly people. Social platform to notify the relatives to contact the patient. Robotic Assistant e.g. Pepper to take care the patient
4. PAINPOINT: Passive smoking is harmful to the lung and may leads to lung cancer
   SOLUTION *digitalization*
   Smart Smoke Detector – Sensor that detects the harmful smoke and sends warning to the patient
5. PAINPOINT: Chemical radon polluted environment
   IMPLEMENTED SOLUTION *digitalization*
   Home Gas Detector – Smart indicator of radon with prevention suggestions
6. COVID-19 – PAINPOINT: Regular planned check-ups are canceled out of fear from COVID-19. Early symptoms may no be detected by the doctor.
   SOLUTION *digitalization*
   CT Innovation – Use of telemedicine and if the doctor wants the patient to go to a CT examination, offer e.g. mobile CT/Uber CT.

3 SYMPTOMS

HOSPITAL
In the reception hall

STAKEHOLDERS

- **The Patient** – People that suffer from lung cancer
- **Receptionist** – People who answer the telephone, arrange appointments, etc.
- **Oncologist** – Doctor that diagnose the patient with lung cancer
- **Hospital Administration** – Manage the procedure of diagnosis & treatment in the hospital
- **Medical Device Companies** – Produce medical devices



Difficult to get patient's old medical history
Patients often wait for a long time

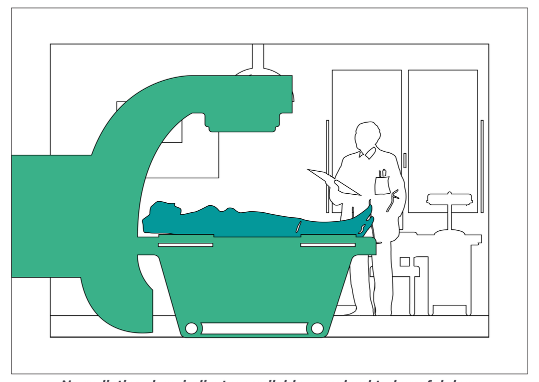
1. PAINPOINT: Difficult to recollect detailed medical history
   SOLUTION *digitalization*
   Cloud Database – Cloud computing medical base data with blockchain RFID ID card
2. PAINPOINT: Information overload on the internet
   SOLUTION *digitalization*
   Social platform – Social platform to identify accurate information given by patients & qualified doctors
3. PAINPOINT: Difficult to get an appointment, in case of cancelled appointment , the patient is not notified well in advance
   SOLUTION *digitalization*
   Appointment management – Smart calendar platform to reminds the patient & the hospital smart platform to classify patients between physicians
4. PAINPOINT: Certain symptoms can have different causes and aren't always a sign of cancer
   SOLUTION *clinical innovation*
   AI diagnostics application – AI diagnostics application that can calculate the probability of cancer based on the symptoms
5. PAINPOINT: Difficult to track the symptoms in an early stage
   IMPLEMENTED SOLUTION *digitalization*
   Self Monitor Device – Monitoring the SpO2 & pulmonary function using spirometer & oximeter sensor
6. COVID-19 – PAINPOINT: Some symptoms similar to COVID-19,there is a high risk of missed or delayed diagnosis due to the pandemic.
   SOLUTION *digitalization*
   Point of care – Point of care Nucleic acid testing

4 DIAGNOSIS

HOSPITAL
Radiation room

STAKEHOLDERS

- **The Patient** – People that suffer from lung cancer
- **Nurse** – For blood taking & CT scan
- **Oncologist** – Doctor that diagnose the patient with lung cancer
- **Polyclinic** – Hospital that takes lung cancer patients
- **Medical Device Companies** – Produce medical devices



No radiation dose indicator available, may lead to harmful dose

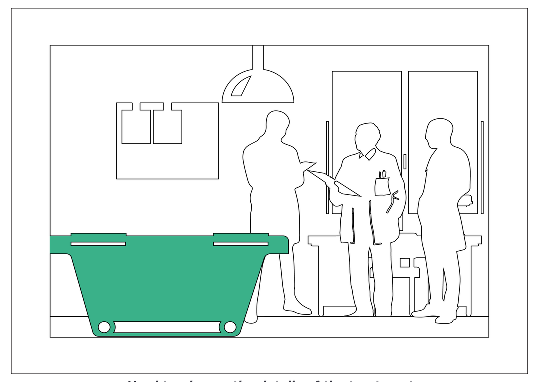
1. PAINPOINT: No proper directions given inside the hospital
   SOLUTION *digitalization*
   Smart navigation device – Smart navigation device with audio guidance and led color coding between departments
2. PAINPOINT: Failed punctures & taking wrong volume of blood
   SOLUTION *clinical innovation*
   Smart blood taking system – IoT scan device to see where to take blood samples Automated blood taking robot, Image processing to determine the best puncture point
3. PAINPOINT: Improper radiation dose
   SOLUTION *clinical innovation*
   Smart radiation management – AI prediction device that stores data, gives diagnostic suggestions and indicates the levels of radiation dose
4. PAINPOINT: Complicated admission and billing process
   SOLUTION *digitalization*
   Integrated payment system – Platform to integrate all the patient data including financial control
5. PAINPOINT: Biopsy through thoracoscopy is invasive to the body
   IMPLEMENTED SOLUTION *digitalization*
   EFIRM-based liquid biopsy – EFIRM-based liquid biopsy that detects salivary exosome biomarkers like EGFR mutations from plasma and saliva
6. COVID-19 – PAINPOINT: Patients experienced delays in imaging examinations due to self-isolation/quarantine. Diagnosis tests only performed in patients with signs of severity.
   SOLUTION *digitalization*
   Appointment management – smaller/modular/mobile CT/ Uber CT
7. COVID-19 – PAINPOINT: Risk of getting infected by medical staff who have contact to lots of patients which may be undetected COVID-19 positive.
   SOLUTION *digitalization*
   Medical robots – Medical robots

5 TREATMENT

HOSPITAL
In the treatment room

STAKEHOLDERS

- **The Patient** – People that suffer from lung cancer
- **Nurse** – Work on different therapies
- **Oncologist** – Doctor that diagnose the patient with lung cancer
- **Radiation Therapist** – Plan and administer radiation treatments
- **Medical Device Companies** – Produce medical devices



Hard to plan on the details of the treatment

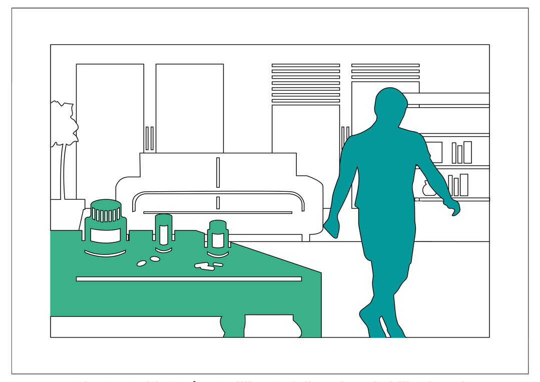
1. PAINPOINT: Complex Planning/ Treatment. E.G. Intervention
   SOLUTION *digitalization*
   AI treatment mapping – AI software suggesting treatment based on machine learning patients' data history (global database)
2. PAINPOINT: Chemotherapy & radiography have side effects
   SOLUTION *clinical innovation*
   New therapies – Immune therapy or molecular targeted therapy
3. PAINPOINT: Missing or delayed patient feedback
   SOLUTION *digitalization*
   Smart Calendar Platform – Smart calendar platform that reminds the patient of the feedback and sends it online
4. PAINPOINT: Surgery on tumor is often difficult to carry out
   SOLUTION *clinical innovation*
   Neoadjuvant Treatment – Neoadjuvant Treatment can shrink the tumor enough to make it easier to remove with surgery
5. PAINPOINT: Local ablation therapy in lung cancer is difficult to monitor
   IMPLEMENTED SOLUTION *digitalization*
   AR Surgery Assistance – AR helps in surgery planning by showing the internal structure of the lung
6. COVID-19 – NPOINT: Problems of availability of medicines in local pharmacy due to production n the countries the gs are produced.
   SOLUTION *digitalization*
   Central databank – Central databank to monitor the invetory of medicines and home delivery

6 REHABILITATION

HOME

STAKEHOLDERS

- **The Patient** – People that suffer from lung cancer
- **Rehabilitation Therapist** – Doctor that follows the long-term treatment of lung cancer patients
- **Medical Device Companies** – Produce medical devices



Patient not able to / not willing to follow the rehabilitation plan

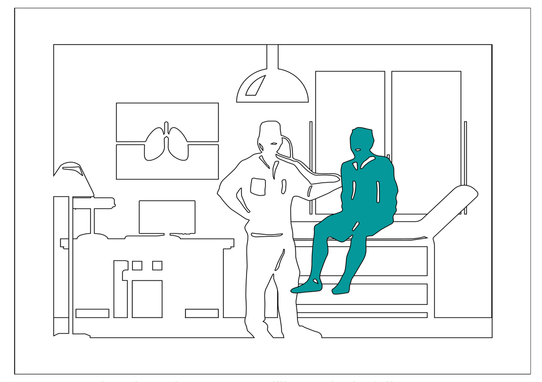
1. PAINPOINT: Functional decline, activity limitations and participation restrictions due to the cancer
   SOLUTION *digitalization*
   Smart Rehabilitation Assistance Devices – Kinect for physiotherapy Breath helping wearable device for palliative rehabilitation
2. PAINPOINT: Patient unwilling to stick to the rehab. plan
   SOLUTION *digitalization*
   Patient encouraging device – Daily stimulator speaking device/ platform with rewards to help the patient stick to the plan
3. PAINPOINT: Patient suffers from pain after the surgery
   SOLUTION *clinical innovation*
   Palliative Rehabilitation – Palliative rehabilitation including breathing retraining, relaxation techniques and activity pacing
4. PAINPOINT: Patient suffers from physical and emotional setbacks
   SOLUTION *digitalization*
   Exercise Rehabilitation – Well-designed exercise program may help individuals feel better physically and mentally and may also decrease the risk of further disease
5. PAINPOINT: Patient's follow-up plan is not suitable for the specific situation
   SOLUTION *digitalization*
   AI Personalized Follow-up Plan – Ai-generated follow-up plan according to the patient's medical history and current status
6. COVID-19 – PAINPOINT: Patient is isolated at home, due to the lock-down some treatments (e.g. physical therapy) are p ostponed.
   SOLUTION *digitalization*
   Telemedicine – Use telemedicine to instruct the patient to do exercises.
7. COVID-19 – PAINPOINT: 40%-75% of lung cancer patients have mental health problems which may increase by loss of social contacts and support
   SOLUTION *digitalization*
   Online consultation – Follow up plans through online consultation, APP

7 FOLLOW-UP

HOSPITAL
In the doctor's room

STAKEHOLDERS

- **The Patient** – People that suffer from lung cancer
- **Rehabilitation Therapist** – Doctor that follows the long-term treatment of lung cancer patients



Patient don't show up or unwilling to do the follow-up tests

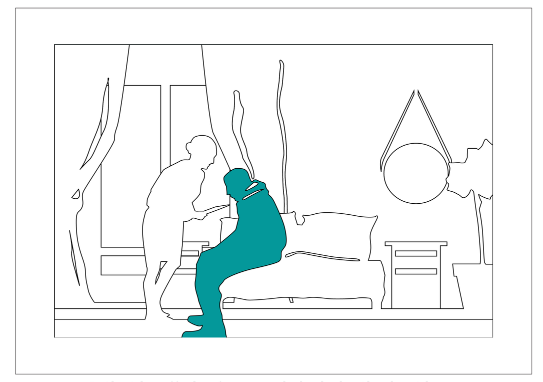
1. PAINPOINT: Patient suffers from physical and emotional setbacks
   SOLUTION *digitalization*
   Appointment Management Platform – Smart calendar platform to reminds the patient and also the hospital the appointments & quick message between them
2. PAINPOINT: Follow-up tests & feedback are time-costing and patient have no idea how frequent should they go for the examinations
   SOLUTION *digitalization*
   Smart Follow-up Test Management – AI based software to calculate the best procedure & frequency for testing and scanning
3. PAINPOINT: Patient suffers from pain after the surgery
   SOLUTION *clinical innovation*
   Maintenance Medications – Patient takes maintenance medications regularly to keep the situation stable and decrease the risk of recurrence
4. PAINPOINT: Patient feels depressed, lonely and helpless
   SOLUTION *clinical innovation*
   Community Communication – Join the lung cancer patient community to share the concern, fear and information about recovering from the disease
5. PAINPOINT: Patient has problem breathing properly
   SOLUTION *clinical innovation*
   Breathing and Respiratory Therapy – Patient benefits from oxygen therapy or a respiratory treatment known as continuous positive airway pressure therapy
6. COVID-19 – PAINPOINT: Postponed of some exam tests due to cancellation of regular check-ups.
   SOLUTION *digitalization*
   Telemedicine – Follow up plans through online consultation, APP

8 Out-Patient

HOME

STAKEHOLDERS

- **The Patient** – People that suffer from lung cancer
- **Radiation Therapist** – Doctor that follows the long-term treatment of lung cancer patients



Patient is suffering from psychological setbacks at home

1. PAINPOINT: Psychological problems
   SOLUTION *digitalization*
   Smart room for relaxation – Relaxation rooms & controlled light in smart home
2. PAINPOINT: Incorrect protection may cause side effects to the treated area
   SOLUTION *clinical innovation*
   UV clothing – Cloth made of UV resistant material
3. PAINPOINT: Difficult to identify the metastasis at early stage
   SOLUTION *digitalization*
   AI re-examination planning system – AI software to determine or suggest more scans performed based on probability & other patients' history data
4. PAINPOINT: Patient don't follow the rehabilitation plan in the long run
   SOLUTION *digitalization*
   Continue home-based rehabilitation – AI software to make plan based on the status of the patient with an encourage system to help the patient to stick to the plan
5. PAINPOINT: It is hard to notice a recidivation
   SOLUTION *digitalization*
   Smart Breathalyzer – Breathalyzer with saliva indicator to check if the symptom reappears
6. COVID-19 – PAINPOINT: Patient forget to do homebased rehabilitation
   SOLUTION *digitalization*
   Application – App offers daily reminder for home-based rehabilitation, like Keep

THROUGH THIS CAREPLAN WE HIGHLIGHT DATA FROM A COLLECTION OF

50 respective solutions

72 painpoints