

# DESIGN OF MICROWAVE-BASED DEVICES FOR PREHOSPITAL DIAGNOSIS OF TRAUMATIC INTERNAL INJURIES

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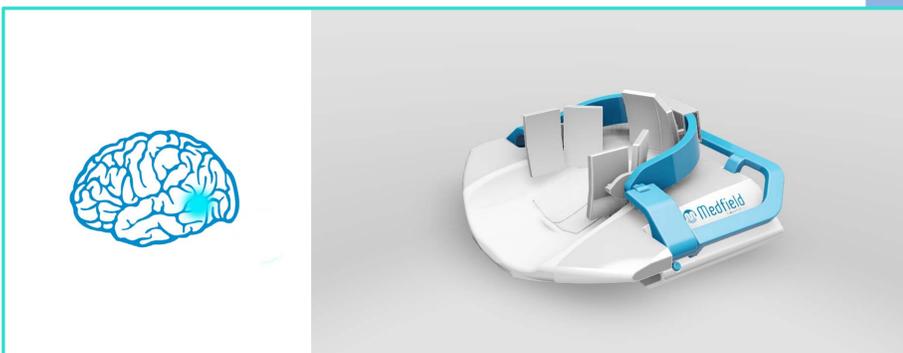
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## Introduction

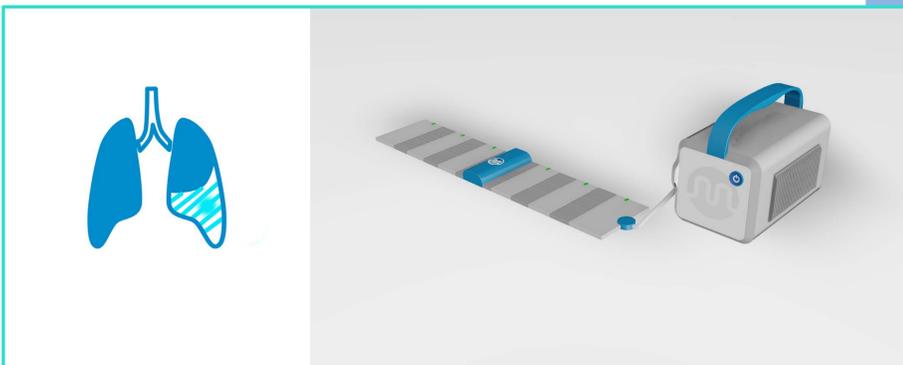
There are around 8500 cases of intracranial injuries (injuries inside the head) and about 900 cases of Pneumothorax (one type of traumatic chest injuries) per year in Sweden. The traumatic injuries might lead to a great deal of harm and even death to the patients if proper treatments cannot be received in time. A way to address these issues is to introduce diagnostic devices in prehospital trauma care procedures. Medfield Diagnostic AB has developed a microwave-based technology which can scan for traumatic injuries inside the head and chest. **The aim of this study** was to do a conceptual design of microwave-based devices for detection of intracranial bleedings and Pneumothorax in a prehospital setting.

A crucial part of the study was to include all relevant stakeholders in a **co-design process** where all participants were enabled to not only express their views on suggested solutions, but encouraged to take an active part in the design process and actively propose solutions based on own experience. This was achieved by conducting workshops in the ideation, concept generation and development phases. The stakeholders were developers from the manufacturer Medfield Diagnostics AB and users from emergency medical services. The technical issues as well as the usability of the concept devices were discussed and designs were explored.



## Trauma Detector for Head (TDH)

TDH is the concept device created in the study to detect traumatic brain injuries. It is made up of two parts, a headrest and arms for fixation of antennas. The patient can lay on the headrest and the arms can be rotated to the right positions and fastened to the patient. Then the measurement can be taken. The concept is designed to stabilize the patient and can work with or without a supporting neck collar.



## Trauma Detector for Chest (TDC)

TDC is the concept device that detects traumatic injuries in the chest. It consists of two parts, the component box and the stretchable antenna belt. When using the device, the user can remove the sticky cover under the belt one at a time and stretch or squeeze the belt to fit it on the patient. There are light indicators designed on the belt to inform the user about the rough position and size of the internal injury.

## Use case scenarios

1. receive alarm
2. arrive at the scene
3. examine the patient
4. prepare the patient (a. clean wounds, apply neck collar; b. cut off the clothes, clean wounds, shave if the patient is hairy)
5. apply the device (a. remove the sticky cover one at a time and apply to the right position; b. rotate the top arm and slide the device under the patient, push and adjust the arms to fit the patient)
6. control the measurement and read the result using a tablet
7. scoop the patient onto a scoop stretcher, fasten the patient and the devices
8. carry the patient with the devices to the ambulance
9. monitor the patient using the devices during the transfer to the hospital
10. patient arrival at the hospital
11. wipe clean the devices and change/restore sticky pads
12. store the devices in bags.

## Conclusion

The time to diagnose traumatic internal injuries can be reduced if the suggested designs are further developed to actual products and introduced in prehospital care. The availability of such products also opens up for life-saving activities in the ambulance by means of early detection of occult traumatic internal injuries.