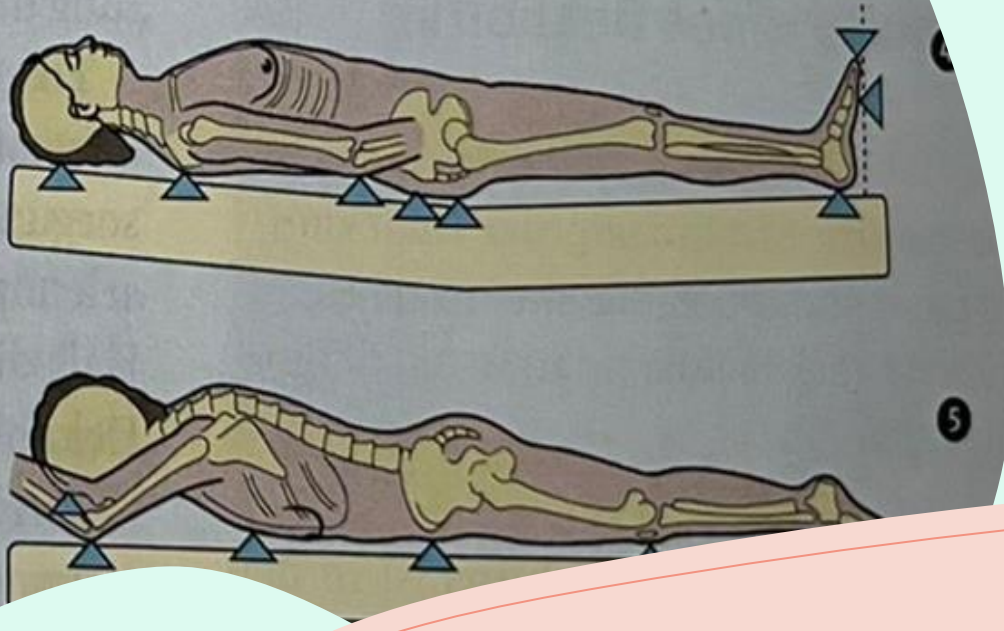


decubiTUM

prevention of **pressure ulcers**

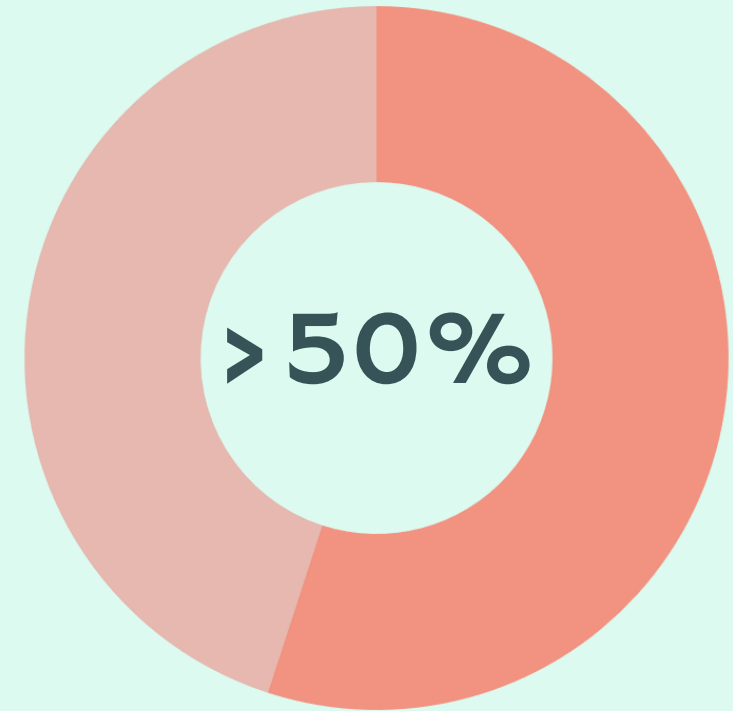




Decubitus

Skin wounds resulting from high **pressure** on single body parts over a longer period of time

Would you know what to do?



Of decubitus cases
arising in **nursing homes**

“Therapeutic care, is de facto often carried out by caregivers or **lay caregivers without sufficient supervision and feedback**”



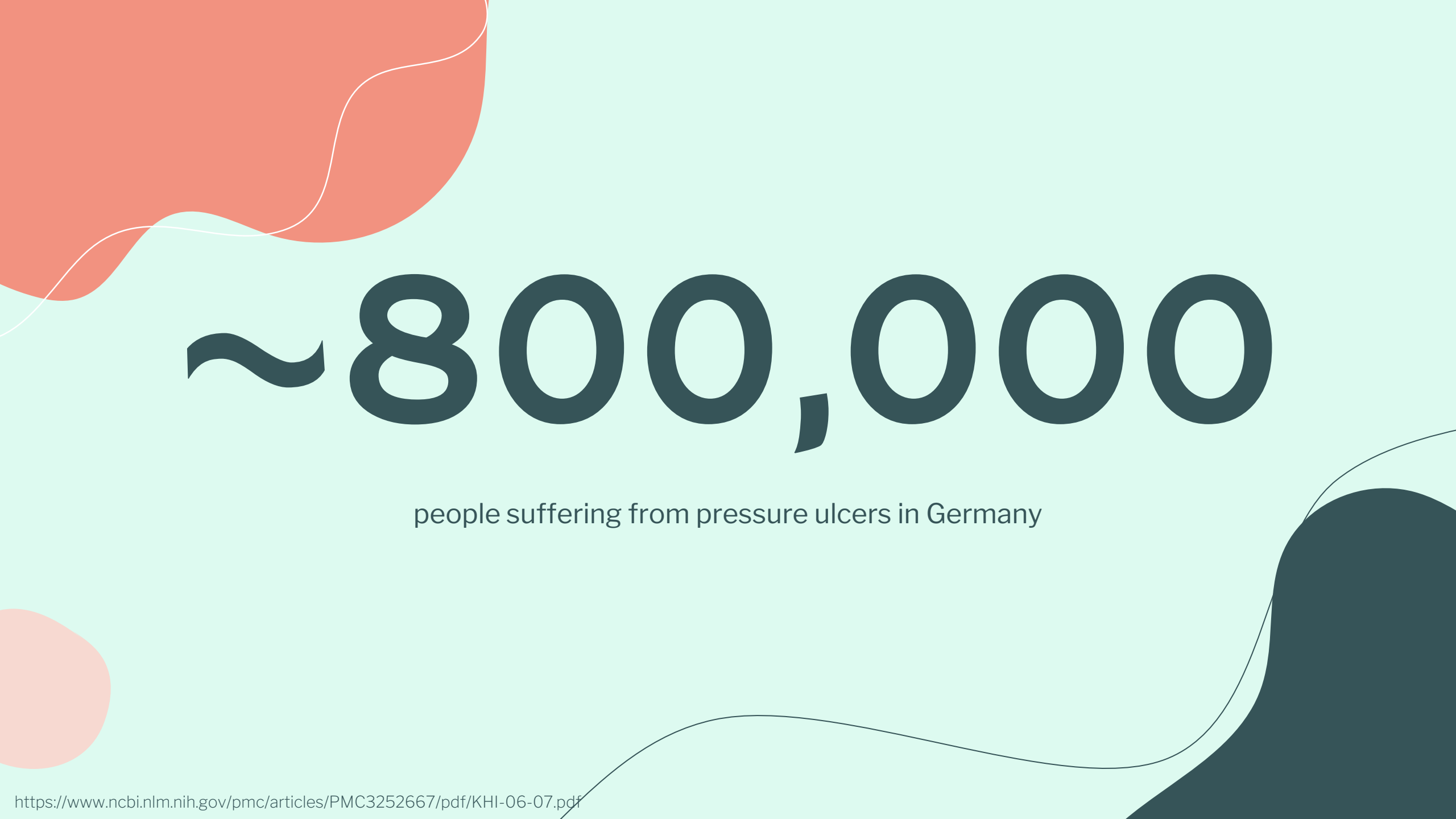
uncertain



staff shortage



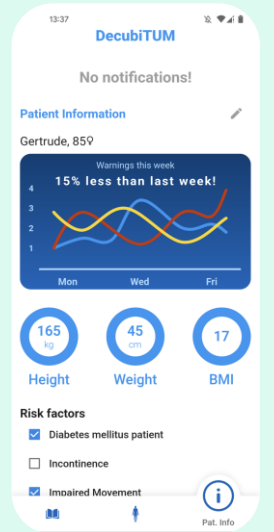
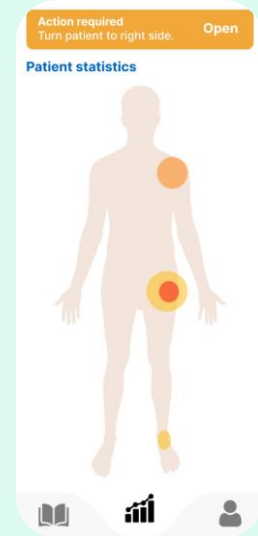
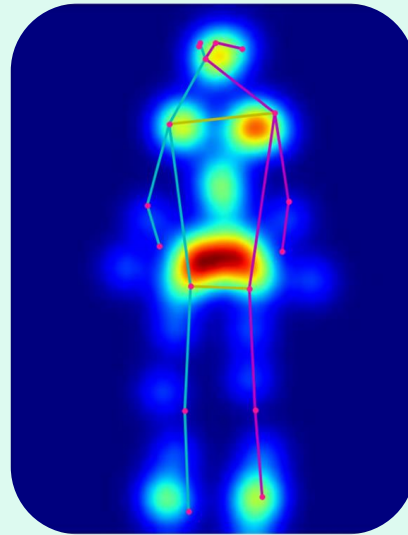
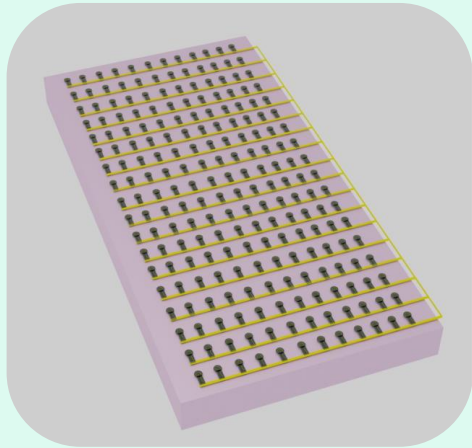
overworked



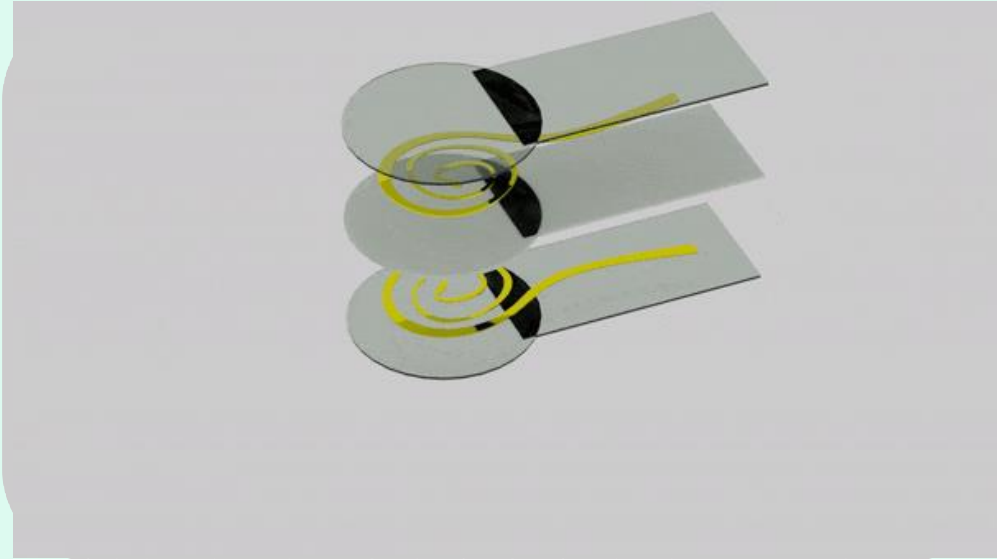
~800,000

people suffering from pressure ulcers in Germany

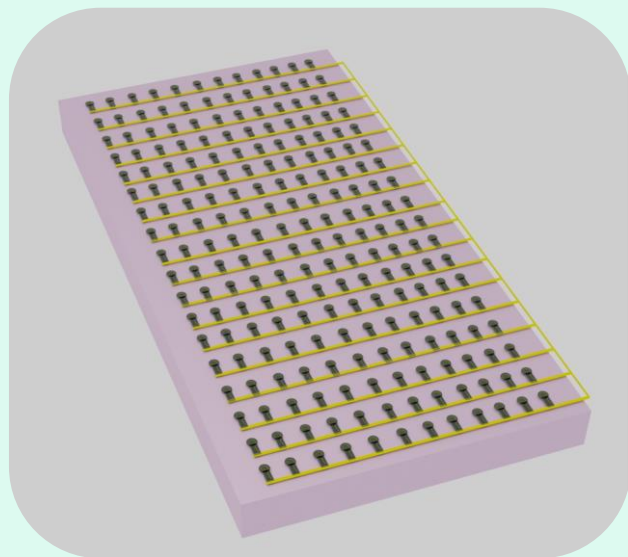
enabling everyone...



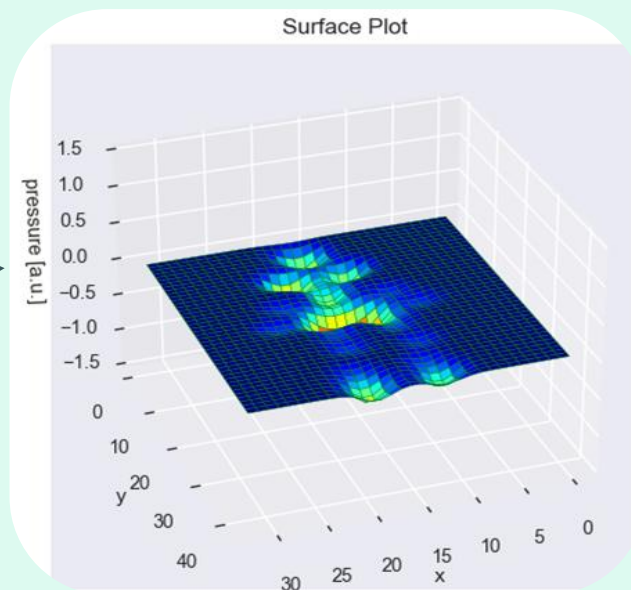
...to prevent decubitus



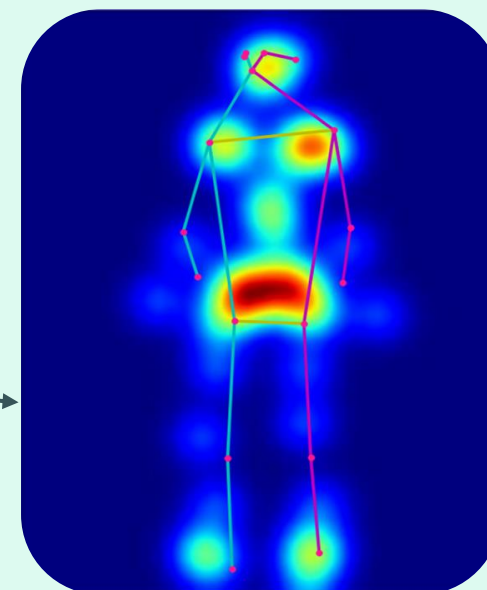
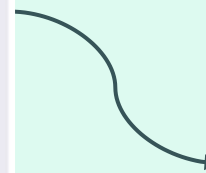
pressure sensor
2d array
100 μ m thin
flexible
low cost



IoT Pressure
Sensor Array



2D pressure
matrix



Advanced ML
Pose Detection

13:31



DecubiTUM

I am a ...



Professional

I am working as Nurse/Doctor/
professional caregiver



Caregiver

I am a family member/friend/non-
professional caregiver



Patient

I am a patient under care



Information
Confidence in care



Quality in treatment
Pain prevention



Less complications
and workload relief

> 1.500.000.000€

direct cost per annum
in Germany

1.000 -

14.000€

p. treatment

€1 billion

potential savings p.a.
in Germany

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3252667/pdf/KHI-06-07.pdf>

<https://www.nursinghomelawcenter.org/for-an-individual-how-much-does-it-cost-to-treat-bed-sores.html>

decubiTUM



**Maximilian
Andrejew**

Medicine,
Examined nurse



**Viviana
Sutedjo**

Medicine,
M.Sc. Informatics



**Almo
Sutedjo**

B.Sc. Informatics



**Sami
Wirtensohn**

M.Sc. Physics



**Dominik
Wernberger**

M.Sc. Mechanical
Engineering



**Niels
Goczoll**

B.Sc. Mechanical
Engineering



LITERATURE AND SOURCES

Medical Literature:

- ❑ Lauster, M., Drescher, A., Wiederhold, D., & Menche, N. (2014). Pflege Heute. In Pflege Heute. Elsevier GmbH, Urban & Fischer Verlag. ISBN 978-3-437-26774-1
- ❑ <https://www.bmfsfj.de/resource/blob/79282/e63f072094b789d529124b921491d4d3/prm-25046-forschungsbericht-data.pdf>
- ❑ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3252667/pdf/KHI-06-07.pdf>

Sensors:

- ❑ Vu, C. C., & Kim, J. (2020). Simultaneous Sensing of Touch and Pressure by Using Highly Elastic e-Fabrics. *Applied Sciences*, 10(3), 989. <https://doi.org/10.3390/app10030989>
- ❑ Aigner, R., Pointner, A., Preindl, T., Parzer, P., & Haller, M. (2020). Embroidered Resistive Pressure Sensors: A Novel Approach for Textile Interfaces. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–13. <https://doi.org/10.1145/3313831.3376305>
- ❑ Arcelus, A., Veledar, I., Goubran, R., Knoefel, F., Sveistrup, H., & Bilodeau, M. (2011). Measurements of Sit-to-Stand Timing and Symmetry From Bed Pressure Sensors. *IEEE Transactions on Instrumentation and Measurement*, 60(5), 1732–1740. <https://doi.org/10.1109/TIM.2010.2089171>
- ❑ *Pressure sensor array made with polyamino acid*. (n.d.). Retrieved June 26, 2022, from <https://phys.org/news/2012-08-pressure-sensor-array-polyamino-acid.html>
- ❑ *Embedded Force Sensors | Tekscan*. (n.d.). Retrieved June 26, 2022, from <https://www.tekscan.com/products-solutions/embedded-force-sensors>
- ❑ *Film Druck sensor - AliExpress*. (n.d.). Retrieved June 26, 2022, from <https://de.aliexpress.com/item/32960696900.html>

Appendix

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Therapie

Die therapeutische Betreuung des Dekubituskranken obliegt ärztlicher Verantwortung. Die Ausführung dagegen wird de facto oftmals ohne ausreichende Supervision von Pflegekräften oder Laienpflegerinnen und Laienpflegern ausgeführt. Einmal ausgebrochen, verstärkt Dekubitus die zur Entstehung beitragenden Risikofaktoren; die Krankheit unterhält sich selbst. Prophylaxe und Therapie sollten daher in mehreren Bereichen ansetzen und die beschriebene Pathophysiologie unterbrechen. Eine solche multidimensionale Intervention erfordert die Einbindung verschiedener medizinischer und therapeutischer Disziplinen (Chirurgie, Geriatrie, Pflege, Physiotherapie, Ergotherapie etc.). Ziele sind sowohl die Abheilung des Druckgeschwürs als auch die Vermeidung weiterer Komplikationen (z.B. Sepsis), die letztlich zum Tode führen können. Erste Maßnahme ist allerdings immer die Druckentlastung in Form von aktiver und passiver Bewegungsförderung des Erkrankten.

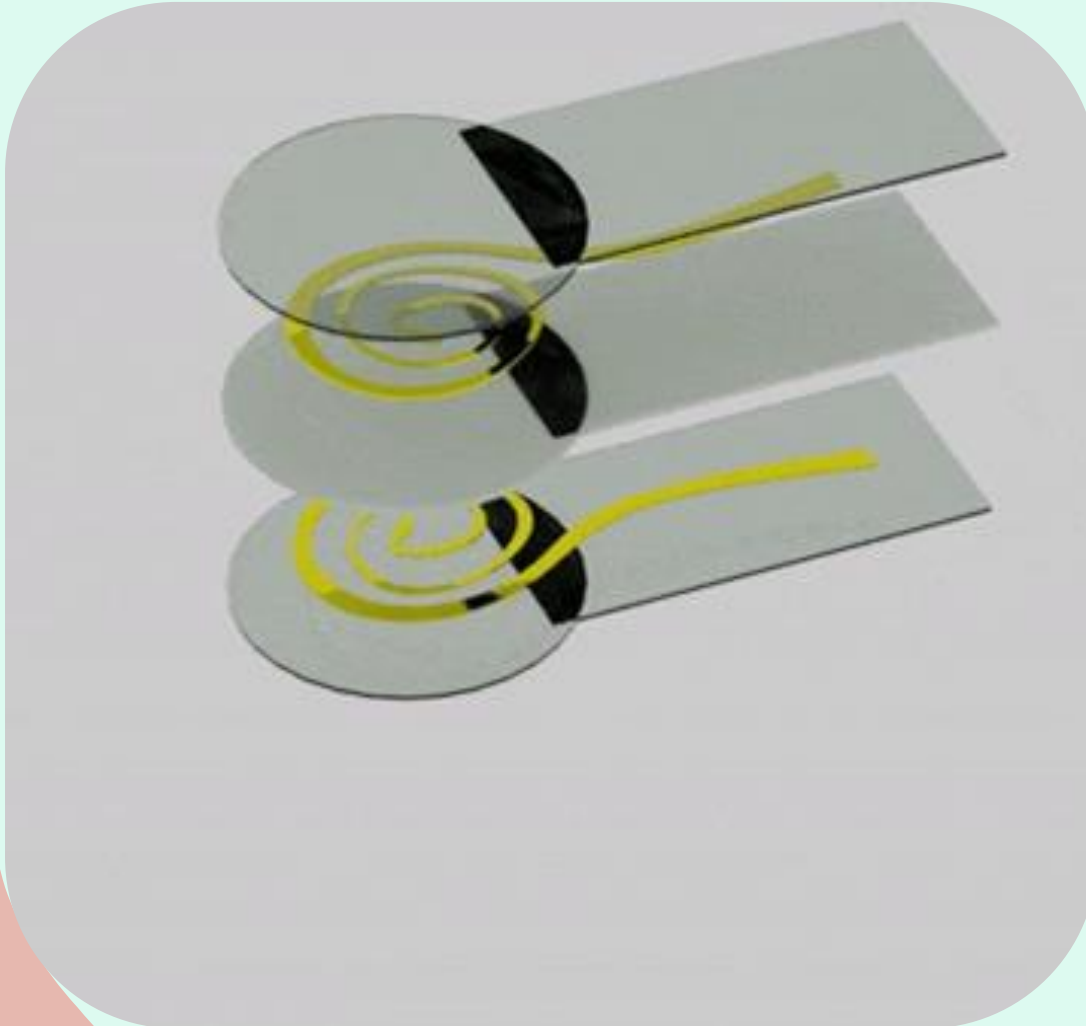
Pflegeheime waren Ort der Dekubitusentstehung in über 50% aller Fälle. Der Median der Krankheitsdauer betrug hier 123 Tage (Mittelwert 307 Tage). Die Pflegedokumentation der untersuchten Institutionen v.a. bei der Dekubitusprävention war sehr problematisch. Es bestanden durchgängig erhebliche Defizite im Bereich der Dokumentation von Lagerungsmaßnahmen. Ärztinnen und Ärzten waren in der Therapie höhergradiger Ulcera in ca. 20% der Fälle nicht involviert. Es zeigten sich Fälle obsoleter Verordnungspraxis bei der Wundbehandlung. Höhergradiger Dekubitus war in der Sterbephase in 7% der Fälle mit Pflegestufe I, in 42% mit Pflegestufe II und in 52% mit Pflegestufe III verbunden. Im Fall von ambulanter Pflege bestand bei Angehörigen offenbar ein erheblicher Informationsbedarf zu Möglichkeiten der Leistungsanspruchnahme sowie der Beratung durch professionelle Hilfen.

Schlussfolgerung

Aus den Defiziten im Rahmen der dekubitusbezogenen Qualitätssicherung in stationären Institutionen der Altenpflege ging ein erhebliches Optimierungspotential hervor.

OUR SENSOR ANIMATION

01

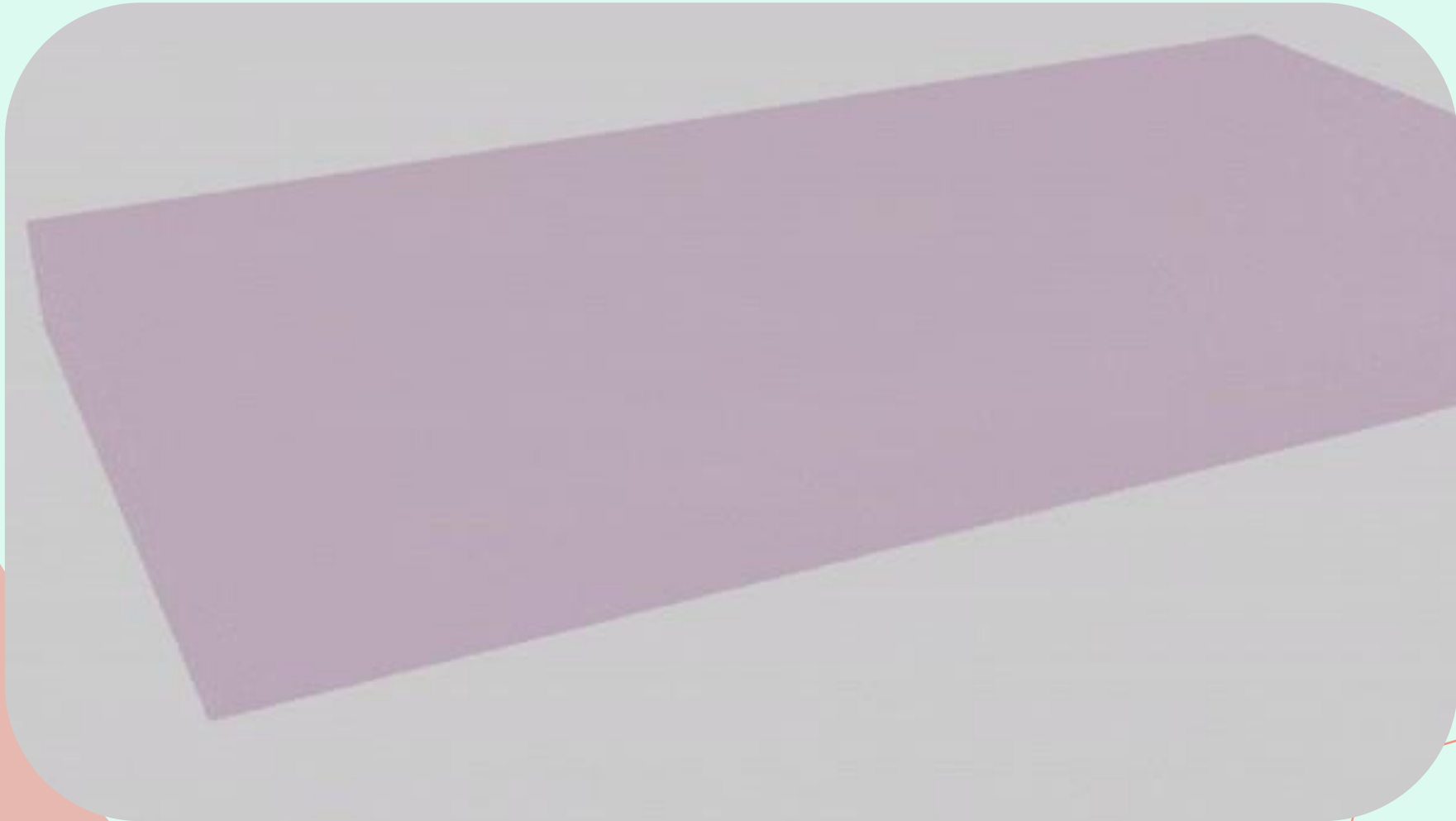


pressure sensor

- 100 μ m thin
- Pressure influences electric resistance
- flexible
- low cost
- Wide range of force values

SENSOR ARRAY ANIMATION

02

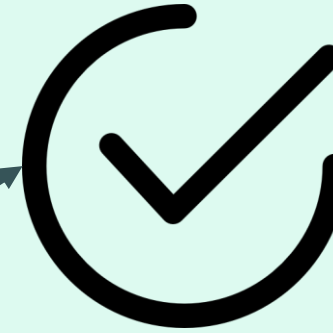


Connecting patient and app

QR code on the bed

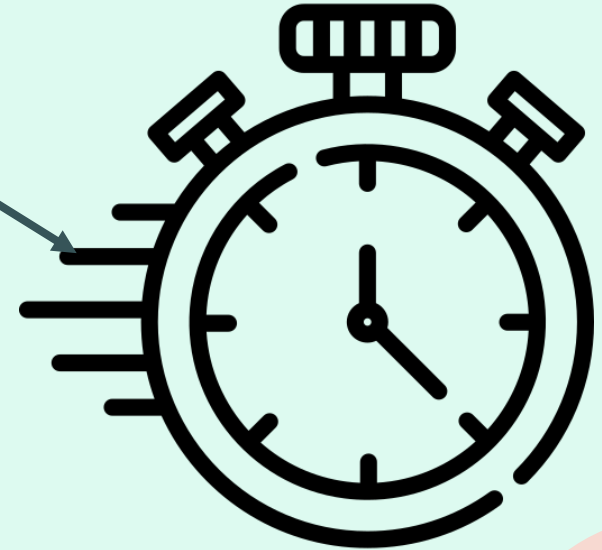


scan with decubiTUM app



Registration complete

Auto-detection when patient is gone - asking nurse



Micro- vs. Macro position change

Alternating pressure mattresses do not replace the need for macro position management through a caregiving person! Furthermore, there is no feedback from the mattress about the effectiveness.

DecubiTUM delivers feedback to optimize individual position through pressure data taken from the corresponding body parts.

This improves macro position changes and deliver informations about micro position changes from the patient.

It's compatible with different kinds of mattresses and may even improve treatment.



ROUGH PRODUCTION COST ESTIMATE

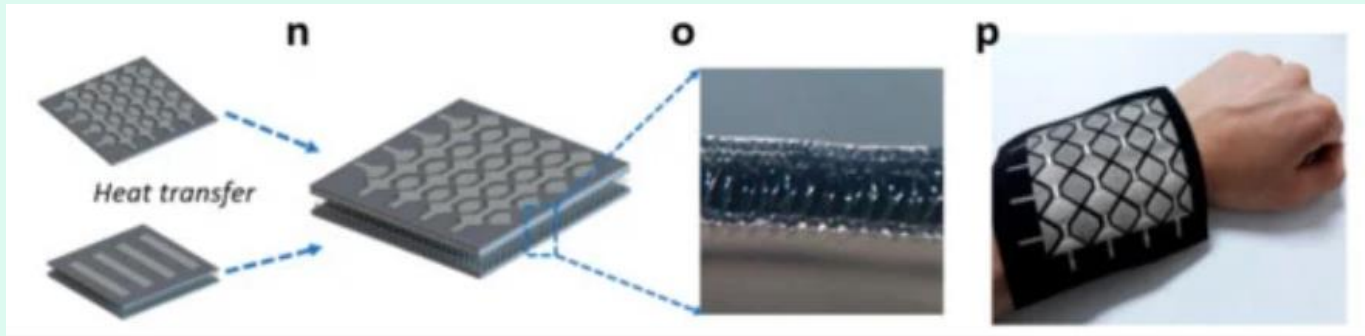
#	object	quantity	Cost / piece	Cost total
1	Pressure sensor	300	1 €	300 €
2	Cabling	1	-	50 €
3	µC	1	-	15 €
4	Bedsheet	1	-	5 €
SUM				370 €



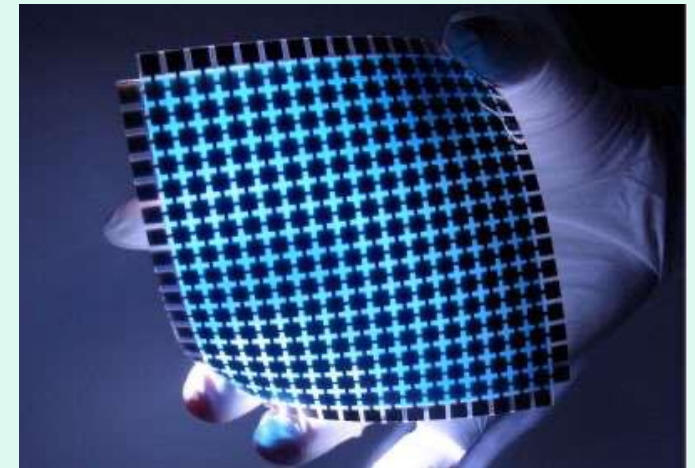
Film Force Sensor



Woven electric threads

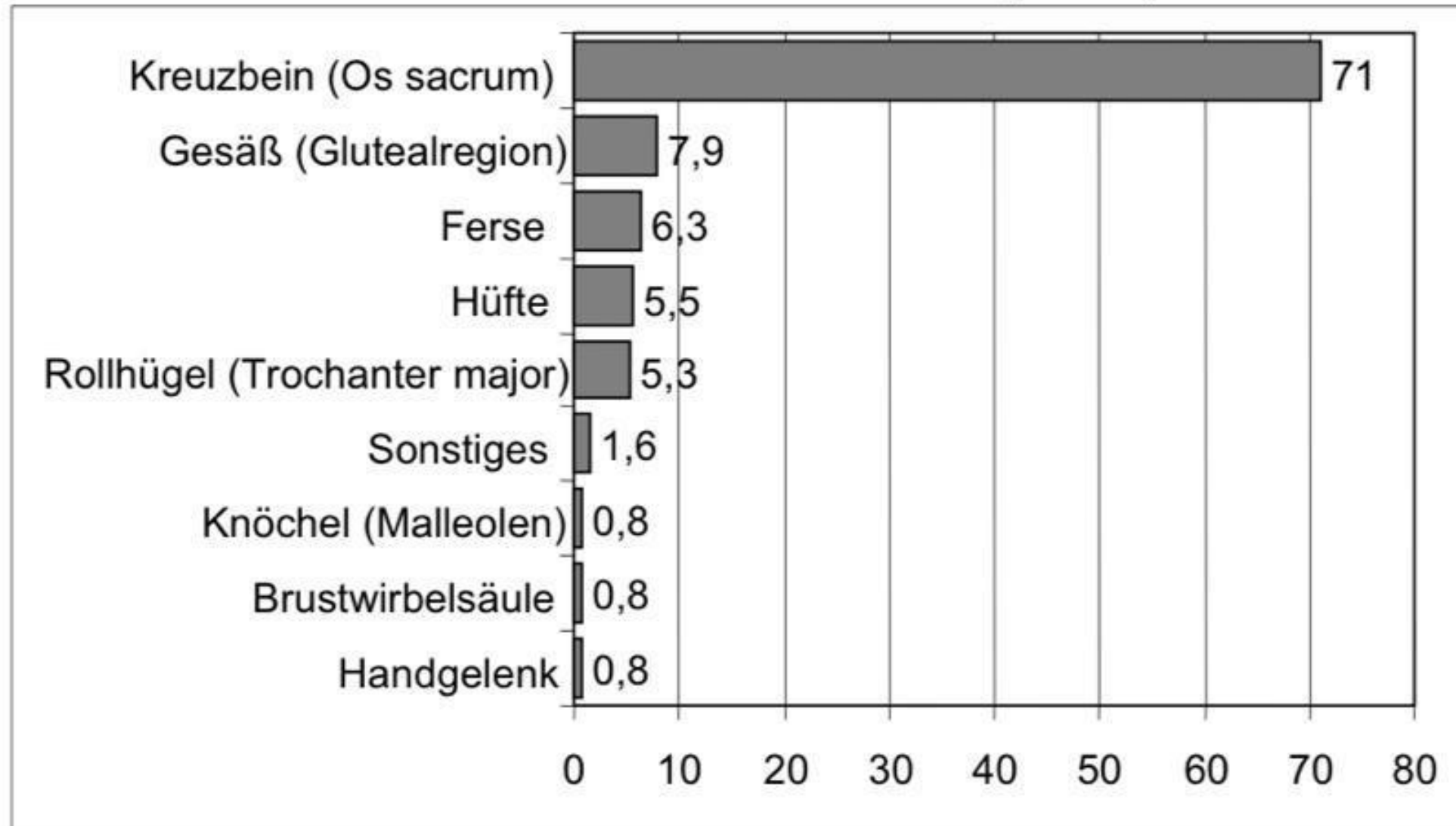


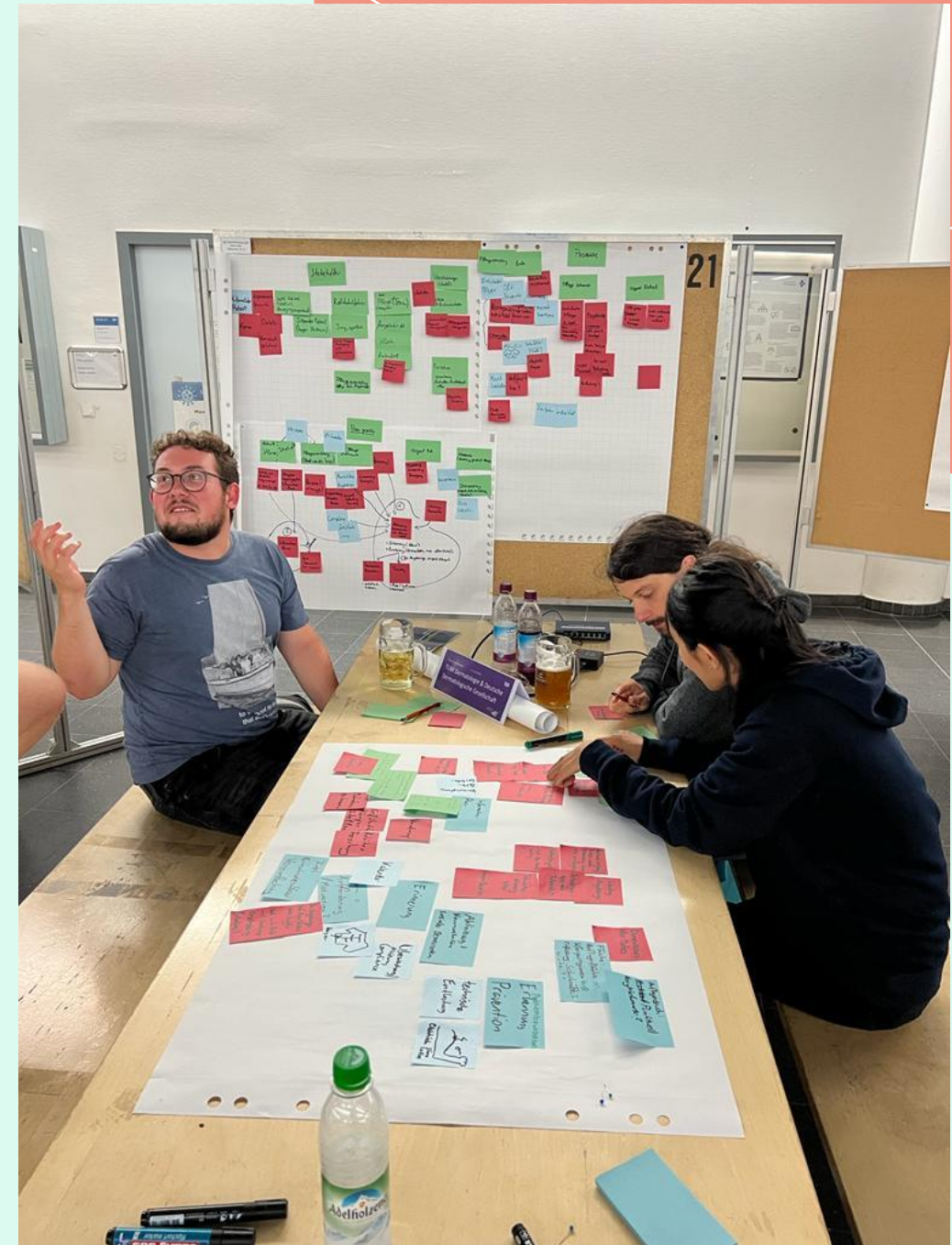
e-fabrics



pressure sensor piezo
array

Abb. 4.2: Dekubitus-Lokalisationen • Grad II in % (n=127)





13:37



DecubiTUM

I am a ...



Professional

I am working as Nurse/Doctor/
professional caregiver



Caregiver

I am a family member/friend/non-
professional caregiver



Patient

I am a patient under care

13:37



DecubiTUM

Patient name:

Gertrude

Patient age:

85

Patient weight:

45

Patient height:

165

Continue

13:37



DecubiTUM

☒ Diabetes mellitus patient

☐ Incontinence

☒ Impaired Movement

☒ Damaged or irritated skin

☐ Difficult cooperation

☐ Confused mind state

Continue

13:37



DecubiTUM

No notifications!

Patient Information



Gertrude, 85?



165
kg

Height

45
cm

Weight

17

BMI

Risk factors

☒ Diabetes mellitus patient

☐ Incontinence

☒ Impaired Movement



Pat. Info

