

International Forum on QUALITY & SAFETY in HEALTHCARE COPENHAGEN

15-17 May 2023 Bella Center | Copenhagen, Denmark

#### B10: The science of workforce and patient safety the challenges and opportunities of technology for improvement







# Adapting to a changing world: equity, sustainability and wellbeing for all











International Forum on QUALITY & SAFETY in HEALTHCARE COPENHAGEN

# Welcome

#### Inge Kristensen, Danish Society for Patient Safety







International Forum on QUALITY & SAFETY in HEALTHCARE COPENHAGEN



# implications for workforce

Arendse Tange Larsen, VIVE – The Danish Center for Social Science Research







### The economics of using Artificial Intelligence to improve patient safety: potential and implications for workforce

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May 16, 2023





### Context

- > Artificial intelligence (AI) is increasingly being applied to technologies within healthcare
- > Rapid advances in AI raise many expectations and hopes for future health care provision
  - > Enhance quality of care
  - > Reduce errors
  - > Detect adverse events
- > AI-assisted technologies may help tackle current challenges faced by healthcare systems
  - > Ageing populations
  - > Shift in disease burden
  - > Increased healthcare costs
  - > Medical staff shortages





#### **Demand for healthcare professionals**

Healthcare system
+40,000 in 2030
+100,000 in 2045
Hospitals
2030: +16 %

> 2045: +36 %

> Need to prioritize!

Reference: The Danish Medical Association – Workforce analysis 2023. Graph based on data from Statistics Denmark.







### WARD Clinical support system (CSS)

- Continuous vital signs monitoring (VSM) with the integration of machine learning algorithms
- > Detection and prediction of physiological deterioration
- > Real-time alarming of hospital staff







#### **Expectations**



#### More efficient workflows







**Research objectives** 







### **Research objectives**

- > To review the literature on the impact of AI-assisted continuous VSM on economic outcomes
- To quantify the maximum potential for WARD-CSS in terms of decreasing length of stay (LOS) and avoiding readmissions
- > To examine the potential for home monitoring by WARD-CSS in terms of avoiding readmissions





### **Potential savings – in hospital**

- Aim: To estimate the costs of adverse events (AEs) detectable by WARD-CSS among hospitalized patients in Danish somatic hospitals.
  - > Difference in LOS between patients exposed and not exposed to AE during admission
  - > Probability of readmission given the exposure to AE during primary admission
- > Data and methods: Danish national registry data
  - > GLM identity-gamma model to analyze the difference in LOS between patients exposed and not exposed to AEs
  - > Logistic regression model to analyze the probability of readmission given AE exposure
  - > Patients matched using coarsened exact matching





### **Main results**

	Excess bed days	OR for readmission
	n = 664,419	n = 616,416
Exposed to any AE	2.4 ***	1.14 ***
Exposed to neurologic AE	5.3 ***	0.93 *
Exposed to respiratory AE	2.8 ***	1.14 ***
Exposed to circulatory AE	1.1 ***	1.20 ***
Exposed to infectious AE	2.9 ***	1.07 **
Exposed to 'other' AE	5.2 ***	1.42 ***





#### **Maximum cost savings**

> Shortening duration by 2.4 days  $\rightarrow$  EUR 1,582.30 per patient

> Avoiding readmissions caused by AE  $\rightarrow$  EUR 14.77 per patient



7,000 admissions per year

17.5 % exposed to AE



2,940 bed days EUR 1,956,411 per year

SDU 🎓



### Home monitoring by WARD-CSS

- > Let WARD-CSS move into the patients' home
- > Continuous monitoring by WARD-CSS for 3 days
- > Avoiding readmissions?
- > Earlier discharge?
- > Averted admissions?





### Wrap-up

- > AI-assisted continuous VSM such as the WARD-CSS has the potential to
  - > Assist hospital staff and release resources
  - > Introduce new and improved workflows
  - Shorten treatment process and decrease healthcare costs
  - > Release hospital beds for more requiring patients
- > However, evidence is limited and proper evaluations are needed





## Thank you!

Acknowledgements

#### Supervisors and co-authors

Søren Rud Kristensen, Associate Professor, DaCHE, University of Southern Denmark

Liza Sopina, Postdoc, DaCHE, University of Southern Denmark

Jakob Kjellberg, Professor, VIVE – The Danish Center for Social Science Research

Eske Kvanner Aasvang, Professor, Anaesthesiological Dpt., Center for cancer and organ dysfunction., Rigshospitalet

#### Funding

Innovation Fund Denmark









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Creating new ways of working with patient transfer: the Patient Transfer and Rehabilitation (PTR) Robot supporting caregivers and patients

Helle Nutzhorn Gaud, Zealand University Hospital







#### PROJEKT UNIVERSITETSHOSPITAL KØGE

### New ways of working in hospitals – patient transfer robot



#### Why the need for a transfer robot?

• Demography – shortage of staff – the number of elderly and fragile patients



- Working environment
  - The most common work related health problem in the healthcare sector – injuries and physical strain
- Ceiling mounted lifts or manual lifts inflexible solution



# The possibility...

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211

789 Single bed rooms in the new hospital

Ber 148 5 11 11 8 21 10

13

Use the new building as a Gamechanger, but remember to actually change the Game!



# The new buildings have to be a game changer...

But we also need to change the game..

- Co operation with patients and relatives
- Efficient use of ressources
- Flexibility by standardising





#### Pain, discomfort, injury due to work exertion

Did you experience any kind of pain, discomfort or injury related to the patient transfer in the past 2 years?

- for a mane



#### Pain, discomfort, injury due to work exertion

3rd, and 4th workshops.

Have you already been on sick leave due to work exertion injuries?



#### Pain, discomfort, injury due to work exertion





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BLUE OCEAN ROBOTICS

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#### Types of pain at work

# of valid cases: 83

2) This field accepts mor 1 answer per respondent.



## Co-creation in a PPP

- The healthcare sector is the owner of the wicked problems
- With the right partners – we can co-create innovative solutions





## Learnings from the proces

- It takes time !
  - We started in 2016 the first robot was implemented in 2021
- Spend time to create a good relationship with your partners
  - It is important that you keep having the same goals
- Involve hospital staff and patients in
  - defining needs (functionality, hygiene, safety, it and technical support)
  - Testing solutions
  - Planning the training
- Implementing the finished product takes time
  - Educate "superusers"











## Result

- We have a CE-approved product
- In the proces new features was added – training
- It is introduced in the hospital
- Implementation will propably lead to developing new uses and exploring future needs, weighing patients, empowering patients
- New markets Denmark (Scandinavia), Germany, Netherlands, USA









#### System Usability Scale

- I think that I would like to use PTR Robot frequently.
- 2. I found PTR Robot unnecessarily complex.
- 3. I thought PTR Robot was easy to use.
- I think that I would need the support of a technical person to be able to use PTR Robot.
- 5. I found the various functions in PTR Robot were well integrated.
- 6. I thought there was too much inconsistency in PTR Robot.
- I imagine that most people would learn to use this system very quickly.
- 8. I found PTR Robot very cumbersome to use.
- 9. I felt very confident using PTR Robot.
- 10. I needed to learn a lot of things before I could get going with this system.



Measure the perceived usability and ease-of-use of systems and products.

#### 238 participants from Køge Hospital

Score in April/21:80

Score in September/21:84

Score in February/22: 79

Score in April/22: 78

#### Overall score: 81 of $100 \Rightarrow$ Excellent



would like to use the PTR Robot frequently



# Training in the old hospital





# Testing all possibilities



### Testing additional features



Tests to ensure training efficiency



# Certified superusers





#### Training focusing on using Roberta and demystifieing the technology



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Robots
```

Test as both operator and 'patient'

- Placement of robot ind different case-situations
- Planning the transfers (step 1, step 2, step 3 etc.)



SLUE OCEAN ROBOTIC



Implementing in the new hospital



Over længere afstand kan 'Hurtig Transport' aktiveres i menuen

Vær opmærksom på, at 'objektdetektering' er deaktiveret under 'Hurtig Transport', og at det ikke er tilladt at transportere patienter i 'Hurtig Transport'

Robotten kan køres gennem en standard døråbning

Objektdetektorerne vil sænke robottens fart, når den senser dørkarmen



#### **Patient transfers routine**



On average, how many people are involved in a recurrent patient transfer?



Most transfers are carried out by **a single professional**, based on the justification that "there is no need to involve more colleagues" in the task.



The data also indicates **lack of human and time resources**. The caregivers are **often under pressure to perform the transfers quickly. Often with an increased risk associated herewith**.



Resons for being one caregiver only

# of responses: 133

% of participants







ROBOTS

## **Results from implementation**

• The results from the pre-survey show that transfers are often carried out by a single professional (45%), because "there is no need to involve more colleagues" (61%). However, the data also indicates lack of personnel (32%) and time (36%). Such transfers constitute a high-risk situation for caregivers and patients. Here, the PTR Robot can actively support caregivers as almost all transfers can be performed safely by a single user. Current regulations prevent single-caregiver transfers and thus, a regulatory change concerning assistive technology is required. The qualitative findings show that the robot offers new ways of working with patient transfer as a higher variety of transfers can be performed with the PTR Robot compared to manual or semi-manual devices. To exploit this, caregivers need to be given time to explore these opportunities and change their daily routines and workflows. Management needs to support and prioritise this change.



## Thank you for listening ?

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## Discussion

Inge Kristensen, Danish Society for Patient Safety Arendse Tange Larsen, VIVE – The Danish Center for Social Science Research Helle Nutzhorn Gaud, Zealand University Hospital









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# Panel: How can Improvement Science improve the quality of care?

Inge Kristensen, Danish Society for Patient Safety Søren Valgreen Knudsen, Danish Center for Clinical Health Services Søren Paaske Johnsen, Danish Center for Clinical Health Services Camilla Palmhøj Nielsen, DEFACTUM Simon Tulloch, Danish Society for Patient Safety





# Did you hear about breakthrough ideas, methods, or results in the Improvement Science Stream?

#### Share them in the Learning Agents response form!

**Relevant sessions:** 

- A9. Introduction to the Science Symposium stream and new methodologies / evaluation design (Tuesday 11:00 12:15)
- B10. The science of workforce and patient safety the challenges and opportunities of technology for improvement (Tuesday 13:15-14:30)
- C9. The science of workforce and patient safety (Tuesday 15:00-16:00)
- D9. How can Improvement Science improve the quality of care? (Wednesday 11:00 12:15)
- E9. Delivering equity and sustainability (Wednesday 13:15-14:30)

) F9. What have we learned about the science of improvement? What's next? (Wednesday 15:00 - 16:00)

