

*Seminar T5 Novel ways of dispensing drugs*

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## **Standardization & Centralization: *The Right Way Forward***

András Vermes, PharmD, PhD

EAHP 2016 – Vienna, Austria

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## **Disclosure statement**

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Conflict of interest: nothing to disclose



## Control Question #1

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*Is the proportion of preparation and administration errors larger than 20% of all medication errors?*

**YES / NO**



## Control Question #2

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*Is moving from ward preparation to pharmacy preparation a proper way to reduce medication errors?*

**YES / NO**



## Control Question #3

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*Should the ultimate goal be to move  
100% of ward preparation to  
pharmacy preparation?*

**YES / NO**



## Topics to cover today

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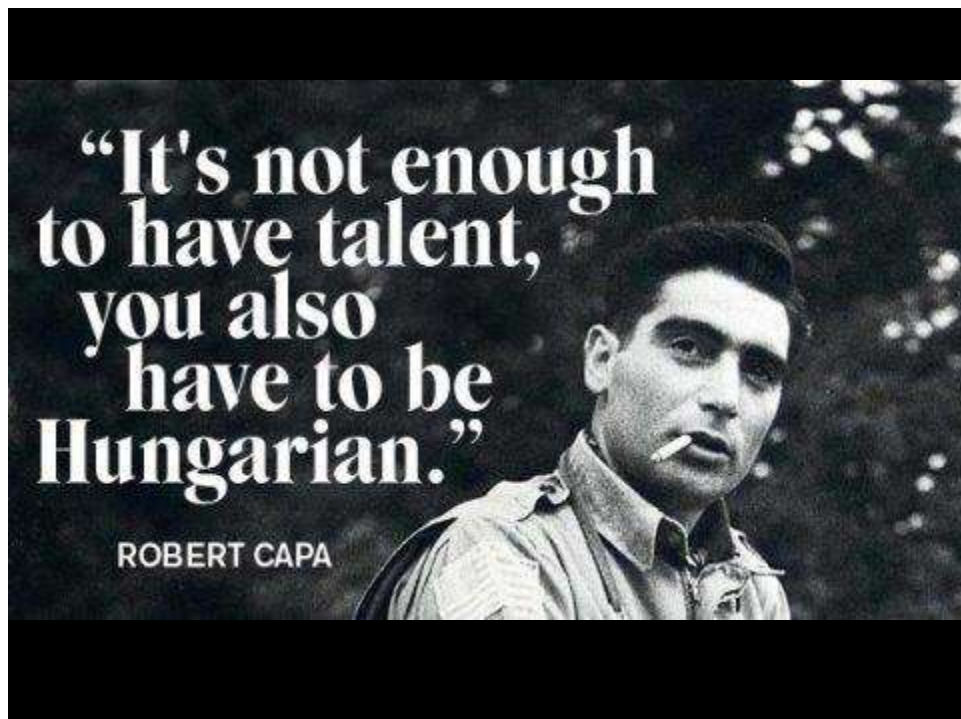
- Drug manufacturing & Compounding
- Standardization & Centralization
- Centralized RTU / RTA preparation
- Centralized compounding
- Ward preparation
- Robotics
- Centralized medication service
- The Erasmus MC perspective

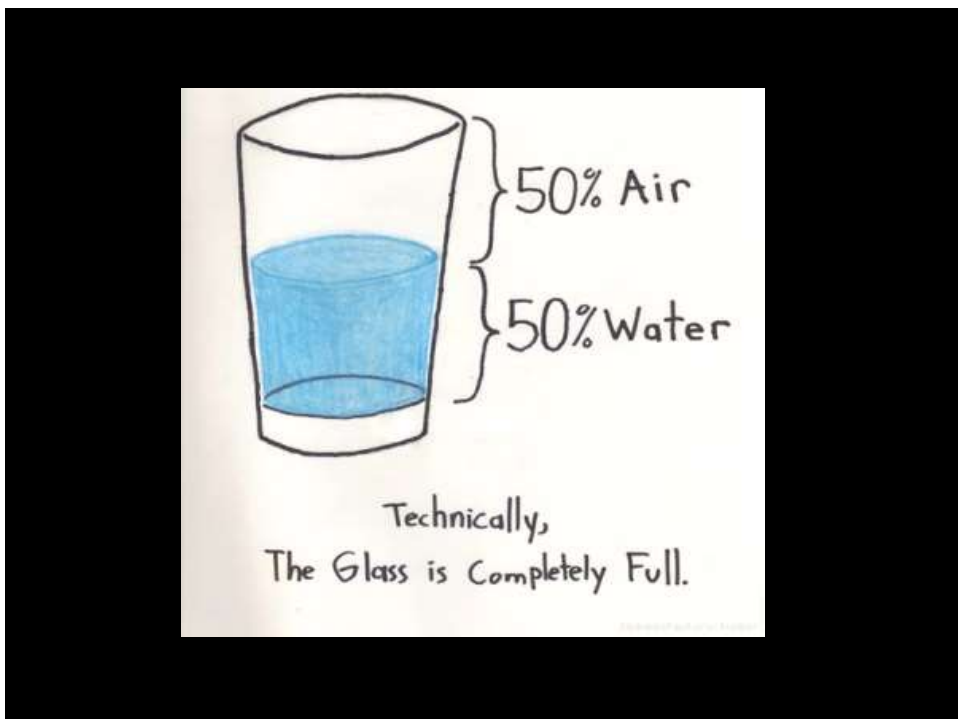


# Who am I?

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- Hospital pharmacist
- Senior staff member (focus on compounding & manufacturing),  
Dept. of Pharmacy, Erasmus Medical Centre (Rotterdam, the Netherlands)
- Head of Pharmacy Apotheek A15 (Gorinchem, the Netherlands)
- Past Board member of the Dutch Association of Hospital Pharmacists (Drug Manufacturing, Compounding, QC & QA; December 2011 – December 2015)





# Erasmus MC

- Largest Academic Medical Centre in the Netherlands
- Dept. of Pharmacy: 115 FTE
- Three main parts: general hospital, children's hospital & cancer centre
- Compounding activities 2015:  
Grand total: 200,000 units  
Children: 130,000 units  
Adults: 70,000 units
- Drug manufacturing: outsourced completely to Apothek A15 (including QC, QA and logistics)



- A *state of the art* GMP licensed manufacturing facility
- 2000 m<sup>2</sup> of cleanrooms (GMP class B, C, D)
- Capable of manufacturing every type of product (non-sterile, sterile, aseptic) as well as performing individual and bulk compounding
- Manufacturing necessary but not commercially available drugs for primary care & drugs for investigator initiated trials
- Developing new products to ensure regular patient care as well as medication safety
- Production site for Erasmus MC (full scale), Academic Centre Groningen (full scale) as well as approx. 35 other parties (non-full scale)



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# What is my intention with you for today?

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## Drug Manufacturing & Compounding

***On a hospital level  
is a hard core  
necessity!!***







## Main Advantages

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- Raising medication safety
- Raising quality levels, true specialisation & centralisation
- More time for nurses at the bed side of the patient (instead of performing pharmaceutical work)
- Minimising overall costs



## Necessity for Drug Manufacturing and Centralized Compounding

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- Therapeutically necessary, but not commercially available products
- Production problems with commercial products (temporarily / permanently)
- Investigator initiated drug research
- Medication safety (reducing medication errors)
- Service products (making things easier for nurses and patients)
- Individual needs of patients



## Medication Errors (%)

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• Prescription	20
• Referral / rewriting	17
• Distribution	10
• <b>Compounding /preparation</b>	<b>5</b>
• <b>Administration</b>	<b>45</b>
• Other	3

Data from CMR = Dutch Registry of Medication Errors



## Standardization & Centralization

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Get the right balance of:

1. Centralized (and outsourced) RTA / RTU manufacturing
2. Centralized compounding
3. Preparation on the ward



## Standardization & Centralization

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Get the right balance of:

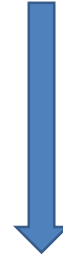
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- 2. Centralized compounding**
3. Preparation on the ward



## Quality of products: Ranking

- Preparation on the ward
- Preparation in the pharmacy
- Preparation to stock
- Commercially available products

improvement



## Prevention of errors

- **Product**
  - Ready to Use (RTU)
  - Ready to Administer (RTA)
- **Process**
  - Centralized compounding
  - Process help for ward preparation



## RTU

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- Ready To Use
- Standard dosage
- Prepared dose by the pharmacy
- Commercially available dosages



## RTU availability: Pharmacy prepared

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- Norepinephrine 50 mg = 50 ml
- Morphine 50 mg = 50 ml
- Midazolam (2)50 mg = 50 ml
- Furosemide 250 mg = 50 ml
- Heparine 25,000 IE = 50 ml
- Many electrolyte solutions
- Ropivacaine – Sufentanil
- etc



## RTU availability: commercial



## Evident advantages....

Standard preparation steps using glass ampoules



## RTA

- Ready To Administer
- Commercial syringes, examples
  - Anticoagulants
  - Vaccines
  - LMWHs
  - Other
- Prepared in the pharmacy



## RTA preparation in the pharmacy

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Infusion pumps               <ul style="list-style-type: none"> <li>– Elastomer pumps</li> <li>– Cartridges</li> <li>– ...</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Syringes               <ul style="list-style-type: none"> <li>– Smart filler®</li> <li>– RapidFill®</li> <li>– Robotics</li> </ul> </li> </ul> |
|--|---|





## Stock preparation in the Pharmacy



Smartfiller, Pharmacy of Leiden University Hospital



## Future perspective

- Robotics?



- Several possibilities



# Robotics

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## What do you try to achieve with them?

- ✓ Raising quality level (+)
- ✓ Minimising manual operations (+)
- ✓ Preventing RSI complaints of personal (+)
- ✓ Utilization directly on the ward at any given time (+)
  
- ✓ Reduction of staff numbers (?)
- ✓ Reduction of overall costs (?)



# Robotics

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## Practical problems (at least at the Erasmus MC situation....)

- ✓ Extensive validation period
- ✓ Limited robustness (too much overall down time)
- ✓ Limited possibilities for use (expensive repeater pump....)
- ✓ No reduction in staff numbers
- ✓ No increase in overall output



# Standardization & Centralization

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Get the right balance of:

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# Process

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## Basic problems during ward preparation:

- Calculations
- Hand hygiene
- Control by second nurse

## Basic problems during administration:

- Patient identification
- Hand hygiene
- Control by second nurse



# Example

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## Remiphentanyl

For neonatal intubation

1 mcg/kg  
Dilution 100 times!  
(0.1 ml/kg)



## You could state that...

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Compounding by a nurse on the ICU is in fact.....

...wrong person

...wrong place

...wrong time



## Best Practices in the Netherlands

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### Moving from ward to pharmacy compounding:

- 'Veiligheid op recept' project 2007 ZMC/VuMC \*
- 'Feniks' project 2010 MUMC+ \*\*

### Basic results:

- Decrease in (serious) medication errors during compounding
- Decrease in microbiological contamination during compounding
- More nurse time for direct patient care
- More awareness and concentration during administration

\* PW Wetenschappelijk Platform. 2007;1(4):78-83

\*\* <http://www.eahp.eu/press-room/feniks-project>



# Implementation

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## Decrease compounding on the ward

- Process management (up close and personal)
- Is it actually necessary to administer the drug parenterally?
- Can the IV product be supplied in an easier to use (less handling) form (RTU / RTA)?
- Who is capable to actually perform the compounding?
- Are the relevant staff members in charge of the compounding properly trained?
- ....



# Implementation & Ongoing Concern

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## Decrease compounding on the ward

- Process management (up close and personal)
- Use as much as possible readily available, in stock, products
- Focus your logistics on RTU & RTA
- Large numbers? Centralise preparation!
- Complex handling? Centralise preparation!





## Necessary needs

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### *On a ward level:*

- Up to date and easily accessible drug database
- Up to date and easily accessible protocols
- Up to date and easily accessible instructions
- Etc
  
- Adequate facilities
  
- Well trained personnel



## Training and Education

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The pharmacy will not take over 100% of compounding....

And thus training and instruction of ward personal is critical!



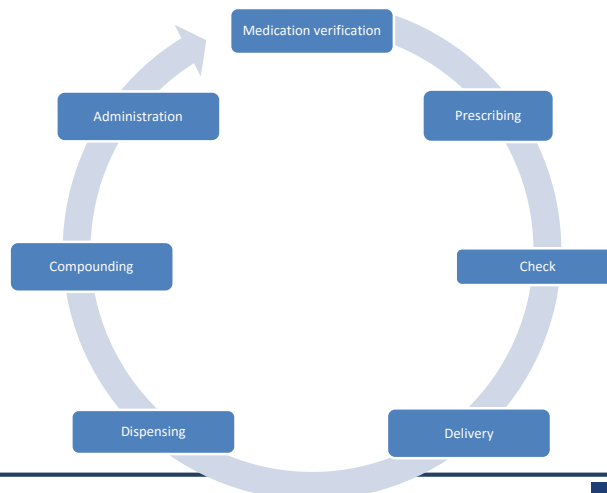
# Centralized medication service

## Perspective from the Erasmus MC

- Raising quality and safety
- Logical consequence from the overall construction of the new hospital (less ward space for compounding / desire for centralized compounding)
- Realisation of a closed medication loop (including barcoding)



## Closed medication loop



## Centralized medication service: *Dispensing Robot*

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- Different possible robots are available
- Dispensing per patient per 24h, including barcode



## Centralized medication service: *Compounding*

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- Complex compounding is done in the centralized pharmacy
- 12 extra LAF cabinets within centralized pharmacy (already 8 units available)
- Maximisation of RTU (ready to use) and RTA (ready to administer); manufactured centrally, outside of the hospital
- On the ward: in case the first two options are not applicable (emergency, simple compounding or short half-life)



## Centralized medication service: *basis principles*

- Matter of urgency vs throughput time; 4 categories:
 

– Acute (max 1 min)	} On the ward	} Maximising RTU/RTA
– Life saving (1-15 min)		
– Urgent (16-60 min)	} Centralized	
– Standard (>60 min)		
- Reducing ward stocks; critical products and fast moving products
- Good and clear communication on the applied rules and procedures as well as well-tuned processes in the centralized pharmacy and on the wards



## Summary

- Preparation and administration errors make up 50% of all medication errors
- In order to minimise these types of medication errors, there are several options to possibly consider (product & process level)
  - ✓ Centralised manufacturing (RTU & RTA)
  - ✓ Centralised compounding
  - ✓ Process support on the ward
- Choices depend on the local situation and in general a combination of the options will be necessary



# Acknowledgments

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- Paul Janssen – Erasmus MC (Rotterdam)
- Paul le Brun – Apotheek Haagse Ziekenhuizen (The Hague)
- Sjoukje Troost – Maxima Medisch Centrum (Veldhoven)



BE NICE TO  
**PHARMACISTS**  
BECAUSE  
WE CAN **KILL** U  
**WITH ONE**  
mistake  
☺

## Q & A

***Thank you for your  
attention!***



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