MeDD

Metrology for Drug Delivery

Peter Lucas (project coordinator)

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Motivation Metrology for drug delivery (MeDD)

1. IV therapy *can* cause adverse patient incidents (various (inter)national studies)
2. Wide spread usage of infusion
3. Characteristics of infusion pumps + accessories not fully known
4. Un(der)developed and underused infrastructure for (low) liquid flow rate calibrations

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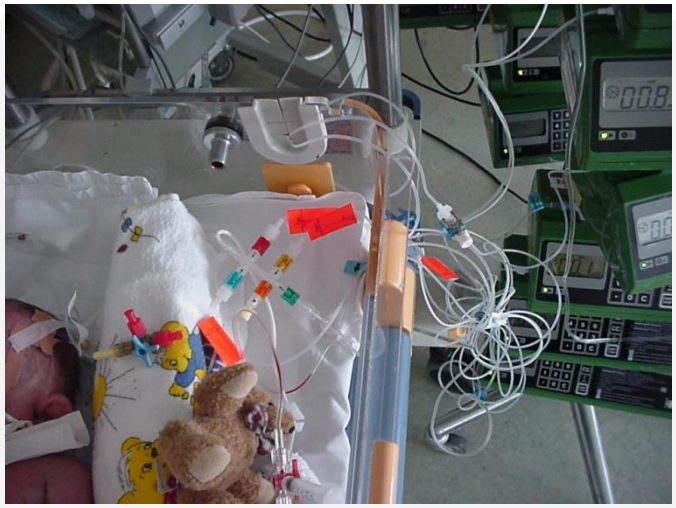
Adverse incidents

Applications and conditions



- Low flow rates (< 2 ml/h)
- Set ups involving more than 1 pump
- Changing conditions / set points
- Non-matching syringes / accessories
- Weak patients
- Special class of drugs
  - short half-life
  - narrow therapeutic band width
  - required small blood concentration because of toxic effects
- Typically 5% maximum permissible error *for the complete system* is accepted (in dosage per minute)

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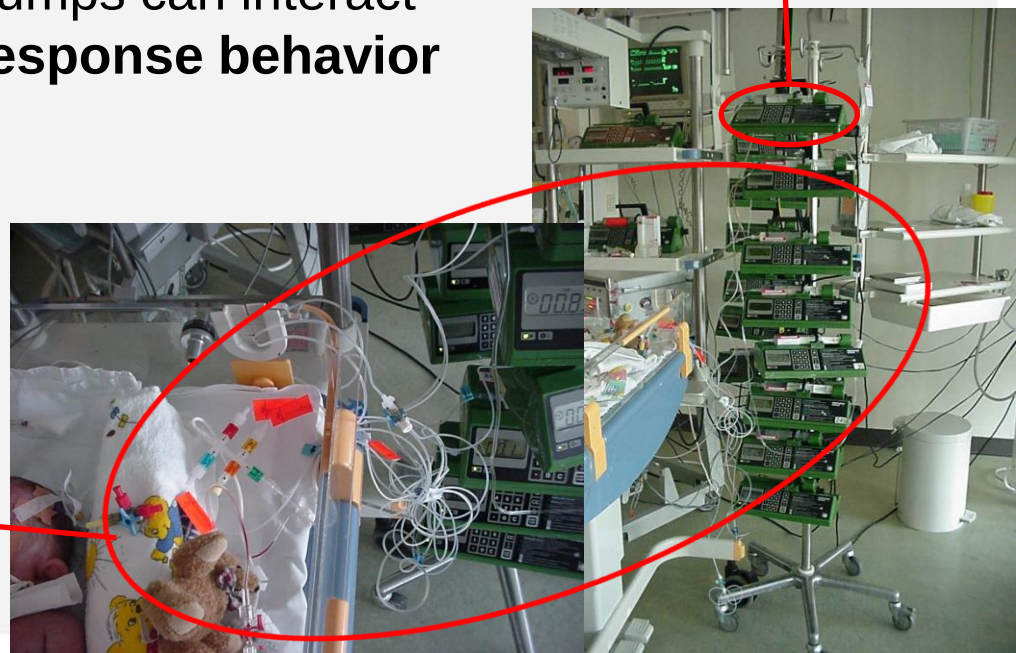
Unknown characteristics

Reduced accuracy in delivered doses

- Typically only the infusion pump (plus syringe) is ‘calibrated’ (according to existing written standards)
- Adding accessories changes the **response time**
- For a multi-pump set up, the pumps can interact with each other affecting the **response behavior**

Well characterized



Hardly characterized

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Underdeveloped and underused metrological infrastructure

- Limited calibration standards for flow rates down to 1 ml/h
- No calibration standards for flow rates < 1 ml/h
- No validation of calibration standards for flow rates < 6 l/h
- Hospitals are in general not familiar with metrology

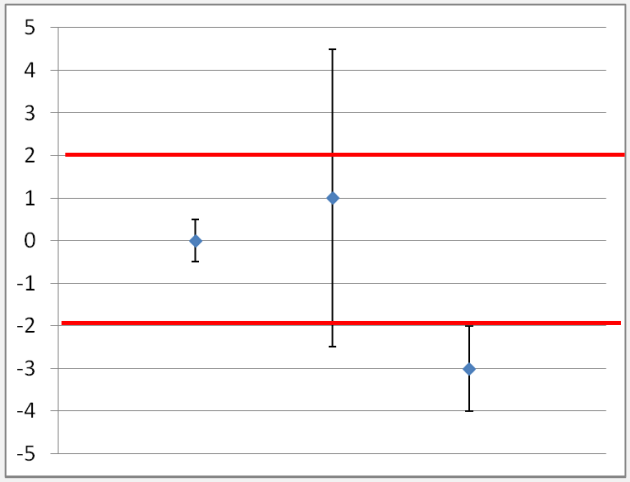
Consequences?

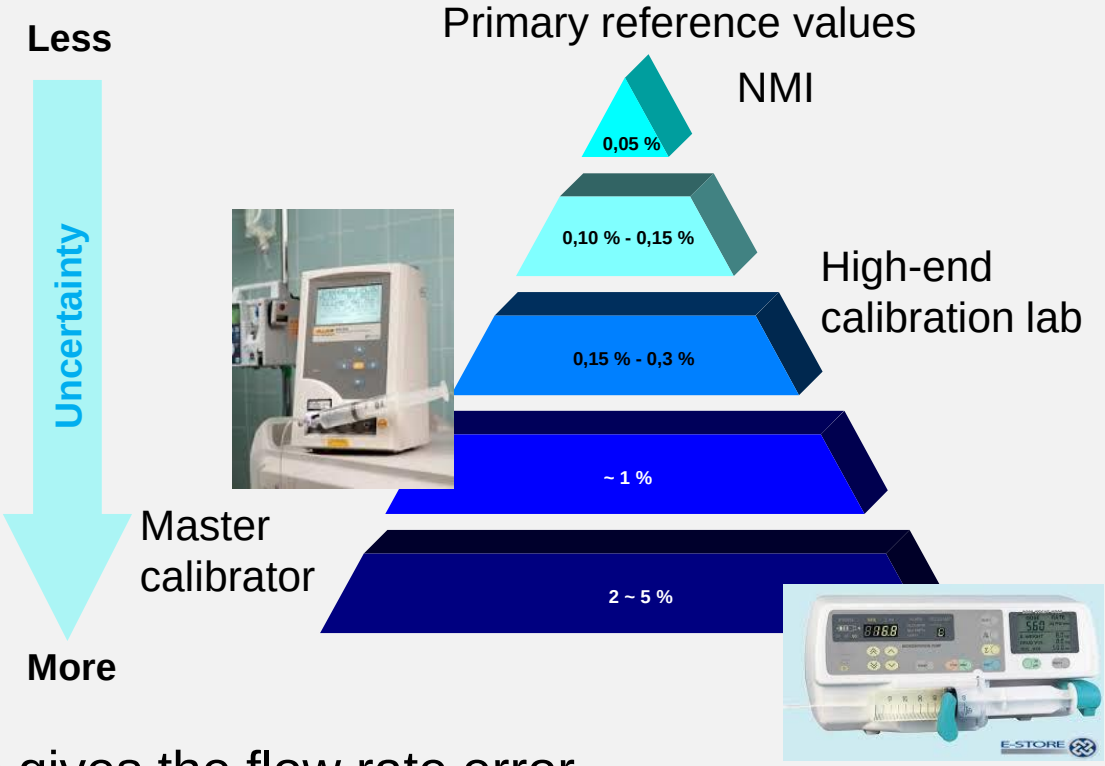
- Lack of traceable calibration services for low liquid flow rates
- Potentially poor established link to SI units for liquid flow rates, potentially leading to high or unestablished uncertainties
- Not fully understand risk of (high) measurement uncertainties

Metrological infrastructure

Traceability pyramid

"All measurements are wrong unless proven otherwise"





- A sound calibration gives the flow rate error and the uncertainty in that error
- The true error is in that interval (95%)
- Traceability is a guarantee for quality of calibration results

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What has MeDD delivered?

1. Metrology: upgraded and validated infrastructure for flow rate calibrations from 600 ml/h down to 0.1 ml/h
2. System characteristics: show cases infusion pump set ups
   - Pump plus accessories: effective flow rate, stability and start up time (compliance)
   - Dependency on fluid and process parameters (temperature, viscosity, flow rate, …)
3. Knowledge and awareness: best practice guide and input to current written standards

MeDD

Consortium

- National Metrology institutes: VSL (NL), CETIAT (FR), CMI (CZ), DTI (DK), IPQ (PT), METAS (CH), UME (TR)
- University Medical Centre Utrecht (NL)
- Lübeck University of Applied Sciences (DE)
- EMRP Grant (2012, Health call)
  - Metrology-focused European programme
  - Accelerate innovation and competitiveness in Europe whilst continuing to provide essential support to underpin the quality of our lives

Presenting the results of MeDD

Today's program session 1 and 4

Session 1 MeDD (1)

- Clinical relevance (Timmerman, A.M.D.E. – UMC Utrecht)
- Calibration services for health care (Bissig, H. – METAS)

Session 2 Multi-infusion and new technologies

Session 3 Clinical applications and policy

Session 4 MeDD (2)

- Dosing errors in multi-infusion (Snijder, R.A. – UMC Utrecht)
- Assessment of drug delivery systems (Batista, E. – IPQ)
- Infusion best practices (Timmerman, A.M.D.E. – UMC Utrecht)

Future work?

1. Proposal for amendments to written standards, e.g. IEC 60601-2-24 and ISO 7886-2
    1. Upgrade procedures for low flow rate calibrations (< 2 ml/h)
    2. Include uncertainty and traceability
    3. Differentiation between general and high-risk applications
2. Role out of metrology and traceability to hospitals
3. Active control of outflow concentration multi-pump infusion based on disposable flow meters


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