

# Bezpečnost pacientů a finanční úspory při automatické přípravě sterilních i.v. léků

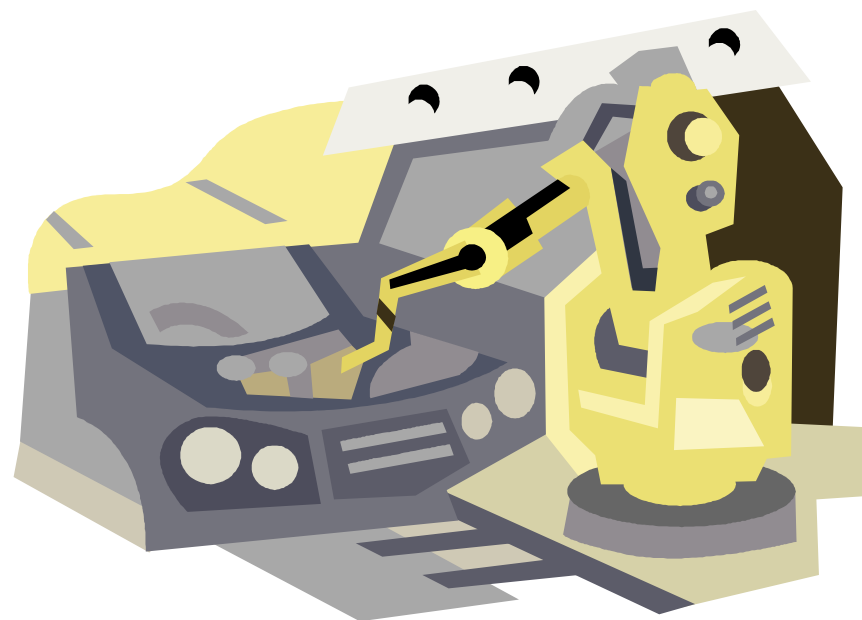
**RNDr. Ivo Strnad**

Praha listopad 2011



# Bezpečnost pacientů a finanční úspory při automatické přípravě sterilních i.v. léků

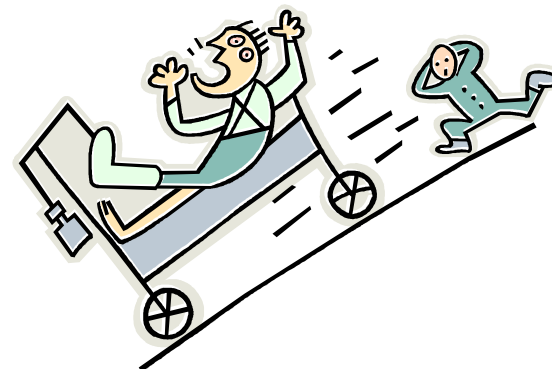
## Roboti prozatím jen v průmyslu ?



# Bezpečnost pacinetů a finanční úspory při automatické přípravě sterilních i.v. léků

## Jaké problémy může řešit automatizace?

- Snížení nákladů
- Lepší využití personálu
- Zlepšení bezpečnosti a kvality
- Lepší dokumentace procesů
- Akreditace nemocnice
- Integrace dat a jejich správa
- Kontrola skladových zásob
- Kontrola přístupu k citlivým informacím



# Problémy při tradiční přípravě sterilních i.v. léků

# Chyby v přípravě – až 9%

## Observational Study of Accuracy in Compounding Admixtures at 5 USA hospitals

American Journal Health-Systems Pharmacists, 1997; 54:904-12

### Types of Errors Observed in I.V. Admixtures

Errors observed in 9% of all IV doses

Error Category	No. Errors					Total No. Errors (%)
	Mountain	Midwest	Pacific	Southeast	Northeast	
Unauthorized drug	9	0	1	0	0	10 (7)
Wrong dose (as % deviation from labeled dose)						
5.0–9.9	7	11	9	10	10	47 (32)
10.0–14.9 <sup>a</sup>	0	6	4	9	2	21 (15)
≥15.0 <sup>b</sup>	1	9	5	6	11	32 (22)
Wrong base solution						
Volume	1	1	1	5	0	8 (6)
Content	8	5	0	0	2	15 (10)
Omission	1	0	4	0	0	5 (3)
Wrong preparation technique	0	6	0	1	0	7 (5)

<sup>a</sup>For example, fluorouracil (11% deviation from labeled dose), potassium chloride (10%), and tobramycin (10%).

<sup>b</sup>For example, leucovorin (100% deviation from labeled dose), insulin (60%), dopamine (20%), and ciprofloxacin (33%).

7% Wrong Drug, 69% Wrong Dose (22% Cases Error > 15%)

# Kontaminace - až 5%



## Microbial Contamination observed in 5.2% of all I.V. doses

**Purpose.** The estimated microbial contamination rate for complex, multiple-step, medium-risk-level compounding was studied.

**Methods.** The results of evaluations of the aseptic technique of pharmacists and technicians in compounding complex USP medium-risk-level sterile preparations were compiled to estimate the microbial contamination rate. The testing took place in 2002 and 2003 at a single institution and involved reconstitution of sterile dry growth medium and a series of complicated transfers of the medium from vials and ampuls to intravenous bags. The bags were incubated at 25–35 °C for 14 days and observed for microbial growth.

**Results.** Of 539 evaluations, 28 (5.2%) resulted in preparations that yielded micro-

al growth. Pharmacists' compounding resulted in a slightly lower contamination rate (4.4%) than that of technicians (6.2%). Inadvertent touch contamination may have been the principal source of the contamination.

**Conclusion.** A two-year series of 539 evaluations of the aseptic technique of pharmacists and technicians conducted with sterile growth medium and designed to simulate the compounding of USP medium-risk-level sterile preparations yielded an overall contamination rate of 5.2%.

**Index terms:** Compounding; Contamination; Drugs; Injections; Methodology; Personnel, pharmacy; Pharmacists; Stability; Sterile products; Storage

**Am J Health-Syst Pharm.** 2005; 62:285-8



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## Deaths spur debate about drugs made in pharmacies

Updated 9/7/2006 11:41 PM ET

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Enlarge

Family handout

Albert Perreault, right, died in March 2004 after undergoing heart surgery at Mary Washington Hospital. His widow, Sue Carol Perreault, left, is suing the hospital and the pharmacy that made the unsterile drugs he was given during surgery.

By Julie Appleby, USA TODAY

In eight days last summer, the same dangerous inflammation struck three cardiac surgery patients at Mary Washington Hospital within hours of their operations. On Sept. 2, one man died.

The unusual cluster of cases alarmed chief cardiac surgeon John Armitage, who feared a contaminant was in the surgery center. Tests confirmed it: Bacteria were found in a solution injected into patients' hearts during surgery.

The Fredericksburg, Va., hospital shut down its cardiac surgery program the next day and called state health officials, who brought in the Food and Drug Administration and the Centers for Disease Control and Prevention. Within days, the FDA and the CDC confirmed the presence of several types of bacteria in opened and unopened bags of the cardiac surgery solution, a state report later showed.

The hospital later determined that at least 11 cardiac surgery patients were stricken during a 10-month period from the end of December 2004 to September 2005, and three died. The illnesses and deaths drew attention to a practice few patients know about: Some drugs, including high-risk sterile preparations, are made in pharmacies under less-restrictive rules than those that drug companies follow.



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Health Robotics

Architecting the **Life Room** of the Future

# Nevyužité přípravky – až 24%



## Other examples of I.V. Waste (syringes only..)



- 6,000 + IV Syringes prepared per week
- Due to patient conditions, all IV syringes are patient-specific
- 24% (1,416 syringes) returned to waste
- Waste reasons: patient discharge, drug discontinuation, drug-dosing regimen changes, and missed doses
- Total Waste per Year: \$463,164 (\$8,907 per week)

Pharmacy Purchasing & Products, July 2007



Lifespan

Rhode Island Hospital

Advancing Medicine. Touching Lives.

- 11,000 patients
- Most wasted drugs:
  - Propofol (\$80,863) or 16% of wasted syringes cost
  - Sodium Thiopental (\$32,839) or 5% of wasted syringes cost
  - Midazolam (\$25,511) or 4% of wasted syringes cost
  - Rocuronium (\$12,545) or 2% of wasted syringes cost
  - Atracurium (\$10,954) or 2% of wasted syringes cost
- Total Waste per Year: \$165,667 (26% of all anesthesia drug expenditures)

Anesthesia & Analgesia 2000;91:921–4

**Je řešením tolik populární „outsourcing“?**

# „Outsourcing“ – až o 50% dražší než robot

Outsourcing I.V.s is Expensive...especially as compared with i.v.STATION....

Comparison of i.v.STATION Total Costs vs. Outsourcing for O.R. Syringes, Boston Metro Area

Drug strength and size of choice	Total i.v.Station Cost per dose including consumables	weekly volume
Acyclovir 1000mg/20ml	\$ 3.298	200
Diltiazem 50mg/10ml	\$ 6.956	70
Midazolam 50mg/10ml	\$ 13.156	115
Oxytocin 10units/1ml	\$ 4.913	200
Hydromorphone 50mg/5ml	\$ 5.513	250
Fentanyl 2500mcg/50ml	\$ 2.110	50
Morphine 100 mg/10 ml	\$ 7.241	150
Fentanyl 2500mcg/50ml	\$ 3.678	140
Hydromorphone 50mg/5ml	\$ 39.668	40
Fentanyl 2500mcg/50ml	\$ 6.348	125
Morphine 100 mg/10 ml	\$ 5.278	30
Hydromorphone 50mg/5ml	\$ 9.018	80
1 Hospital Total O.R. Syringe Production		1,450

Comparison of i.v.STATION Processing

Container Size and Type	i.v.Station Processing Cost per dose	weekly volume
Small Syringe	U 1.0	346
Medium Syringe	U 1.0	238
Large Syringe	U 1.0	75
Small IV Bag	U 1.0	374
Medium IV Bag	U 1.0	198
Large IV Bag	U 1.0	132
1 Hospital Total I.V. Production		1363



## Less Detailed Data (we keep trying...)

- Allegiance Health, Jackson , Michigan
  - Tom Crampton, DOP
  - i.v.STATION is 50% cheaper than IV Outsourcing, all costs considered
  - Savings of 50 cents for each dollar spent on IV Outsourcing (more than \$1M)
  - This means \$500K savings per year
- Memorial Care, Long Beach , California
  - Jane Hodding, DOP
  - i.v.STATION is 50% cheaper than IV Outsourcing, all costs considered
  - Savings of 65 cents for each dollar spent on IV Outsourcing (more than \$1M)
  - This means \$650K savings per year



**Co přináší automatizace ?**



# Robot optimalizuje využití léků



Data z pilotního provozu v nemocnici Vall d'Hebron v Barceloně



Aktivní látka: **Infliximab**

Dávkování podle tělesného povrchu

Použije se cca 3,3 balení /1 infuzní vak

**Prášek (rozpuští se v 10 ml )**

Po rozpuštění nutno 5 minut čekat

Velmi drahý lék (537 €/1 balení)

10 příprav /den



Aktivní látka: **Tocilizumab**

Dávkování podle tělesného povrchu

Použije se cca 2,5 balení /1 infuzní vak

**Liquid Drug**

Velmi drahý lék (400 €/ 1 balení)

3 přípravy/den

	WEEK 1	WEEK 2	WEEK 3	WEEK 4	TOTAL
<b>TOTAL DOSES (mg)</b>	11.805	10.262	10.315	12.430	44.812
<b>PREPARATIONS</b>	36	30	31	40	137
<b>VIALS USED WITH I.V.STATION</b>	119	103	104	125	451
<b>VIALS POTENTIALLY USED MANUALLY (WORST CASE)</b>	132	112	114	133	491
<b>I.V.STATION DRUG COST</b>	63.817,32 €	55.236,84 €	55.773,12 €	67.035,00 €	241.862,28 €
<b>MANUAL DRUG COST</b>	70.788,96	60.063,36	61.135,92	71.325,24	263.313,48
<b>I.V.STATION COST REDUCTION</b>	6.971,64 €	4.826,52 €	5.362,80 €	4.290,24 €	21.451,20 €
<b>AVERAGE COST PREP I.V.ST</b>	1.772,70 €	1.841,23 €	1.799,13 €	1.675,88 €	1.765,42 €
<b>AVERAGE COST PREP MANUAL</b>	1.966,36 €	2.002,11 €	1.972,13 €	1.783,13 €	1.922,00 €
<b>% WASTE WITH MANUAL PREPARATION</b>					<b>8,15%</b>

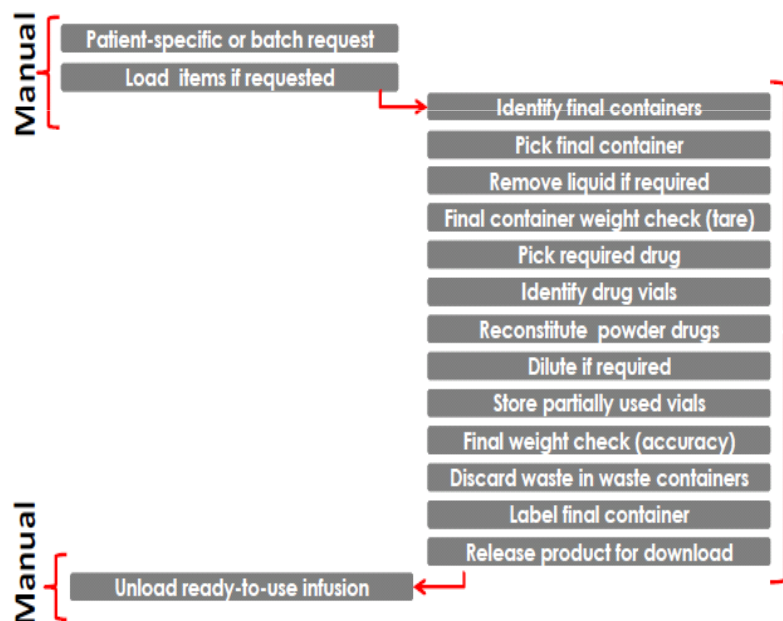
Although some errors (software, hardware and user's) have happened, no medication has been discarded. A total of 398 preparations prepared & administered during June, July & August

Převzato z prezentace Dr. Berlany na 15. Kongresu nemocničních lákárníků, Brno 2011

# Robot ušetří lidskou práci

**Na 9 lůžkovém JIP je potřeba více než 1 sestru pro přípravu i.v. léků**

## Solutions Provided by i.v.STATION™



## EU ICU example Labour Costs

- Data from an Oslo ICU
  - 9 patients
  - 10-20 syringes/patient/day
  - around 130 syringes + 50 bags daily
  - over one intensive care nurse just for IV preparations
- Biggest challenge: shortage ICU nurses
- 2010 → capacity ICU will be increased to 30 beds
  - around 430 syringes + 160 bags daily !

# Robot ušetřil 2744 hodin práce ROI v USA 6 měsíců (nahrazení outsourcingu)

s&t



FOR IMMEDIATE RELEASE

## Health Robotics Proves i.v.STATION® Exceptional R.O.I., Implementation and Safety Outcomes at Allegiance Health

Bozen, Sud-Tirol, Italy – October 13<sup>th</sup>, 2011. Health Robotics today revealed some of its

Concluded Mr. Crampton: *“Unlike some other industry claims that justify I.V. Automation by replacing I.V. Outsourcing contracts, we focused our i.v.STATION savings on switching from Frozen, Snap/Screw I.V. Bags, and RTU products together with related annual labor savings from both pharmacy “hands-on” time (664 hours) and nursing “activation” time (2,080 hours), yielding a payback period of less than 6 months for i.v.STATION. We had initially planned to add 2 more i.v.STATIONS to maximize the amount of Automated I.V.s., but after observing real i.v.STATION’s speed, we believe that we might only need 1 more.”*

### **About Allegiance Health:**

Allegiance Health is a 480-bed, community-owned and locally-governed health system. As the 2010 Foster G. McGaw Award Recipient, we are proudly entering our 10<sup>th</sup> decade of



# Automatizace v ČR?

- Jsme připraveni k prvním pilotním projektům
- Technologie bude v ČR k dispozici v lednu 2012
- Máme vyškolený personál
- Náš tým má zkušenosti s klinickými informačními systémy
- Jsme na trhu od roku 1999



**Děkuji za pozornost!**