

Vision from a hospital pharmacist on bar coding of pharmaceuticals

Prof. Pascal BONNABRY

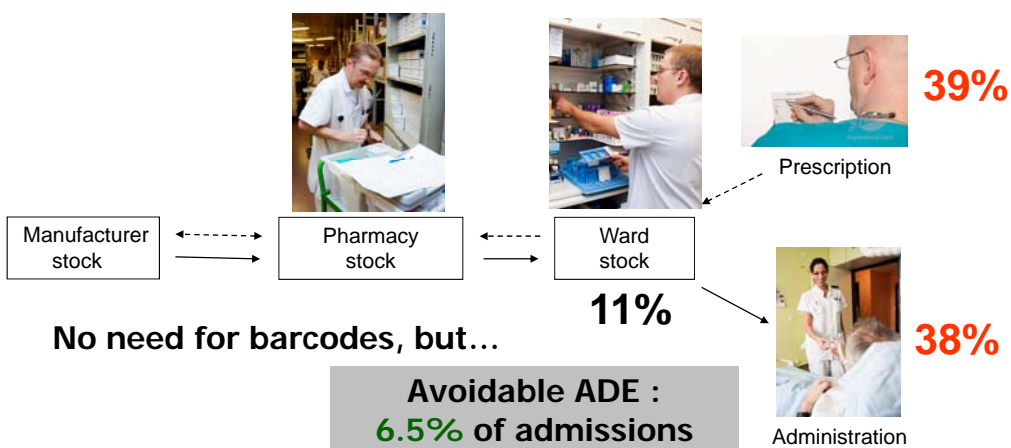
GS1 Healthcare conference

Prague and Ostrava, March 9-10, 2011



The medication process

Past (and still actual) perspective



Bates DW, JAMA 1995;274:29



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The medication process Past (and still actual) perspective



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Human reliability

« On the 6th day, God created man ... »

... but God was tired, and his creation was not perfect ...



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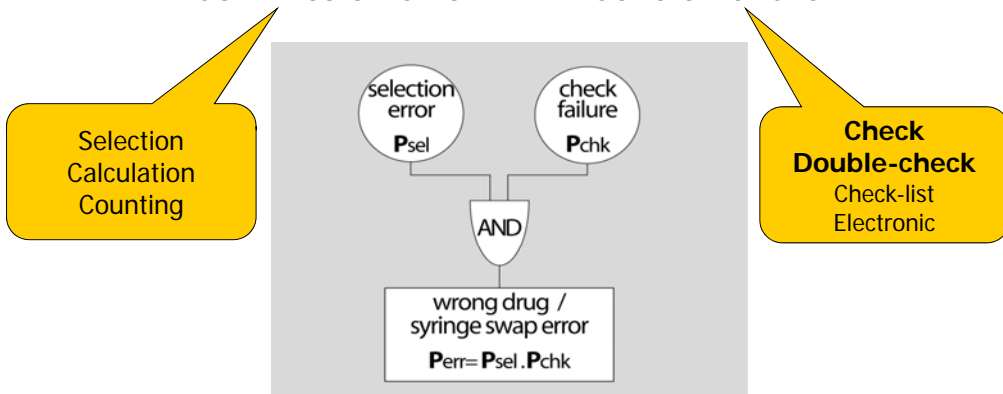
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The addition of two errors

Commission error **AND** Control failure



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Limited performance of controls

- Introduction of errors during unit dose dispensing
- Detection ability during human-performed control:
 - Pharmacists: **87.7%**
 - Nurses: **82.1%**

Facchinetti NJ, Med Care 1999;37:39-43

Efficiency \approx 85%
(known value in the industry)

Do not be too confident with the double-checks !



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Potential interests of IT

- **To improve**

- **The safety**
by improving the reliability of controls
 - five "R"
 - authentication of drugs
- **The traceability**
by facilitating the registration of logs
- **The efficiency**
by increasing the working performance
- **The communication**
by connecting the different steps of the processes



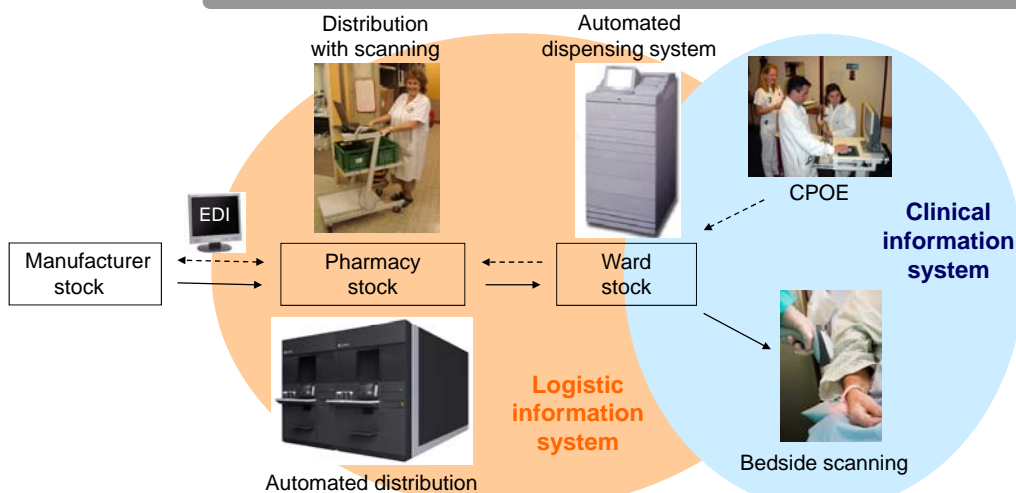
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The medication process

Future perspective



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Pharmacy stock Management with barcodes

- **Stock exit**
 - Product ID → quantity → validation in software



Réception fournisseur	Transfert de stock	Commande CHUV	Commande Externe	Retour Moon
Edition commande				
N° commande : PH 180263	Date commande : 27/03/09	Commande par : Coffin Marcia D		
Commande produits bar : COMPHIA 020021	Adresse de livraison : CFRIPA, Chi pleysine - Convaldium	Cpa/Cybl : CPR15000		
Art. : 04490000	Qté v date	Ende barre	Qté barre	
2030007	OXYC BODIUM CHLORURE ITRALV DOL PERE 0.08 % 20	1	0	
	MINIFLAC(S) 50 ML			

B. Hirschi, CHUV, 2009



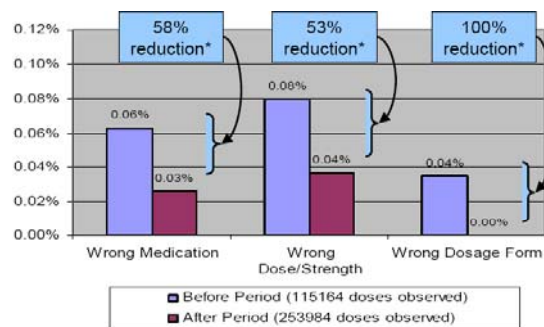
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Pharmacy stock Impact of barcoding on adverse drug events

- **Potential ADE: 0.19 → 0.07%**



Poon EG, Ann Intern Med 2006;145:426



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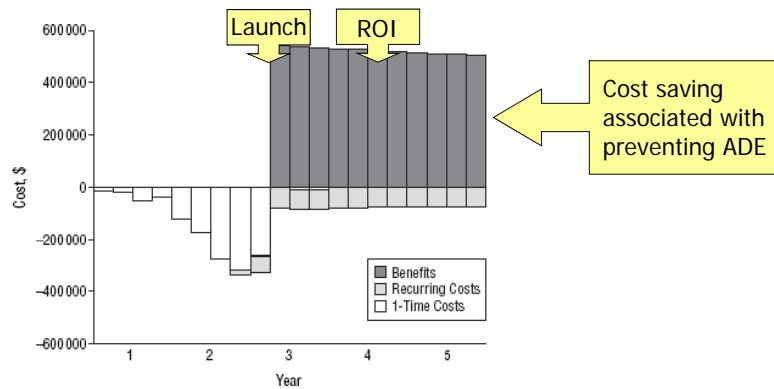
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Pharmacy stock Cost-benefit analysis

- Net benefit (5 years): \$ 3.5 million



Maviglia SM, Arch Intern Med 2007;167:788-94



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Pharmacy stock Robotisation



<http://www.arx-ltd.co.uk>



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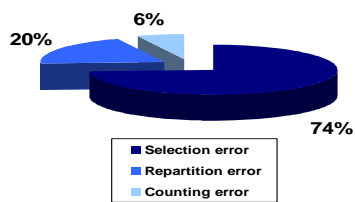




Dispensation Error rates

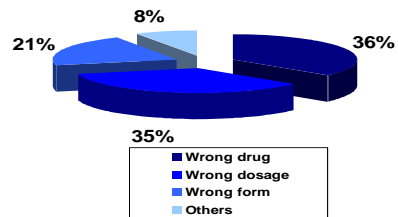
• Nurses

- 3,0 % dispensation errors
- Control not tested



• Pharmacy

- 3,6 % dispensation errors
- 79% detected during control



Selection errors \approx 2%

Garnerin Ph, Eur J Clin Pharmacol 2007;63:769

Cina JL, Jt Comm J Qual Patient Saf 2006;32:73



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Dispensation Automation

Centralised



Decentralised



Barcodes are needed to secure the process



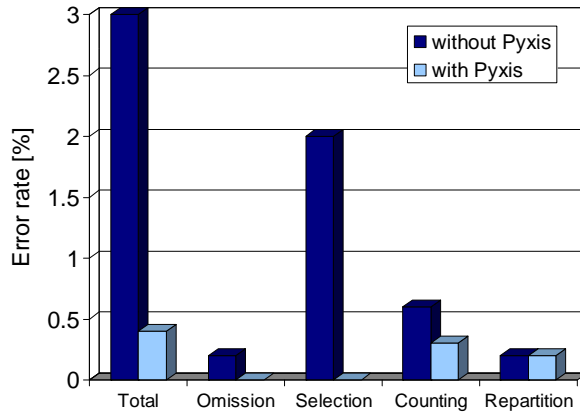
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Dispensation Impact on error rates



C. Du Pasquier, L. Riberdy, HUG, 2003



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Dispensation Impact on error rates

Disconnected

Prescription ↔ Pyxis

Error	Pre-CPOE	Post-CPOE
Dispensing error, <i>n</i> (% per admit)	36 (3.01) ^a	4 (0.33) ^a
Overdose, <i>n</i> (% per admit)	13 (1.09)	12 (0.99)
Underdose, <i>n</i> (% per admit)	50 (4.18)	37 (3.06)
Wrong drug choice, <i>n</i> (% per admit)	15 (1.25) ^b	0 (0) ^b

^a Data are the RR of a dispensing error in pre-CPOE compared with post-CPOE (RR: 0.11; 95% CI: 0.04–0.31).

^b Denotes a difference in this error type; *P* value is <.001 by χ^2 analysis.

Holdsworth MT, *Pediatrics* 2007;120:1058



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Administration to patients

Error rates

- 19% errors

Error Category	Overall
Omission	183 (6)
Wrong dose	103 (3)
Unauthorized drug	22 (1)
Wrong form	20 (1)
Extra dose	10 (0)
Wrong route	6 (0)
Wrong technique	2 (0)
Wrong time	259 (8)
Total errors	605 (19)
No error	2611 (81)
Total Doses	3216 (100)

Observation study in 36 institutions

Barker KN, Arch Intern Med 2002;162:1897



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Administration to patients

Objectives of bedside scanning

- Increase patient safety
- Increase patient satisfaction (safety feeling)
- Increase efficiency (documentation, stock management, billing,...)
- Increase nurses satisfaction
- Reduce costs (especially related to errors)



Foote SO, Nursing Economics 2008;26:207



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Administration to patients Benefit of bedside scanning

• Positive impact

- Wrong drug - 75%
- Wrong dose - 62%
- Wrong patient - 93%
- Wrong administration time - 87%



Globally

- 80%

Johnson, J *Healthcare Inf Manag* 2002;16:1



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Administration to patients Benefit of bedside scanning

Table 2. Nontiming Medication-Administration Errors and Potential Adverse Drug Events on Units without and Those with the Bar-Code eMAR.*

Nontiming Administration Errors	Medication Errors				Potential Adverse Drug Events			
	Units without Bar-Code eMAR (N=6723 doses)	Units with Bar-Code eMAR (N=7318 doses)	Relative Change in Error Rate	P Value	Units without Bar-Code eMAR (N=6723 doses)	Units with Bar-Code eMAR (N=7318 doses)	Relative Change in Error Rate	P Value
	no. of errors (% of doses)	no. of errors (% of doses)	% (95% CI)		no. of errors (% of doses)	no. of errors (% of doses)	% (95% CI)	
Total errors	776 (11.5)	495 (6.8)	-41.4 (-34.2 to -47.6)	<0.001	213 (3.1)	114 (1.6)	-50.8 (-39.1 to -61.7)	<0.001
Error type								
Oral vs. nasogastric-tube administration	298 (4.4)	260 (3.6)	-19.9 (-6.6 to -33.3)	0.003	0	0	—	—
Error in administration documentation	192 (2.9)	41 (0.6)	-80.3 (-73.7 to -87.0)	<0.001	86 (1.3)	18 (0.2)	-80.3 (-70.7 to -90.5)	<0.001
Dose error	136 (2.0)	84 (1.1)	-41.9 (-27.9 to -58.7)	<0.001	63 (0.9)	46 (0.6)	-33.0 (-10.5 to -59.6)	0.005
Wrong medication	64 (1.0)	29 (0.4)	-57.4 (-39.2 to -76.3)	<0.001	9 (0.1)	10 (0.1)	2.1 (-89.8 to 93.7)	0.97
Error in directions, monitoring, or both	37 (0.6)	46 (0.6)	18.9 (-33.9 to 68.4)	0.51	28 (0.4)	32 (0.4)	10.0 (-47.0 to 64.4)	0.76
Administration without order	19 (0.3)	8 (0.1)	-60.7 (-29.4 to -93.3)	<0.001	12 (0.2)	2 (0.03)	-83.3 (-70.7 to -90.5)	<0.001
Errors in routes of administration other than oral or nasogastric tube	17 (0.3)	6 (0.1)	-68.0 (-37.4 to -97.7)	<0.001	7 (0.1)	2 (0.03)	-70.0 (-32.6 to -99.9)	<0.001
Other errors	16 (0.2)	21 (0.3)	20.5 (-57.9 to 98.7)	0.61	8 (0.1)	4 (0.05)	-54.0 (-99.9 to 0.9)	0.05
Severity of potential adverse drug events								
Clinically significant	—	—	—	—	123 (1.8)	69 (0.9)	-48.5 (-33.9 to -64.0)	<0.001
Serious	—	—	—	—	88 (1.3)	44 (0.6)	-54.1 (-36.8 to -70.4)	<0.001
Life-threatening	—	—	—	—	2 (0.03)	1 (0.01)	-53.9 (-99.9 to 56.4)	0.34

Poon EG, *NEJM* 2010;362:1698



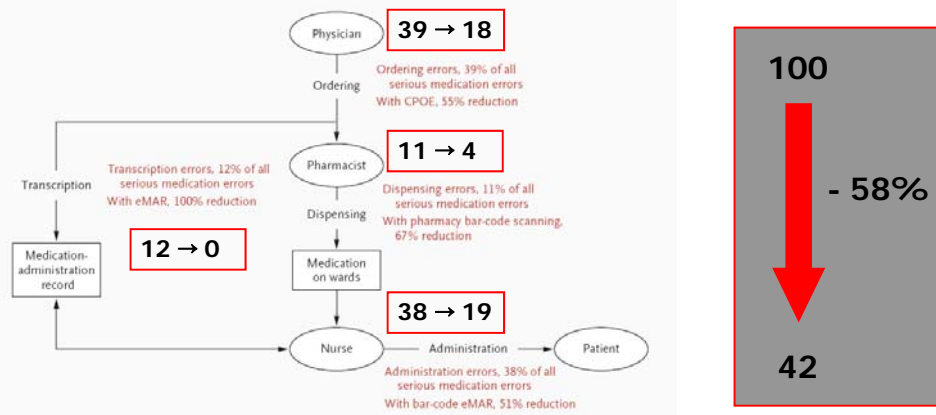
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Impact on safety: summary



Poon EG, NEJM 2010;362:1698

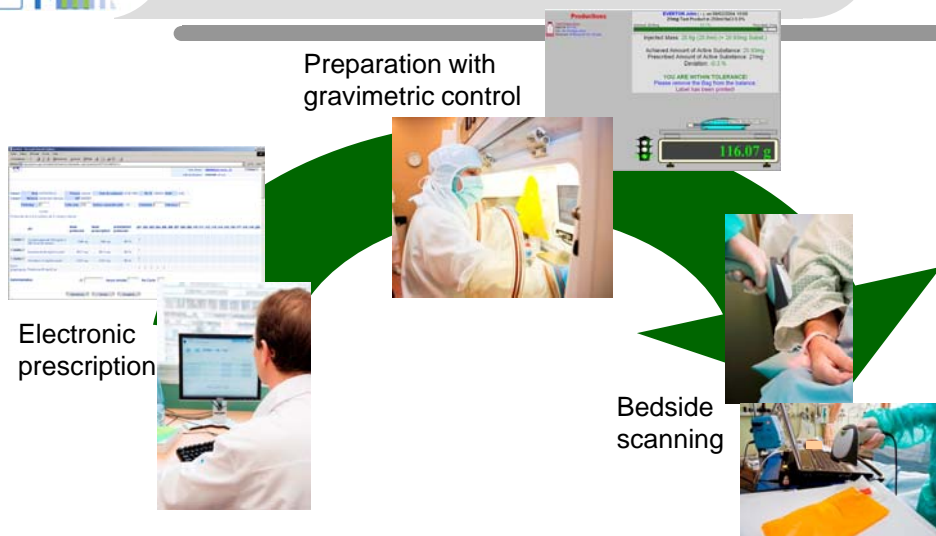


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Global process management Cytostatics



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Production Scan and weigh

- **Cytostatics – CATO®**
 - Direct calculation from the prescription
 - Operator guided step by step
 - Gravimetric control
 - Product ID controlled by barcoding
(*version 2*)
 - Traceability



www.cato.eu



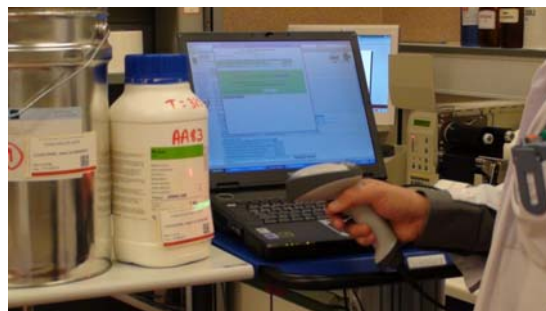
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Production Scan and weigh

- **Batch production**
 - ID operator
 - Selection of balance
(scan)
 - ID raw material
(scan)
 - Control and registration
of weighing



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Production Traceability

- Cytostatics**

Préparation no cyt/09-68373 - ETOPOSIDE PHOSPHATE 191 mg

Date visa	Date expiration	Type	Statut	Remarque
07 09 2009 08 19 24	07 09 2009 08 19	prescription SEP chr (190)	ncp	
07 09 2009 08 19 24	07 09 2009 08 19	sortie matériel	ncp	
07 09 2009 08 49 10	07 09 2009 08 49	mat-ent	ncp	
07 09 2009 08 49 10	07 09 2009 08 49	pharmac à cat	ncp	
07 09 2009 08 50 23	07 09 2009 08 50	Annexa 21	ncp	
07 09 2009 11 01 02	07 09 2009 10 44	cat	FACE	Préparation terminée correctement (aléateur 2044E-0208)
07 09 2009 11 01 02	07 09 2009 10 44	cat	FACE	Etoposide 20 mg/ml (09 57%)
07 09 2009 11 01 02	07 09 2009 10 44	prescription	FACE	Préparé par CATO
07 09 2009 11 01 02	07 09 2009 10 44	à facturer	FACE	Préparé par CATO
07 09 2009 18 01 27	07 09 2009 18 01	debAdm	ncp	
07 09 2009 18 02 41	07 09 2009 18 02	facture	ncp	

When ? What ? Who ?



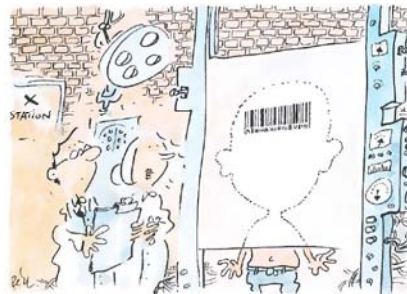
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Prerequisite to successful scanning

- Electronic management of processes (CPOE, stocks, ...)
- Technical infrastructure (hard-, soft-)
- Actors identification (caregivers, patients, drugs)
- Acceptability (patients, caregivers)
- Adaptation to processes
- Project leadership
- Financing



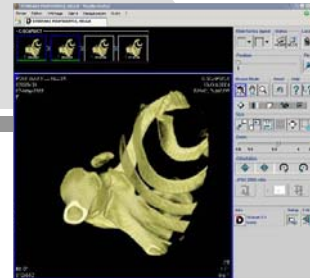
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Electronic patient record



Radiology

furosemide-Furosemide lasix® inject

Raison du traitement: [furose]

Dose par prise	Fréquence	A passer sur	Voie
10 mg	[2x]	[IV direct]	[intramusculaire]
40 mg	[3x]	[sur 24h]	[per os]
80 mg	[1x]	[sur 12h]	[autre]
120 mg	[1x]	[sans précision]	
autre	[matin-midi-soir 1x]	[autre]	

Debut: [estimer DE SUITE] | Fin: [arrêter à nouvel ordre] | Condition: [en fonction]

ne pas dépasser une vitesse d'injection de 4mg/min (2.5 mg/min en cas d'eff. sévères)

Informations: Ordre Salet le 23.02.2004 à 14.15 par Dr. Chestan Lovis

CPOE

Labo	Code	Unité	Quantité	Unité	Quantité	Unité	Quantité	Unité	Quantité	Unité	Quantité	Unité	Quantité	Unité	Quantité	Unité	Quantité
...

Laboratory

Handwritten → electronic traceability

C. Lovis, HUG



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Actors identification

The caregiver



The patient



The drug



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Acceptability by patients

Table 1 Support for identification bracelet among former patients

Variable	N	Hospital should introduce compulsory wearing of identification bracelet (% agree)		Would wear such a bracelet during a future hospitalisation (% agree)
Overall	1289	83.6		90.2
Examples of situations in which patient identification was a concern				
Given	648	87.9	(p<0.001)	92.2 (p=0.015)
Not given	641	79.2		88.1
Means of patient identification on bracelet				
Patient name	626	83.7	(p=0.92)	90.2 (p=0.98)
Anonymous code	636	83.5		90.2

p values based on χ^2 tests.



Cléopas A, *Qual Saf Health Care* 2004;13:344



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Adaptation to processes

• Reasons for workaround

- **Process**
 - Training requirements
 - Process flow (administration of drug before scanning, shortage of time)
- **Technology**
 - Hardware (performance of scanners)
 - Software (delays in response)
 - Barcode (difficulties in reading)
- **Resistance**
 - Communication
 - Changing role
 - Negative perception of IT



Nanji KC, *J Am Med Inform Assoc* 2009;16:645
Van Onzenoort HA, *Am J Health-Syst Pharm* 2008;65:644



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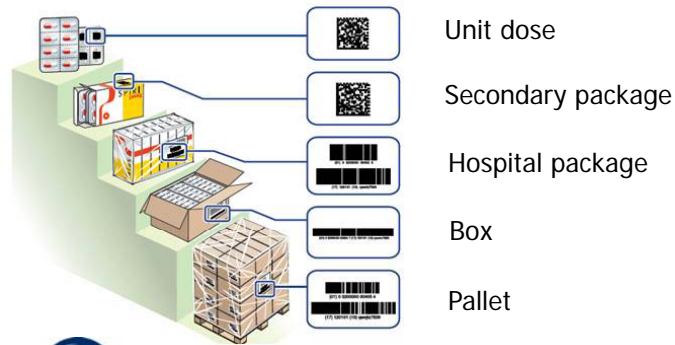
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Drug identification

- Hierarchy



GS1 = international standard



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Secondary package



Safety
ID product
(minimal)



EAN-13



Traceability
Batch number
Expiry date
(Serial number)
(ideal)



GS1-128

or



Datamatrix



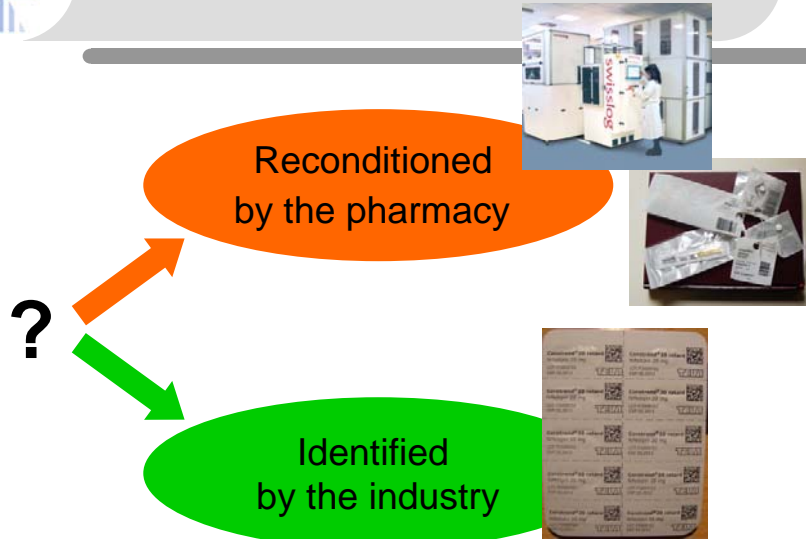
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Unit dose identification

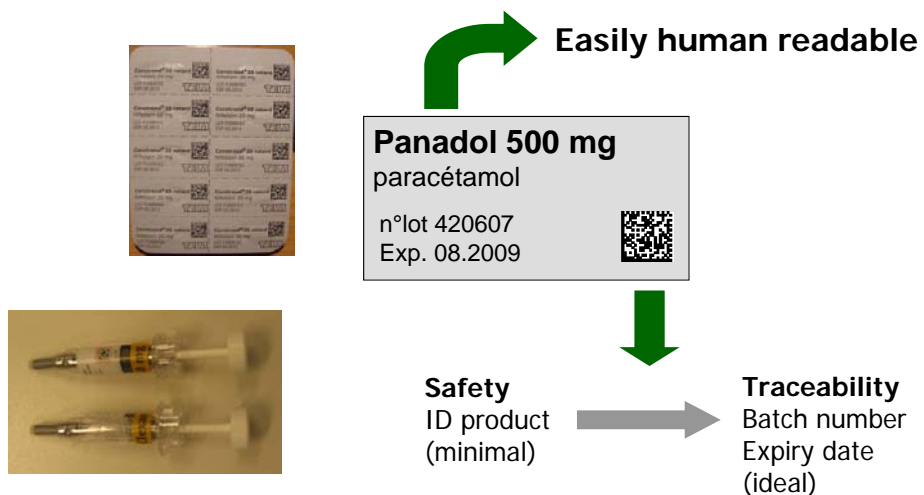


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Unit doses identification



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Unit dose identification

Europe - EAHP

- Unit doses blisters, with each single dose containing the whole information
 - Trade name
 - Active substance
 - Dosage
 - Expiry date
 - Batch number
 - Barcode
 - Including product ID, expiry date and batch number
 - Use of a recognized international standard (i.e GS1)
 - Datamatrix



EAHP, 2007



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Conclusion

- Barcoding **can improve the safety and the traceability** of drug use at each step of the process
- The implementation requires
 - an **exhaustive identification of drugs** without reducing the human readability (industry)
 - the **development of information technologies** in the medication process (hospital)
- **Hospitals are in action** and work in close collaboration with the industry and GS1
- The **implementation is a real challenge** and will take several years !



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Barriers ... how to progress ?

• Hospitals

- Implementation of IT (hardware, software)
 - Logistic
 - Clinical (CPOE=main actual focus)
- Costs / uncertainty in ROI
- Institution readiness (culture)

• Industry

- Adaptation of production lines
- Costs
- Heterogeneous requirements by
 - Customers
 - between countries
 - in a same country
 - hospital vs community
- Authorities

- **Availability of drugs with barcodes...**
(necessity to relabel)



- **Availability of customers scanning the barcodes...**
(producing for whom ?)



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Thank you for your attention

This presentation can be downloaded:

<http://pharmacie.hug-ge.ch/ens/conferences.html>



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