

# “From cow to C.O.W.”

Bedside Barcode Scanning prevents errors and even deaths



Bertil Lenderink

Hospital Pharmacy Midden-Brabant  
Tilburg, The Netherlands



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Hospital Pharmacy Midden-Brabant



# Proverb

Anything that can go wrong,  
will go wrong

**BUT....**

If things that can go wrong, do not ;  
it would, in the end,  
have been better for us  
if they had done so !

**Murphy**



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# Errare humanum est

- 1939

- Faddis MO. Eliminating errors in medications.  
*Am J Nurs.* 39:1217.

perseverare diabolicum

- 1962

- Barker KN, McConnel WE. The problems of detecting medication errors in hospitals.  
*Am J Hosp Pharm* 19:360-69



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# Causes of medication errors

- failed communication (55%)
- mistakes pharmacy/nursing staff (5%)
- failed organisation (6%)

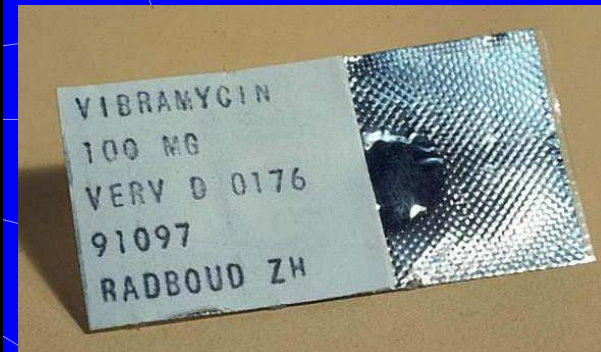
leads to

- incorrect drug administration (34%)
  - not given, unnecessary given, wrong time, wrong dose

**Tilburg study 1971**



# Unit Dose Package



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# Medication Administration Registration



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# Unit Dose Packaging Machines



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# Guidelines Standard Unit Dose



- **Materials**
- **Measures**
- **Labelling**
  - boxes
  - unit dose cell



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# EAHP Summary

- Barcode standards for medicaments exist in 43% of EC countries
- In another 43% initiatives on standardisation are taken
- Barcode is used mostly to support the distribution process
- Barcode is used mostly on “outer/inner package”
- Pictographs are seldom used



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# Conclusion

- 25 years of unit-dose systems have diminished the number of medication errors in some countries tremendously

but ...

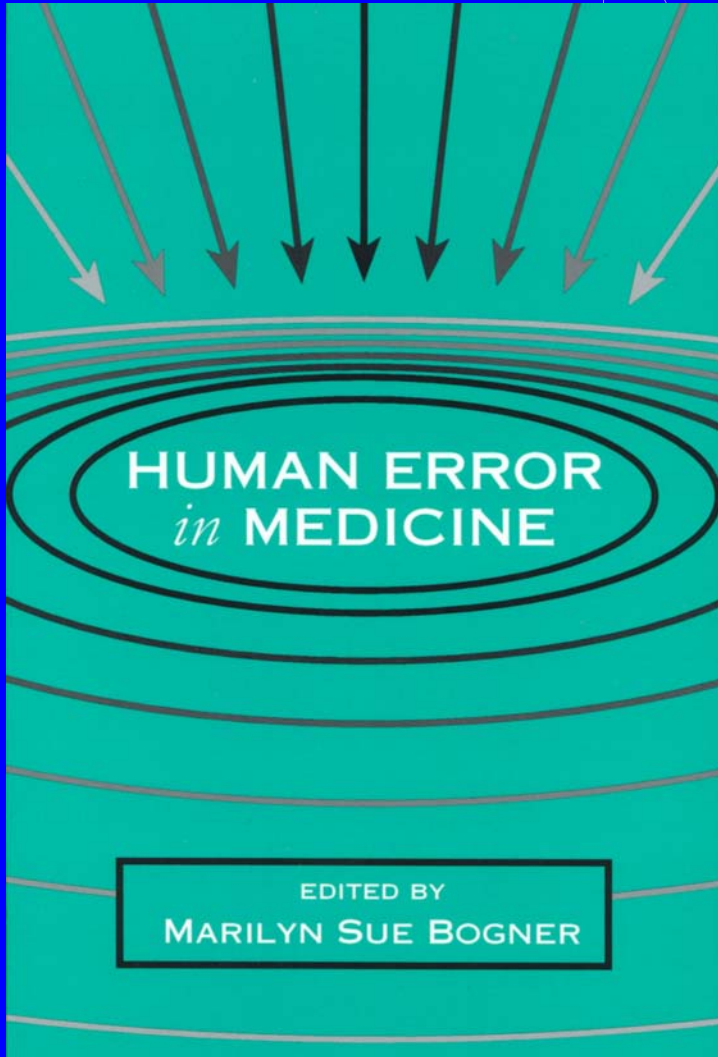
- it is still possible to further decrease this number by introducing a unit-dose package containing a barcode (and a pictograph) on the cell which can be used at the time of administration of the drug



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# How to Get Out of the Hospital Alive

A GUIDE TO  
PATIENT POWER



*"It is important to your survival to be informed, and this book is an excellent resource."*  
—Bernie S. Siegel, M.D., Author of *Love, Medicine, & Miracles*

SHELDON P. BLAU, M.D., F.A.C.P., F.A.C.R.  
and ELAINE FANTLE SHIMBERG



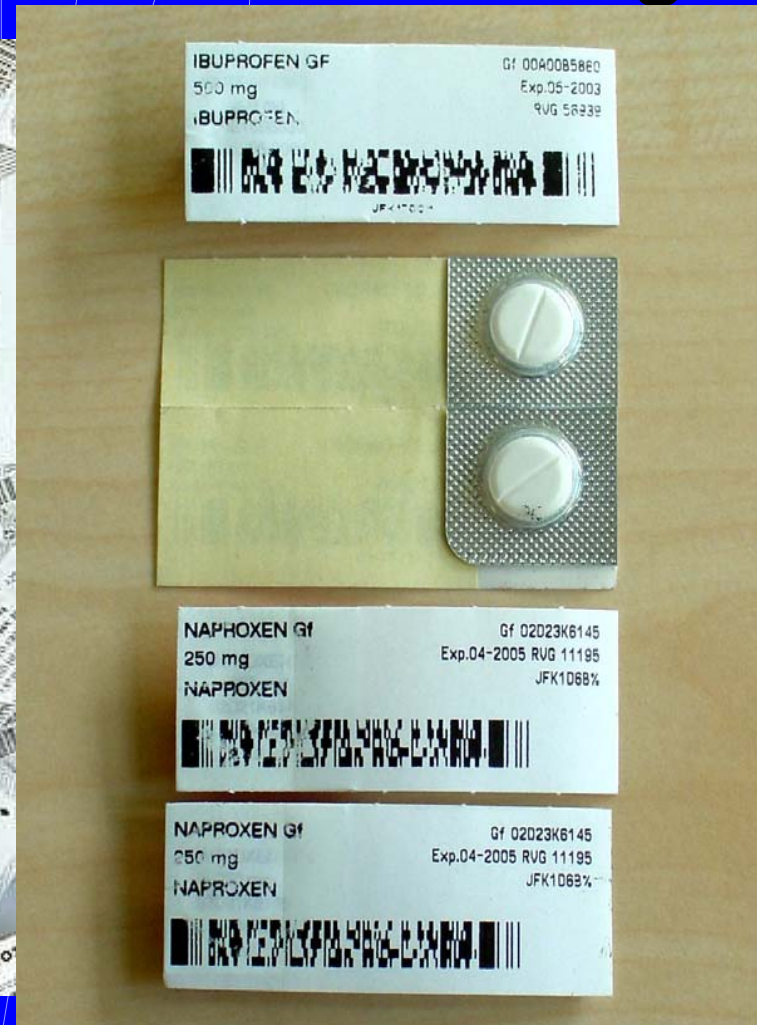
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# Diversity oral Unit Dose Packages



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# Dutch guidelines new millennium

- Usage in- and outside hospital
- Environment
- Cell
  - Polypropylene
  - 35 x 20/40 mm
  - 2D barcode (articlenumber, lotnumber, expiry date)
- Box
  - carbon
  - removable top
  - 7 cells/strip, 14/28/56 per box



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# “Forward integration”

Pharmacy is not just about dispensing  
or distributing medicines;

It is a clinical risk management service !

Michael Yates  
Audit Commission UK



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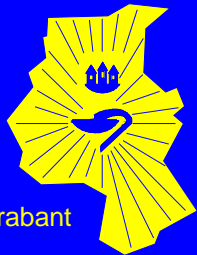
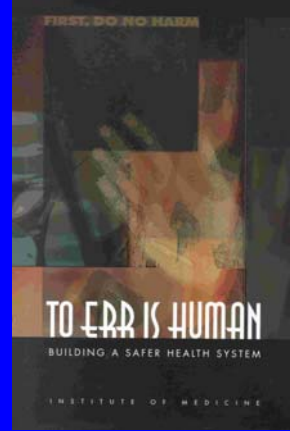
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# Best practice recommendations IOM report

- Pharmacists in patient care rounds
- No concentrated medications on ward
- Improve voluntary reporting
- Use unit dose system
- Check patient identity
- Implement computerized prescribing
- Use barcoding



# An ideal distribution system is a “Closed Loop” proces

- Prescribe
- Authorise
- Accept
- Agree
- Dispense
- Administer
- Outcome
- (Perhaps again) Prescribe

- doctor/nurse
- doctor
- pharmacist
- doctor
- pharmacy/nurse
- nurse
- patient



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**“Our distribution system is old-fashioned and insufficient“**



**From sticking labels to  
high-tech scanning**



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# Conclusions pilot



- The hand-held terminal-system is not optimal yet
- Nurses were skeptical about bar-coded bracelets; patients didn't have any trouble with them.
- Nurses formed a favorable opinion about implementing a different (complete) system.



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# Theriak™ Therapy Management System

- Patientdata and lab-values registration
  - Allergy, medication dependent variables
- CPOE, Prescribing
  - EPF, Clinical, Outpatient
- Decision Support, Authorisation
  - Medication info, Formulary, Cost
- Pharmacy review
- Dispensing, Preparation info
  - Intra/Internet
- **Medication Administration Registration**
- Medication review
- Logistics



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# Current hardware



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# Global A

## for Coding Ve

Implementation Guide  
for the Use of  
Bar Code Technology

# 2004-003

Eenheids Aflevering Geschikte verpakking.

Versie: definitief  
Datum: 24-12-2003  
Document: Voorstel EAG.doc

re Initiative

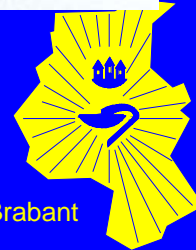
### 6. Eisen EAG.

- Verpakking: per dosis verpakt en zonder hulpmiddelen afscheurbaar
- Etikettering: per dosis stofnaam + sterkte + vervaldatum + chargennummer + (indien noodzakelijk) doseervorm
- Geschikt voor geautomatiseerd toedieningsregistratiesysteem, bij voorkeur EAN/RSS
- Geschikt voor geautomatiseerd chargennummerregistratiesysteem (bijv. chargennummerbarcode) (denk aan bloedproducten)
- Geschikt voor geautomatiseerd vervaldatumsysteem (bijv. vervaldatumbarcode).



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[FDA Home Page](#) | [Search FDA Site](#) | [FDA A-Z Index](#) | [Contact FDA](#)

## Press Release

FOR IMMEDIATE RELEASE  
Wednesday, Feb. 25, 2004

FDA Press Office  
301-827-6242

### HHS Announces New Requirements for Bar Codes on Drugs and Blood to Reduce Risks of Medication Errors

**DATES: Effective Date:** This rule is effective on April 26, 2004.

**Compliance Dates:** Drug products that receive approval on or after the rule's effective date must comply with the bar code requirement **within 60 days after the drug's approval date.** Drug products that received approval before the final rule's effective date must comply with the bar code requirement **within 2 years** after the final rule's effective date. Specific information on how the rule will be implemented can be found in section II.I of this document.



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- Contact Us

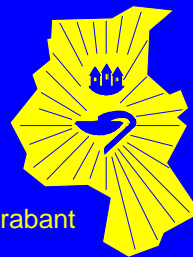
Home: [Products](#): RSS & Composite Symbology Specification Barcode FAQ and Tutorial:

# RSS & Composite Symbology Barcode FAQ and Tutorial



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# Findings Netherlands



- < 50% of units available in unit dose
- < 50% of unit doses have bar code
- Some CPOE-systems cannot use EAN-RSS
- Most affordable scanners cannot read EAN-RSS or 2D-barcodes

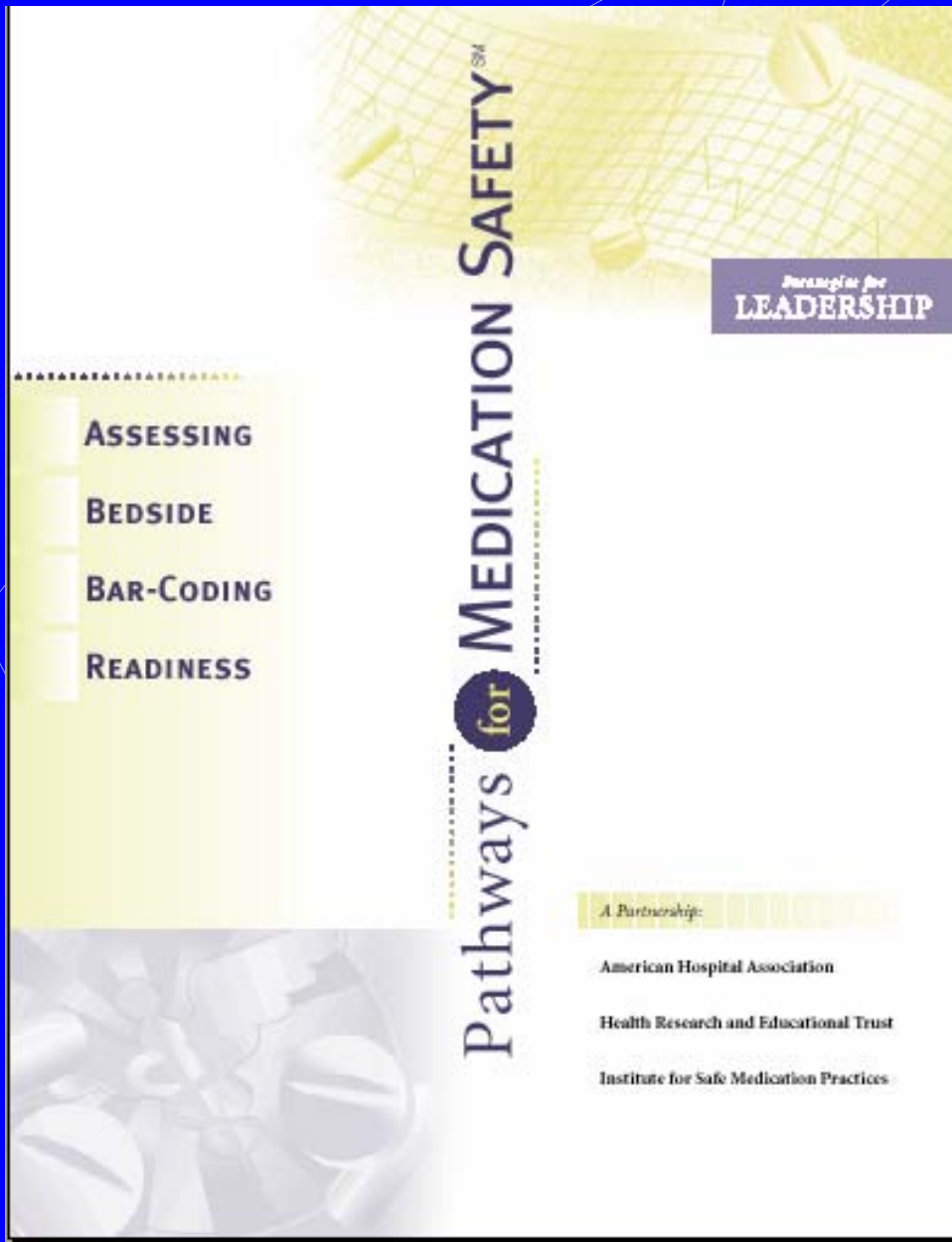


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Pathways **for** MEDICATION SAFETY<sup>SM</sup>

- ASSESSING
- BEDSIDE
- BAR-CODING
- READINESS

Paradigm for  
**LEADERSHIP**

*A Partnership:*

American Hospital Association

Health Research and Educational Trust

Institute for Safe Medication Practices

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# Current challenges in bar coding

- Only 35 % manufacturers bar code
- Trend towards fewer unit-dose form
- No uniform standard for medication barcodes
- No standard for relabeling/in house barcoding
- In house repackaging unreimbursed
- No affordable scanners
- “Floating” nurses
- Patient-specific medications



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# Failure Mode and Effects Analysis

- **People** : Technician labels incorrectly  
Pharmacist checks incorrectly  
Uncoded medication to ward
- **Material** : Barcode becomes unscannable  
Not available  
Small items, obscuring of info  
Multi-dose items



AANTAL	MERKNAAM GEN. NAAM ART. NUMMER	STERKTE MAG.-CODE	GEN.NR.
--------	--------------------------------------	----------------------	---------

510	EFEXOR XR 150MG CAPSULE MGA VENLAFAXINE (ALS HYDROCHLORIDE) 1053418	150MG G 343	10511
-----	---	----------------	-------

Quarantaine artikel

RVG / EUNUM : 20863 /

Vervaldatum: 8-2007A.

Charge nr. : M4854B

Aantal ontvangen : 510

Aantal verpakkingen: 17

Prf. 1 .....

Naar centraal magazijn

Prf. 2 .....

!!! PICTOGRAM "NIET VERPULVEREN" OF

EFEXOR XR

150 MG

Venlafaxine

Exp.: 08-2007



\*1053418\*

EFEXOR XR

150 MG

Venlafaxine

Exp.: 08-2007



\*1053418\*



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**Tjoapack B.V. Basisdocument Verpakken FOR 5700 - 02 Rev. 0**  
 BDV nr. 80001363 Datum 31/01/2005

**A. Klant- en artikelgegevens**

Klantnaam TWEE STEDEN ZIEKENHUIS Klantnr. Tjoapack DB0000092  
 MIDDEN-BRABAN  
 Productnaam SINEMET CR 125 MG 50T EAV 2SZ  
 Generieke naam Carbidopa 25 mg/ Levodopa 100 mg  
 Artikelnr. klant X Artikelnr. Tjoapack 80001363  
 Bewaarconditie Bewaren bij kamertemperatuur Opiumwetartikel N  
 Houdbaar x maanden Wettelijke status x

**B. Farmaceutische gegevens geneesmiddel**

Farmaceutische vorm tablet mga Kleur x  
 Geneesmiddelcodering x Vorm x  
 Breukgleuf x Formaat x  
 Gewicht per eenheid x

**C. Beschrijving verpakkingshandelingen**

Speciale verpakkingscondities: nvt  
 Maatregelen voor werken met risicovolle stoffen: nvt

**D. Eisen verpakking**

Omschrijving	Formaat (lxb (mm))	Omschrijving	Formaat (lxbxh (mm))
Bliester	125 x 50	Omdoos	146x60x60
Bijsluiters		Overdoos	312x252x148

Omschrijving	Aantallen	Omschrijving	Aantallen
Pockets per bliester	5	Omdozen per overdoos	20
Blisters per omdoos	10	Omdozen per bundel	.
Kruisperforatie bliester	x		

**E. Benodigde materialen**

Omschrijving artikel	Aantal per omdoos	Eenheid	Artikelnr. Tjoapack	Versie
SINEMET CR 125 MG TAB 2STEDEN ZKH	50.0000	ST	10001357	
ETIKETROL EAV 75 MM	0.6250	MTR	20000045	
SINEMET CR 125	1.0000	ST	201562OM	
SINEMET CR 125	0.0500	ST	201562OV	
PVC 250 uM 99 MM TRANSPARANT	0.6250	MTR	30000002	
ALU 20 uM 98 MM MAT	0.6250	MTR	35000004	
INKTROL TEC B-472/572 84 X 600 RG2	0.6250	MTR	40000002	
DS EAV ZONDER DUIMGAT	1.0000	ST	50000162	
OVERDOOS 312X252X148 EAV	0.0500	ST	55000031	
SLUITZEGEL BLANCO WIT	1.0000	ST	90000001	TJO2047

**F. Eisen bedrukking en etiketten**

Omschrijving	Kleurcode etiket	Formaat (lxb (mm))
Bliesteretiket	Wit	25 x37
Omdoosetiket	Blanco	48 x127
Overdoosetiket	Blanco	48 x127

Chargennummer en vervaldatum conform de orderovereenkomst tussen de klant en Tjoapack.  
 RVG nr.: 15175  
 HPK nr.: 700347  
 VPK/KNMP nr.: 13638084

**Dekfoliebedrukking / Bliesteretiket****Omdoosetiket**

E.A.V. 50 tabletten

**SINEMET CR 125**  
 Carbidopa 25 mg  
 Levodopa 100 mg

Chargenr.: 992299  
 Niet te gebruiken na: 09-9999

TWEE STEDEN ZIEKENHUIS

E.A.V. 50 tabletten

**SINEMET CR 125**  
 Carbidopa 25 mg  
 Levodopa 100 mg

Chargenr.: 992299  
 Niet te gebruiken na: 09-9999

TWEE STEDEN ZIEKENHUIS

**Overdoosetiket**

E.A.V. 20 x 50 tabletten

**SINEMET CR 125**  
 Carbidopa 25 mg  
 Levodopa 100 mg

Chargenr.: 992299  
 Niet te gebruiken na: 09-9999

TWEE STEDEN ZIEKENHUIS

E.A.V. 20 x 50 tabletten

**SINEMET CR 125**  
 Carbidopa 25 mg  
 Levodopa 100 mg

Chargenr.: 992299  
 Niet te gebruiken na: 09-9999

TWEE STEDEN ZIEKENHUIS

**G. Goedkeuring alle BDV-onderdelen**

Naam Datum Paraaf  
 Hoofd QC Tjoapack G. Amini 31.01.05  
 QA klant

31/01/05 - 12:56:20 - 00002

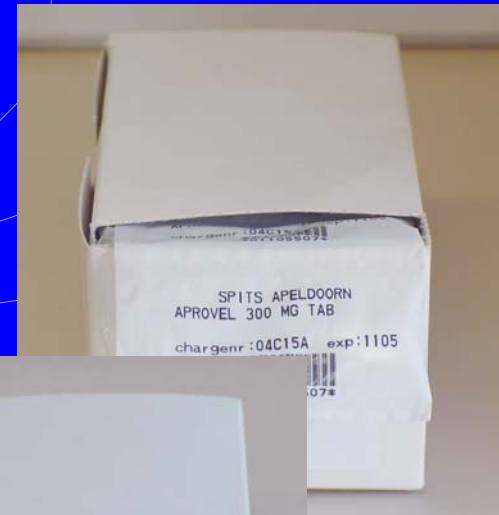
31/01/05 - 01:06:56 - 00002



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# Examples made by wholesaler



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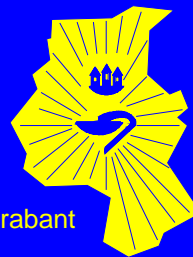


# Non-oral “Unit” Dose Packages



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# Failure Mode and Effects Analysis

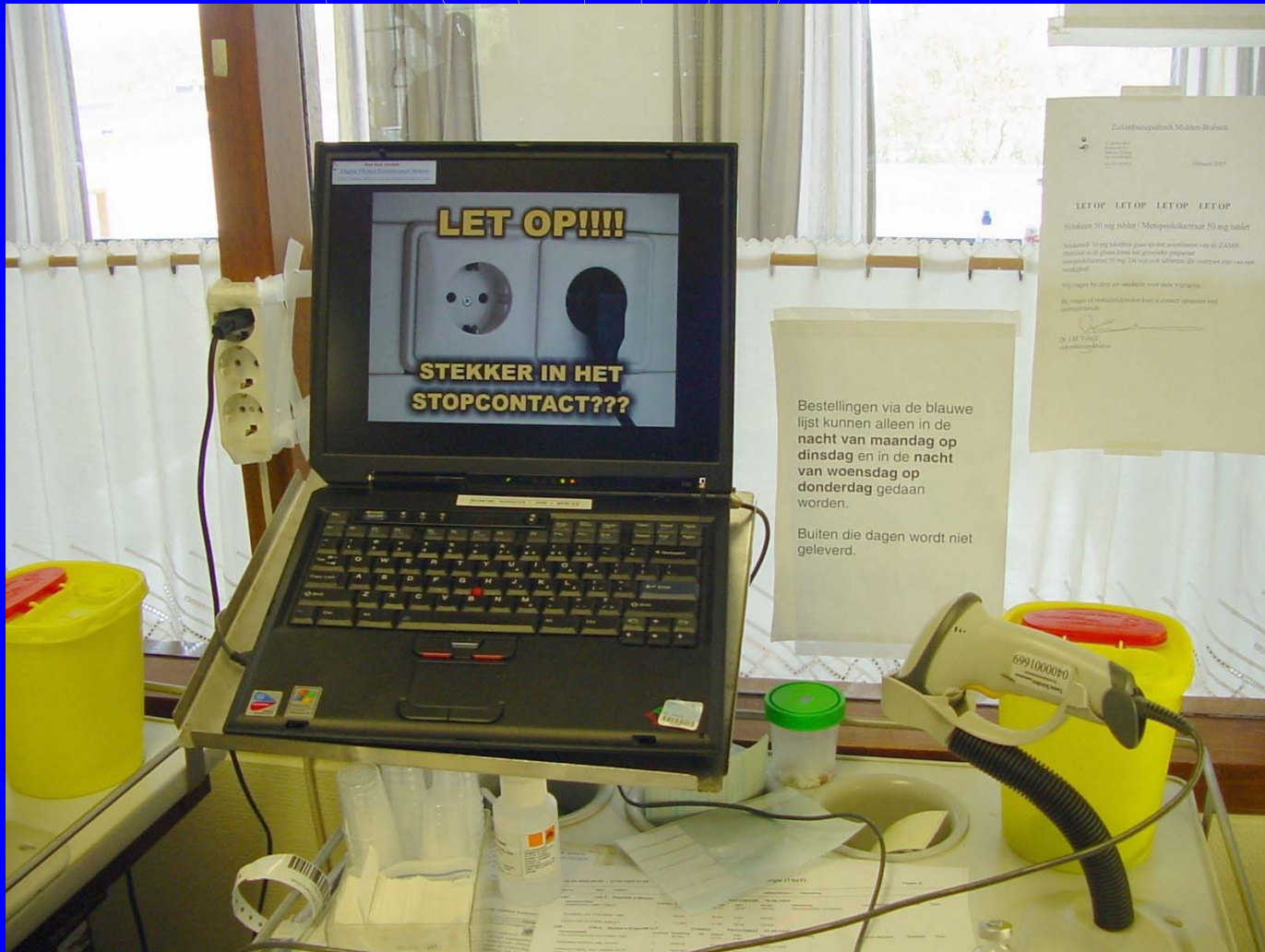
- Equipment: Not (correctly) functioning  
Package not standardised
- Environment: Not enough space
- Methods : Article not in G-standard - trials  
Needed before barcoding  
Personalised medication  
Uncoded home medications



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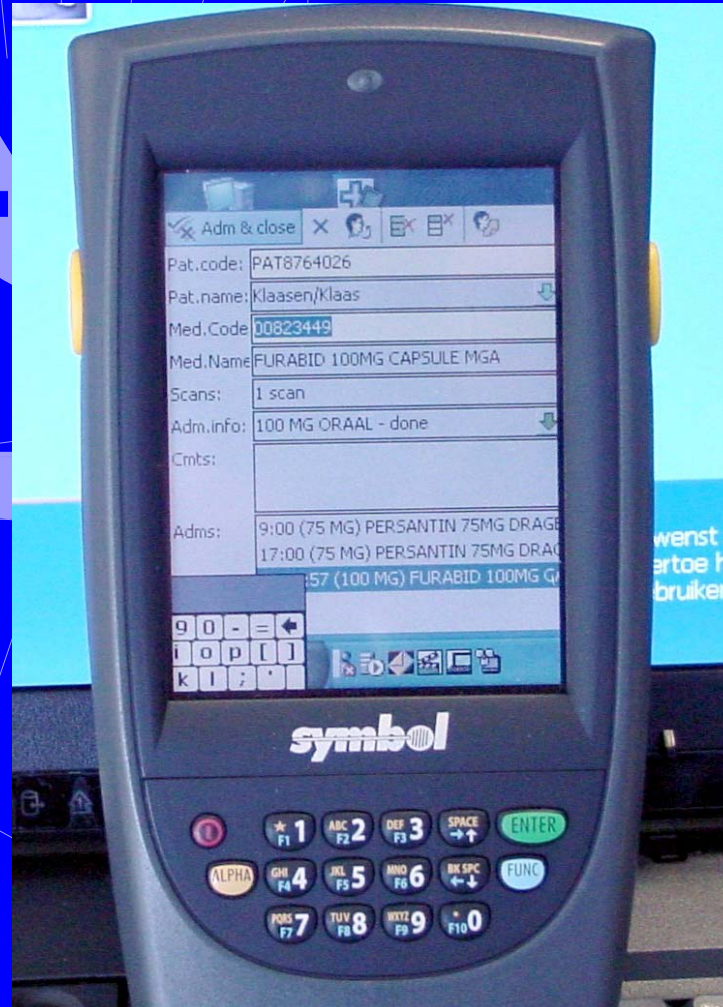
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# Other hardware



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# Trustworthy partners in patient-safety ??



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# Reliable partners in patient-safety ??

## Lilly Announces Individual Bar Coding on All Insulin Vials

February 7, 2005

*Industry believes bar codes may reduce risk of medication errors in hospital settings*

INDIANAPOLIS, Feb 07, 2005 /PRNewswire-FirstCall via COMTEX/ -- As part of its long-standing commitment to patient safety, Eli Lilly and Company (NYSE: LLY) has announced that it is including bar codes on individual vials of its insulin products including Humulin® and Humalog®.

The bar codes -- much like the linear bar codes found on many retail products -- have been included on Lilly's insulin product outer packaging in the past, but this marks the first time the bar codes are being included on the vial labels.

The bar coding is part of a larger effort within the health care industry to decrease medication errors. In February 2004, the U.S. Food and Drug Administration (FDA) issued a new regulation that requires all new pharmaceuticals to be bar coded upon launch in the marketplace and all existing medications be bar coded within two years of the ruling. Lilly completed its bar coding of insulin vials 18 months before the FDA's deadline, and the bar codes appear on vials for nine insulin products.

Bar code labeling on prescription drugs is projected to reduce error by 500,000 instances over the next 20 years with an estimated savings of \$93 billion in additional health care costs, patient pain and suffering and lost wages, according to the FDA. Studies by U.S. Pharmacopeia in 2003 indicate insulin products have the highest rates of errors in a hospital setting.



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# Reliable partners in patient-safety ??



**Pfizer**

**PURCHASE ORDER**  
No. E514223

**Leverancier**  
TWEESTEDENZIEKENHUIS  
POSTBUS 90107  
5000 LA TILBURG

**Factuuradres**  
PFIZER B.V.  
c/o Account Payable  
Postbus 80  
2900 AB Capelle aan den IJssel  
The Netherlands

**Afleveradres**  
Pfizer bv  
Rivium Westlaan 142  
2909LD Capelle a/d IJssel  
The Netherlands

**Telefoonnummer**  
Faxnummer 0031 0134630196  
Contactpersoon B. LENDERINK

**Pfizer contactpersoon** Hagendijk, Edwin  
**Telefoonnummer** +31 10 4064 203

Vermeld s.v.p. het PURCHASE ORDER NUMMER op alle correspondentie, facturen, creditnota's en afleverbonnen.

De gegevens op deze Purchase Order moeten correct zijn. Wijzigingen moeten schriftelijk en voorafgaand aan levering van de goederen of diensten aan Pfizer worden doorgegeven.

Purchase Order datum  
28-Nov-2006

**GOEDGEKEURD**

Voorwaarden voor verzending		Betalingsvoorwaarden		Additionele informatie		
Free On Board		30 Days Net				
Pos	Aantal	Item Number	Eenheid	Beschrijving	Afleverdatum	Totaalprijs
1	1		Each.	okt / nov 4e kw 2006 medicatieveiligheidsstestag  Verzend details Aantal besteld 1 Verzenden via BWY Adres bovenaan de pagina	11-Dec-2006	5.333,33 €
2	1		Each.	dec 4e kw 2006 medicatieveiligheidsstestag  Verzend details Aantal besteld 1 Verzenden via BWY Adres bovenaan de pagina	13-Dec-2006	2.666,67 €
<b>Totaalbedrag</b>						<b>8.000,00 €</b>

Opmerkingen: \*\*\*\*

VOOR VRAGEN OVER DEZE PURCHASE ORDER VERWIJZEN WIJ U NAAR ONZE PURCHASE DEPARTMENT

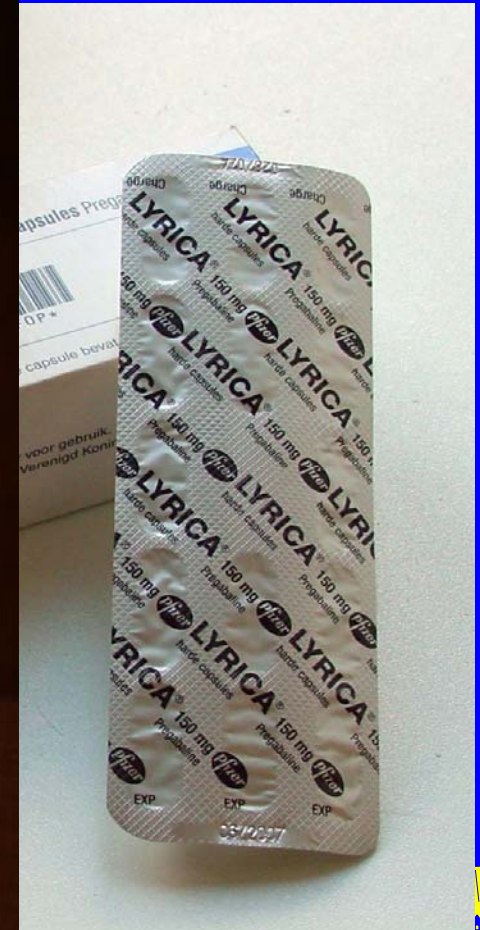
**OPM: IEDERE LEVERING MOET WORDEN VOORZIEN VAN EEN AFLEVERBONNEN. INDIEN DEZE NIET BIJ DE LEVERING ZIJT KAN DIT TOT GEVOLG HEBBEN DAT UW AFLEVERING WORDT GEWEIGERD. DE AFLEVERBONNEN MOET TENMINSTE DE VOLGENDE GEGEVENS BEVATTEN:**

1. Naam leverancier	2. Afleveradres	3. Purchase Order nummer en pos nummer	4. Aantal en beschrijving goederen	5. Product code	6. Lot- of controle nummer (indien van toepassing)	7. Pfizer contactpersoon (wanneer bekend)
---------------------	-----------------	--	------------------------------------	-----------------	--	---

Alle facturen moeten ten minste het Pfizer Purchase Order nummer en regel nummer vermelden, en worden geadresseerd aan het Pfizer bedrijf dat de Purchase Order heeft gezonden. Indien dit niet het geval is kan dit resulteren in vertraging in betaling van de factuur. Vermelde prijzen zijn exclusief BTW, tenzij anders vermeld.

Opmerkingen: PFIZER B.V.  
Vragen over deze Purchase Order moeten worden gericht aan de Purchase Department  
Telefoonnummer +31 10 4064 610

BTW nummer 0014.93.802.B.01  
Voor hulp aangaande facturen kunt u contact opnemen met de Accounts Payable Department  
Telefoonnummer +31 10 4064 680



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# Reliable partners in patient-safety ??



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# Reliable partners in patient-safety !!

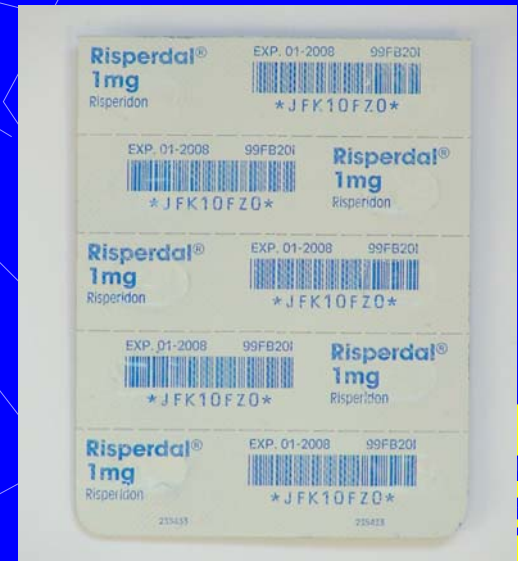


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# Reliable partners in patient-safety !!



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# Reliable partners in patient-safety !!



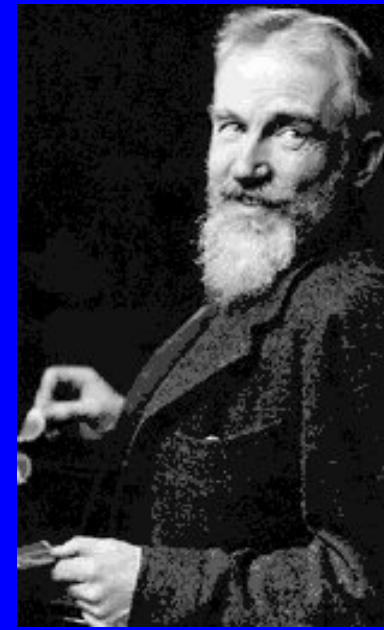
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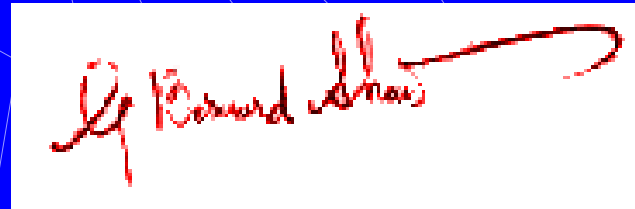
# George Bernard Shaw



**I don't believe in circumstances !**

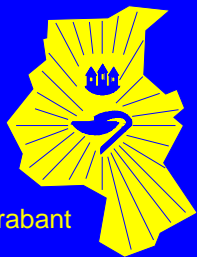


**The people who get on in this world are those who get up and look for the circumstances they want, and, if they cannot find them make them (themselves)**



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# Your challenge !

To be a trustworthy and reliable partner  
(together with clients and users of your products)  
in the permanent improvement of  
medication and patient-safety  
by offering  
barcode labeled unit doses



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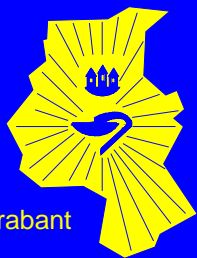
# Take home message

All intelligent thoughts have already been thought; what is necessary is only to try to think them again.

Knowing is not enough; we must apply !  
Willing is not enough; we must do !

Johann Wolfgang von Goethe  
(1749 - 1832)

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# Berlin 2007

The GS1 HUG-meeting  
that brought down the  
wall between producers  
and users of  
a barcoded unit dose



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# Information ?



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**Director of Pharmacy**  
**Hospital Pharmacy Midden-Brabant**  
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**5000 LA Tilburg, The Netherlands**

**Email : [awlenderink@zamb.tsz.nl](mailto:awlenderink@zamb.tsz.nl)**



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# “Dutch” bar-code

- On unit of use
- Readable
  - article number
  - 2 D OK, 1D better untill....
    - lotnumber, expiry-date



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# Closing the loop of the medication use process using electronic medication administration registration

- Bertil W. Lenderink and Toine C.G. Egberts

*Pharm World Sci 2004; 26: 185–190.*

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## Key words

Bedside pharmacy  
Hospital pharmacy  
Medication use process  
Registration and documentation  
The Netherlands

## Abstract

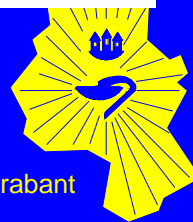
Recent reports and studies of errors in the medication use process have raised the awareness of the threat to public health. An essential step in this multi-stage process is the actual administration of a medicine to the patient. The closed loop system is thought to be a way of preventing certain

able studies originate from the USA, studies conducted in other countries such as the United Kingdom<sup>3</sup> and the Netherlands<sup>4</sup> have shown similar results. This strongly implies that medication errors are a major public health problem in many western as well as developing countries.

In light of these findings, we were therefore highly motivated to analyse the medication use process and to implement improvements, where necessary. The major conclusion from this particular analysis is that:

- 1) A medication order should contain all necessary items in such way that interpretation is only possible in a single manner and that there should not be more than one copy;
- 2) During the time of administration to the patient the uniquely identifiable medicine should be verified against the original medication order.

In addition, we concluded that these goals could only be achieved using electronic medication order entry



# Cijfers MIP TSz Tilburg

- 2002 en 2003
  - 750 meldingen: 300 vallen, 300 medicatie
    - 1998/9 100 ; 2000/1 200
- 2004 t/m september
  - 263 medicatie
  - 224 toedienfout ( 85% )
    - 99% te voorkomen mbv MO-gekoppelde MAR
  - 41 andere
    - 50% te voorkomen mbv Theriak



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# Cijfers MIP TSz Tilburg 2004

- 224 gemelde toedienfouten
  - 59 voorgeschreven maar niet toegediend
  - 64 niet voorgeschreven wel toegediend
    - 80% verwisseling middel
    - 10% verwisseling patiënt
    - 10% onterecht gegeven
  - 10 onjuiste toedieningsvorm/route
  - 5 onjuiste toedieningswijze
  - 81 verkeerde dosis (incl. pompstand)
  - 5 verkeerd tijdstip (> 1,5 uur te vroeg/te laat)



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# Summary cost benefit study

## 2 Steden Ziekenhuis Cash Flow Analysis Summary Kosten/Baten analyse Theriak

Prepared by:

Deloitte & Touche

	Total	Year						
		0	1	2	3	4	5	6
Cash Outflows	(1404326)	(1243874)	(32090)	(32090)	(32090)	(32090)	(32090)	
<b>TOTAL COSTS</b>		(1243874)	(32090)	(32090)	(32090)	(32090)	(32090)	
Ongoing Savings			450595	450595	450595	450595	450595	
<b>TOTAL BENEFITS</b>			450595	450595	450595	450595	450595	
Net Cash Flow (NCF)		(1243874)	418505	418505	418505	418505	418505	
Cumulative NCF		(1243874)	(825369)	(406864)	11641	430146	848651	848651
Discounted Cash Flows (DCF)		(1243874)	402409	386931	372049	357740	343981	
Cumulative DCF with WACC =	4,00%	(1243874)	(841466)	(454534)	(82485)	275255	619236	619236
Internal Rate of Return (IRR)				-22,8%	0,5%	13,0%	20,3%	20,3%
Payback Period					3,0			
Discounted Payback Period						3,2		

# Figures

## Medication Administration Return-on-Investment (ROI) Model

# beds	400
Occupancy rate	0.90
Avg. # patients	360
Meds per patient	4
Daily dose frequency	4
Meds per day	5,760
365 days/year	x 365
Meds admin. Per year	2,102,400
Error rate (1%-7%; assume best)	1%
# of medication errors per year	21,024
Cost per error (assume minor)	x \$75
Total error costs per year (best case)	\$1,576,800



# Summary Business Case Findings

The cost-benefit analysis shows that the investment will generate a positive net cash value

## Financial Impact:

5 Year NCV = € 619.000,=  
Revenue time = 3.2 year

Project Costs = € 1.200.000,=  
Yearly expected yields = € 450.000,=

