General introduction and the use of automated picking systems for packages and unit dose systems

Thessaloniki, Dr. Knoth

21/04/2012
University Hospital Dresden in numbers

1.320 beds

3.511 staff members

51,659 inpatients per year

165,231 outpatients per year
Employed staff of the pharmacy at the University Hospital

<table>
<thead>
<tr>
<th>profession</th>
<th>number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacists</td>
<td>18</td>
</tr>
<tr>
<td>Pharmacy engineers</td>
<td></td>
</tr>
<tr>
<td>Pharmacy technicians</td>
<td>15</td>
</tr>
<tr>
<td>Pharmaceutical-commercial assistants</td>
<td>11</td>
</tr>
<tr>
<td>System administrator</td>
<td>1</td>
</tr>
<tr>
<td>Economist</td>
<td>1</td>
</tr>
<tr>
<td>Unskilled employees</td>
<td>6</td>
</tr>
<tr>
<td>Apprentices</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>58</strong></td>
</tr>
</tbody>
</table>
Organisational chart

Manager: Dr. rer. nat. H. Knoth

- Quality assurance/ Analytics
  - Drug information/ Clinical studies
    - Clinical pharmacy/ Logistics
      - Drugs
      - Unit-dose
    - Laboratory Diagnostics
  - Pharmaceutical production
    - Preparation of cytostatic drugs
    - General and aseptic drug-preparation
- Secretary’s office
- Controlling/ EDP
Our performance (I)

Ensuring an effective supply with medical products

- 1320 beds in UKD
- 1900 beds in other hospitals

- Pirna
- Freital
- Bad Berggießhübel
- Bad Schandau
- Gohrisch
- Altenberg
- Gut Gamig

http://maps.google.de/
Our performance (II)

- Controlling
- Drug information service
- Preparation of parenterals and other medical products
- Supervision of projects in pharmacy and medical research
- Medication service for clinical trials
- Supply of narcotics and other controlled drugs
- Sourcing of international registered medicines (§73/3 AMG)
- Dispensing of OTC-products to employees of UKD
Research topics

- electrochemical behavior of drugs (i.e. polarography)
- HPLC, plasma levels and stability of drugs
- filters for parenterals
- pharmacoepidemiology
- strategies for prevention of medication errors
- antimycotic drugs
Medication service for clinical trials

- about 120 clinical trials conducted in our hospital every year
- special licence for the preparation of drugs used in clinical trials (§13 German drug law)
- products are used in the whole of Germany and Europe (IIT for special centres – KKS)
- special services for pharmaceutical manufacturers conducting small scale trials
decision criteria for an automated system

- it depends on
  - legal regulations
  - available space
  - financial resources
  - number of supplied wards
  - sufficient members of staff
  - historic development of pharmacy services

Picture www.floridaipblog.com
The “six rights” for medication administration

- right patient
- right medication
- right route
- right dose
- right time
- right documentation
different ways to accomplish these aims

<table>
<thead>
<tr>
<th>automated picking systems for packages</th>
<th>patient-oriented picking systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>semiautomatic</td>
<td>fully automatic</td>
</tr>
<tr>
<td>Kardex</td>
<td>Apostore</td>
</tr>
<tr>
<td>Axon</td>
<td>Rowa</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>
automated picking systems for packages
Stock flow

- gravity fed storage system
- combination of sloping trays and horizontal drawers
- wide range of modular components
- easily adapted for variations and changing requirements
- efficient storage
- ergonomic workbenches available
- convenient and accurate display of drugs
- “First-in First-out” principle
- basis for semiautomatic picking systems
Kardex

- path-optimized picking
- Pick To Light Technology consists of four basic functions
  - Picking of a specific or active item.
  - Placing the item in an active order or location.
  - Communicating a message such as quantity, description, etc.
  - Completing the task and moving on to the next job.
- price about 50 000 €
pick-to-light products

- **TIC (Transaction Information Center)**
  - discrete item identification (1/10 inch increments)
  - communicates descriptions, quantities and other messages

- **Light Tower**
  - consists of extruded columns and display modules
  - indicates the active carousel, shelf level, cell location and quantity to pick
  - often placed in between two carousels

- **Put Lights**
  - lights that direct an operator to “put” items in a specific location
  - indicate the quantity and description of items
  - ideal for consolidation, batch picking and sortation of applications
Batch flow

**work flow**

- incoming orders are processed to one batch
- manual picking of the packs (paperless)
- transport on a conveyor belt to a sorter (splits back into original orders)
- software-based scanning (end control)
- filling of the assigned boxes and carts

**effectiveness** depends on the performance of individual staff members (  ⬇️ approx. 750 picks/hr;
 ⬇️ ⬇️ ⬇️ 2000 picks/hr; ⬇️ ⬇️ 4000 packets in 2,5-3 hr)

**advantages**

- nearly every item can be processed
- alphabetic storage can be maintained
- in a way indifferent to IT-system and power failure
- quick installation (4-5 days), short initial supervision (2 – 3 days)
Pharma-Flo-System

- stock flow storage
- manual picking on a conveyor belt into a box
- speed of the conveyor belt: 70 cm/sec
- performance 1 sec/pack
- four hour training session, while the system is put into operation
- full manual operation in case of an emergency (e.g. power loss)
- able to support the 2-D/GS1 standard
- picking of many products which cannot be picked by automated systems, but not suitable for all drugs (i.e. cool stored packs)
- producer: P@P Picking Systems
- price about 50 000 €
Axon

- batch order picking
- order picking with handhelds
- optical classification in size, outlines and colours and also recognition of special features like labels, icons and barcodes
- check point for outgoing goods and recording of incoming returned goods
- speed of transport: 0,5 m/sec
- throughput: 3 000 objects/hr
- recognition time: 1 sec
- price about 50 000 €
Fully automated picking systems for packages

**Apostore 3000**
- patient oriented dispensing
- average 2 packs per order line
- broken pack handling
- fully automated loading
- best degree on article handling

**Carryfix Pusher**
- patient oriented dispensing
- ward box dispensing
- approx. 5 packs per order line
- limited article spectrum
- integrated material flow management
Apostore 3000

- Maximum Dimensions: 17.25 x 1.80 x 3.60 m (LxWxH)
- Pack’s capacity: up to 50,000 Packages
  up to 100,000 Packages with Capacity Extension Unit
- Pack’s Input: automatic loading with 450 packs/hr
- Output performance: 1,000 packs/hr based on average 2 packs per order line
- Reliable handling based on special gripper technique
- Wide range of packing sizes (15 x 15 x 35 mm – 120 x 140 x 240; weight: max. 1,200 g)
  approx. 98% of Rx products
- plenty accessories (conveyors, elevators, spiral chutes, falling towers, funnels etc.)
- Price about 300,000 €
Carryfix Pusher

- Maximum Dimension: 12,00 x 2,50 x 3,20 m (LxWxH) one-liner
  12,00 x 5,00 x 3,20 m (LxWxH) two-liner
- Pack´s capacity: up to 40,000 Packs in one-liner
  up to 80,000 Packs in two-liner
- Pack´s input: Automatic operation
  1,000 Packs/hr for one-liner
  1,500 Packs/hr for two-liner
- Dispensing performance: (for 3 items/order line)
  1,500 Packs/hr for one-liner
  2,250 Packs/hr for two-liner
- Degree of article handling: approx. 85% of hospital pharmacy article
- Less staff needed
- Automatic Stock and dynamic storage channel control
- Integrated manual dispensing from different stock areas
- Integrated box control system
- Price about 500,000€
**Rowa V\textsubscript{max}**

- dimension: 3-15 m length, 1.30-1.60 m width, different heights
- storage capacity: up to 60,000 packs
- fully automated input of up to 900 packages/hr
- output speed up to 2,000 packs/hr
- recording of batches and expiry dates
- different certifications
- noise pressure level of 48.3 dB(A)
- refrigerated unit, second belt etc. also available
- price about 300,000 €
disadvantages and advantages

- occasionally low input speed (especially semiautomatic systems)
- time-consuming control of expiry dates
- legal accreditation by the responsible authority
- time and effort for data management, supervision and service of the machine
- further training of the staff required

- significant error rate reduction
- decreased picking time
- optimized utilization of the available space
patient-oriented picking systems
Swisslog PillPick System

BoxStation
Filling/recording station

PillBox / PhialBox
Locked canisters for loading of medications into packaging station

PillPicker
Drugs are packaged in unit dose bags, with a printed barcode containing all the drug information

AutoPhial

AutoBox

PickRing
Dispenses daily patient therapy into a plastic ring

The right patient receives the right drug, in the right dose, at the right time!
**BoxStation**
- to fill canister with drugs, register the drug information to the canister chip (TAG) and print sticker labels for visual identification of canisters content

**PillBox and PhialBox**
- for medication in bulks (PillBox), blisters, vials, syringes etc.
- content is recorded with the RFID tag

**PillPicker**
- able to produce single doses
- different dimensions of the bags (modifying the length according to the assorted drug)
- bags have unique barcode and information about medication printed on them
PillPicker Consumables
- 250-meters-long polypropylene roll to produce 2500 bags
- thermal transfer of an ink ribbon (200 meters long and follows film consumption)

AutoPhial
- automatic loading of vials, ampoules, blisters, cups, suppositories
- optional blister cutter for automated loading and cutting of multidose blisters

AutoBox
- buffer for up to 12 PillBoxes to be loaded into PillPicker
- PillBoxes are automatically transferred from AutoBox to PillPicker if it is required
- PillBoxes are automatically expelled when the production is finished
DrugNest

- automated “multifunction” storage system for bags produced by PillPicker
- 4 different types of DrugNest to be part of a complete PillPick System
- double loading- and unloading robot
- 8-to-24 conveyor belt sizes; a maximum of ten bags are stored on one pin
- each conveyor has 3 “levels”, 2 for short bags, 1 for long bags
- DrugNest with typical dimensions can store up to 5 – 7 days of stock
- re-load into DrugNest through return window is possible

<table>
<thead>
<tr>
<th>Model</th>
<th>Pins quantity (drug types number)</th>
<th>Theoretical storage capacity</th>
<th>Real Storage capacity (based on 65% occupancy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19L20</td>
<td>2.640</td>
<td>26.400</td>
<td>17.160</td>
</tr>
<tr>
<td>19L24</td>
<td>3.168</td>
<td>31.680</td>
<td>20.592</td>
</tr>
<tr>
<td>33L20</td>
<td>4.440</td>
<td>44.400</td>
<td>28.860</td>
</tr>
<tr>
<td>33L24</td>
<td>5.328</td>
<td>53.280</td>
<td>34.632</td>
</tr>
</tbody>
</table>
**PickRing**

- collects all the single dose bags for one patient and binds them together with a plastic ring
- number of bags per plastic ring depends on the therapy order and the dimension of the drugs
- pre-perforated label (patient data and drug list) is attached to the ring as well as the drugs
- plastic cord to produce rings (200 meter long roll can produce about 800 rings)
- patient labels come in rolls of 450
- to print patient labels the same ribbon is used as for the PillPicker

**Price**

- about 1 000 000 €
KRZ Multiblist

- horizontal packer
- pre cut blister packer, big sizes
- packaging of the medication treatment
- packaging of cut medication and multiple specialities
- hermetic sealing
- speed: 2,500 units/hr
- low maintenance
- direct printing on the terminal film (integrated icons and forms possible)
- consumables: two rolls (thermal aluminium and colour)
- price about 15 000 €
Pyxis MedStation ES

- automated dispensing system for a decentralized medication management
- one system formulary through integration of the Pyxis into the Pharmacy Information System
- access to comprehensive medication and patient information is located in one place
- barcode scanning
- prevents loading of wrong medication
- active alerts for high risk medication
- Price: 20,000 € (MedStation 3500)
Three generations of Baxter Unit Dose systems

1987 - 2000: ATC 212 SYSTEM

2000 - 2010: FDS 330/520 SYSTEM

Since 2010 : FDS II PROUD 260/336 SYSTEM
# Technical data FDS 330-/520 systems

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producer</td>
<td>YUYAMA (JAPAN)</td>
</tr>
<tr>
<td>Capacity</td>
<td>330 or 520 cassettes</td>
</tr>
<tr>
<td>Dispensing speed</td>
<td>40-45 packs/minute</td>
</tr>
<tr>
<td>Printing mode</td>
<td>Thermal Printing</td>
</tr>
<tr>
<td>Dispensing of less used</td>
<td>DTA-Tray</td>
</tr>
<tr>
<td>tablets</td>
<td></td>
</tr>
<tr>
<td>life expectancy</td>
<td>Min. 15 years</td>
</tr>
<tr>
<td>Price about</td>
<td>200 000 €</td>
</tr>
</tbody>
</table>
FDS II PROUD 260/336 systems

- different facilities with 260 or 260 + 76 cassettes slots available
- identification of cassettes and medication through RFID
- refill of cassettes on a scanable drawer and scanable medication packaging
- easily accessible row of cassettes and funnels
- dispensing of unit dose and/or multi dose possible
- price about 170 000 €
DTA-Tray

- special way for picking less used medication (i.e. divided or effervescent tablets)
- 63 slots per tray, but infinite trays per order
- faster processing with new types of DTA-Trays
- theoretical dispensing speed: 60 packs/min
- net dispensing speed: 30-35 packs/min
Cassettes

- individually produced and calibrated for each drug (more than one cassette can be calibrated for the same drug)
- matching of drawers and cassettes through individual barcodes
- available in different sizes
Packs

- Multi Dose, Combi Dose or Unit Dose possible
- Different packaging sizes (60, 70, 76, 80, 90 mm)
- Length of the roll 420 meters
- Environmental friendly and hygienic material
- Ribbon (Cartridge-cassettes)
- Printing of barcodes etc.
- Text is sent as bitmap file
- Quality certificates exist (GMP)
Which kind of information can you print on the packs?

- Patient name or number
- Patient picture (optional)
- Date of birth
- Hospital ward, room number
- Time of administration
- Medication and dosage
- Name of the drug/means of identification
- Directions of use
- Lot number and expiring date
- Barcode (Scan for Safety)
- Emblem of the pharmacy
ZiuZ Foresee Inspector

- optic control element
- counts and identifies dispensed medication
- picture of the front and backside of the pack (two cameras)
- automatic matching of taken picture (identity and amount) with master image (calibration required)
- image can be saved for documentation
- error statistic can be evaluated
- processing speed equivalent to the output of 2 FDS machines
- problems we are facing at the moment
  - a lot of false error messages
  - time consuming
  - technical limits of identification (limited picture definition)
# Robotik 5000

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (fixed + variable canisters bases)</td>
<td>500 (440 + 60)</td>
</tr>
<tr>
<td>Dispensing speed</td>
<td>Maximum 60 packs/min</td>
</tr>
<tr>
<td>Printing mode</td>
<td>Thermal Printing - Printing service for selected contents (Specified Form)</td>
</tr>
<tr>
<td>Dispensing of less used tablets</td>
<td>FSP (Free Shape Packing System) or MDU (Manual Device Unit)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>1098(W) * 1080 (D) * 2040 (H)</td>
</tr>
<tr>
<td>System weight</td>
<td>About 850 kg</td>
</tr>
<tr>
<td>Environment</td>
<td>Temperature : 10-40° C/ Humidity 10-80%</td>
</tr>
<tr>
<td>Noise standards</td>
<td>&lt; 85 db (5 Aeration fans)</td>
</tr>
<tr>
<td>Price</td>
<td>About 150 000 €</td>
</tr>
</tbody>
</table>
Dijkstra

- compatible with all commonly used hospital and pharmacy information systems, patient management as well as warehouse and accounting systems
- automatic cassette recognition system for time-saving changing of medicines (cassettes can be replaced on every drawer)
- photo-optic and fully automated checking of the pre-packed rations for compliance with the prescription plus reporting in the form of pictures and text (optional)
- authorization system RFID operating on the basis of magnetic cards and reporting of the accesses which occurred
# Dijkstra

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassette capacity</td>
<td>up to 500</td>
</tr>
<tr>
<td>Dimensions W x D x H</td>
<td>up to 1087 x 1207 x 2317</td>
</tr>
<tr>
<td>Weight (without cassettes)</td>
<td>up to 1,160 kg</td>
</tr>
<tr>
<td>Pouch sizes (in mm)</td>
<td>70 x 75 / 70 x 55 / 70 x 45</td>
</tr>
<tr>
<td>Maximum working rate</td>
<td>Single dose: 60 packs/min</td>
</tr>
<tr>
<td></td>
<td>multi-dose: 50 packs/min</td>
</tr>
<tr>
<td>Printing system</td>
<td>Thermal transfer system</td>
</tr>
<tr>
<td>Dispensing of less used tablets</td>
<td>DTA</td>
</tr>
<tr>
<td>Manual STS capacity</td>
<td>60 doses/1 tray</td>
</tr>
<tr>
<td>Price about</td>
<td>150 000 €</td>
</tr>
</tbody>
</table>
Florence on the Elbe
Thank you for your attention

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