

Advantages of closed medication cycle (closed loop) in practice

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Background and objectives:

Spital STS AG began introducing automation in 2001. Although the clinic was already using medicine cabinets introduced on a pioneering basis (Pyxis) with electronic prescription and patient dossier (CPOE phoenix), as well as an automated storage system (Rowa) and a pharmacy IT system (Nexus), manual interfaces and media discontinuities prevented full exploitation of the added benefits. Many clinic and hospital pharmacies¹ have started to introduce automation in recent years, especially in relation to automated storage systems. The medicine cabinets in Thun were connected up to the pharmacy IT system and the associated automated storage systems (Rowa Vmax) in 2016. For the first time this allowed a closed medication cycle (closed loop) – from prescription to dispensing of medication to the patients. A vast proportion of the available range of medicines come under this category. The goal was to provide an initial overview of the advantages that could be gained in relation workflows and in part to illustrate consequences for medication safety.



Pyxis system in the nursing ward



Rowa Vmax

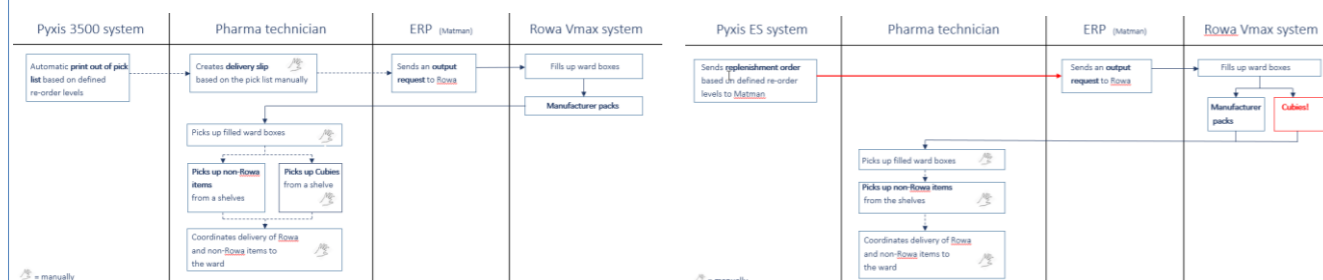
Fig. 1 General illustration

Prerequisites:

The newly developed Pyxis ES Mobile Dock became available to the clinic in Thun with the rollout of the new generation of Pyxis systems (Pyxis ES) and was used for pre-filling the likewise newly designed cubies (intelligent medicine boxes). Cubies were filled with medicines by pharma technicians and counter-checked by a pharmacist. The new system offered an advantage here in that pharma technicians could fill the medicines independently of the pharmacist and thus work faster. There was an upper limit on the number of cubies that could be filled in the old system for reasons of space.

Re-orders for Pyxis systems were printed on paper prior to 2017 and then validated. The quantities were adapted by a pharma technician if necessary and manually settled in the system. Goods in the Rowa Vmax were then picked automatically by the system subsequently. The majority of goods of relevance for Pyxis, including cubies, had to be manually picked additionally from secondary storage (Fig. 2 on the left).

With the upgrade to Pyxis ES and the introduction of the new interfaces in 2017 between the Rowa Vmax, the Pyxis ES system and the materials management system/ERP Nexus Matman, re-orders from Pyxis were imported directly into Nexus Matman. Once the order was validated by a pharma technician, the picking order was forwarded to the Rowa Vmax. Since the upgrade allowed cubies to be stored in the Rowa Vmax, the majority of the re-ordering for Pyxis was picked by the Rowa Vmax. The manual additional picking from secondary storage could therefore be reduced to a minimum (Fig. 2 on the right).



Procedure prior to 2017

Procedure after 2017

Fig. 2

Methods:

The time required to fill cubies and pick Pyxis re-orders was measured with a stopwatch before and after the introduction of the interfaces. The complete workflow for filling cubies was compared in the old and new system. The time required for filling as well as checking the cubies was recorded separately and added (number of filled cubies in the old system = N(491), new system = N(316); number of checked cubies in the old system = N(331), new system = N(478)). The time recorded did not include the preparation of the medicines, since this work step was not influenced by the changes.

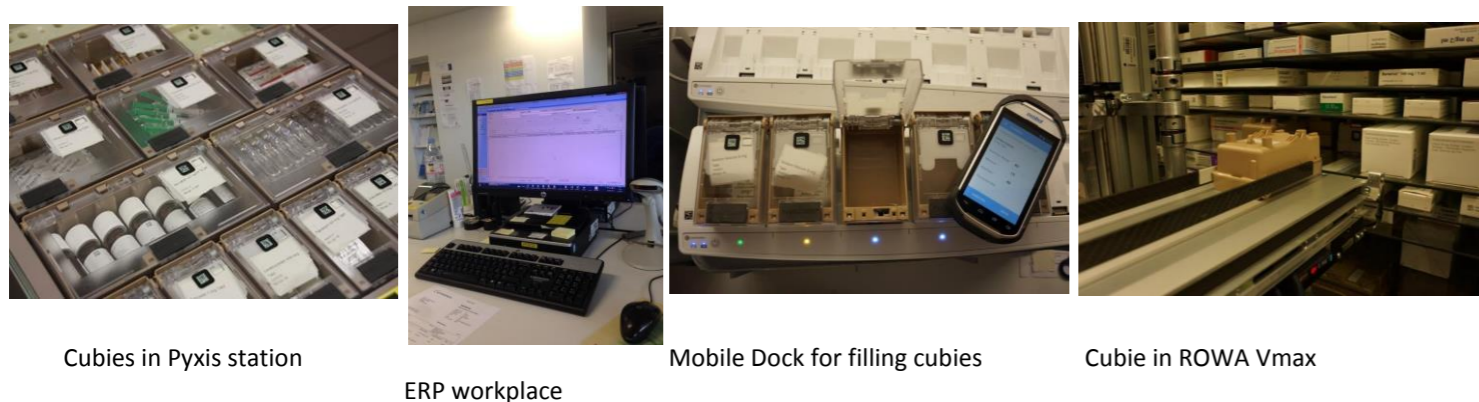
In terms of picking for Pyxis, the time required for the entire workflow – from processing re-orders, picking, through to settlement in the old and new system – was compared. The time was recorded for each ward and considered in relation to the number of requested items (number of lines) (measurements 2015 = N(90), measurements 2017 = N(87)). A comparison was then made of the average working time per line based on the old and new approach.

The automated picking from Rowa (894 items) was compared with the manual picking from the other storage (362 items) in order to prove the reduced number of misdeliveries. Measurements were taken over a period of three months. In this respect, the pharma technician carried out a survey of the total number of misdeliveries that were identified either in the dual control process or subsequently by the nursing ward. An analysis was also made of whether the misdelivery was caused by the nursing ward (incorrect request) or by the pharmacy (incorrect recording or incorrect picking). Averted misdeliveries were identified by multiplying the failure rate measured from the storage with 362 items by the number of items in the Rowa Vmax.

Results:

The first measurements produced the following findings: The processing time for Pyxis refills per line was successfully reduced from 54 seconds to 12 seconds. The introduction of the new interfaces and the option to store cubies in Rowa yielded an average time saving of approx. 78%. In terms of filling cubies, no time gain was established in the new system. Some 46.3 seconds were required on average in the old system, while 45.2 seconds per cubie were required in the new system. While the new Mobile Dock allows the pharma technician to work independently, the additional work steps required prevent any time gains. The result recorded in terms of quality was that pharmacists had to intervene increasingly in case of more complex problems with the system. The shorter setup times allowed some savings for the pharma technicians. On the other hand, additional time was needed by the pharmacists for system support.

When recording the misdeliveries, it could be assumed that no incorrect deliveries arose as a result of inaccurate picking in the case of the Rowa in the closed loop. The number of misdeliveries from the storage with manual picking amounted to 18 over the three recording months (all caused by the pharmacy). 15 were identified during the dual control and 3 on the ward. If the errors are calculated as a proportion of the number of items in the secondary storage compared to the number in Rowa, around 44 misdeliveries were successfully avoided in the measurement period of three months. This contributed directly to medication safety.



Cubies in Pyxis station

ERP workplace

Mobile Dock for filling cubies

Cubie in ROWA Vmax

Fig. 3 Illustration in relation to requirements section

Discussion:

The verdict after just a short period of use, during which time some teething problems had to be overcome, was that the closed logistics cycle essentially proved its merits. The expected time savings in processing the setup lines were successfully confirmed. The filling of cubies by the pharma technician independently of the pharmacist allowed enhanced flexibility. Even on busier days (Friday), the setup activities were managed within a reasonable time. If the connected software systems caused technical problems, this generally consumed more personnel resources including a pharmacist. Manual stock control mechanisms were wasted as a result of the automation. This has led at present to additional overhead in relation to delivery processes and needs to be optimized. Our impression is that we have benefited primarily in terms of flexibility from using the new solution but have not made time gains. This will have to be confirmed by further measurements however.

In the three month period under review, we were able to prevent around 44 misdeliveries through automatic picking with Rowa Vmax. This figure should probably be higher though since the recording of misdeliveries was not the top priority in day-to-day work (underreporting). Likewise, errors in manual picking are likely to fluctuate sharply and be influenced by stress or inefficient allocation of staff. In contrast, the machine is not affected by this when functioning properly. The reduction in misdeliveries on the wards contributed directly to medication safety.

Literature:

¹ Kunkel M, Krämer I; Krankenhauspharmazie; Automatisierung und Optimierung der pharmazeutischen Logistik mit dem Rowa Vmax Logistiksystem in der Apotheke der Universitätsmedizin Mainz; 2016;1:1-8

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