

# Drug Shortage Management on Swiss Hospital Wards – Current Practices and Optimization Strategies

Evaluation of the Survey from April 2024

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*Lieferengpassmanagement auf Schweizer Spitalstationen –  
Aktuelle Praktiken und Optimierungsstrategien*

*Auswertung der Umfrage vom April 2024*

*Gestion des pénuries dans les services hospitaliers suisses –  
Pratiques actuelles et stratégies d'optimisation*

*Evaluation de l'enquête d'avril 2024*

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## 1. Background

### Survey Implementation

This survey was conducted as part of a master's thesis at the University of Bern, in collaboration with the pharmaceutical ward management work party established by the Swiss Association of Public Health Administration and Hospital Pharmacists GSASA.

### Parties Involved

Name	Institution	Function
<b>Maria Danielova Zlateva</b>	University of Bern	Master's student in Pharmacy
<b>Carla Meyer-Masseti</b>	Inselspital – University Hospital Bern	Hospital Pharmacist, Assistant Professor for Clinical Pharmacy Co-Lead Working Party
Petra Strub Henz	St. Claraspital Basel	Head of Hospital Pharmacy Co-Lead Working Party
Nadine Amsler	Zuger Kantonsspital	Clinical Pharmacist
Sophie Bartel	Luzerner Kantonsspital LUKS	Pharmacist, Clinical Support
Rachel Bregy	Kantonsspital Graubünden	Pharmacist, Clinical Support
Rebecca Das Gupta	Psychiatrisches Universitätsspital Zürich	Deputy Head of Hospital Pharmacy
Beatrice Pasquali	Kantonsspital Aarau	Pharmacist, Head of Cytostatic Preparation
Vera Neumeier	Züripharm Zürich	Hospital Pharmacist
Giulia Poretti Cavadini	Ente Ospedaliero Ticinese EOC	Hospital Pharmacist
Martin Stalder	Universitätsspital Basel	Pharmacist, Responsible for the Formulary Committee
Alexandra Willimann	Psychiatrische Dienste Aargau	Head of Hospital Pharmacy

## Time Frame

Distribution of the Survey	Thursday, 18 <sup>th</sup> of April 2024
Reminder per E-Mail	Wednesday, 1 <sup>st</sup> of Mai 2024
Final Deadline	Tuesday, 7 <sup>th</sup> of Mai 2024

## Survey Participants

The survey was distributed to all chief hospital pharmacists who were registered members of GSASA at the time (N=68).

The response rate totaled 48.5% (N=33).

There were no mandatory questions, and the completion of all survey questions was voluntary. Please note that for certain questions, multiple answers were possible. Additionally, a limited amount of questions was only visible to certain participants whose previously submitted answers met a pre-defined condition.

## Data Analysis and Evaluation

Data from the closed questions was analyzed through descriptive statistics, where categorical variables were presented as percentages. For both single-choice and multiple-choice questions, results were broken down by respondents, with 100% representing the total number of respondents per question. Descriptive statistics were also employed for the data analysis of open-ended questions which explicitly requested numerical values as free-text responses. These continuous variables were reported as means and standard error of the mean. The remainder of the free-text responses were manually reviewed, and the emerging themes were used to code the data.

## Abbreviations

PWM	Pharmaceutical ward management
EPS	Electronic prescription system
FDL	Formulary drug list
ADC	Automatic dispensing cabinets

## 2. Summary

Drug supply shortages pose a significant challenge for Swiss hospitals, particularly within the hospital pharmacies. In recent years, the number of drug shortages has increased significantly, which has greatly complicated the work of hospital pharmacists. In addition to the resource-intensive procurement of replacement products and the resulting necessary adjustments to logistics, care providers active on the wards - in particular physicians and nursing staff - must be adequately informed in advance about the situation and sufficiently prepared for the impending changes. These processes are complex, and they vary from one hospital to another. Drug shortage management in hospitals is insufficiently researched, especially at the level of inpatient wards.

In order to address this issue and provide new insights, the GSASA pharmaceutical ward management (PWM) working party conducted a survey with the aim of recording national data on practices currently in place in Swiss hospital institutions related to the management of medicine shortages on the wards. The project was completed in the scope of the master's thesis of Maria Danielova Zlateva at the University of Bern.

The survey centered on pharmaceutical ward management, and other ward related activities affected by drug shortages, such as communication between pharmacy and ward, management of medication returns, ward inventory management and re-prescription practices. The focus was primarily on General Internal Medicine- or Geriatrics wards, due to their expansive inventory and high usage of medications.

The survey was completed by 33 of the 68 participants invited to participate (response rate of 48.5%). Most commonly represented in the survey were regional (N=11/30; 36.7%) and cantonal hospitals (N=8/30; 26.7%). The majority of the institutions were up to 499 beds in size (N=19/28; 67.9%).

Ward personnel was informed about drug shortages primarily via E-mail, the institutions' intranet- and/or website and the electronic prescription system. Information pertaining to drug shortages was predominantly distributed in the form of info-sheets/pharmacy notices and tables (e.g., Excel). Return management practices for medications no longer required on the wards remained unchanged in the majority of participating institutions (N=23/31; 74.2%), where no adjustments and relaxations of criteria for the reuptake of said medication returns were considered to secure drug supply during times of drug shortages. Regarding ward inventory management, the hospital pharmacy made an effort to adapt certain processes so as to facilitate the medication management on the wards during drug shortages. In particular,

the electronic pathways for medication ordering on the wards were re-programmed, so as to support ward staff in the ordering of substitute products in place of the missing standard drug product. Within the ward pharmacy, some institutions (N=11/31; 35.5%) considered visually distinguishing substitute medicines replacing standard drug products from the rest of the ward stock in order to help ward staff identify them better, either by providing the drug product with a note (N=8/11; 72.7%) or placing a specific label on them (N=4/11; 36.4%). In specific situations, where a prescribed drug was missing on the ward, but the corresponding substitute drug product was available, the majority of the participants (N=17/29; 58.6%) allow for the substitute drug to be prepared and administered to the patient, even before a formal re-prescription by a physician can take place. In this instance for most of the cases, the substitute drug product needed to be identical to the missing prescribed medication (e.g., generic) (N=14/17; 82.4%).

Among the biggest challenges regarding drug shortage management on the wards participants faced were communication issues, uncertainty about the availability of the standard- and substitute drug products on the wards and difficulty in the re-prescription process. Participants expressed, that in order to improve the communication process, better electronic support should be installed in place, so that more direct and active communication can be encouraged. Additionally, it was suggested to introduce summary tables or display-tools to facilitate a better overview of all drug shortages and substitute drug products, as well as procure more recourses and staff.

Swiss hospitals employ a variety of strategies to manage medicine shortages and improve daily practice on the wards. The implemented strategies showed a notable consistency among the institutions, however, there were no clear indications for best practice approaches. The collection of additional data from the perspective of ward personnel might be needed in further research to determine the efficacy of the practices currently in place.

## 3. Results of the survey

### 3.1. Demographic data

#### 3.1.1. Hospital type

The types of the participating institutions are summarized in Table 1. The most represented in the survey were regional hospitals, totaling 11 institutions, followed closely by cantonal hospitals with eight institutions. University and private hospitals were the third most represented (four institutions respectively), and only three institutions belonged to a specialized facility (two psychiatric clinics and one geriatric long term care institution).

**Table 1:** Types of participating institutions

Type of institution	Respondents (n)	Respondents (%)
University Hospital	4	13.3
Cantonal Hospital	8	26.7
Regional Hospital	11	36.7
Private Hospital	4	13.3
Rehabilitation Clinic	0	0
Psychiatric Clinic	1	3.3
Other	2	6.7
-Psychiatric University Clinic	1	3.3
-Geriatric Long Term Care	1	3.3
<b>Total</b>	<b>30</b>	<b>100</b>

#### 3.1.2. Number of beds

Table 2 summarizes the size of the participating institutions expressed in the total number of beds (internal and external) supplied by the corresponding institution. The majority of the participants reported of supplying between 0 and 499 beds (N=19/28, 67.9%). In this category, seven institutions (25%) supplied between 251 and 499 beds, followed by six (21.4%) supplying 151-250 and another six (21.4%) supplying ≤150 beds, respectively. Only four participants (14.3%) reported of supplying above 1000 beds.

**Table 2:** Institutions' size expressed as the total number of beds supplied (externally and internally)

No of beds (internal and external)	Respondents (n)	Respondents (%)
≤ 150	6	21.4
151 - 250	6	21.4
251 - 499	7	25
500 - 999	5	17.9
> 1000	4	14.3
<b>Total</b>	<b>28</b>	<b>100</b>

### 3.1.3. Type of implemented PWM services

Table 3 illustrates the type of services as part of PWM that the hospital pharmacy implements on the wards of the participating institutions. Of the 12 pharmaceutical services available for selection, the least implemented were the check of prepared medications (N=3/28; 10.7%), the patient specific medication preparation (N=7/28; 25.0%), and cleaning tasks of the ward pharmacy (N=7/28; 25.0%).

**Table 3:** Type of implemented services within PWM

Type of implemented PWM service	Respondents (n)	Respondents (%) <sup>a</sup>
Checking the expiration date of medication	24	85.7
Processing of medication returns	24	85.7
Managing general medication returns	22	78.6
Processing medication stock orders	22	78.6
Storage of medication stock deliveries	22	78.6
Checking the storage temperature	21	75.0
Narcotics control	18	64.3
Managing patient specific medication returns	16	57.1
Training of ward staff	16	57.1
Cleaning tasks of the ward pharmacy	7	25.0
Patient specific medication preparation	7	25.0
Check of prepared medication	3	10.7
<b>Total number of respondents</b>	<b>28</b>	<b>100</b>

<sup>a</sup> Multiple answers were possible. The percentages are in relation to the total number of respondents (n=28) who answered the question (i.e., 28=100%)



### 3.1.4. Hospital pharmacy staffing

The participants were asked to report the number of employed pharmacists and the number of employed pharmacy technicians and/or chemists at their respective institutions in full time equivalents (FTEs), where one FTE is equivalent to the working hours of a full-time employee (e.g., 40 hours per week). A distinction was made between the **total number** of hospital pharmacy staff members and the **number of staff members specifically employed for pharmaceutical ward management (PWM)**.

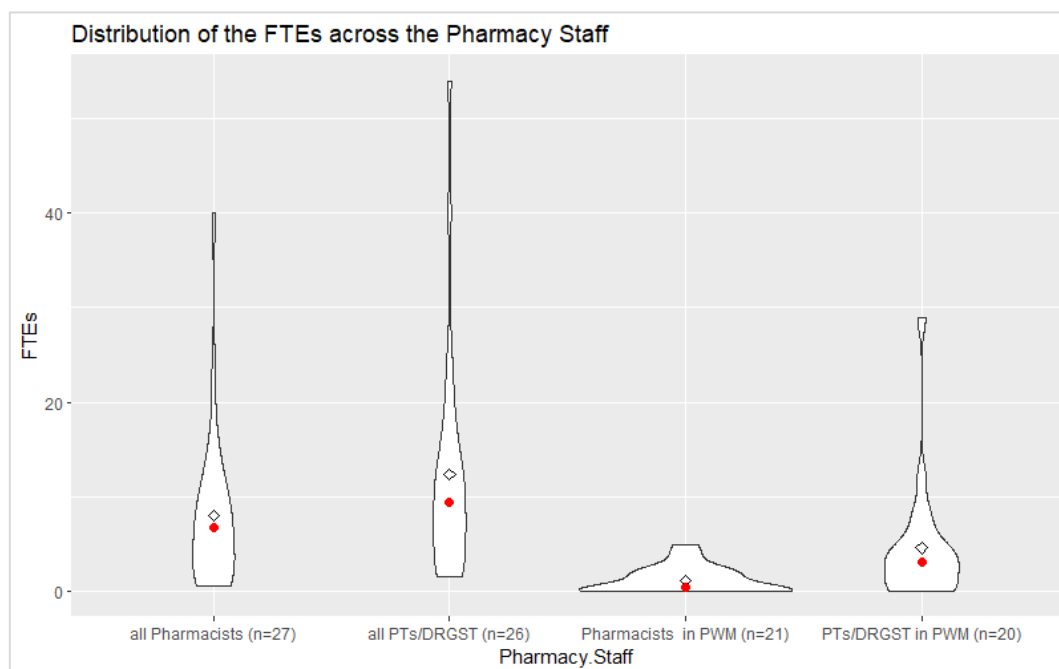
The total number of employed pharmacists averaged 8.0 FTEs per institution, while in contrast, the number of pharmacists employed for PWM was only 1.2 FTEs on average. A similar trend could be observed for the number of employed pharmacy technicians and/or chemists, with staff members' total averaging 12.3 FTEs, and a lower average of 4.6 FTEs for staff employed specifically for activities within PWM (see Table 4). Figure 1 provides a visual presentation of the distribution of the reported pharmacy staff full time equivalents (FTEs) of the participating institutions.

The relationship between the number of pharmacy staff FTEs and the institutions' sizes were analyzed (see Table 5). The number of all employed pharmacists FTEs and pharmacy technicians' and/or chemists' FTEs correlated with the number of beds supplied by the institutions – the more beds an institution supplied, the higher the number of pharmacy staff FTEs. However, no similar correlation could be observed between institution size and pharmacy staff FTEs employed for PWM (see Table 5).

**Table 4:** Number of employees per institution, expressed in full time equivalents (FTEs)

	All Pharmacists (n=27)	Pharmacists for PWM (n=21)	All PTs/CHMSTs <sup>a</sup> (n=26)	PTs/CHMSTs <sup>a</sup> for PWM (n=20)
Mean FTEs	8.0	1.2	12.3	4.6
Median FTEs	6.7	0.4	9.5	3.1

<sup>a</sup> PTs = Pharmacy Technicians; CHMST = chemists



**Fig. 1:** Violin plots depicting the distribution of the reported full time equivalents (FTEs) across the different pharmacy staff groups (PTs=pharmacy technicians; DRGST=chemists). The white dots represent the mean, and the red dots represent the median of the FTEs of the respective staff groups. The width of the individual plots represents the density of each reported number of FTEs – the wider the plot, the higher the number of institutions who reported a certain FTE. (Note: the plots for staff employed for PWM are both wider at 0 FTEs, since the question asked institutions if they employed staff specifically for PWM services and most institutions answered with “0 FTEs”).

**Table 5:** The average staff numbers of the responding institutions given in full time equivalents (FTEs), in relation to the number of served beds.

No of served beds	n <sup>a</sup>	Mean + S.E. <sup>b</sup> FTEs		n <sup>d</sup>	Mean + S.E. <sup>b</sup> FTEs	
		all Pharmacists	all PTs/CHMST <sup>c</sup>		Pharmacists in PWM	PTs/CHMST <sup>c</sup> in PWM
0-150	5	1.00±0.11	3.36±0.67	2	0.00±0.00	0.10±0.10
151-250	5	3.78±1.38	5.74±2.44	4	0.7±0.42	3.58±1.53
251-499	7	7.63±1.07	10.45±1.11	6	1.90±0.62	5.48±1.34
500-999	4	10.56±2.93	17.60±4.11	3	0.33±0.33	2.67±2.67
>1000	4	21.03±7.17	30.18±10.27	4	1.00±0.58	8.38±6.93

<sup>a+d</sup> number of respondents who provided information on both the number of served beds and the FTEs of the pharmacy staff

<sup>b</sup> S.E. = standard error of the mean

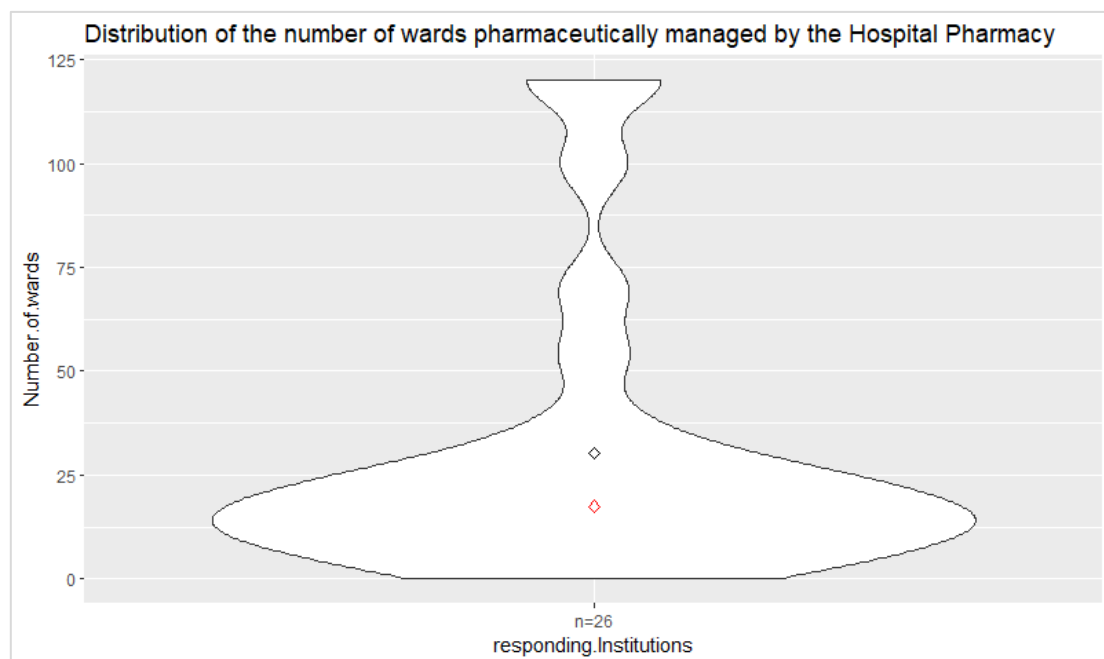
<sup>c</sup> PTs = Pharmacy Technicians; CHMST = chemists

### 3.1.5 Type of wards

The survey was geared toward practice on General Internal Medicine- or Geriatrics wards. Participants that did not meet these criteria were instructed to describe the ward that they used as a reference for completing the survey. All but four institutions filled out the survey in relation to a ward of the General Internal Medicine- or Geriatrics department. The remaining four participants used a Geriatric Psychiatry-, Paraplegic-, Psychiatry-, and Surgical ward as an example for filling out the survey. There were however no distinct differences between their results and the results of the remaining respondents.

### 3.1.6 Number of wards pharmaceutically managed by the hospital pharmacy

The participants were asked to disclose the total number of wards that were subject to pharmaceutical management by their respective institutions. On average, institutions provided pharmaceutical services to 30 wards (mean = 30.2). Figure 2 presents the distribution of the reported number of pharmaceutically managed wards by the participants.



**Figure 2:** A violin plot depicting the distribution of the reported number of wards pharmaceutically managed by the institution's pharmacies. The white dots represent the mean (=30.2), and the red dots represent the median (=17.5) of the managed wards. The width of the plot represents the density of each reported number of managed wards – the wider the plot, the higher the number of institutions who reported a certain number of wards.

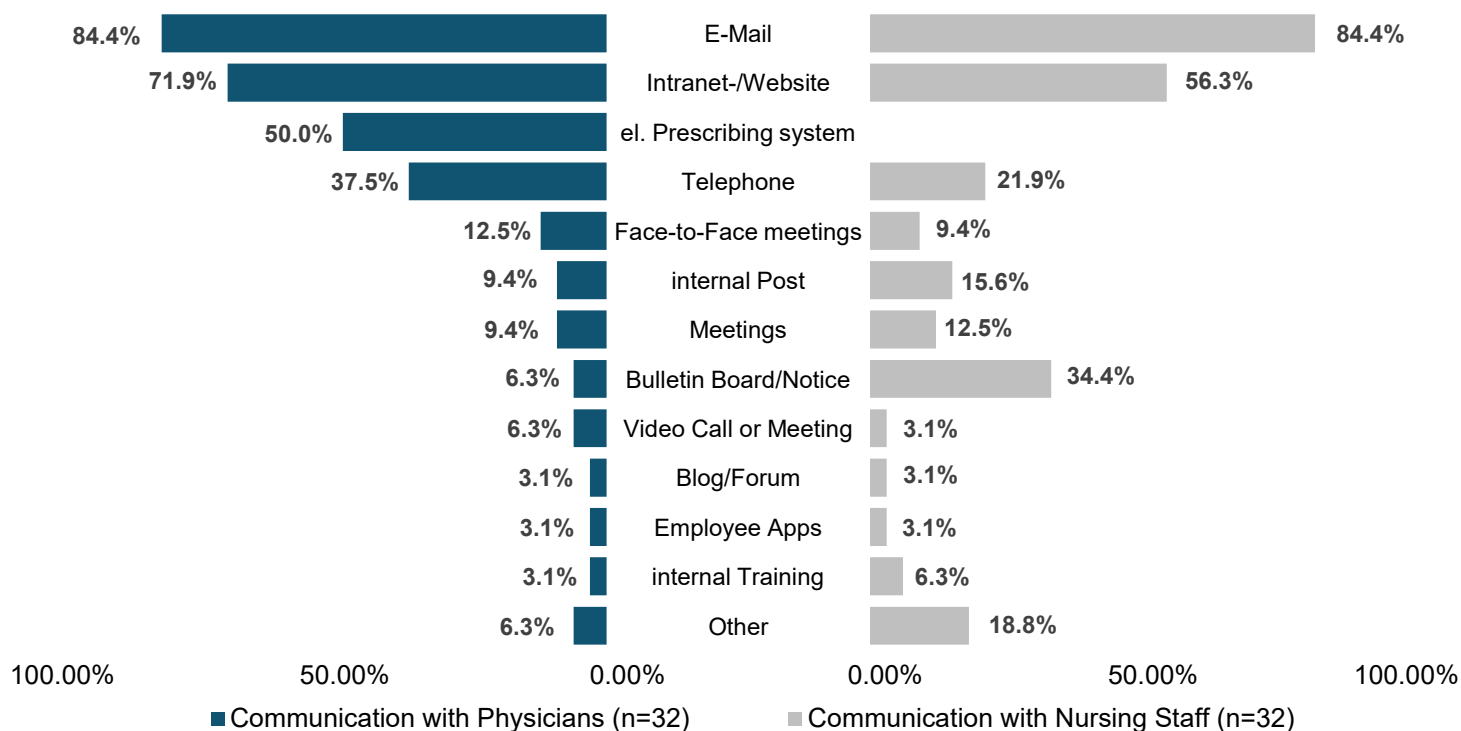
## 3.2. Communication of drug shortages

### 3.2.1 Communication channels

Participants were asked to select all communication channels utilized to inform ward personnel about drug shortages. The survey distinguished between channels for communicating with physicians and channels for communicating with nursing staff.

Of the multiple communication channels employed by the participating institutions, the two most widely used for communication of drug shortages for both physicians and nursing staff were E-Mail and the institution's intranet- and/or website (see Figure 3). For physicians, the electronic prescription system (EPS) took third place, with 50% of institutions (N=16/32) using it as a communication channel. The bulletin board and/or notice found a much higher usage within the communication with nursing staff (N=11/32; 34.4%) compared to with physicians (N=2/32; 6.3%).

*Which communication channels does the hospital pharmacy use to communicate with physicians and nursing staff about drug shortages?*



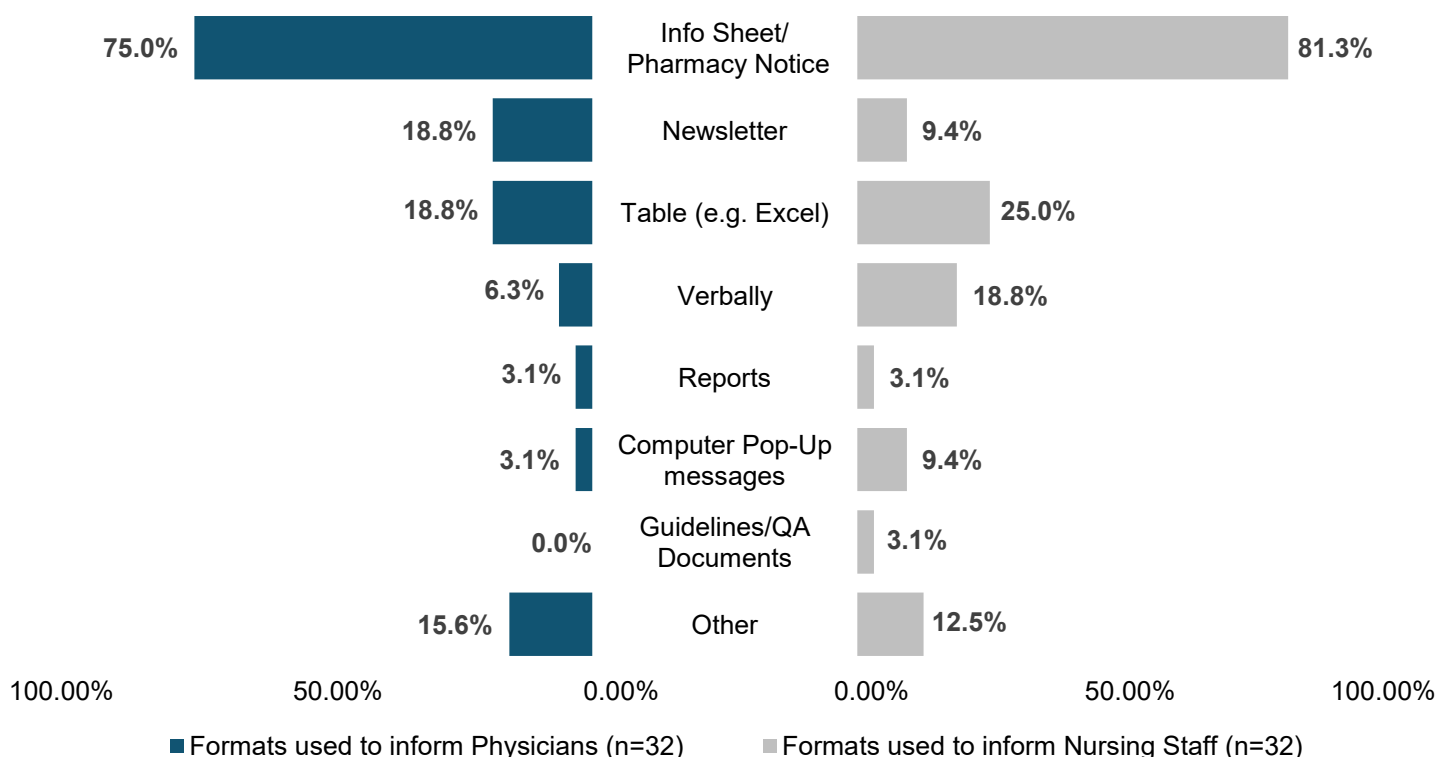
**Figure 3:** Communication channels used by the participating institutions (n) for the communication with physicians and nursing staff. Multiple answers were possible. Note: the option “electronic prescription system” was only available for the question regarding the communication with physicians.

### 3.2.2 Information formats

The survey asked participants to name the type of formats in which information regarding drug shortages was displayed in the communication with physicians and nursing staff.

Information pertaining to drug shortages was predominantly distributed in the form of info-sheets/pharmacy notices to both physicians (N=24/32; 75%) and nursing staff (N=26/32; 81.3%). Tables came in second, with 18.8% of institutions (N=6/32) using it as a format to inform physicians, and 25% of institutions (N=8/32) using it as a format to inform nursing staff. One institution reported in a comment, that they list the medication affected by drug shortages on their extranet page, where upon clicking on the name, the corresponding info sheet could be viewed. Figure 4 summarizes all types of formats the participating institutions utilized.

*What formats are used to inform physicians and nursing staff about drug shortages?*



**Figure 4:** Type of formats used by the participating institutions (n) to inform physicians and nursing staff about drug shortages. Multiple answers were possible.

### 3.2.3 Communication with physicians

In a series of questions, participants were inquired about the exact nature of communicating with physicians about drug shortages, specifically in regard to the manner of information dissemination and the applied criteria for said communication.

When asked about whether physicians were being informed about drug shortages, 20 institutions (62.5%) answered with "Yes", 11 (34.4%) only did so partially and one institution (3.1%) did not inform physicians about drug shortages.

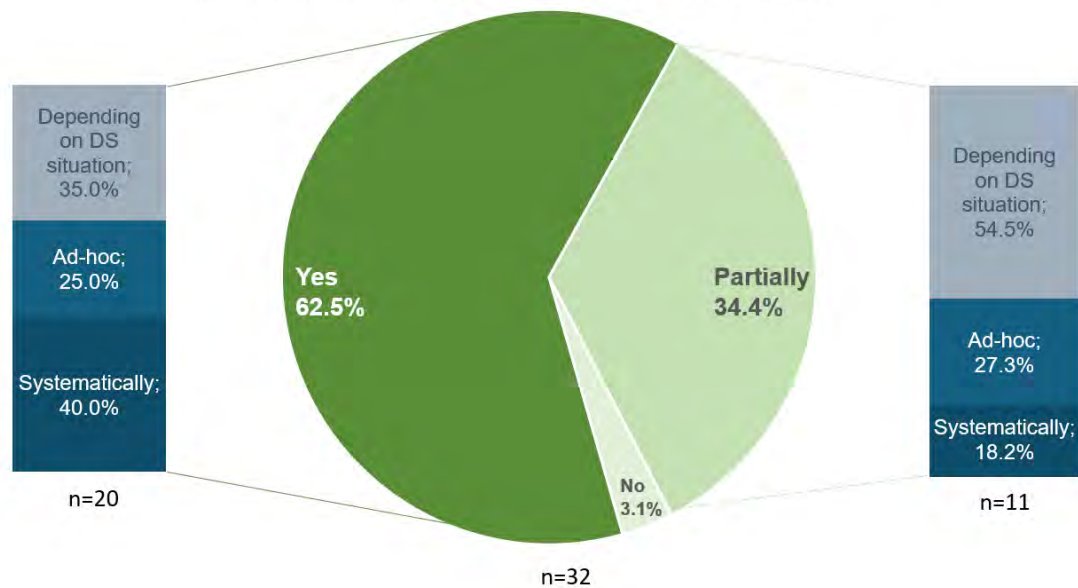
Further, the survey inquired about the manner and frequency of communicating drug shortages' information to physicians, differentiating between systematically (e.g., drug shortages are communicated to physicians in a planned and structured way, for example at fixed intervals, according to clear criteria, etc.), on an ad-hoc basis (e.g., drug shortages are communicated spontaneously or as required e.g., only when ordered, only when prescribed, only when requested, etc.) or both systematically and ad-hoc, depending on the drug shortage situation. In this context, the majority (N=14/32; 43.8%) reported of informing either systematically or ad-hoc, depending on the drug shortage situation (see Table 6). However, when viewing the manner of information dissemination depending on whether or not physicians are informed about drug shortages, the results changed: in the case of institutions who answered with "Yes" to informing physicians about drug shortages, 40% (N=8/20) did so in a systematic manner. In comparison, only two of the institutions who only partially informed physicians about drug shortages (18.2%), did so systematically (see Figure 5).

**Table 6:** Manner of information dissemination about drug shortages to physicians

Answer option	Nº (%) <sup>a</sup> of respondents
<b>Systematically</b> – drug shortages are communicated to physicians in a planned and structured way, e.g., at fixed intervals, according to clear criteria, etc.)	<b>10 (31.3)</b>
<b>Ad-hoc</b> – drug shortages are communicated spontaneously or as required e.g., only when ordered, only when prescribed, only when requested	<b>8 (25.0)</b>
<b>Either systematically or ad hoc</b> , depending on the drug shortage situation	<b>14 (43.8)</b>
<b>Other</b>	<b>0 (0)</b>

<sup>a</sup> Due to rounding, the percentage values exceed a 100%

In which manner are drug shortages communicated to physicians?



**Figure 5:** Manner of information dissemination about drug shortages to physicians, based on whether physicians are informed ("Yes") or only partially informed ("Partially") about drug shortages (DS).

Table 7 summarizes the criteria that must be met with regard to the medicine affected by a shortage and its substitute in order for the pharmacy to inform physicians about the drug shortage. The majority (N=23/32; 71.9%) responded that physicians are informed when the active ingredient of the substitute available is not identical to the drug that is being replaced (see Table 7). The second and third most selected criteria were that the substitute differs in concentration and/or galenic form (N=20/32; 62.5%), followed by drugs in shortage, which have special and/or life-threatening indications (N=18/32; 56.3%). Only 43.8% of institutions (N=14/32) reported of communicating all types of drug shortages.

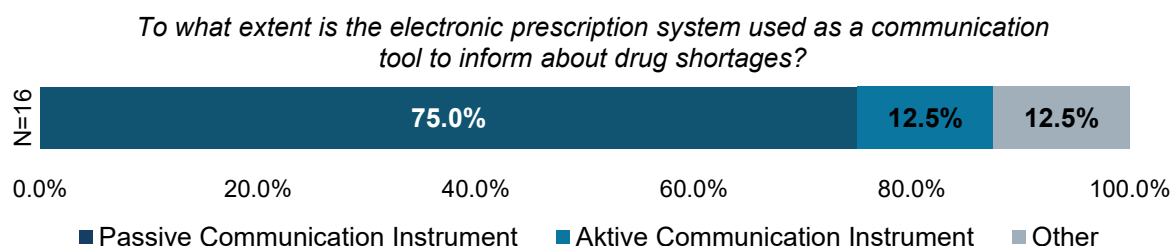
As previously reported, 16 out of 32 institutions (50%) utilize the EPS as a channel for communicating drug shortage information to physicians. 12 of these institutions (75%) reported using the EPS passively, meaning only to facilitate the prescribing process by providing information aids in the electronic system on which medication is missing, and which substitute should be prescribed in its place (see Fig. 6). Only two institutions (12.5%) utilized the EPS as an active communication instrument, meaning that they regularly utilized to make physicians aware about current drug shortages and communicate relevant information.



**Table 7:** Required criteria, in order to inform physicians about a drug shortage

Required criteria, in order to inform physicians about DS <sup>b</sup>	Nº (%) of respondents <sup>a</sup>
The substitute's active ingredient is not identical to the drug in shortage	23 (71.9)
The substitute's active ingredient is identical to the drug in shortage, but it differs in concentration and/or galenic form	20 (62.5)
DS of drugs with special (e.g., rare) and/or life-threatening indications	18 (56.3)
DS for which the substitute must be ordered from abroad (delivery delay)	17 (53.1)
DS with long or indefinite duration	17 (53.1)
All types of DSs are communicated to physicians	14 (43.8)
DS where the substitute is outside the institution's formulary drug list	9 (28.1)
The substitute is identical to the drug in shortage in every aspect, but has a different name and/or pack size	9 (28.1)
Other	1 (3.1)

<sup>a</sup> Multiple answers were possible. The percentages are in relation to the total number of respondents who answered the question (N=32; 100%)



**Figure 6:** The way the electronic prescription system (EPS) is used as a communication tool to inform physicians about drug shortages.

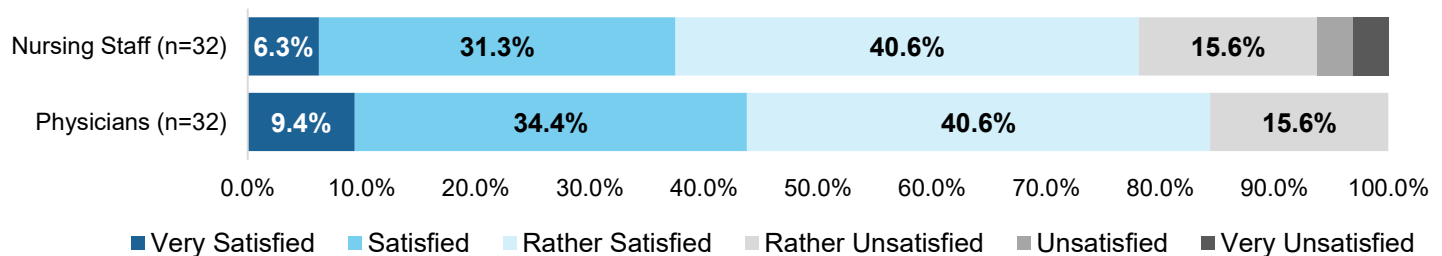
To understand this process, the participants were asked to describe how exactly medicines affected by supply shortages were communicated within the EPS. Fifteen free-text responses were analyzed, and three main themes emerged. Eight participants indicated that they adapt the EPS by introducing visual aids, either by adding color labels (N=4/8) and/or adding info-texts and comments to the medication affected by shortage and its corresponding substitute (N=5/8). Seven institutions adapted the formulary drug list, by either removing the drug product affected by a shortage, so it could not be as easily prescribed as before (N=4/7) and/or adding the substitute drug to the formulary list if it wasn't there previously (N=3/7). Finally, three institutions reported of using pop-up-windows for when a drug affected by a shortage is prescribed by a physician, with an active suggestion of prescribing a chosen substitute medication.



### 3.2.4 Satisfaction with current communication processes

Figure 7 depicts the satisfaction rate of the participating institutions with their current processes for communication of drug shortages with physicians and nursing staff. The hospital pharmacies of the responding institutions were overall content with the current communication processes with both physicians and nursing staff. Only 15.6% (N=5/32) responded with “rather unsatisfied” for the communication with both care provider groups, and 3.1% (N=1/32) with “unsatisfied”, and 3.1% (N=1/32) with “very unsatisfied” for the communication with nursing staff.

*How satisfied is the hospital pharmacy with the current solution for communicating medication supply shortages to physicians and nursing staff?*



**Figure 7:** Satisfaction of the institutions (n) with the current communication processes for both physicians and nursing staff.

### 3.2.4 Proposed suggestions for improvement

In an open question, the participating institutions were asked what they would change in the processes of communicating drug shortages with physicians and nursing staff. From total of 41 free-text responses (22 for the communication with physicians and 19 for the communication with nursing staff), three themes emerged (see Table 8):

- Implementation of better electronic support (21 responses in total)
- Introduction of summary tables or display-tools to facilitate a better overview of all drug shortages and available substitute drug products (9 responses in total)
- Procurement of more recourses and staff (6 responses in total)

Generally, implementation of better electronic support included suggestions such as automation within the clinical information system (e.g., KIS) and introduction of active alerts and pop-up windows during the prescription process. Introduction of summary tables or display-tools was suggested as an alternative to sending individual E-mails.

Among the responses that could not be categorized into any of the three main topics, it was argued that electronic support would be good, but the extent to which it would be helpful is difficult to assess, since it is needed to consider which physicians actually need the information in order to minimize the problem of alert fatigue. Additionally, two institutions addressed the uncertainty of whether the drug shortage information provided on the intranet was consulted by the care providers or not, with one institution commenting that they keep getting requests from the nursing staff, which would be unnecessary if they looked it up themselves.

**Table 8:** The three main categories of the proposed suggestions for improvement of the processes for communication of drug shortages to physicians and nursing staff and the number of answers for each category.

	Communication with Physicians	Communication with Nursing Staff	
Theme	No of answers <sup>a</sup>	No of answers	Examples from the survey <sup>b</sup>
<b><u>Electronic Support</u></b>	13	8	<p>"Automation via KIS - in the future, substitutes should already be visible there."</p> <p>"Implementation of a pop-up window when the medicine affected by the drug shortage is prescribed [...]"</p> <p>"Have Pyxis cabinets that can more specifically inform of market changes"</p>
<b><u>Overview Lists/Tables</u></b>	5	4	<p>"If necessary, (additionally) create an overview list for the recipients and not just send individual messages."</p> <p>"Generally create a tool where all drug shortages are listed. You can check it yourself. The pharmacy updates the tool. In my opinion, regularly sending an information E-mail is not expedient."</p>
<b><u>More Recourses/Staff</u></b>	3	3	<p>"I need more pharmacists to establish proper communication"</p>
Other	3	4	<p>"Nursing Staff does not use the intranet enough. We keep getting requests that would be unnecessary if they looked it up themselves. "</p>

<sup>a</sup> multiple answers were possible in one single free-text response to the open question

<sup>b</sup> direct translations from individual answers to English

### 3.3 Management of medication returns

Table 9 summarizes the criteria needed to apply for medications in solid form within blister packs, which are no longer required on the wards, to be eligible for return to the hospital pharmacy.

**Table 9:** Criteria needed to be met for medication in solid form within blister packs in order for it to be returned to the hospital pharmacy

	Opened packages of medication from the FDL <sup>c</sup>	Full packages of medication from the FDL	Opened packages of medication outside the FDL	Full packages of the medication outside the FDL
Price of the medicine	5 <sup>a</sup> 16.1% <sup>b</sup>	6 19.4%	6 19.4%	5 16.1%
Intact batch number/lot number	26 83.9%	30 96.8%	27 87.1%	28 90.3%
Expiry date/expiry period	26 83.9%	30 96.8%	26 83.9%	27 87.1%
Storage conditions (e.g., storage in robotic dispensing machine, refrigerator, etc.)	23 74.2%	26 83.9%	23 74.2%	24 77.4%
Condition of the secondary packaging	16 51.6%	21 67.7%	18 58.1%	19 61.3%
Condition of the primary packaging	24 77.4%	28 90.3%	25 80.6%	26 83.9%
None	3 9.7%	1 3.2%	3 9.7%	2 6.5%

<sup>a</sup> number of responses (multiple responses per column were possible)

<sup>b</sup> percent respondents (=institutions), calculated by dividing the number of responses with the total number of respondents which answered the question (=31 institutions).

<sup>c</sup> FDL = formulary drug list

In general, almost all of the available criteria for selection were considered more or less equally by all institutions when determining if medications in solid form within blister packs were eligible for return to the pharmacy inventory. Out of the six categories, only price of the medicine was the least selected option, regardless of the state of the packaging or the inclusion of the medication within the FDL.

To determine if hospital pharmacies make exceptions within these guidelines to additionally secure drug inventory during supply shortages, participants were asked if they relaxed certain criteria for the acceptance of medication returns. In 74.2% of institutions (N=23/31), the criteria remained unchanged. Only 25.8% (N=8/31) considered adjustments. The criteria "expiration date" was the most selected one (N=5/8; 62.5%), meaning that the majority of institutions considered accepting returns to the pharmacy, even if the product is to expire soon, e.g., within the next month. Table 10 summarizes the remaining medication return criteria which institutions considered to relax in order to secure drug supply during drug shortages.

**Table 10:** Relaxed criteria due to the problem of drug shortages for the return of medication in solid form within blister packs to the hospital pharmacy

Relaxed Criteria for returning medication to the hospital pharmacy	Nº of responses	Respondents (%) <sup>a</sup>
for opened packages of medication from the FDL <sup>b</sup>	5	62.5%
for full packages of medication from the FDL	3	37.5%
for opened packages of medication outside the FDL	3	37.5%
for full packages of the medication outside the FDL	3	37.5%
for price of the medicine	1	12.5%
for expiry date/expiry period	5	62.5%
for storage conditions	3	37.5%
Condition of the secondary packaging	2	25.0%
Condition of the primary packaging	1	12.5%
Other	1	12.5%
<b>Total Responses</b>	<b>27</b>	<b>100%</b>

<sup>a</sup> multiple answers were possible; therefore, percent respondents (=institutions) were calculated by dividing the number of responses with the total number of respondents which answered the question (=8 institutions)

<sup>b</sup> FDL = formulary drug list

## 3.4 Ward stock management

### 3.4.1 Use of automated dispensing cabinets

The six institutions who reported using automated dispensing cabinets (ADCs) on the ward were asked to explain the extent to which the utilization of ADCs was helpful in overcoming the problem of drug shortages in terms of ward management. The following aspects were named<sup>a</sup>:

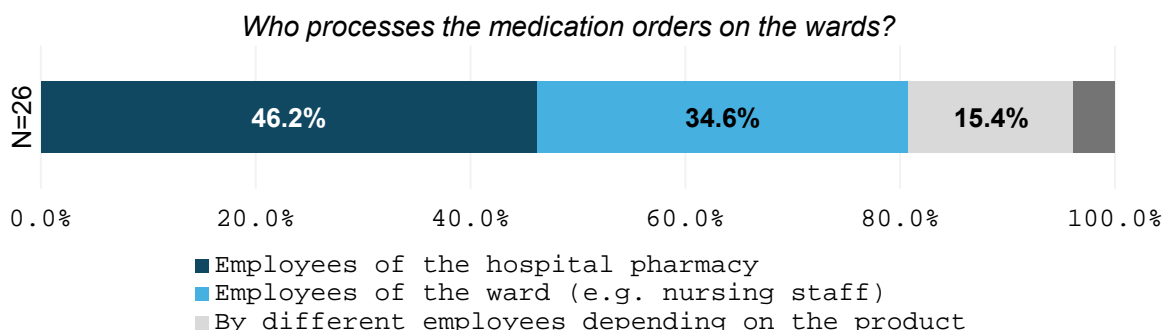
- Exact knowledge of the amount of stock on each ward (n = 2)<sup>b</sup>
- Replacing the out-of-stock item with a substitute directly in the same slot (n = 2)
- Possible to identify wards that use a product less frequently, so said item can be transferred to a ward with a higher need, to help them preserve their stocks (n = 1)
- Helps to manage the whole situation easily for the nursing staff (n = 1)
- Pharmacy can decide for itself which medicines are to be stored (specific information) (n = 1)

<sup>a</sup> topics extracted from the analysis of the free text responses

<sup>b</sup> number of answers (out of 7 answers)

### 3.4.2 Management of medication orders

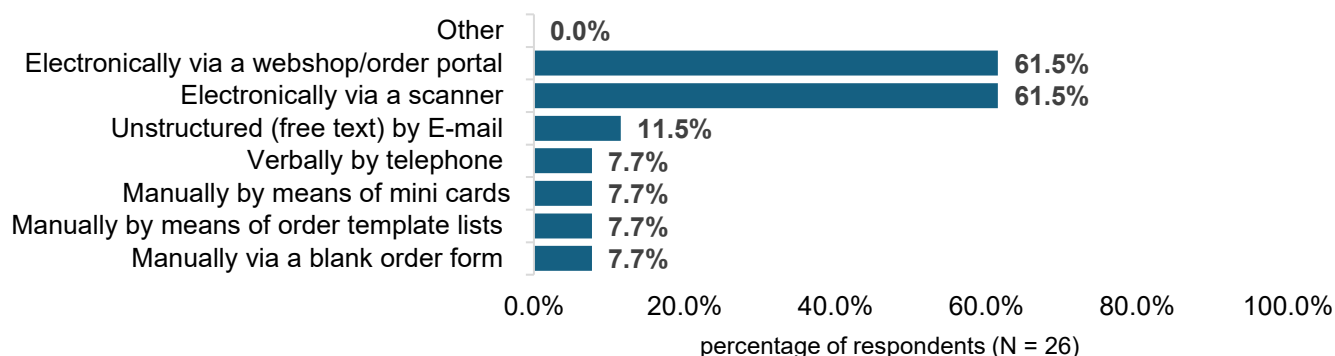
Figure 8 illustrates the employees responsible for the medication orders on the wards. For the majority of institutions, it is the hospital pharmacy staff that processes medication orders on the wards (e.g., pharmacy technicians).



**Figure 8:** *Employees responsible for the medication orders on the wards*

Figure 9 illustrates the means of ordering medication on the wards of the participating institutions. The medication ordering process on the wards was predominantly conducted via an electronic path, with institutions utilizing either a scanner (N=16/26; 61.5%) and/or a web shop/order portal (16/26; 61.5%).

*How are regular orders (as opposed to emergency orders) on the wards for medications from the formulary drug list transmitted to the hospital pharmacy?*



**Figure 9:** Means of ordering medication on the wards (Multiple answers were possible; the percentages are in relation to the total number of respondents who answered the question (N=26)).

The survey inquired about how this process was adapted to facilitate the ordering of substitute products in place of the missing standard drug product. The majority of institutions opted for reprogramming the inventory ordering system (see Table 11). In 47.6% (N=10/21) of cases, the ordering of the substitute drug product was introduced in place of the medication affected by a supply shortage. The remainder of the participants blocked the ordering of the missing drug item in the system, either **with** (N=3/21; 14.3%) or **without** (N=2/21; 9.5%) adding a reference or link to the corresponding substitute drug product. Only 23.8% of institutions (N=5/21) did not adjust the ordering process in any way.

**Table 11:** Adjustment of the electronic ordering process

Answer Option	Nº (%) of respondents
No adjustment - substitute products must be ordered in another way	0 (0)
No adjustment, but ordering in the same way	5 (23.8)
Ordering of the out-of-stock drug item is blocked in the inventory management system - NO reference to corresponding substitute drug product	2 (9.5)
Ordering of the out-of-stock drug item is blocked in the system - WITH reference/link to corresponding substitute drug product	3 (14.3)
The ordering of the out-of-stock drug item is reprogrammed so that the corresponding substitute drug product can be ordered instead (linkage/link)	10 (47.6)
Other	1 (4.8)

### 3.4.3 Storage of medication on the wards

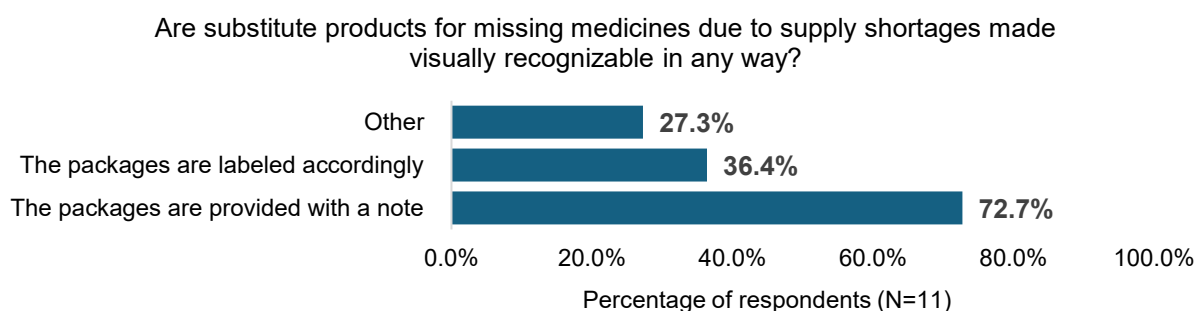
The survey asked participants to describe how substitutes for medications unavailable due to shortages were stored on the wards (see Table 12). The majority (N=16/24; 66.7%) stated that substitutes were stored in the same place as the medication they replaced (e.g., the same spot on a shelf or within a drawer), despite a different name. Seven out of 24 (29.2%) stored the substitute products according to the already established ward order (e.g., alphabetically). In the comments, two respondents specified that for supply shortages of a short duration, substitutes were kept in the same location as the missing drug product. However, in the event of a prolonged shortage, the substitute drug products were stored according to the standard practice for all medicines on the ward (e.g., alphabetically).

**Table 12:** Ways of storing substitutes to medication affected by a shortage on the wards

Answer Option	Nº (%) <sup>a</sup> of respondents
Separated from the rest of the medication	0 (0)
In exactly the same place as the missing medication affected by a shortage (despite a different name)	16 (66.7)
Like the rest of the ward stock (e.g., alphabetically)	7 (29.2)
Other	1 (4.2)

<sup>a</sup> Due to rounding, the percentage values exceed a 100%

Participants were further asked if the substitute drug products were made visually distinguishable from the rest of the stock in any way, so that ward staff can be able to identify them more easily during daily practice. Twenty out of 31 respondents (64.5%) answered with "No". Of the remaining 11 respondents, eight (72.7%) stated that the packages were provided with a note, while only four (36.4%) reported of placing a label on them (see Figure 10). The three respondents (N=3/11; 27.3%) who answered with "Other" specified that they leave an info-notice or a post it with the corresponding substitute product.



**Figure 10:** Ways of making substitute products for missing medicines visually recognizable (Multiple answers were possible; the percentages are in relation to the total number of respondents who answered the question (N=11)).



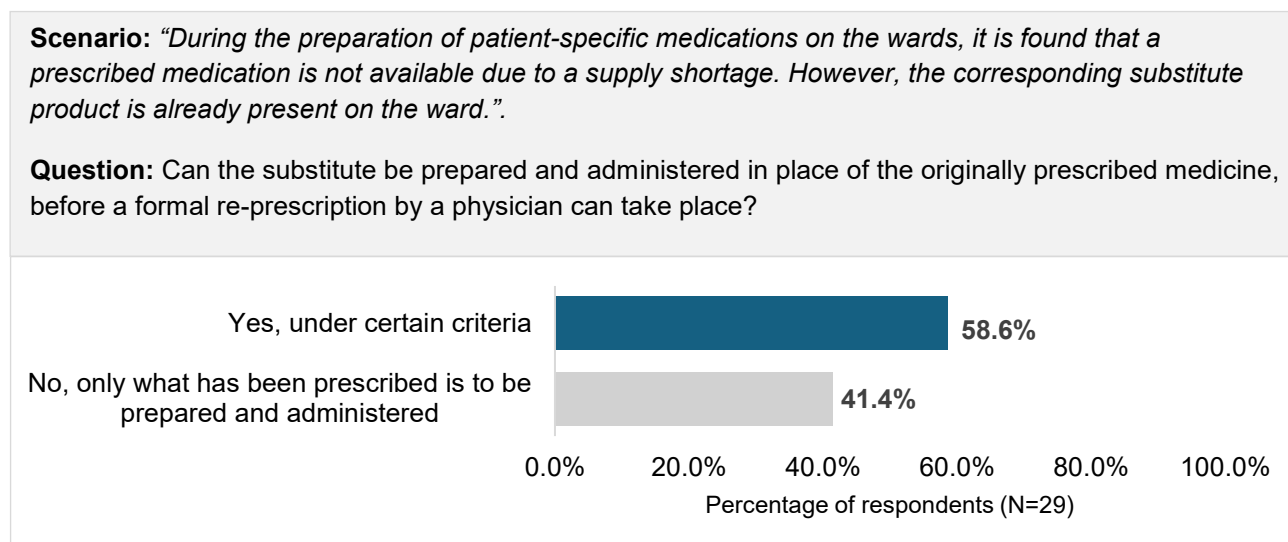
### 3.5 Re-prescription of prescribed medicines

The survey presented the participants with the following specific scenario to consider:

*“During the preparation of patient-specific medications on the wards, it is found that a prescribed medication is not available due to a supply shortage. However, the corresponding substitute product is already present on the ward.”*

Based on this scenario, the participants were asked if the substitute was allowed to be prepared and administered in place of the originally prescribed medicine, before a formal re-prescription can take place. Twelve out of 29 (41.4%) answered with “No” (see Figure 11).

The remaining 17 participants (58.6%) answering with “Yes” were further asked to specify under which conditions this was allowed. The majority of them (N=14/17; 82.4%) stated that the substitute product needed to be completely identical (e.g., generic drug) (see Table 13). Six institutions (35.3%) considered preparing and administering the substitute drug product before the formal re-prescription by a physician only in cases, where patients urgently required the medication and could not wait for the re-prescription. Only four (23.5%) allowed the preparation and administration of substitutes non-identical to the originally prescribed medication, given that specific predefined instructions are followed beforehand (e.g., authorization lists).



**Figure 11:** Preparation and administration of medicines before a formal re-prescription by a physician in a specific drug shortage scenario.

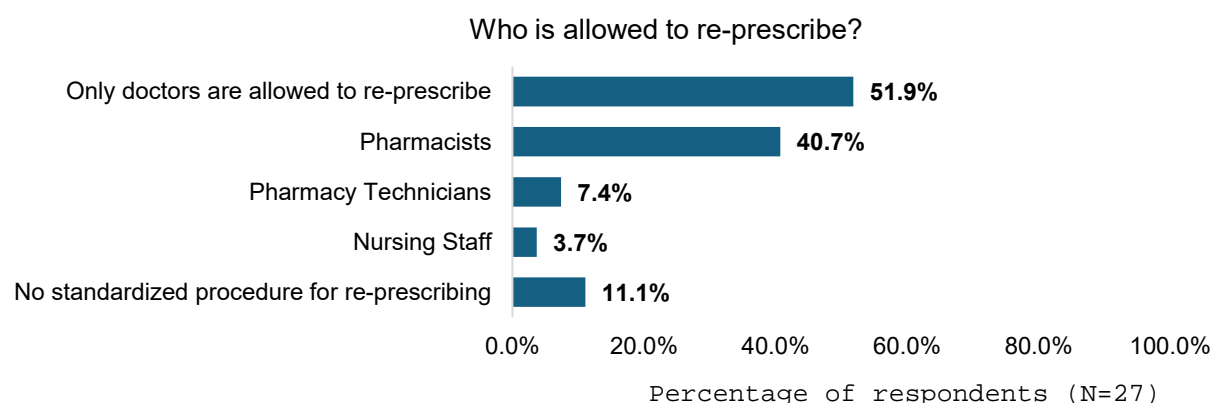


**Table 13:** Conditions under which substitutes could be prepared and administered before a proper re-prescription can take place

Answer Option	Nº (%) <sup>a</sup> of respondents
Substitute product is completely identical to the missing medication (e.g., generic)	14 (82.4)
Substitute product is not completely identical to the missing medication, but can be prepared on the ward using predefined provision instructions (e.g., authorized list)	4 (23.5)
For patients who urgently need the medication and cannot wait for a re-prescription	6 (35.3)
Other	3 (17.6)

<sup>a</sup> multiple answers were possible; the percentages are in relation to the total number of respondents who answered the question (N=17; 100%)

Related to the same scenario as before, participants were asked to state the type of employee allowed to conduct a re-prescription (see Figure 12). The majority (N=14/27; 51.9%) reported that only physicians were permitted to re-prescribe. In the remaining institutions, pharmacists were the most selected among the employees authorized to conduct re-prescriptions (N=11/27; 40.7%).



**Figure 12:** Employee allowed to conduct a re-prescription in the case that the prescribed medication is unavailable on the ward due to a supply shortage (Multiple answers were possible; the percentages are in relation to the total number of respondents who answered the question (N=27)).

The survey inquired further about the specific conditions under which pharmacists were authorized to re-prescribe medication. Generally, institutions allowed pharmacists to re-prescribe medication in cases, where the substitute didn't differ majorly from the originally prescribed medication missing due to a drug shortage.

Every respondent (12/12; 100%) indicated that pharmacists were allowed to re-prescribe drugs if the substitute was identical to the originally prescribed medication, e.g., a generic drug (see Table 14). Other institutions additionally allowed the re-prescription for cases, where the substitute product differed only in dose/concentration (N=7/12; 58.3%) and/or differed only in the galenic form (N=5/12; 41.7%).

**Table 14:** Conditions under which pharmacists are authorized to re-prescribe substitutes when the originally prescribed medication is missing due to a supply shortage.

Answer Option	Nº (%) <sup>a</sup> of respondents
Substitute product is completely identical to the missing medication (e.g., generic)	12 (100)
Substitute product differs ONLY in dose/concentration from the missing medication	7 (58.3)
Substitute product differs ONLY in the galenic form from the missing medication	5 (41.7)
Substitute product differs in dose/concentration and galenic form from the missing drug	4 (33.3)
Substitute product differs from the missing medication in terms of the active ingredient	3 (25)
Other	1 (8.3)

<sup>a</sup> Multiple answers were possible. The percentages are in relation to the total number of respondents who answered the question (N=12; 100%)

### 3.6. Biggest challenges in managing medicine shortages on the wards

Participants were asked to name the biggest challenges they faced regarding the management of drug shortages on the wards at their respective institutions. A total of 27 free-text responses were analyzed (multiple answers were possible in one single response). The following 10 themes emerged:

- Communication/information dissemination (n=12)
- Unclear what is and is not on the ward (replacement vs. standard product) (n=7)
- Difficult to re-prescribe (n=4)
- Too many drug shortages to manage (n=4)
- Maintain a clear overview (n=3)
- Lack of resources (n=3)
- Master data management (n=5)
- Constant switching back and forth between products (n=2)
- Uncertainty among the nursing staff (e.g., due to a change in the appearance of the substitute medication, a lack of medication know-how) (n=2)
- Lack of time (n=2)