

Supplementary Material

QUALITATIVE AND QUANTITATIVE QUESTIONNAIRE: AUTOMATED TECHNOLOGIES FOR PHARMACEUTICAL LOGISTICS IN THE HOSPITAL SETTING

Dear Pharmacist/Doctor/Nurses/Healthcare Professional,

We kindly ask you to complete the present questionnaire, to study the implications, the indicators and value drivers related to the **introduction of automated technologies for pharmaceutical logistics in the hospital setting**.

In the analysis, the following four scenarios will be considered:

- **Scenario 1: Manual dispensing, both in the Hospital Pharmacy and in the Wards**
- **Scenario 2: Presence of centralized automated Drug Dispensing System in the Hospital Pharmacy**
- **Scenario 3: Presence of decentralized automated Drug Dispensing System in the Wards**
- **Scenario 4: Presence of automated Drug Dispensing System both in the Hospital Pharmacy and in the Wards**

We undertake to use the data obtained for this survey exclusively in an aggregated manner and therefore to treat the information with privacy and confidentiality, pursuant to art. 13 of the Legislative Decree 30/06/2003, n.196 and of the EU Regulation n. 679 dated 04.05.2016.

By filling this online questionnaire, the respondent consents to the processing of perception data released by the LIUC Business School - Cattaneo University for the purposes related to the present study, agreeing participating in the research project, and giving the consent to data processing.

All the data will be anonymously analyzed and the aggregated results will be used for the production of scientific evidence.

Thank you for the collaboration

1.1. Please indicate the current level of automation within the considered hospital.

- ☐ **Scenario 1:** Manual dispensing, both in the Hospital Pharmacy and in the Wards
- ☐ **Scenario 2:** Presence of centralized automated Drug Dispensing System, in the Hospital Pharmacy
- ☐ **Scenario 3:** Presence of decentralized automated Drug Dispensing System, in the Wards
- ☐ **Scenario 4:** Presence of automated Drug Dispensing System both in the Hospital Pharmacy and in the Wards

1.2. Interviewee role

- ☐ Hospital Pharmacy Director
- ☐ Pharmacist
- ☐ Head of nurse, *please specify if:*
 - ☐ Medical Departments
 - ☐ Surgical Departments
 - ☐ Emergency Departments/Intensive Care Units
- ☐ Nurse, *please specify if:*
 - ☐ Medical Departments
 - ☐ Surgical Departments
 - ☐ Emergency Departments/Intensive Care Units
- ☐ IT specialist
- ☐ Biomedical engineer or similar
- ☐ General Manager
- ☐ Healthcare Director
- ☐ Other profession (please, specify)_____

1.3. Information to be collected by Hospital, not by individual interviewee, also before the interview

Hospital Beds [N.]	
Hospitalizations 2019 [N.]	
Outpatients services 2019 [N.]	
Drug packs received in Hospital Pharmacy per week [Average]	
Requests to central pharmacy from wards per week [Average]	

HTA QUESTIONNAIRE

We kindly ask you to complete the present questionnaire, considering the implications related to the **introduction of automated technologies for pharmaceutical logistics in the hospital setting**.

The study objective is the evaluation of the dimensions of the **HTA - Health Technology Assessment**: this method assesses the impact of technologies on patient health and, therefore, their effectiveness. Moreover, HTA provides support to decision makers at different decision levels, in healthcare policy choices, with reference to the adoption or development of innovative technology.

The questionnaire is divided into three different sections, as described below.

- 1) Prioritization of the HTA dimensions**, to evaluate their weight within the analysed context.
- 2) Qualitative assessment**, using the EUnetHTA Core Model to analyse the following dimensions,: i) safety; ii) effectiveness; iii) social and ethical impact; iv) equity impact, v) organizational impact, vi) legal impact.
- 3) Quantitative assessment**, to analyse the organizational impact, from a quantitative perspective, due to the introduction of innovative technologies – **TO BE CONDUCTED ONLY FOR EXISTING users!**

1. Prioritization Phase

The following table presents all the aspects that will be evaluated within a Health Technology Assessment analysis, through the Core Model approach. Please prioritise the following dimensions from the most important and relevant dimension (score equal to 9) to the least important and relevant one (score equal to 1), on the basis of your own experience and perception of automated technologies for pharmaceutical logistics (referred to as ‘investigated technologies’ in the statements below). Please use each number composing the 9-level evaluation scale just one time!

Dimension of reference	Prioritisation
<u>General relevance</u> , in terms of population that could benefit from the investigated technologies	
Technical relevance, in terms of technical characteristics related to investigated technologies, the technical description of the evaluated technologies	
<u>Safety</u> , in terms of errors and risks that may occur in the use of investigated technologies, both to the patient and to the healthcare personnel	
<u>Effectiveness</u> , in terms of harms prevention, associated with the occurrence of errors in the use of the investigated technologies	
<u>Cost and economic impact</u> , i.e. economic absorption of resources, budget impact analysis from the hospital point of view and economic evaluation (cost-effectiveness of cost-utility analysis)	
<u>Organizational impact</u> , both qualitative and quantitative impact, on the hospital where the investigated technologies are introduced	
<u>Equity impact</u> , in terms of accessibility to care, assuming the patient perspective	
<u>Social and ethical impact</u> , in terms of improvement of satisfaction, quality of life or well-being, assuming the patient perspective	
<u>Legal impact</u> , in terms of regulatory issues related to the acquisition of the investigated technologies	

2. Qualitative Assessment of HTA's dimensions

On the basis of your own experience and perception, we kindly ask you to evaluate every single item related to each HTA dimension

We ask you to indicate the answer that seems most appropriate to you.

2.1. Safety

This section aims to evaluate the **perceived safety impact** related to **adverse events or harms due to errors** in the drug dispensing processes in relation with the use of the different technologies.

1. Impact of the technology on adverse events or harms due to dispensing errors

	High negative	negative	Low negative	No impact	Low positive	positive	High positive
Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2. Impact of the technology on adverse events or harms due to management of expired drugs

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

3. Impact of the technology on general patient's safety

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2.2.Efficacy & Effectiveness

This section aims to evaluate the perceived **effectiveness** related to **error occurrence** in the drug dispensing processes, in relation with the different technologies.

1. Impact of the technology on medication administration errors

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2. Impact of the technology on outpatients dispensing errors

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

3. Impact on dispensing errors if combined with additional technologies as electronic prescribing and/or BCMA

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2.3.Equity Impact

The questionnaire that we ask you to fill-in, aims at evaluating the perceived **equity impact (in terms of accessibility to care for patients)** related to the use of the different technologies

1. Impact of technology on patients' clinical pathway efficiency (reduction in follow-ups, or in clinical pathway timing)

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2. Impact of technology on general accessibility to healthcare services (factors influencing the facility to access to care for the patients)

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2.4. Social & Ethical impact

The questionnaire that we ask you to fill-in, aims at evaluating the perceived **social and ethical impact (in terms of patients' point of view)** related to the use of the different technologies

1. Impact of the technology on the patient's perceived quality of life (related to a different dispensing error risk occurrence) and on the patient's satisfaction

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2. Impact of the technology on the trust between clinicians/nurses and patients/citizen

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
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2.5. Legal impact

The questionnaire that we ask you to fill-in, aims at evaluating the perceived **legal impact** (i.e. legislation and regulatory issues) related to the use of the different technologies

1. Existence of specific legal requirements/laws or scientific recommendations/guidelines that should be respected at national or European level

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2. Technology impact on legal controversies or disputes or claims in the drug dispensing process

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

3. Technology impact on drugs thefts from hospital stocks

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2.6. Qualitative organizational impact

The questionnaire that we ask you to fill-in, aims at evaluating the perceived **organizational impact** related to the use of the different technologies, considering **both a 12-months and 36-months time horizon from the introduction of the different technologies in hospital setting.**

1. Need for additional staff

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

2. Need for additional training courses and additional hospital meetings needed to promote the proper use of the technology

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

3. Learning time and curve

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

4. Technology impact on the healthcare professionals' workflow (nurses, pharmacists, technicians, other professionals)

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

5. Impact of technology on time of the overall drug dispensing process (from the purchase order to the request from wards to the administration to patient)

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

6. Impact of technology on facilitating connectivity/connection between wards and between Hospital Pharmacy and wards

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

7. Impact of technology on the relationship between healthcare workers (Pharmacist, Nurse, technician or other)

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

8. Impact of technology on storage capacity, drugs allocation criteria, inventory management and stock out

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

9. Impact of technology on healthcare professionals' organizational well-being and healthcare professionals' satisfaction

12-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

36-MONTHS TIME HORIZON

Manual dispensing	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy	-3	-2	-1	0	1	2	3
Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3
Centralized Automated Drug Dispensing System in the Hospital Pharmacy+ Decentralized Automated Drug Dispensing System in the Wards	-3	-2	-1	0	1	2	3

3. Quantitative organizational impact – TO BE CONDUCTED ONLY FOR existing users of automated technologies

The questionnaire that we ask you to fill-in, aims at evaluating the organizational impact from a quantitative point of view, related to the introduction of a Centralized Automated Drug Dispensing System in the Hospital Pharmacy and a Decentralized Automated Drug Dispensing System in the wards, considering a 12- months' time-horizon in order to define necessary investments or divestments.

A. Training courses to professionals involved in the use of investigated technologies (e.g. pharmacists, nurses, other professionals)

	Centralized Automated Drug Dispensing System in the Hospital Pharmacy	Decentralized Automated Drug Dispensing System in the wards
Are needed training courses to professionals involved in the use of investigated technologies?	☐ Yes ☐ No	☐ Yes ☐ No
Average number of hours of training courses		
Average number of professionals involved in the training courses		

B. Communication / Hospital meetings

	Centralized Automated Drug Dispensing System in the Hospital Pharmacy	Decentralized Automated Drug Dispensing System in the wards
Are hospital meetings necessary to communicate the change of technology within the hospital, as a whole?	☐ Yes ☐ No	☐ Yes ☐ No
Average number of hours of hospital meetings/communications		
Average number of hospital meetings/communications		

C. Resistance to change

C1. Considering the first 12 months of introduction of new drug dispensing technology, please indicate your level of resistance to change, considering the following main reason of resistance to change.

Please consider a 7-items scale ranging from 1 to 7 (1: extremely likely; 2: quite likely; 3: slightly likely; 4: neither; 5: slightly unlikely; 6: quite unlikely; 7: extremely unlikely).

Lack of technical support	1	2	3	4	5	6	7
Lack of motivational support and incentives	1	2	3	4	5	6	7
Lack of proper competencies to use new technologies	1	2	3	4	5	6	7
Wrong time of implementation (e.g. short time to adapt to new technologies)	1	2	3	4	5	6	7
Habits	1	2	3	4	5	6	7
Other. Please specify: _____	1	2	3	4	5	6	7

C2. When did you recognize the value and the benefits of the introduction of new technologies? _____