

EXPLORING THE POTENTIAL OF DRONES FOR URBAN DELIVERIES IN THE HEALTHCARE SECTOR

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Drone deliveries of medical goods in urban healthcare

Patient safety improvements enabled by a drone-based logistics system

Master's Thesis in the Master's Program Management and Economics of Innovation

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AGENDA

CASE CONTEXT
BACKGROUND

04-05

08-11

EMPIRICAL FINDINGS

RESEARCH QUESTIONS
DELIMITATIONS

06

10-17

DISCUSSION &
CONCLUSION

DATA COLLECTION

07

18

PROJECT STATUS

CASE CONTEXT

Gothenburg

2nd
largest city
in Sweden

Area:
450 sq km
(or 5.6 sq miles)

Population:
1M
metropolitan
area

Population:
600k
city center

Density:
**1300 / sq
km**
(or 3300 sq miles)

Traffic
congestion

The study focus on the largest hospital in the region, spread geographically at three different hospital sites



BACKGROUND



Urbanization



Centralization of supporting
services and goods in healthcare



Patient safety



Drones



Pre-study showed
time-saving potential*

*50-70% faster compared to
roadbased transport

RESEARCH QUESTIONS

RQ1

How can patient safety be supported by a drone-based delivery system of medical goods within an urban healthcare organization?

RQ2

Which types of medical goods are initially most beneficial to be delivered by drones from a patient safety perspective?

DELIMITATIONS



Transplantation logistics

Excluded



Internal transports

Only briefly considered



Technical aspects of drones

Only briefly considered



DATA COLLECTION

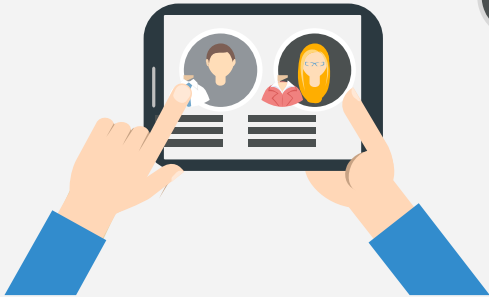


RESPONDENTS

Semi structured interviews

Observations

Secondary data
Transport statistics

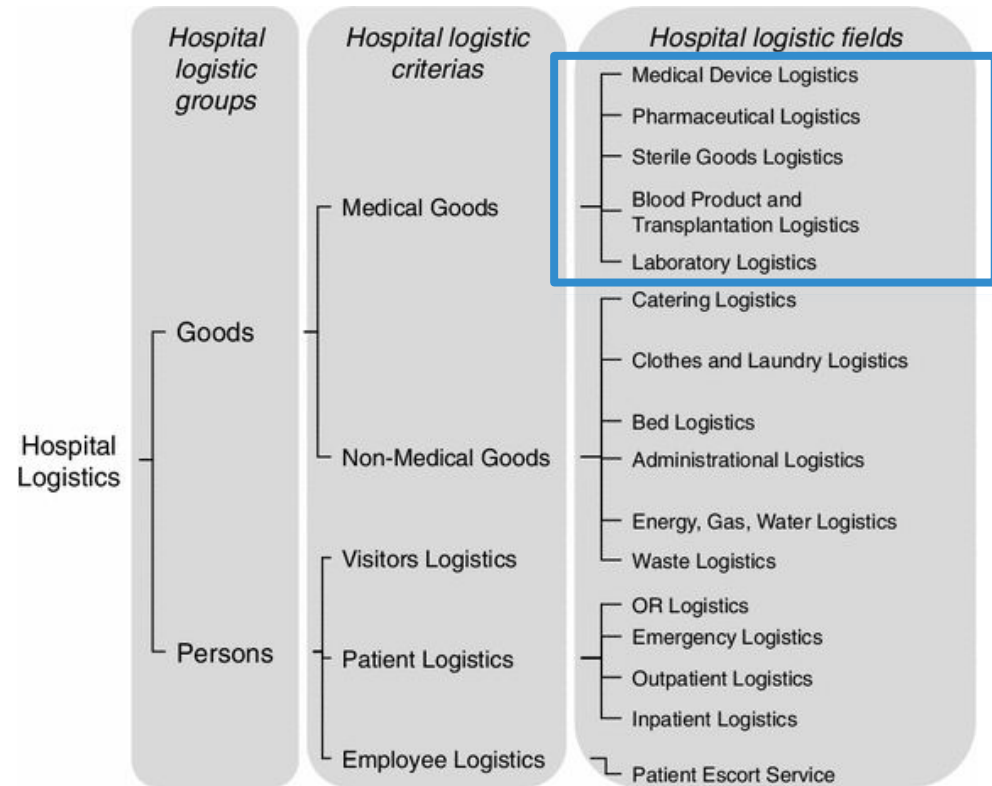


FOCUS OF EMPIRICAL FINDINGS

The focus of the empirical findings was based on Kriegel's (2009) division of medical goods.

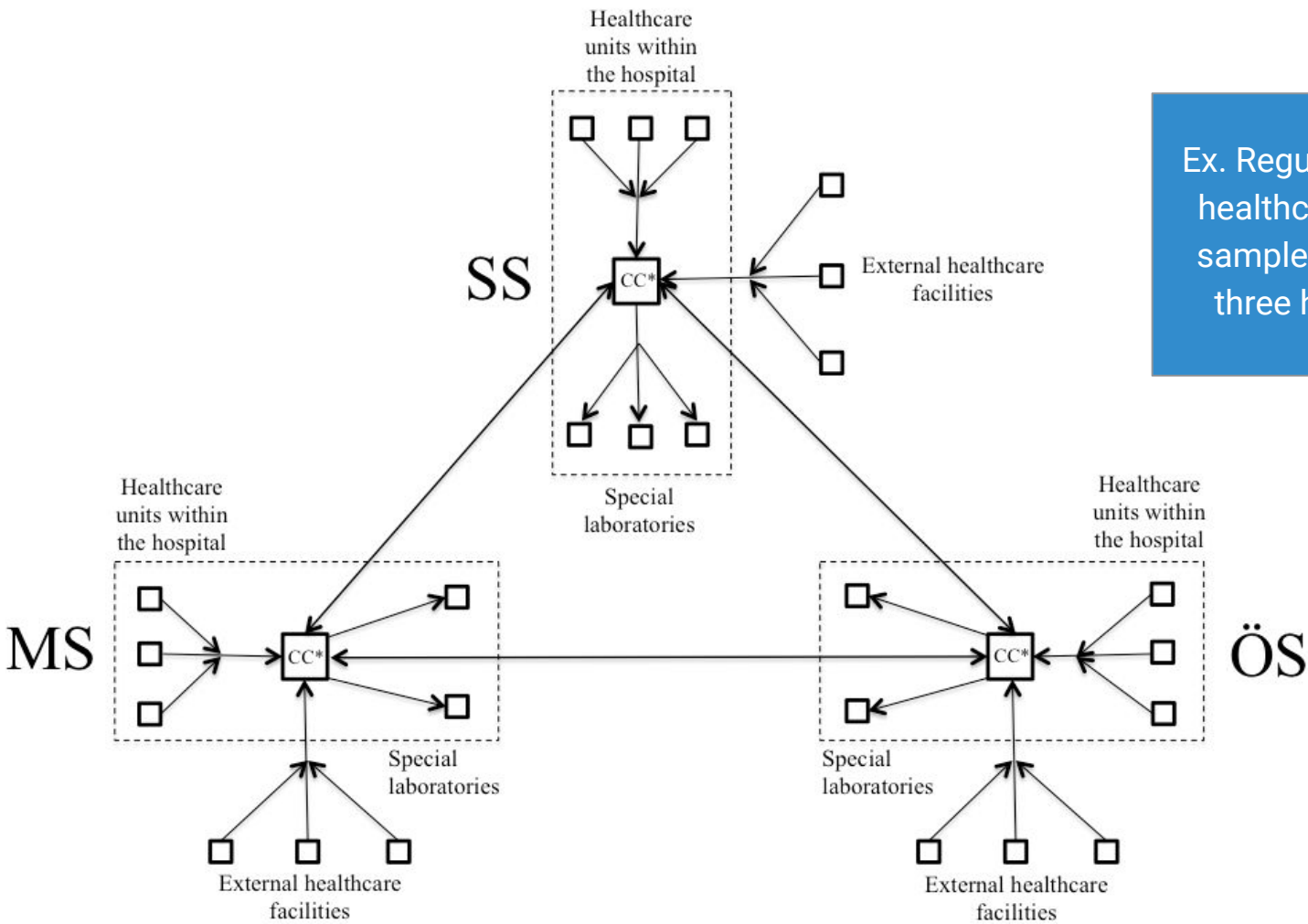
Current state analysis and mapping of:

- Regular deliveries
- On-demand deliveries
- Goods characteristics
- Logistic system risk factors



Medical goods	Sub-categories	Size	Weight	On-demand deliveries	Transport requirements	Personal information	Economic value	Replaceability
Medical devices		Small to large	Low to high	Rarely	N/A	No	Low to high	Yes
Pharmaceuticals	Standardized pharmaceuticals	Small to large	Low to high	Sometimes	Traceability Temperature Humidity Stability* Security (risk of theft)*	Sometimes	Low to high	Yes
	Extempore pharmaceuticals	Small to medium	Low to medium	Rarely	Traceability Temperature Humidity Stability* Security (risk of theft)*	Sometimes	Low to high	Yes
Sterile goods	Reusable sterile goods	Small to large	Low to high	Rarely	Three-layers package	No	Low to high	Yes
	Consumable sterile goods	Small to medium	Low to medium	Rarely	Three-layers package	No	Low to medium	Yes
Laboratory samples	Healthcare laboratory samples	Small	Low to medium (with ice)	Daily	Traceability Temperature Stability*	Yes	Low	No*
	Research laboratory samples	Small	Low to medium (with ice)	Depends on each research project	Traceability Temperature Stability*	Yes, until aliquoted. Later coded.	Low	No*
Blood supplies	Blood	Small	Low	Daily	Traceability Temperature (2-6 °C) Stability	Yes	Medium (ca €100)	Yes
	Plasma	Small	Low	Sometimes	Traceability Temperature (2-6°C)	Yes	Medium (ca €50)	Yes
	Thrombocytos	Small	Low	Sometimes	Traceability Temperature (20-24°C) Movement	Yes	Medium (ca €200-400)	Yes

Ex. Regular deliveries of healthcare laboratory samples between the three hospital sites



EMPIRICAL FINDINGS

REGULAR DELIVERIES

- Extensive network
- High volumes
- Non-urgent goods
- Goods usually pass consolidation hubs at each hospital site
- Available daytime, weekdays

ON-DEMAND DELIVERIES

- Time critical goods
- Low volumes, small and lightweight goods
- Unpredictable need
- Goods delivered directly to units
- Limited availability of currently used transport modes

GOODS CHARACTERISTICS

- Goods vary in:
 - Size
 - Weight
 - Transport requirements
 - Personal information
 - Economic value
 - Replaceability

LOGISTICS SYSTEM RISK FACTORS

- Deviations
 - Unreliable lead times
 - Human errors
 - Lack of traceability
- Lack of security
 - No authorizations
 - Boxes not lockable
- High number of transfers



DISCUSSION AND CONCLUSION

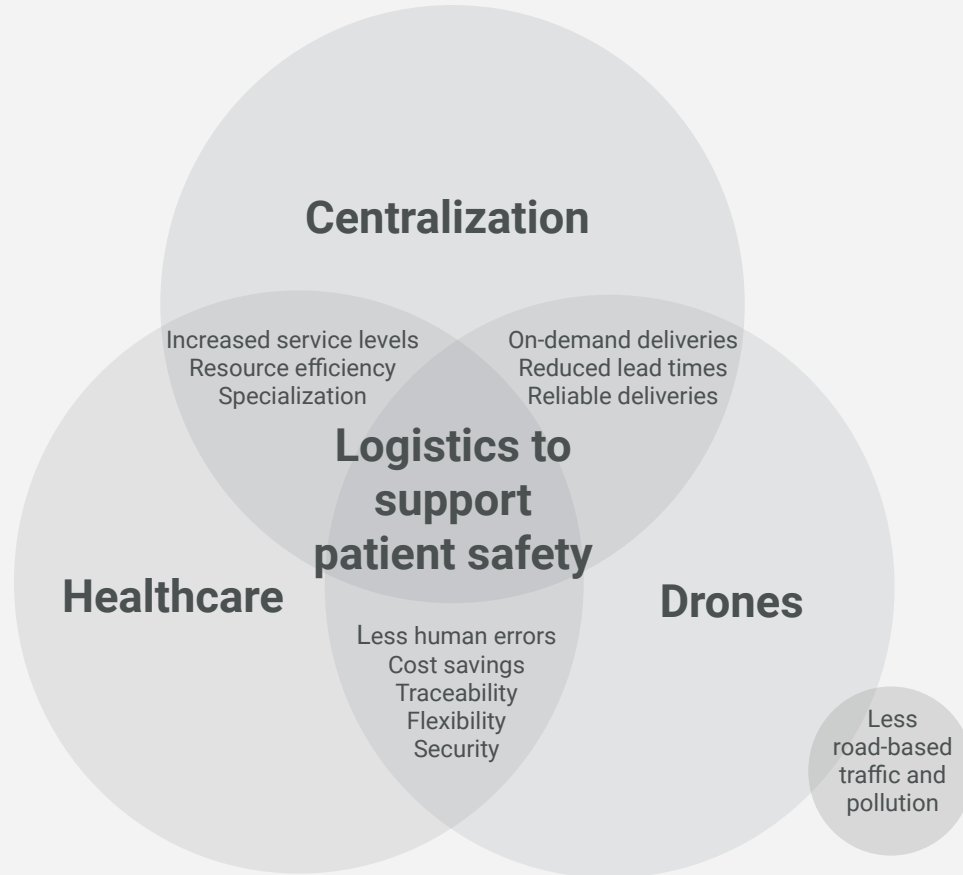


RQ1

How can patient safety be supported by a drone-based delivery system of medical goods within an urban healthcare organization?



BENEFITS OF DRONE DELIVERIES



PATIENT SAFETY BENEFITS ENABLED BY THE USE OF DRONES

Patient safety aim	Enablers through autonomous drone deliveries
<i>Safe</i>	Reduced risk of errors and number of transfers related to deliveries. Improved security, traceability and transparency in the delivery system.
<i>Effective</i>	Reduced overcapacity in terms of payload and human resources.
<i>Patient-centered</i>	Less waiting time for patients, which improves flow efficiency and patient centricity.
<i>Timely</i>	Increased reliability in delivery lead time. Reduction in the number of deviations.
<i>Efficient</i>	Increased utilization rates due to fewer delays and possibilities for further centralization.
<i>Equitable</i>	Improved flexibility of deliveries in terms of both location and time.



RQ2

Which types of medical goods are initially most beneficial to be delivered by drones from a patient safety perspective?



GOODS COMPATIBLE WITH DRONE DELIVERIES IN AN INITIAL STATE



CRITERIA OF GOODS COMPATIBLE WITH DRONE DELIVERIES

- Low volumes
- Urgently needed goods
- Lightweight and small goods
- Replaceable goods
- Low to medium economic value
- High frequency of on-demand deliveries



CRITERIA APPLIED TO DELIVERIES IN THE CASE STUDY

Blood supplies

Healthcare laboratory samples

Not suitable for all samples due to their irreplaceability

Much more complex delivery system



PROJECT STATUS AND FURTHER RESEARCH

- Ongoing collaborative research project
 - Research Institute of Sweden
 - Innovation Platform VGR
 - Drone navigation software company
- Successful test flights this summer

Need for extensive further research.

Examples:

- Last leg deliveries
- Technical requirements; weather conditions etc.
- Operational aspects
 - Internal solutions
 - Drone operators/control tower





THANK YOU FOR LISTENING

TIME FOR QUESTIONS

Full report: <https://hdl.handle.net/20.500.12380/256792>

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