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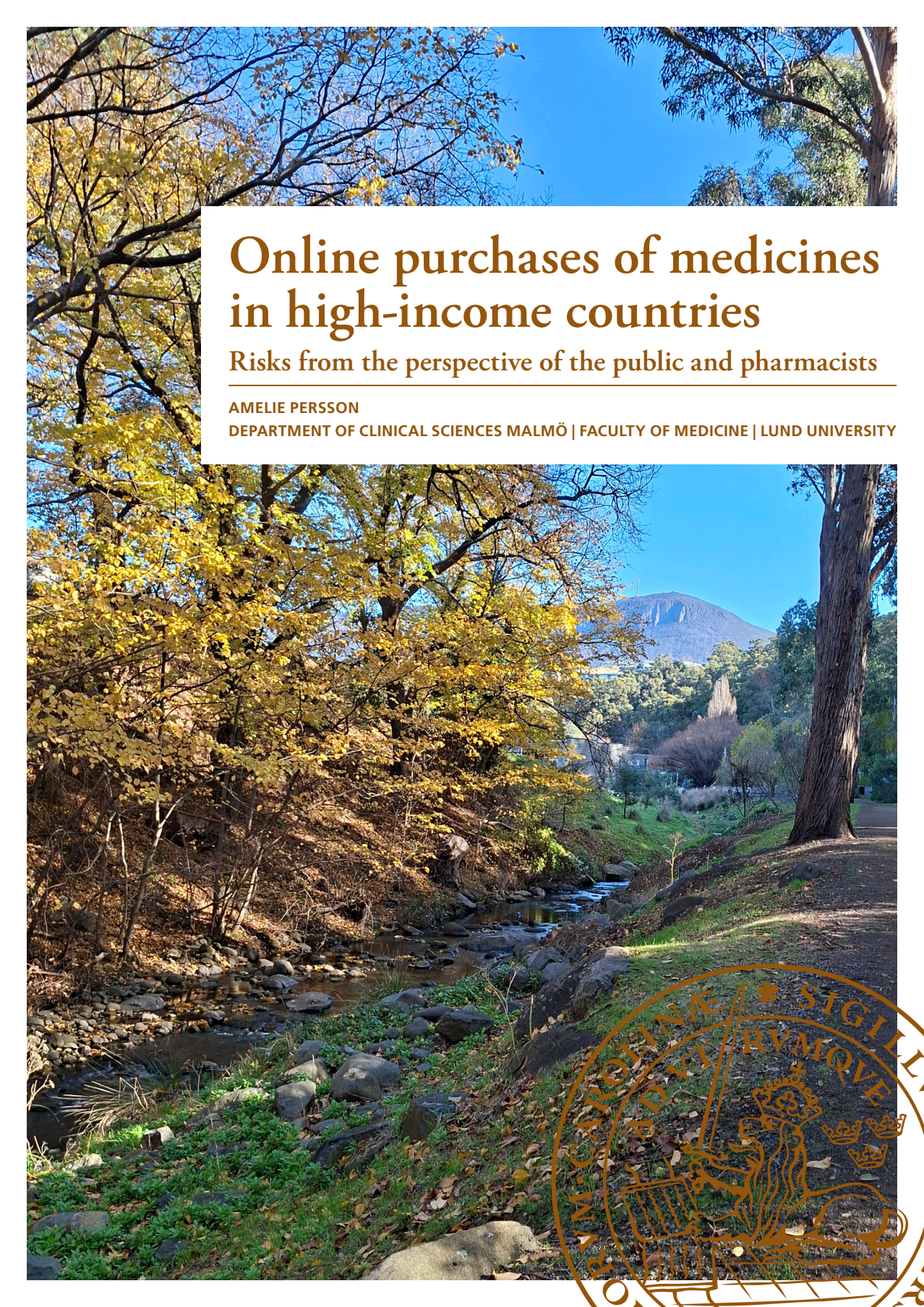
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Online purchases of medicines in high-income countries

Risks from the perspective of the public and pharmacists

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Amelie Persson



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DOCTORAL DISSERTATION

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Abstract:

Background: Online purchasing of medicines is increasing in high-income countries. This opens a global market featuring illegal websites contributing to the spread of substandard and falsified medicines, posing a risk to individuals and society. The aim of this thesis is to describe individuals' online purchasing habits of medicine in a high-income setting and to evaluate the knowledge among the public and the pharmacy employees about safe online purchases of medicines.

Methods: During 2020, a digital questionnaire collected data on Swedish community pharmacy employees' knowledge and experience of substandard and falsified medicines. To gain a deeper understanding, the questionnaire was followed up in 2021 with individual interviews of purposively selected pharmacy employees. The adult general population's online purchasing habits of medicines was evaluated four times during 2022-2025 in two high-income countries, Sweden and Australia, using electronic surveys.

Results: Eighty percent of pharmacy employees were familiar with WHO's definition of substandard and falsified medicines, but only 26% were familiar with the mandatory European logo for authorised online pharmacies. The individual interviews suggested that pharmacists can play a role in counteracting substandard and falsified medicines. Participants emphasised that they work to help patients and increase patient safety. In Sweden, 52% of the general population, and in Australia 36%, were reported to have purchased medicines online within the last year. Ninety-one percent of the Swedish participants did not recognise the mandatory European logo for authorised online pharmacies, and 43% of the Australian participants were unaware or uncertain of safety concerns regarding online purchase of medicines. The results also indicate a continued increase in online purchases of medicines.

Conclusion: Online purchases of medicines are common and increasing. The low knowledge of safety measures implies a risk. Community pharmacy employees have opportunities to help and guide those in need, saving resources for individuals and healthcare.

Keywords: Public health; pharmaceutical services; online; community pharmacy; professional-patient relations; substandard and falsified medical products; drug-related side-effects and adverse reactions

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Online purchases of medicines in high-income countries

Risks from the perspective of the public and pharmacists

Amelie Persson



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MADE IN SWEDEN 

I walk humbly in the footsteps of those that have walked before me

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Preface

My journey as a young pharmacist started in a community pharmacy, working only with pharmacy personnel. I experienced the atmosphere in the pharmacy at this time as black or white; either something was right, or it was wrong. A few years later, I got the opportunity to work at a medical information centre. The task was to reply to patient-related questions about medicines from healthcare professionals, mostly physicians. My co-workers were pharmacists, but also nurses, and physicians. My earlier, so black and white working environment, got more nuances. For the last 20 years, I have worked as a clinical pharmacist with inpatients. Every day, I have been able to be a part of people's lives, and I feel very privileged that they want to share their stories with me. I've got more miles on the clock, and my opinion of life now consists only of different realities, no one more right or wrong than the other.

I have always loved to learn new things. From my point of view, everything can evolve. According to my mum, I set the bar high early in life. I am supposed to have watched the Nobel Prize Award ceremonies on TV at the age of eight or nine and said, "I'll be there one day". A very high bar, not in reach, but that matters less. I have always enjoyed the journey.

Healthcare is now on a journey where it is trying to exploit the benefits of digitalisation. On this journey, it is important to remember that one solution does not fit all; you have to see and listen to the individual in front of you. Accessing medicines is no exception.

As a clinical pharmacist, my goal is to optimise the treatment with medicines for every individual I meet. This is best done in collaboration with the individual and other healthcare professionals. Most of the time details are addressed, which has no meaning if the individual does not access medicines of good quality. When I first heard of substandard and falsified medicines it hurt my soul. I could not believe how anyone could risk the lives of others to make money for themselves.

In this thesis, I focus on describing online purchases of medicines and the reasons why individuals choose to buy medicines online. I do not aspire to eradicate substandard and falsified medicines from the market but aim to prevent purchases of substandard and falsified medicines by mistake. I describe data from two high-income countries - Sweden and Australia. Australia is in many ways similar to Sweden, both being high-income countries investing in digitalisation, but Australia is a non-European country. Based on the data described, information can be formed

that potentially can increase knowledge. Knowledge for individuals, healthcare professionals, and the structures in healthcare. Knowledge, which I hope can improve communication and understanding, which in turn hopefully contributes to creating a better future with access to safe medicines.

I hope you enjoy reading!

Abstract

Background

Online purchasing of medicines is increasing in high-income countries. This opens a global market featuring illegal websites contributing to the spread of substandard and falsified medicines, posing a risk to individuals and society. The aim of this thesis is to describe individuals' online purchasing habits of medicine in a high-income setting and to evaluate the knowledge among the public and the pharmacy employees about safe online purchases of medicines.

Methods

During 2020, a digital questionnaire collected data on Swedish community pharmacy employees' knowledge and experience of substandard and falsified medicines. To gain a deeper understanding, the questionnaire was followed up in 2021 with individual interviews of purposively selected pharmacy employees. The adult general population's online purchasing habits of medicines was evaluated four times during 2022-2025 in two high-income countries, Sweden and Australia, using electronic surveys.

Results

Eighty percent of pharmacy employees were familiar with WHO's definition of substandard and falsified medicines, but only 26% were familiar with the mandatory European logo for authorised online pharmacies. The individual interviews suggested that pharmacists can play a role in counteracting substandard and falsified medicines. Participants emphasised that they work to help patients and increase patient safety. In Sweden, 52% of the general population, and in Australia 36%, were reported to have purchased medicines online within the last year. Ninety-one percent of the Swedish participants did not recognise the mandatory European logo for authorised online pharmacies, and 43% of the Australian participants were

unaware or uncertain of safety concerns regarding online purchase of medicines. The results also indicate a continued increase in online purchases of medicines.

Conclusion

Online purchases of medicines are common and increasing. The low knowledge of safety measures implies a risk. Community pharmacy employees have opportunities to help and guide those in need, saving resources for individuals and healthcare.

List of papers

This thesis is based on the following papers, referred to in the text by their Roman numerals:

- I. **Persson A**, Troein M, Lundin S, Midlöv P, Lenander C. *Swedish community pharmacy employees' knowledge and experience of substandard and falsified medical products: a cross-sectional descriptive survey*. Int J Pharm Pract. 2022 Nov;30(5):414–419. <https://doi.org/10.1093/ijpp/riac059>
- II. **Persson A**, Troein M, Lundin S, Midlöv P, Lenander C. *Exploring pharmacists' perspectives about substandard and falsified medical products through interviews*. Explor Res Clin Soc Pharm. 2024 Feb;13:100421. <https://doi.org/10.1016/j.rcsop.2024.100421>
- III. **Persson A**, Troein M, Jakobsson U, Lundin S, Midlöv P, Lenander C. *Using the advantages and avoiding the risks – a public survey about the challenges of online purchases of medicines*. Scand J Prim Health Care. 2025 Dec;44(1):1-14. <https://doi.org/10.1080/02813432.2025.2584902>
- IV. **Persson A**, Stanesby O, Peterson GM, Sharman JE, Lenander C. *Survey of online purchasing habits for medicines in Australia*. To be submitted.

Starting point of this thesis

In *Of the Epidemics*, Hippocrates wrote, “The physician must be able to tell the antecedents, know the present, and foretell the future - must mediate these things, and have two special objects in view with regard to disease, namely, to do good or to do no harm” (1).

In accordance with this, the sole purpose of medicines is to do good. By definition according to the European Union, a medicine is “Any substance or combination of substances presented for treating or preventing disease in human beings” (2) or, as put by the Australian Government, “Medicines are substances that help our bodies – physically or mentally – to prevent, treat or cure diseases” (3). At a population level, the benefits of medicines must outweigh possible side effects otherwise the medicine will not be approved and legal to sell. Despite this, some individuals can experience side effects that outweigh the benefits of a particular medicine.

The vision of the International Pharmaceutical Federation includes “a world where everyone benefits from access to safe, effective, quality and affordable medicines” (4). The oath of the pharmacist states, “I shall apply the full measure of my knowledge and abilities to supporting the health and wellbeing of all those I serve” (5).

The overall purpose for physicians, medicines, and pharmacists is to do good.

Background

Approved medicines of good quality

Throughout history, nature has been providing us with remedies. Medicines synthesised in laboratories first saw the light in the latter half of the 19th century (6). The first synthesised medicine to gain widespread distribution was Aspirin®, containing acetylsalicylic acid. Medicines containing acetylsalicylic acid are still available on the market, both as over-the-counter medicines, as well as prescription-only medicines. If not familiar with medicines, it might sound odd that tablets containing 500 mg acetylsalicylic acid can be bought over the counter in Sweden while tablets containing lower doses of acetylsalicylic acid need a prescription (7-8). The reason in this specific example is due to why the different strengths are used: The tablets containing 500 mg are used for short-term conditions with pain and fever – conditions obvious to the individual. The individual can easily identify when he or she needs the medicine and when to stop taking it. The tablets containing the lower dose acetylsalicylic acid are used to prevent a new thromboembolism from occurring, for example a heart attack or stroke. Events with thromboembolisms are conditions that should be diagnosed and treated by physicians. Hence, packages with a smaller quantity of the higher dose acetylsalicylic acid can be bought over the counter, while packages with a larger quantity of the lower dose acetylsalicylic acid are a prescription-only medicine. Note that long-term pain is not a condition where self-treatment with over-the-counter acetylsalicylic acid is a suitable choice. This can both delay identification of the underlying cause of the pain and result in side-effects, for example increased risk of bleeding. Aspirin® containing acetylsalicylic acid was not a novel discovery, but a chemical modification (6). People had known for centuries that the bark of the white willow tree could be used to treat fever and pain. The white willow tree contains salicin, or salicylic acid, which has a bitter taste. The chemical modification to acetylsalicylic acid made the substance more palatable, whilst keeping the effect. The process of synthesising acetylsalicylic acid in a laboratory also had the advantage of controlling the amount each tablet contained, in contrast to making an extract of the bark of the white willow tree.

Another historical event was the discovery of penicillin by Alexander Fleming in 1928 (9). Prior to antibiotics, infections that we today colloquially call simple could be deadly. During World War II, penicillin and other antibiotics were available on

the market and saved countless lives. However, the demand for antibiotics was higher than the supply, leading to a black market. For example, Arayne et al. describe how over 300 people died from taking the antibiotic sulfathiazole (10). It was not the antibiotic that killed them but the fact that the tablets were contaminated with phenobarbital. Phenobarbital is a sedative substance that can be deadly, especially if your general condition is affected, as it could be during an infection. This, together with other incidents, led to the first draft of the Good Manufacturing Practice written by the World Health Organization in the 1960s (11).

Good Manufacturing Practice helps ensure that medicines are of high quality by giving guidelines regarding the production (12). This covers both production processes, including qualitative testing, as well as ensuring that personnel, premises, and materials are suitable for the production of medicines. Good Manufacturing Practice also includes legal aspects covering, for example, responsibilities for distribution and responses to product defects and complaints (11). This means all procedures, from initial research until an approved medicine is used by an individual, are highly controlled by rules and guidelines to provide safe, effective medicines of high quality.

All these rules and guidelines mean that the pharmaceutical industry cannot quickly adapt to new conditions, which opens a window for less serious players to enter the market. An example of this is provided by Liu et al., who described Astrid's situation (13). Astrid has two children suffering from a genetic disease. Medicine to treat this genetic disease is approved but not yet available on the legal market for Astrid's family. While waiting, Astrid turns to the Internet to find something that can be helpful for her children. She finds a Facebook group where other parents of children with the same genetic disease share experiences. When her eldest child's health condition worsens, she sees no other options but to do the same as some families in the group have done, hence buy the medicine online from another market.

In summary, rules and guidelines have been implemented to secure access to safe, effective medicines of high quality. However, it is important to keep in mind that extensive rules and guidelines can result in a system that is difficult to navigate and may lead individuals to choose other paths.

Substandard and falsified medicines

Substandard medicines can in accordance with the definition of the World Health Organization be approved medicines that reach the market with quality deficiencies (14). This can be due to poor manufacturing and inadequate quality control, thus not in alignment with Good Manufacturing Practice. Substandard medicines can also deliberately be put on the market with the intention of financial gain. One of the

most reported groups of medicines that have been detected as substandard on the global market is antibiotics, for example, with tampered expiration dates (15). Using antibiotics after the expiration date can result in inadequate efficacy for the individual with an ongoing infection but can also contribute to the spread of antimicrobial resistance. Antimicrobial resistance does not stay within borders, and estimates indicate that antibiotic resistance was directly responsible for approximately 1.27 million deaths worldwide in 2019 and was associated with a further 4.95 million deaths (16).

Falsified medicines are not approved medicines; instead they are put on the market deliberately for financial gain. Falsified medicines can contain anything from sugar to toxic substances.

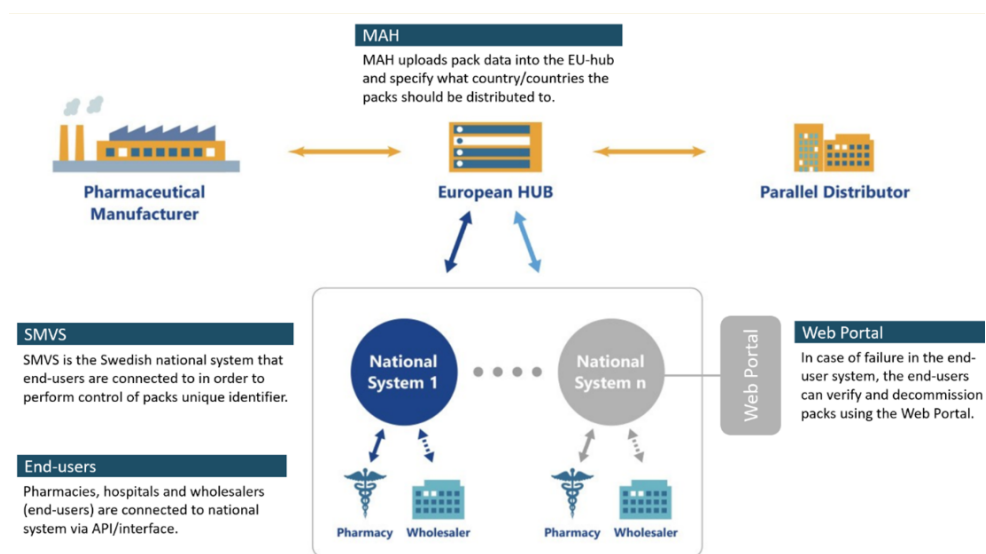
The World Health Organization has described three main contributing factors to why substandard and falsified medicines appear on the market, namely constrained access, poor governance, and weak technical capacity (15). These contributory factors are based on global reports of substandard and falsified medicines.

The problem with substandard and falsified medicines is more widespread in low- and middle-income countries compared to high-income countries (15). Logically, most research has been conducted in a low- and middle-income setting. Estimates show that 10% of medicines in low- and middle-income countries are substandard or falsified, compared to 1% in high-income countries (15, 17). The proportion is even higher in informal markets compared to authorised pharmacies (18-19). With rising e-commerce, a global market opens to the citizens in high-income countries. Studies show that approximately 95% of all websites posing as pharmacies lack correct authorisation (20). From these unauthorised online pharmacies, it is estimated that 50% of delivered medicines are substandard or falsified (21-22). The research from low- and middle-income countries has mainly focused on the supply side; less research is done on the demand side in a high-income setting (23).

To conclude, research regarding substandard and falsified medicines is limited from high-income settings, focusing on the people buying medicines from unauthorised online pharmacies.

Authorities' role

Authorities in several high-income countries have taken action to secure the supply of safe, effective medicines of high quality. One example to secure the supply of high-quality medicines is the European Union's Falsified Medicines Directive (24). The directive demands safety details on every medicine packaging, one detail being a unique 2D code. The manufacturer uploads the 2D code to a European hub, as shown in Figure 1, which makes it possible to track a specific package from manufacturer to end-user. The Falsified Medicines Directive applies to all prescription-only medicines and is implemented in all authorised pharmacies in Sweden, both community pharmacies and online pharmacies (25).



MAH, Marketing Authorisation Holder. SMVS, Swedish Medicines Verification System. API, Active Pharmaceutical Ingredient

Figure 1. Description of how unique 2D codes on every medicine packaging are spread from manufacturer to end-users. The figure is from E-vis (25).

Another safety feature within the Falsified Medicines Directive, which applies to authorised online pharmacies, is the mandatory common logo (26), Figure 2. A click on the logo directs you to the medical authority of the pharmacy's country of origin where you can ensure that the online pharmacy is authorised.



Figure 2. The common logo for legally operating online pharmacies within the European Economic Area.

Since different rules and regulations regarding medicines apply in different countries, there is not one single way to identify an authorised online pharmacy worldwide. As an example, in Australia, no common logo is available. Instead, the individual needs to check that the online pharmacy is based in Australia by looking for a physical address and a phone number and that the online pharmacy is a real business and has an Australian company number (27).

Both Swedes and Australians can legally purchase over-the-counter-medicines and prescription-only medicines online. Australians can legally buy only from Australia, with few exceptions, and Swedes from all countries within the European Economic Area (28-29). A valid prescription is a prerequisite for buying prescription-only medicines legally online. At the moment, an e-prescription from a Swedish physician can only be dispensed in a Swedish pharmacy, while a prescription on paper can be dispensed throughout Europe (30). Note that even within Europe rules and regulations regarding online purchases of medicines are not the same; citizens in some European countries can only purchase over-the-counter medicines online, while citizens from other European countries can buy both over-the-counter medicines and prescription-only medicines online (29).

The responsibility to provide affordable medicines for both society and the individual often resides with authorities in high-income countries. As an example, both the Swedish and Australian governments subsidise prescription-only medicines (31-32). Australia has different discounts depending on your income, while the discount in Sweden is equal for all adults. In Sweden, a law applies that pharmacies should always stock up and offer generic medicines at lower prices (33). Generics are also sold in Australian pharmacies, but it is up to the pharmacy which generic brand they have in stock. The important role of authorities regarding medicine quality has been shown by Gabel et al (34). They purchased and analysed 711 samples of medicines, and, without exception, all samples manufactured in

countries with stringent regulatory authorities complied with pharmacopeial specifications, while 21.1% of medicines manufactured in countries without stringent regulatory authorities did not comply.

In high-income countries, authorities take on the responsibility to secure the supply chain through rules and regulations to avoid substandard and falsified medicines. Authorities also advocate for generic medicines and subsidise most medicines to make them affordable, both for the individual and society. Hence, in high-income countries, safe medicines are available through authorised pharmacies.

Medicine shortages

Medicine shortages are an increasing global problem. Around one-third of the global population lacks access to medicines, most of them residing in low- and middle-income countries (35). The World Health Organization has identified access to medicines as one of the urgent health challenges for the next decade. As mentioned before, limited access is one of the main reasons for the emergence of substandard and falsified medicines. When there is a need for a medicine but not enough supply, substandard and falsified medicines fill that void.

There are different reasons for medicine shortages, for example the production chain for approved medicines is fractionated to a higher degree today, which implies higher vulnerability that can contribute to medicine shortages. Another reason is that the market for approved medicines is globalised to a higher degree today and exposed to competition, meaning that different companies and countries compete for the available medicines. To counteract medicine shortages of essential medicines such as antibiotics, insulin, painkillers, vaccines and medicines for chronic and acute diseases (e.g. cancer, heart conditions, diabetes), the European Union are working on the Critical Medicines Act, a proposal for a new regulation that aims to improve the availability and security of supply (36).

Not accessing a medicine has several impacts on the individual. Phuong et al. published a review in 2019 which compiles the effects of medicine shortages on patient outcomes (37). The conclusion was that medicine shortages were reported to have adverse economic, clinical, and humanistic outcomes on patients. Economic burdens could be, for example, increased out-of-pocket costs for patients and economic consequences for the health system. Clinical outcomes ranged from medicine errors to mortality, and humanistic outcomes could be concerns like uncertainty, frustration and anger among patients as well as feeling like a burden to themselves and to caregivers. Not accessing a medicine can also affect trust between healthcare professionals and users (38).

Medicine shortages are reported to affect the well-being of pharmacists in community pharmacies, but it is also seen to be a possibility for pharmacists to use their professional knowledge and prevent adverse effects related to medicine shortages from occurring (39). Pharmacists' possibility to act on medicine shortages in Sweden is limited today due to the legal framework.

Hence, individuals with difficulties accessing their medicines need extra attention. Medicine shortages is an area where pharmacists are a suitable profession to relieve healthcare and increase patient safety.

The societal roles and responsibilities of pharmacies and pharmacists

Pharmacists are registered healthcare professionals working in areas such as the pharmaceutical industry, pharmacies, healthcare (primary, secondary and tertiary), and authorities. Pharmacists working in pharmacies are uniquely accessible to the public; during opening hours, no appointment is required. Compared to other healthcare professionals, pharmacists working in pharmacies are employed by a pharmacy company and not a healthcare institution. This means that pharmacists work in a different context, including separate premises, compared to other healthcare professionals, and access to medical records is often lacking in pharmacies, which makes it difficult to fully use pharmacists as healthcare professionals.

One of the core missions for authorised pharmacies in Sweden, whether it is community pharmacies or online pharmacies, is to dispense affordable medicines of high-quality (40). Authorised pharmacies' core mission in Australia is to enable community pharmacies to serve the needs and preferences of patients and health consumers across Australia using their unique role in medicine management and safety (41).

Even though authorised pharmacies provide approved medicines whose safety and efficacy have been thoroughly tested, the pharmacist is obliged to perform an assessment before dispensing a prescription-only medicine to an individual (42). Note that this responsibility applies even though the medicine is prescribed by a physician. The assessment includes making sure that the prescribed medicine is suitable for the individual and his or her needs, hence acting as an additional safety net to increase patient safety. Even if the medicine is government approved, it can be unsafe if not adjusted to the user. Another core mission is also the responsibility of the pharmacist to give individually tailored information on how to gain the best possible effect of the medicine and reduce the risk of side effects, i.e. yet another way to enhance patient safety (40). The information can include when and how to

take the medicine (with or without food, swallowing whole, etc.), how to act if side effects occur, or how to store the medicine at home so it will not lose its effectiveness and become substandard.

Studies from European countries show that the roles and responsibilities of pharmacies and pharmacists are not well-known to society. Paloumpi et al. have shown that patients lacked awareness of the roles and responsibilities of pharmacies and pharmacists, and saw pharmacies more as a retail space than a health service (43). This is in line with a study from Majchrowska et al. (44).

Pharmacies and pharmacists have an important role in supplying individuals with safe medicines, together with information on how to use and store the medicines to enhance patient safety. This is a role not well-known to the public.

Digitalisation

Almost all individuals in high-income countries used the Internet in 2023, for example, 95% in Sweden and 97% in Australia (45). Regarding healthcare, Sweden's vision was "In 2025, Sweden will be best in the world at using the opportunities offered by digitisation and eHealth to make it easier for people to achieve good and equal health and welfare, and to develop and strengthen their own resources for increased independence and participation in the life of society." (46). Australia's vision is similar: "Creating an inclusive, sustainable and healthier future for all Australians through a connected and digitally enabled health system." (47)

As an example from the pharmaceutical area, 99% of all prescriptions in Sweden are e-prescriptions (30). Prescriptions on paper are also valid, but only used in exceptional cases. Although the first e-prescription was sent in the 1980s, e-prescriptions in Sweden were implemented widely around the year 2000 (48). In Sweden, all e-prescriptions are uploaded to a national hub where authorised pharmacies can access and dispense them. So, when you visit an authorised Swedish pharmacy online, you will need to identify yourself using an authorised electronic identification system, for example BankID (49). After identification, you will access all your e-prescriptions and can place your order. This is another way to secure that you are using an authorised online pharmacy than the earlier mentioned mandatory European logo for online pharmacies.

In Australia, most but not all pharmacies are set up to dispense medicines using e-prescriptions (50). The first e-prescription was sent in 2020 (51), and today paper prescriptions are still more common than e-prescriptions even though the latter are increasing. According to a study from 2024, one-third of the prescriptions dispensed in Australia were e-prescriptions (52). This aligns with my personal communication with the Electronic Prescribing Team, Department of Health, Disability and Ageing,

Australian Government, during July 2025, who stated that 26% of prescriptions dispensed the preceding week were e-prescriptions. Individuals in Australia can choose to get an e-prescription sent to their mobile phone or register for the Active Script List. From the Active Script List, participating pharmacies can access e-prescriptions and dispense medicines. If Australians buy their medicines online, they first choose the medicine on the pharmacy's website and then (if the pharmacy is legitimate) provide a valid prescription. So, both Sweden and Australia are investing in digitalisation. Compared to Australia, Sweden has more experience in digitalisation in the pharmacy sector.

Even though digitalisation offers great possibilities, it is important to be aware of the risks as well, for example unauthorised online pharmacies potentially dispensing substandard and falsified medicines.

The ethical approach of person-centred care

According to the Centre for Person-centred Care in Gothenburg, Sweden, "Person-centredness is an ethical standpoint that guides our practical actions as fellow human beings and professionals." (53)

To understand, you need to see healthcare from the individual's point of view. As quoted in the starting point of this thesis, Hippocrates stated that the physician (and other healthcare professionals – author's note) need to understand what has been, what is now, and what lies in the future - not an easy task to accomplish.

To start with, the insight that when an individual requests help from a healthcare professional, the individual always has a reason. It is the professional's responsibility to address this reason in the best way possible for the individual. To do this, the professional needs to understand the reason, not only from a medical point of view but also from the individual's point of view. A way to do this is to carefully listen to the individual's narrative to get a wider understanding. The narrative will elaborate the reason as well as provide additional information, for example earlier bodily experiences and/or information gained from other people or via the Internet. For a healthcare professional, this gives a broader picture of why the individual requested help and a greater chance to find a suitable solution. The solution might be reassuring that everything is alright and that there is no need to worry, maybe the individual has a proposal on how to solve the situation, or perhaps this is a matter that needs medical attention.

Based on the narration, healthcare professionals can then make up a plan together with the individual, where the individual is involved in the decision-making process (54). The plan needs to be followed up on. These are the three steps of person-centred care: the narrative, the partnership, and the health plan.

Barriers to conducting person-centred care in a pharmacy setting are compiled in a commentary by Murry et al. (55). Four areas are presented:

- Missing information and how to collect it
- Inadequate trust, respect, and trustworthy exchange of information
- Organisational culture and clinicians' training, demographics, and beliefs
- Alignment of incentives and other factors from the external environment

Other important aspects are described by Gyllensten et al. (56) “A degree in pharmacy stems from a positivist discipline where scientific evidence is seen as the guiding principle to be adhered to, or the one and only correct truth”. “Yet patients live in a constructivist world as opposed to a positivist world. A constructivist world includes the complex intersections of social life that influence a patient's actions (e.g., medication-taking). Patients' actions or behaviours are a result of their decision-making that is in turn directed by how they experience medications and their relationship with health professionals.”

Paloumpi et al. describe that external and internal stakeholders in the pharmacy market think that since the market of online pharmacies are expected to increase, there is a need for community pharmacies to establish a role based on supporting patients (57). For this task shift, reimbursement based on dispensing volume instead of service quality is not fit for purpose and hinders the community pharmacy workforce in using its expertise to fully benefit society (57). Community pharmacists also expressed concerns that face-to-face consultations are more effective and might be less common if online purchases of medicines increase. A ‘mixed model’ of digital and face-to-face communication was seen as ideal (57).

In the future, a possible scenario is that the roles of online and community pharmacies diverge. Online pharmacies perhaps go towards mainly dispensing medicines in a convenient way, while community pharmacies might take on a wider approach as a healthcare adviser, using a person-centred approach.

Rationale

Approved medicines of high quality are one of the cornerstones of modern healthcare. Substandard and falsified medicines are estimated to kill over one million people globally each year, and the market generates incomes up to \$432 billion per year (58-61). This makes pharmaceutical crime among the world's largest illegal activities, larger than human trafficking, arms sales, and narcotics. The turnover in the Swedish market is estimated at 10 billion SEK and the profits at 4 billion SEK per year (62).

In low- and middle-income countries, at least 10% of the medicines on the market are substandard or falsified (14). In high-income countries, well-functioning exercise of authority ensures that safe medicines of high quality are supplied through authorised pharmacies. Nevertheless, one-third of the people globally lack access to medicines, and medicine shortages are an increasing problem. Medicine shortages are one reason for the emergence of substandard and falsified medicines, and substandard and falsified medicines are often sold in informal markets or online from unauthorised pharmacies (14). Online purchases of medicines are increasing in high-income countries, and whereas digitalisation offers great possibilities, it is important to be aware of the risks as well.

When I started my PhD project, knowledge gaps in literature existed regarding individuals' healthcare-seeking behaviours and healthcare employees' knowledge about substandard and falsified medicines (23). This thesis addresses access to safe medicines, taking the perspective of the user in a high-income setting (Sweden and Australia), focusing on online purchases. Other perspectives are equally interesting and relevant, but do not fall within the scope of this work.

Describing individuals' healthcare-seeking behaviours regarding access to medicines can give insights which will help suggest strategies to ensure the safety of individuals when purchasing medicines online.

Identifying potential knowledge gaps regarding substandard and falsified medicines among pharmacy employees makes it possible to fill the gaps, so pharmacy employees can prevent individuals from unsafe online purchases of medicines.

Usually, medicines are prescribed by a physician, dispensed by a pharmacist, and used by an individual. Our research group is interdisciplinary, and our competencies

makes it possible to take the perspective of the physician, the pharmacist, and the user when planning the research and interpreting the results.

Aims

The overall aim of this thesis is to describe individuals' online purchasing habits of medicine in a high-income setting and to evaluate the knowledge among both the public and the pharmacy employees about safe online purchases of medicines. The findings will be used to help suggest strategies to ensure the safety of people when purchasing medicines online.

Specific aims

- I. To evaluate if community pharmacy employees can guide the public to safe medicine purchases.
- II. To explore purposively selected pharmacists' experience and knowledge about substandard and falsified medicines.
- III. To describe Swedes' online purchasing habits for medicines.
- IV. To describe Australians' online purchasing habits for medicines.

Materials and Methods

This thesis consists of four papers, three papers with a quantitative approach and one paper with a qualitative approach. Papers I and II address community pharmacy employees' knowledge and experience of substandard and falsified medicines, while Papers III and IV address the general population's knowledge and purchasing habits of medicines online. In Table 1, an overview of the four papers is presented.

Table 1. Overview of the papers included in the thesis.

Paper	I	II	III	IV
Study design	Cross-sectional; descriptive	Qualitative	Cross-sectional; descriptive, serial and analytical	Cross-sectional; descriptive and analytical
Participants	Community pharmacy employees (n=228)	Community pharmacy employees (n=12)	General population of Sweden, 18-79 years old (n=6006)	General population of Australia, 18 years or older (n=548)
Data collection method	Digital questionnaire	Semi-structured individual interviews	Digital questionnaire conducted three years in a row	Digital questionnaire
Data collection period	2020	2021	2022 2023 2024	2025
Data analysis	Descriptive statistics	Inductive qualitative content analysis	Descriptive statistics Chi-square test, ANOVA	Descriptive statistics Logistic regression

Study settings, participants and recruitment

The setting for all four studies was a high-income country. Papers I-III were conducted in Sweden, and Paper IV was conducted in Australia.

Paper I

A digital questionnaire was distributed to evaluate whether community pharmacy employees could guide the public to make safe online medicine purchases. Eligible participants were adults, 18 years or older, employed in a Swedish community pharmacy working with patients. At the time data were collected, Sweden had approximately 1400 community pharmacies. Most of the pharmacies (97%) belonged to one of five dominant companies (63). All five companies were contacted during the planning phase, and all five agreed to cooperate. The companies' role was to distribute information regarding the study to their employees, as well as a link to the digital questionnaire. Three of the companies chose to publish the information and the link to the questionnaire on their Intranets, thereby making it possible for all employees within the company to participate. One company chose to send direct emails to their pharmacists responsible for quality and pharmaceutical knowledge, respectively, i.e. a selection of the company's employees had the possibility to participate. The fifth company suffered technical problems during the recruitment phase, and, due to this, no participants from this company could be included. Data were collected between March 9th and April 5th, 2020. All community pharmacy employees responding to the digital questionnaire had the opportunity to express interest in participating in an upcoming interview, i.e. interest in participating in Paper II. No incentive was given to the participants.

Paper II

Individual interviews were conducted with purposively chosen pharmacy employees to explore their experience and knowledge about substandard and falsified medicines. Eligible participants were adults, 18 years or older, employed in a Swedish community pharmacy working with patients. The interviewees were chosen concerning the known variables from Paper I, i.e. sex, size and location of workplace, and years working in a community pharmacy. During each separate interview, the interviewee was asked if they knew anyone else meeting the inclusion criteria who could supply us with valuable information about substandard and falsified medical products, i.e. snowball sampling. Interviews were conducted between May 2021 and September 2021. No incentive was given to interviewees.

Paper III

A digital questionnaire was distributed by Kantar, a multinational research and analysis company (64), to describe Swedes' online purchasing habits for medicines. Kantar annually distributed our questionnaire (three years in a row) with the aim of a minimum of 2000 respondents each year. Kantar has a panel called the SIFO-panel, which is the largest panel in Sweden, with more than 100,000 active members

(65). All panellists were recruited randomly from national population registers to mirror the Swedish population. Eligible participants were adults aged 18-79 years, who were members of the SIFO-panel regardless of whether they had, or had not, bought medicines online. An incentive was given to participants by Kantar (points that could be changed for gift cards).

Paper IV

A digital questionnaire was advertised via Facebook between July 6th and October 20th 2025, aiming to describe Australians' online purchasing habits for medicines. Eligible participants were adults aged ≥ 18 years who were living in Australia, regardless of whether they had, or had not, bought medicines online. A sample size calculation to ensure representativeness gave an estimated sample size of a minimum of 377 participants. Participants who completed the questionnaire could enter a draw with the possibility of winning a gift card.

Procedure

Papers I, III, and IV

The questionnaires used in Papers I, III, and IV were digitalised using different software programs. Paper I was using Sunet Survey on Lund University's server, Paper III by Kantar on their server, and Paper IV was using REDCap on the University of Tasmania's server. The questionnaire in Papers I and III was distributed in Swedish, and the questionnaire in Paper IV in English in accordance with the participants' native language.

The procedure before the digitalisation process was generic. First, the research group adjusted the questionnaire to the target group, after which the questionnaire was reviewed by an outside party for relevance and clarity. Following the review, adjustments were made, and digitalisation occurred. Layout and functionality were tested in the current program before the questionnaire was distributed.

Paper I had a set timeframe of four weeks for answering, Paper III closed when 2000 panellists had answered the questionnaire each year, and Paper IV closed when a minimum of 377 participants had completed the survey.

Convenience sampling was used in Papers I and IV. In Paper III, panellists were stratified by gender, age, and residential area before being invited, as well as after responding to the questionnaire, to mirror the Swedish population.

Due to the public link advertised on Facebook in Paper IV, reCAPTCHA, a survey timestamp, a “honey pot” question, and an attention check question were included to enhance the possibility to identify robots answering the questionnaire (66-68). The timestamp as well as the “honey pot” question were not visible to humans, and the attention check question asked for a pre-specified alternative. If the “honey pot” question was answered, or if the attention check question had the wrong answer or if the time to complete the questionnaire was below 60 seconds, the participant was considered to be a robot and was excluded from analysis.

Paper II

The respondents chose when and where/how the interviews took place. Most interviews were conducted digitally due to geographical distance. All interviews were audio recorded and transcribed verbatim directly after the interview. To validate the content in the transcripts, the recordings were listened to while reading the transcripts. During the interview, a semi-structured interview guide was used. Questions like “What made you interested in participating (own experience, other incident)?” and “What are your thoughts about buying prescription-only medicines online without a prescription?” were asked. These questions were followed by questions like “How did you get this knowledge?”, “What do you mean when you say...?”, “Tell me more about...?”, “What did you think when...?”. The interviews lasted on average 49 min, ranging from 29 to 97 minutes.

Statistical analysis

Papers I, III, and IV

The data were analysed using IBM SPSS (69). In Papers I, III, and IV descriptive statistics were used. In Paper III, ANOVA was used to compare the continuous variable age between non-buyers and buyers of medicines online. Chi-square test was used to compare categorical variables, such as gender, between non-buyers and buyers of medicines online. In Paper IV, univariable logistic regression was used to explore associations between participant characteristics and the likelihood of buying medicines online. An alpha level of 5% was considered significant in Papers III and IV.

Qualitative analysis

Paper II

The analysis of the interviews was conducted continuously, as shown in Figure 3 (70). The steps in the analysis consisted of the following parts: First the proofread transcript was read through several times to get a complete picture of the content. Then units of meaning were identified. The units of meaning could be single words, sentences or sections. These units of meaning were condensed and coded. All codes were sorted into categories. These steps were repeated after each interview, and the codes and categories were evaluated continuously as the content of another interview was added.

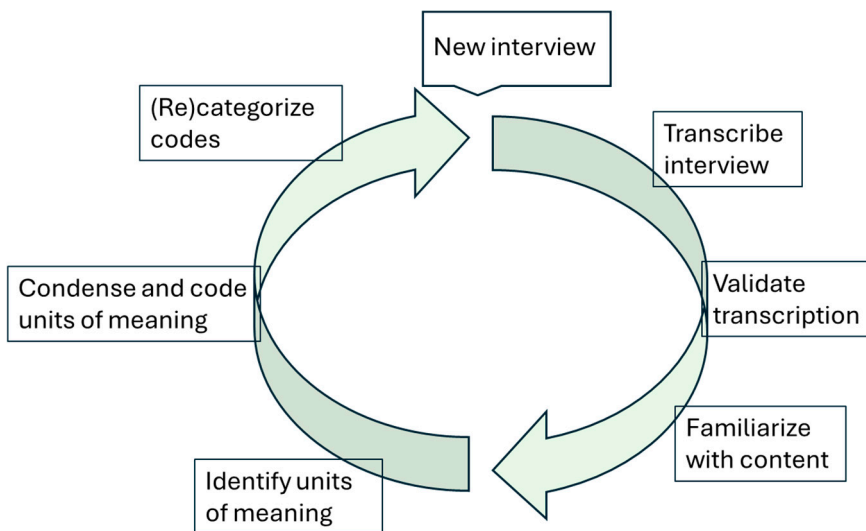


Figure 3. Description of the qualitative analysis

When no new information emerged during the interviews, the content was considered saturated. Two more interviews were conducted to ensure saturation. The preliminary analysis was conducted by me and one of my supervisors separately. If differences were identified, these were solved through discussion. When all interviews had taken place, triangulation was conducted by a third researcher who received all transcribed interviews, the identified and condensed units of meaning, codes, and categories to evaluate the preliminary analysis. Finally, all three researchers discussed the results and made a deeper analysis together to find themes describing the latent meaning of the collected data.

Paper III and IV

Answers to the open-ended questions in Papers III and IV were grouped according to content and tagged with labels inspired by the qualitative analysis process described above.

Data management

Papers I and II

The collected data will be securely stored for 15 years at Lund University.

Paper III

A pseudonymised dataset, where the respondents' identities and postal codes were kept unknown to the researchers, was delivered by Kantar to the research group. All analyses were made by the researchers based on the delivered data. The dataset will be securely stored for 15 years at Lund University.

Paper IV

The collected data will be securely stored for five years at the University of Tasmania, according to local recommendations. The analysed data will be securely stored for 15 years at Lund University.

Ethical considerations

General ethical considerations

All four papers have been performed in accordance with the principles stated in the Declaration of Helsinki (71). All participants received written information about the study and were able to ask questions before deciding whether to participate or not. They were informed that they could always choose to refrain from answering any question or stop participating if they wanted to. All respondents gave their consent to participate.

From an ethical point of view, we have done our very best when data has been analysed and interpreted, as well as when we formulated and presented our gained knowledge to the community. We have also taken precautions so that no participant can be identified or designated.

The first three manuscripts have been written in accordance with the EQUATOR Network “Enhancing the QUALity and Transparency Of health Research” (72). Papers I and III in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement (73), and Paper II in accordance with the Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups (74). Paper IV has been written in accordance with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (75).

Our position is that the included studies in this thesis do not pose any obvious risks to the participants since no intervention took place. As always, when the focus is on knowledge and experiences, some people can feel discomfort if they discover gaps in their knowledge.

Paper I examined the knowledge and experience regarding substandard and falsified medicines of community pharmacy employees in their role as healthcare professionals. The link to the digital questionnaire collecting data was distributed by pharmacy companies, but the companies had no influence on the questions asked or access to the collected data. The pharmacy companies approved that their employees answered the questionnaire during work hours, but no demand or encouragement for participation was communicated.

Paper II explored the knowledge and experience regarding substandard and falsified medicines of purposefully chosen pharmacists. Only those interested in taking part in the interview shared their name and contact information in the questionnaire in Paper I. Most interviews were conducted digitally, and the meetings were secured to include only the interviewer and the interviewee. The interview was relatively time-consuming for the respondents, which was why it was their decision when and where/how the interview took place. Since the sample was small, extra efforts were made to publish only the most important background features and ensure these could not be combined to identify respondents.

Paper III examined the knowledge and purchasing habits of the Swedish public regarding medicines online. Kantar distributed the questionnaire, and surveys conducted by Kantar follow the European Union's General Data Protection Regulation. Data are stored within Kantar for up to two years and only within the European Union/European Economic Area.

Paper IV examined the knowledge and purchasing habits of the Australian public regarding medicines online. The questionnaire was advertised on Facebook, but all data were collected in REDCap on the University of Tasmania's server.

Specific ethical considerations

Papers I and II

An application for ethical review was submitted, and an advisory opinion was requested. The Swedish Ethical Review Authority judged Papers I and II not to require an ethical review according to the Ethics Review Act (reference number 2019-05011).

Paper III

The first survey was approved by the Swedish Ethical Review Authority in October 2021 (reference number 2021-05062) and conducted in 2022. An amendment was approved in March 2023 to conduct the surveys in 2023 and 2024 (reference number 2023-01671-02).

Paper IV

An application for ethical review was submitted both in Sweden and Australia. In Sweden, the survey was approved by the Swedish Ethical Review Authority in February 2025 (reference number 2025-00466-01), and in Australia, an exemption

of ethics review was granted in May 2025 by the University of Tasmania Human Research Ethics Committee (reference number 32122). An amendment was approved in August 2025 to include an incentive (reference number H40161).

Author contribution

All authors contributed to the conception and design of all four papers in this thesis. I wrote the first draft of all four manuscripts, and all co-authors reviewed the drafts. We all read and approved the final version of the manuscripts, making everyone ready to take public responsibility for the content. I have submitted and been the corresponding author for all papers. I have made the revisions during the publishing process, with guidance from my co-authors. I have applied for and received grants which covered parts of the costs during the time I worked on this thesis.

Paper I

The questionnaire had earlier been used in a study addressing physicians' knowledge and experience of substandard and falsified medicines (76). I took part in preparing the questionnaire used in Paper I so it would suit the new target group: community pharmacy employees. The ethics application was submitted by one of my supervisors, addressing both Papers I and II. I digitalised the questionnaire in Sunet Survey with help from Ola Stjärnhagen. Together with one of my supervisors, I invited the five dominant pharmacy companies to an initial meeting aiming to get them onboard. After this, I was the one who stayed in touch with their representatives during the entire process. I analysed the data, and all co-authors discussed the result.

Paper II

I took part in developing the interview guide. I was the researcher reaching out to the community pharmacy employees who had expressed interest in taking part in an interview through Paper I, as well as potential participants who emerged during the interviews. I conducted all interviews and transcribed half of the interviews (the other half was transcribed by Margaretha Svensson). I was one of the researchers conducting the initial analysis.

Paper III

The survey conducted in 2022 had already been carried out when I joined the project “Why do we choose the Internet instead of the doctor next door”. The changes in the questionnaire for the surveys in 2023 and 2024 were discussed by all co-authors. I was involved in the preparations for the amendment regarding the ethical review in 2023. I was responsible for staying in contact with Kantar’s representative during the process for the last survey. Analyses for all three years were made by me under the supervision of Ulf Jakobsson, co-author of this specific paper.

Paper IV

All co-authors took part in the process of adapting the questionnaire from Paper III to the Australian context. We also addressed limitations that had emerged in the Swedish version. I was involved in the preparations both for the ethical review application in Sweden and the application for exemption and the amendment in Australia. I digitalised the questionnaire in REDCap and analysed the data with help from Oliver Stanesby, co-author of this specific paper.

Results

Participants

In Paper I, a total of 228 pharmacy employees answered the survey, and the response rate was calculated to 5%. Most of the participants were pharmacists (89%, 203/228), women (84%, 191/228), and most had 10 or more years of experience working in a community pharmacy (56%, 127/228).

In Paper II, 12 purposefully selected pharmacists were interviewed. Half of the participants were women, and the work experience from community pharmacies ranged from six to 24 years. They worked in smaller and larger pharmacies in urban and rural areas. Most of the participants had previous experience from other pharmaceutical areas such as research, pharmaceutical industry, or authority work.

Paper III collected data for three years in a row, 2022 – 2024. A total of 6006 individuals participated (2022 n=2004, 2023 n=2000, 2024 n=2002), and the response rate was 26%. The participants were equally distributed regarding gender and age, with 50% being women (n=2985/6006), and both mean and median age being 49 years old (mean (SD) 49 (17) and median (IQR) 49 (39) years). Most participants had a post-secondary education (66%, 3942/6006) and most had a monthly income between 1900 – 5000 EUR (60%, 3627/6006).

In Paper IV, a total of 548 individuals gave their consent to participate, of whom 434 completed the survey (79%). Percentages from Paper IV are calculated from valid answers. The majority were women (82%, 356/433), mean age (SD) being 55 (17) years old and a median age (IQR) of 58 (28) years old. Most participants had a post-secondary education (84%, 364/433), and approximately half had a monthly income of \leq 5000 AUD (51%, 196/382).

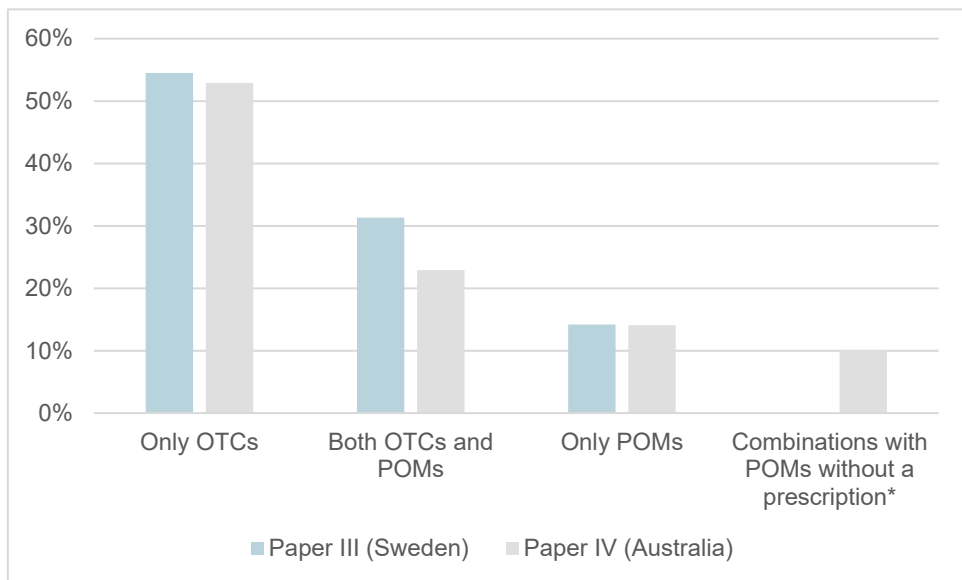
Description of online purchasing habits of medicine in a high-income setting

Proportion

In Paper III, 52% (n=3099/6006) of the participants reported having purchased medicines online in the last 12 months. The corresponding number in Paper IV was 36% (n=170/471). Regarding the pharmacy employees answering our questionnaire in Paper I, approximately half reported having received questions or been shown medicines at work that were not purchased or approved in Sweden in the last 12 months (47%, 108/228).

Type of medicine

Papers III and IV showed that over-the-counter medicines were more frequently bought online than prescription-only medicines, see Figure 4. In Paper IV, 3.6% (n=17/471) reported that they had knowingly bought prescription-only medicines without a prescription online in the last 12 months.



*The alternative Combinations with POMs without a prescription were not available in Paper III. OTCs, over-the-counter medicines. POMs, prescription-only medicines

Figure 4. Distribution of type of medicines purchased in Paper III, n=3099, and Paper IV, n=170.

Demographic features

The mean age (SD) for people buying medicines online in Paper III was significantly lower than that of non-buyers, 47 (17) vs 51 (16) years old, $p < 0.001$. This pattern was also seen in Paper IV, 51 (17) vs 58 (16) years old, $p < 0.001$.

Female gender was significantly associated with online purchases of medicines compared to males in Paper III, $p < 0.001$. No statistical significance could be seen in Paper IV.

A significant association was also seen between respondents in Paper III who had a post-secondary education and online purchases of medicines, compared to respondents whose highest level of education was primary school and their proportion of online purchases of medicines, $p < 0.001$. No statistical significance could be seen in Paper IV.

Purchasing patterns over time and external reasons that possibly can impact them

Most buyers in Paper III, 79% ($n=2440/3099$), reported that external factors did not affect their purchasing patterns of medicines. The corresponding number in Paper IV was 56% ($n=90/160$).

A total of 12% of the buyers ($n=373/3099$) in Paper III reported increased online purchasing habits regarding medicines over the last year due to external reasons. The following reasons were mentioned: convenience and economic factors, health-related factors such as not getting an infection, and a way to secure access to medicines, i.e. better planning. The corresponding number in Paper IV was 28% ($n=45/160$). The main reason for this was cost aspects.

Of the 1.6% ($n=49/3099$) in Paper III, whose online purchasing habits regarding medicines had decreased in the last 12 months due to external reasons, the following reasons were mentioned: the desire to support local pharmacies, together with safety aspects such as the risk of receiving substandard and falsified medicines. The corresponding number in Paper IV was 13% ($n=21/160$).

The interviews with purposefully selected pharmacists in Paper II highlighted their perception that limited access to medicines could be one reason for searching online for medicines. Limited access could include economic factors, the need for a prescription, and medicines being out of stock. Example response below from the published article:

“Melatonin has raised a lot of questions [at the pharmacy]. One patient asked, “Why do I need a prescription? I don’t in Great Britain. And why is it so expensive? It is not addictive” B152.

Another reason that the pharmacists perceived could lead to online purchases was that the individual wanted to be able to choose both medicine and provider. Example response below from the published article:

“I had a dialogue with a patient who had a problem with her thyroid. She had found something from another country, not approved in Sweden. She wanted the physician to apply to the Medical Product Agency to prescribe it [as a special license], but the physician did not think that it was a good idea. So, she bought it from Thailand [...] She decided what she wanted, and then she felt safe” C200.

Regarding that limited access could be a reason for searching online for one’s medicines, we note that most pharmacy employees in Paper I (69%, 158/228) reported that they did not advise the individuals where to buy their prescription-only medicines in case the medicine could not be dispensed at their pharmacy, hence potentially pushing them towards unsafe venues.

Evaluation of knowledge about safe online purchases of medicines

The public

The logo mandatory for authorised online pharmacies within the European Economic Area was recognised by less than 10% of the respondents in Paper III. When a comparison was made between buyers and non-buyers, significantly more buyers recognised the logo, 14% vs 3%, $p < 0.001$. Participants in Paper IV (Australians) did not have the corresponding ability to identify authorised online pharmacies. Participants buying over-the-counter medicines, and prescription-only medicines with a prescription, reported knowing that the medicine they bought online was approved by the Australian government and legal to sell in Australia, 65% and 91% respectively. Regarding the participants reporting to buy prescription-only medicines without a prescription in Paper IV, approximately one-third reported knowing that the medicine they bought online was approved by the Australian government and legal to sell in Australia.

In Paper IV, the participants were asked if they were aware of any safety concerns with purchasing medicines online. Just over half of the participants (57%, 253/444) reported being aware of safety concerns, and 247 provided additional information. Most frequently, they highlighted the risk for substandard and falsified medicines

and the risk of side effects and interactions with other medicines when bypassing advice from health professionals like physicians and pharmacists. The data security concerns with sharing medical and financial details online were also mentioned. No difference could be seen between buyers and non-buyers regarding self-reported safety concerns.

Community pharmacy employees

Of the community pharmacy employees in Paper I, most were familiar with the definition of substandard and falsified medicines (80%, 182/228) but expressed the need for more knowledge (72%, 165/228). The majority (86%, 197/228) identified an authorised online pharmacy with the Swedish national logo (combined with the information that it should redirect you to the Swedish Medical Product Agency and then back to the original website). Fewer chose the European logo as an identifier of an authorised online pharmacy (26%, 59/228) even though this logo is mandatory for all Swedish online pharmacies and identifies authorised online pharmacies throughout Europe.

Suggested strategies to ensure the safety of people when purchasing medicines online

During interviews in Paper II, the following actions to prevent unsafe purchases of medicines online emerged:

Public awareness campaign

The pharmacists suggested a public awareness campaign to increase knowledge about substandard and falsified medicines.

Continued interventions made by authorities

The pharmacists highlighted that authorities, both nationally and internationally, play a major role in preventing substandard and falsified medicines from entering the legal supply chain. Authorities also have a role to play in prioritising medicines for those most in need when supplies are not enough for everyone. The pharmacists' experience was that this was done unknowingly to the patients.

Increased interventions made by pharmacists

The pharmacists also underlined that their profession had an important role to play in guiding patients to safe use and access to medicines. The respondents called for a better framework so they could conduct their core missions, i.e. dispense the most affordable generic medicines to individuals, together with information about how to use the medicines to get the best effect possible. Nowadays, they feel pressured to downgrade the core mission due to the reimbursement model. Below are quotes from the published article that illuminate this:

“Do we [the society] want pharmacies that focus on advising the public about medicines or do we want pharmacies where the employees are forced to sell other products [than medicines to survive economically]? It is not the companies’ fault, forcing the employees to (do) this as I see it; it is the framework from the government” H143

“You need a certain minimum level of competence to maintain patient safety” I146.

“I am in this business to improve safe use of medicines” H145.

Increased communication and cooperation

Building trust, both with the user and other healthcare professionals, emerged from the interviews as an action to prevent unsafe purchases of medicines online, hence promote the use and access of safe medicines. The respondents talked about building trust by listening and asking open-ended questions to users and healthcare professionals instead of judging and questioning. They also highlighted that trust is built when pharmacists and other healthcare professionals cooperate and reinforce each other’s messages, for example explaining to the user/the other healthcare professional why they choose or do not choose to prescribe or dispense a specific medicine.

Discussion

The overall aim of this thesis was to describe individuals' online purchasing habits of medicine in a high-income setting and to evaluate the knowledge among both the public and pharmacy employees about safe online purchases of medicines. The findings will be used to help suggest strategies to ensure the safety of people when purchasing medicines online.

Summary of the main findings

We have shown that a relatively large proportion of people, 18 years or older, have purchased medicines online within the last 12 months, and our results indicate that the proportion will continue to increase. Most participants preferred either community pharmacies or online pharmacies, and younger age was associated with online purchases. Online purchases of medicines can offer advantages, but also risks, especially if medicines are purchased from unauthorised pharmacies. The mandatory European logo for authorised online pharmacies is not well-known, either by the Swedish public or the pharmacy employees, and approximately half of the Australian participants were not aware of any safety concerns when purchasing medicines online. Limited access can be one risk factor that pushes individuals toward unsafe purchases of medicines online, non-inclusive encounter with healthcare is another. Preventive measures can be to increase knowledge about the risk for substandard and falsified medicines from unauthorised online pharmacies, both among the public and healthcare professionals, as well as how to identify an authorised pharmacy online. Employees working in community pharmacies have the possibility to help individuals to access their medicines, but to do this the legal framework, reimbursement system, and communication possibilities with other healthcare providers must change. A person-centred approach can be one way to reach a more inclusive encounter between care-seekers and healthcare professionals.

Using the advantages and avoiding the risks of online purchases of medicines, as well as using the pharmacy employee's competence, could increase patient safety and save resources in healthcare.

Meaning of findings

Online purchases of medicines are a common feature in a high-income setting. The low awareness of safety concerns and how to identify an authorised online pharmacy are risk factors for purchasing unsafe medicines. This means that a lot of people are at risk of fraud when purchasing medicines online.

Since most people have a preference toward either community pharmacies or online pharmacies, one way for healthcare professionals to prioritise people, possibly needing guidance to make safe purchases online, is to ask which purchasing channel they prefer. If online pharmacies are preferred, the next question might be if they know how to identify an authorised online pharmacy in order not to risk ordering substandard or falsified medicines.

The significant association between online purchases of medicines and especially lower age can be used when targeting people in awareness campaigns, aiming to increase knowledge of safe online purchases of medicines. The habit of purchasing medicines online might follow younger individuals as they get older, giving them the opportunity to increase their knowledge before their use of medicines increases with age (77).

Healthcare, including pharmacies, has limited resources and needs to use these wisely. Online pharmacies will likely expand even more in the future, and their advantages should be used, i.e. convenience, economic, health-related aspects, as well as securing access to medicines. Community pharmacies are still vital in the healthcare system for acute medicines and personalised face-to-face services. For pharmacies to be able to relieve other healthcare professionals from the time-consuming task of, for example, medicine shortages, the Swedish legal framework and reimbursement system need to be adjusted for the pharmacy sector.

To avoid risk situations pushing individuals toward unsafe online purchases of medicines, cooperation and communication between individuals, prescribers, and pharmacists needs to improve. One suggestion is a person-centred care approach, together with a digital communication tool between pharmacies and other healthcare facilities.

Methodological considerations, strengths and limitations

General aspects

Good research presents results that are trustworthy, applicable to the context, consistent over time, and without bias (78).

Quantitative and qualitative methods complement each other and are suitable for different research questions (79). Cross-sectional studies are a good way to answer questions about prevalence and describe features of a population (80). They are often used to examine questions which serve as the basis for future studies. Semi-structured interviews, on the other hand, are better suited when it comes to understanding a problem through exploring different perspectives. Cross-sectional studies are quite easy to conduct at a relatively low cost, while semi-structured interviews are more time-consuming both for researchers and participants.

The results of all four papers in this thesis are based on reported and not controlled information. Papers I, III, and IV were cross-sectional studies, only giving a snapshot of reality. Future studies are needed to validate the results.

Using digital questionnaires examining online purchases of medicines might overestimate the proportion of participants buying medicines online since individuals who do not use digital technology could neither answer the survey nor buy medicines online. On the other hand, citizens in Sweden and Australia are highly digital.

Ideally, the study sample in Papers I and IV would have been drawn through randomisation from the target population. Since this was not feasible, convenience sampling was used.

Specific aspects

Paper I

To evaluate if pharmacy employees could guide individuals to safe online purchases of medicine, we chose a descriptive cross-sectional design. By inviting the five dominant pharmacy companies in Sweden to participate, we had the possibility to reach almost 100% of the target population (97% of all Swedish community pharmacies; 1391/1433), hence a high external validity. In 2020, the pharmacy sector had a total of 12,300 employees, 10,300 working in community pharmacies (not all with customer contact) (51). To ensure representativeness, the study needed at least 371 participants (95% confidence level and a margin of error of 5%).

During the recruitment phase, the following events contributed to limitations in the paper:

- The recruitment phase coincided with the outbreak of the COVID-19 pandemic in Sweden. For ethical reasons, we did not send out any reminders to increase participation, giving us a low response rate and a too small sample to ensure representativeness. The response rate cannot be properly calculated since the number of pharmacy employees reached by the information about the study is not known. As the denominator, we used the

total number of employees that the pharmacy companies gave us (n=4900), which likely gives a response rate that is lower than the real figure (5%, 228/4900). Comparing the three pharmacy companies that presented information and link on their Intranet, with the company only inviting specific pharmacists, gives the insight that the response rate was probably higher with a personal invitation to participate than general information on the companies' Intranet.

- One company only invited pharmacists, hence excluded non-pharmacists, contributing to a higher percentage of pharmacists in this study than in pharmacies in general in Sweden. The specific pharmacists were either responsible for pharmaceutical knowledge or qualitative aspects in their pharmacies, which plausibly meant that they possessed more knowledge than the general pharmacy employee. Comparing the sample in the paper to employees in pharmacies in Sweden, the gender distribution of the respondents equals that of pharmacy employees, and so do the locations of the pharmacies where the respondents worked, which increases the trustworthiness. Additional selection bias is also possible, i.e. pharmacy employees with a greater interest in the subject or in research per se may have been more prone to participate.

Taken together, the knowledge described in the results section may be overestimated compared to that of the general pharmacy employee and must be taken into consideration when reading and interpreting the results.

Paper II

To explore purposefully selected pharmacists' experience and knowledge about substandard and falsified medicines, we chose a qualitative approach and conducted semi-structured interviews. Since the interviewees were purposefully selected, the results do not mirror the general pharmacist's knowledge, i.e. the results cannot be generalised. The purpose was to gain rich material that could later be used to enhance the general knowledge of pharmacy employees. A thorough description of the Swedish pharmacy system is provided in the published article to help the reader assess the relevance to their own context. We tried to provide detailed information about the process, from recruitment through analysis to results, to establish trustworthiness. The analysis was initially made independently by two researchers and finally evaluated through triangulation by a third, experienced researcher. The two features that increase the credibility of the study the most are the purposive selection of respondents and the triangulation in the analysis.

Paper III

To describe Swedes' online purchasing habits for medicines, we chose a serial and analytical cross-sectional design. A strength is that we gained access to the SIFO-panel, where panellists are randomly recruited and mirror the Swedish public,

through cooperation with the company Kantar. It would have been desirable to include participants older than 79 years of age as well. Kantar recruited participants and stratified panellists according to gender, age, and postal code before inviting them to participate, as well as after they responded. This gave us a study sample with equal gender and broad age distribution, living both in rural and urban parts of Sweden, suitable to describe Swedes' online purchasing habits for medicines. The information about the study and the link to the questionnaire were sent directly to invited panellists, which gave an acceptable response rate of 26%. A strength in this paper was the serial design, collecting data three years in a row, giving high validity to the results. Another strength was the sample size, with a minimum of 2000 respondents each year.

Analytical cross-sectional studies can only show associations, not causality, and the associations can be difficult to interpret. In this study, there may be a risk of recall bias regarding the question of whether the respondents had bought medicines online in the last 12 months or not, as well as the classification of over-the-counter medicines and prescription-only medicines.

Paper IV

To describe Australians' online purchasing habits for medicines, we chose an analytical cross-sectional design. To our knowledge, this is the first study aimed at investigating the online purchasing habits for medicines in Australia. We recruited participants through an advertisement on Facebook, which meant recruitment was only by convenience sampling. A randomised sampling approach would have given a more representative selection of participants, hence the sample in this study does not mirror the Australian public. We used a public link, which means we could not identify unique visitors, risking duplicates. Due to slow initial recruitment, an incentive was initiated from August 8th, 2025, increasing the risk of robots answering the survey. We tried to counteract this by building in a reCAPTCHA before the survey was opened, a survey timestamp where questionnaires finished in under one minute were excluded, a "honey pot" question only visible for robots, and an attention check question that asked for a specific answer. We designed the study to describe online purchasing habits for medicines, not to compare different groups.

As in Paper III, there may be a risk of recall bias regarding the question of whether the participants had bought medicines online in the last 12 months or not, as well as classification of over-the-counter medicines and prescription-only medicines.

Findings compared to other studies and literature

Description of online purchasing habits of medicines in a high-income setting

Proportion

When describing and comparing the proportion of people purchasing medicines online, it is important to describe what context and sample you are referring to. It is also important to describe other features, like which time frame the proportion refers to, if the word medicines includes both over-the-counter medicines and prescription-only medicines, and whether you are describing only legal purchases or not. According to a global survey conducted in 89 countries in 2022, Sweden had the most visitors to online pharmacies per thousand residents (81). Australia was in eleventh place. A study from Fittler et al., describing other high-income countries in Europe, showed a proportion of online medicine purchases in the same magnitude as in Paper III, 63% in Poland, 49% in Hungary, 47% in the Czech Republic, and 63% in Slovakia (82). Fittler et al. asked if participants had bought medicines online after March 2020 in their questionnaire, which was conducted from May to August 2022, hence a longer timeframe than ours. The participants in the Fittler survey had a lower age, mean (SD) 38 (15) years, compared to participants in Papers III and IV. In these four countries, only over-the-counter medicines can be purchased legally online. Another study performed in Europe by the Alliance for Safe Online Pharmacy in the European Union showed that 56% of the respondents from Sweden stated that they had bought prescription-only medicines online (83). The timeframe which this refers to is uncertain. Other countries taking part in the Alliance for Safe Online Pharmacy's study were Germany, France, Italy and Spain. Most participants, over 90%, in the study from the Alliance for Safe Online Pharmacy, either had a chronic condition or were caregivers to someone with a chronic condition. The proportion of people buying medicines online in Paper IV was lower than the European data. A possible explanation can be that the Australian pharmacy system is not as digitalised, or that the participants were older. Even though the exact proportion of people purchasing medicines online can be uncertain due to several reasons, this shows beyond any doubt that online purchases of medicines are a common feature in high-income countries.

Type of medicine

In both Papers III and IV, it was more common to buy over-the-counter medicines than prescription-only medicines online. To our knowledge, there are no other studies comparing these types of medicines. Statistics from the legal market in Sweden show that over-the-counter medicines are sold online twice as frequently compared to prescription-only medicines, measured in volume (40).

Demographic features

The purpose of investigating whether certain demographic factors were associated with online purchases was to enable prioritisation of those people who possibly needed information about safe online purchases. After receiving data showing how common online purchases of medicines were, the demographic features became subordinate. However, we believe our data is valuable to address the right target group in, for example, a public awareness campaign.

We show that lower age, female gender, and higher level of education are associated with online purchases of medicines in Paper III. The same associations are shown by Roos et al. (84). Only the association with lower age could be reproduced in Paper IV. Too few participants, hence not enough power to compare subgroups, could be one explanation for this. Regarding age and gender, our results in Paper III are also in accordance with a recently published retrospective study from Denmark, which shows that females and patients aged 30-69 years old more often chose online pharmacies for prescription-only medicines, while men and patients over 70 years of age more often chose community pharmacies (85).

Purchasing patterns over time and external reasons that possibly can impact them

In a high-income setting, the highest risk of receiving unsafe medicines is through unauthorised online pharmacies. According to our results, most participants had a preference toward either purchasing medicines in community pharmacies or online, independent of external reasons. Nevertheless, 12% and 28% respectively, of our participants had increased their online purchases of medicines over the last twelve months due to external reasons, indicating an increase in online purchases of medicines. This is in accordance with ECDB for both Sweden and Australia (86-87). ECDB provides e-commerce data and statistics.

Respondents in Paper III reported that online purchases make life easier, i.e. it is a convenient way to access medicines, and it can give economic favours, especially regarding over-the-counter medicines. This is in alignment with the reviews of Almomani and Limbu (88-89). Convenience and economic advantages are features that primarily benefit the individual. From a wider societal aspect, online purchases of medicines can prevent an individual from getting an infection, i.e. staying healthy and be a way to secure access to medicines, i.e. better planning. It is of value to highlight these advantages to save resources in healthcare.

Risk situations for unsafe online purchases of medicines emerged in Paper II. The first risk situation, limited access, is already known as one of the driving factors for substandard and falsified medicines (15) and can be a reason for people to explore the Internet to buy medicines from unauthorised pharmacies (90). Limited access can be, but are not exclusively, due to medicine shortages. Other reasons for limited

access that emerged in Paper II were economic conditions and the need for a prescription for prescription-only medicines.

The other risk situation that was expressed by the interviewed pharmacists was a wish of the people to have a choice. As described by Liu et al. (91), physicians were experienced as medicinal gatekeepers, making it difficult to actively participate. The individuals in Liu's study expressed that they were not taken seriously, even though they were willing to share responsibility with physicians. This is in accordance with Mol et al. (92) who described that dissatisfaction with healthcare is more tightly connected to feelings of being neglected by healthcare professionals rather than about whether they are provided with treatment. This shows that communication is a key feature in preventing unsafe purchases of medicines.

In Paper IV, participants highlighted the risk of getting substandard or falsified medicines when purchasing online, as well as the risk of side effects and interactions with other medicines if healthcare providers were bypassed. This is in line with interviews made by Almomani et al. (93).

Evaluation of knowledge about safe online purchases of medicines

The public

Most of the websites posing as pharmacies online are not authorised and contribute to the spread of substandard and falsified medicines. Hence, it is important to be able to identify authorised online pharmacies to access medicines of good quality. In Europe, one way can be through the mandatory European logo used for authorised online pharmacies.

Paper III convincingly showed that this logo was not well-known by the Swedish public. Similar data has been reported from Germany, France, Italy and Spain (83). On the positive note, the logo was more known by people reporting on buying medicines online than by non-buyers, but there is room for improvement.

Community pharmacy employees

We also show in Paper I that the mandatory European logo was not well known by healthcare professionals working in community pharmacies in Sweden either. On the other hand, the Swedish pharmacy employees had good knowledge about the national logo for authorised pharmacies, which is a valid way to identify authorised Swedish online pharmacies.

Importantly, the unfamiliarity regarding the mandatory European logo for authorised online pharmacies among the public and pharmacy employees does not equal that medicines are bought from unauthorised pharmacies, but it increases the risk of doing so. In summary, the low awareness of how to identify an authorised online pharmacy is a risk factor for purchasing unsafe medicines.

Suggested strategies to ensure the safety of people when purchasing medicines online

Public awareness campaign

To address the knowledge gap regarding the ability to identify an authorised online pharmacy, a public awareness campaign could be a first approach. This was suggested by the respondents in Paper II. A public awareness campaign could reach a large audience at a relatively low cost, although exposure to the main message is incidental and generally passive (94). Several public awareness campaigns have been conducted or are ongoing, for example Fight the Fakes and One Pill Can Kill (95-96). As concluded by Wakefield et al., the outcome of a public awareness campaign is maximised if it is combined with complementary actions (94). Wakefield et al. also highlight that a repeated message enhances the effect of the campaign. Therefore, we recommend that healthcare professionals, including pharmacy employees, be kept informed about the purpose and goal of a public awareness campaign before it is launched. This will both prepare healthcare professionals so that they can enhance the message when the campaign is running and increase their own knowledge if needed.

We initiated a smaller local public awareness campaign during the autumn of 2025 in the region of Scania, Sweden, where citizens could see information regarding safe online purchases of medicines on buses and trains. This was preceded by a larger national campaign by the Swedish Government and the Swedish Medical Product Agency, and hence repeated and hopefully enhanced the message. The Swedish Medical Product Agency has suggested a follow-up campaign to the government, and we will also work towards repeating the local campaign.

Increased interventions made by pharmacists

A more active way than, and a complement to, a public awareness campaign to prevent unsafe purchases of medicines from unauthorised pharmacies is to implement knowledge in healthcare. Healthcare professionals could then advocate for how to identify an authorised online pharmacy with safe medicines. Healthcare professionals can also proactively work to prevent the above-described risk situations through a person-centred care approach. Results from Paper I show that it is relatively common that people ask for advice in community pharmacies about medicines purchased through other channels than the legal Swedish ones, giving an opportunity to guide people to safe purchases of medicines.

Limited access to medicines is often first discovered when the individual tries to retrieve the medicine, in a community pharmacy or an online pharmacy. In a community pharmacy, the pharmacist then has a direct possibility to communicate with the individual and together find a suitable solution, i.e. person-centred care. On

the other hand, if the individual tries to buy the medicine online, he or she is more alone in the decision-making process on how to handle the situation.

In Paper II, the pharmacists emphasised their role in securing access to safe medicines. The pharmacists' role in preventing the spread of substandard and falsified medicines has earlier been highlighted by, for example, Ferrario et al., and Law et al. (97-98). The role of the pharmacist was also touched upon in Paper IV, where it was mentioned that bypassing professionals like physicians and pharmacists might increase the risk of side effects and interactions with other medicines. The pharmacist's role was not discussed in Paper III. A possible reason is that the roles and responsibilities for pharmacies and pharmacists are not well-known by the public, hence there is room for development.

Managing medicine shortages in pharmacies is time-consuming as shown by Beuriot et al. (39). Time spent on finding a solution has economic consequences for the pharmacy because the current reimbursement system is based on dispensing volume instead of service quality. This might be one reason why the respondents in Paper I reported not advising patients where to access the requested medicine that the pharmacy could not dispense, i.e. possibly driving the individual toward unsafe purchases of medicines. One way to reduce time consumption is to involve the person concerned - he or she might have a solution. Communication skills and inclusion of the individual are key. Beuriot et al. also highlight that when pharmacists use their pharmaceutical knowledge to find a suitable solution for the individual, this enhances the value of the pharmacist's role and profession, i.e. clarifies the roles and responsibilities of both pharmacies and pharmacists. We suggest that community pharmacies' assignment and role are strengthened, allowing community pharmacists to take action to ensure that individuals access their medicines.

Increased communication and cooperation

Interprofessional collaboration is defined as "different professional groups working together to positively impact healthcare" according to Zwarenstein, Goldman, and Reeves (99). It is worth mentioning that the patients are on the same level as the professionals in this collaboration (100). According to a review from Bollen et al., a lack of understanding of each other's skills and knowledge poses a challenge to interprofessional collaboration, as do differences in settings, locations and time constraints (101). All these conditions apply to users, pharmacists and prescribers. As described by Chong et al., general practitioners appreciate the existing roles of community pharmacists dispensing medicines and clarifying prescription details, but are less enthusiastic for clinical collaborations with pharmacists because, for example, absence of a shared patient electronic health record (102).

A likely scenario highlighted by both the public, as well as internal and external stakeholders included in Paloumpi's studies, is that online pharmacies will expand

even more in the future, and this can cause a potential lack of personalised services, which may lead to safety issues (43, 57). One conclusion was that with increasing online trade, time could be freed from dispensing medicines in community pharmacies, which pharmacists can use to spend more time on patient care. To facilitate positive interaction between individuals and pharmacists, a question prompt list has been suggested by Ljungberg Persson and Svensberg (103-104). The question prompt list has been described as an eye-opener as to what one could ask the pharmacist. In particular, those with a newly prescribed medicine especially appreciated the question prompt list and the section about how and when to use the medicine. This is in line with the core mission of pharmacies.

Conclusion and possible clinical implications

The key conclusions of this thesis and their clinical implications are:

- Many individuals in high-income countries purchase medicines online, and this is likely to increase. Used correctly, online pharmacies have the possibility to save resources both for the individual, as well as for healthcare.
- There is an existing knowledge gap regarding how to identify an authorised online pharmacy, meaning a lot of people are at risk of fraud, for example, receiving substandard and falsified medicines. Addressing this knowledge gap has the potential to reduce the spread of substandard and falsified medicines and increase patient safety. A public awareness campaign can be a start, but for a long-lasting effect, the knowledge needs to be implemented in healthcare.
- Limited access to medicines, for example medicine shortages, was one risk factor which might push individuals to search and buy medicines outside legal options. Medicine shortages are increasing and are most often discovered at pharmacies. Pharmacists have the possibility to identify individuals whose medicines are out of stock or where access is limited due to other reasons. Pharmacists have the knowledge to find a solution to the situation together with the individual, which will secure access and relieve healthcare. To do this, pharmacists need to be empowered with an adjusted legal framework.
- Not being included in the decision-making process was another risk factor which might push individuals to search and buy medicines outside legal options. Improved communication and collaboration between users, prescribers and pharmacists, for example with a person-centred care approach, may lead to safer access to medicines. This calls for implementation of a platform to share information between the parties.

Future perspectives

My four papers give a basis for future research. Paper I was conducted in 2020, and the European Union's Falsified Medicines Directive was recently implemented. The COVID-19 pandemic affected the world and gave online purchases of medicines a push. My experience is that substandard and falsified medicines have received a lot more attention in different media lately, not only through the national public awareness campaign, and my hypothesis is that pharmacy employees' knowledge and experience of substandard and falsified medicines has increased, as well as knowledge about safe online medicine purchases. I would like to do a follow-up study to get a picture of the current situation. A follow-up study could serve as a basis to design and evaluate a knowledge-enhancing education for pharmacy employees regarding safe online purchases of medicines.

In the political arena in Sweden, discussions are ongoing on how pharmacists' competence can be better used in society. I am following these discussions with interest and hope to be able to contribute through my involvement in the Swedish Pharmacists Association (a trade union). From the perspective of substandard and falsified medicines, limited access to medicines is a key area to address.

A study of adequate statistical power to describe and compare different subgroups of individuals purchasing medicines online, including those purchasing prescription-only medicines without a prescription, would be of value to further target people with the highest risk of buying unsafe medicines online. This kind of study will also give the possibility to follow the proportion of people purchasing medicines online. This quantitative approach could be combined with a qualitative approach to explore why, for example, younger people and females more often use online pharmacies.

Other access roads to retrieve medicines, besides online purchases, would be of value to examine. My main supervisor and I, together with researchers from Linköping, Gothenburg, and Oslo University, are conducting a pilot study regarding how much and what kinds of antibiotics air travellers are bringing into Sweden and Norway. Data are collected and analysed, and we are currently working on the manuscript. Preliminary results will be presented at the Nordic Conference of General Practice in May 2026. Besides by air, travellers are entering our country by sea and land as well. We are currently discussing conducting focus group interviews with customs officers to share their experience in this area.

Together with James Sharman in Australia, we are also planning to do a review regarding substandard and falsified medicines within the area of cardiovascular disease, focusing on hypertension. We want to look at this from two perspectives. “What is published about substandard and falsified cardiovascular medicines?” and “What is published about substandard and falsified medicines giving side effects on the cardiovascular system?”.

Populärvetenskaplig sammanfattning

Läkemedel är potenta produkter vars övergripande syfte är att göra gott genom att förebygga, lindra och bota sjukdom eller symtom på sjukdom. Alla läkemedel kan ge biverkningar hos enskilda individer men för att ett läkemedel ska bli (och förbli) godkänt måste effekten på övergripande nivå överstiga biverkningarna. För att godkända läkemedel ska vara så säkra som möjligt för användaren omges de av ett rigoröst regelverk från forskning och tillverkning tills de når användaren. Den normala gången är att vården rekommenderar eller förskriver ett läkemedel till en individ som köper läkemedlet på ett apotek. Vanligtvis är det en läkare som förskriver läkemedlet och läkaren gör då en helhetsbedömning av individens situation så att läkemedlet ska göra nytta. På apoteket finns ytterligare ett säkerhetsnät där farmaceuter åter igen gör en bedömning så läkemedlet och dosen är rimlig till individen. Farmaceuterna ger även råd kring läkemedelsanvändningen så chansen för bra effekt ökar och risken för biverkningar minskar. Dessutom ger farmaceuterna råd kring förvaring av läkemedel i hemmet så kvaliteten ska bibehållas. Att vissa läkemedel kräver ett recept samt att de endast lämnas ut på apotek av legitimerade farmaceuter är således ett sätt att öka patientsäkerheten vid läkemedelsanvändning.

Begreppet förfalskade läkemedel inkluderar både godkända läkemedel som säljs med kvalitetsbrister, till exempel passerat utgångsdatum, och produkter som inte är godkända läkemedel utan rena förfalskningar. De senare kan innehålla precis vad som helst. Antibiotika är en av de läkemedelsgrupper som oftast förfalskas och om antibiotika säljs med passerat utgångsdatum så innebär det risker både för personen som är i behov av antibiotika på grund av en infektion och för samhället eftersom otillräcklig effekt kan driva på antibiotikaresistensen. På global nivå är förfalskade läkemedel en lukrativ marknad för kriminella. Problematiken har varit störst i låg- och medelinkomstländer där förfalskade läkemedel förekommer även i de legala distributionsleden bland annat på grund av korruption och svag teknisk kapacitet. Höginkomstländer har varit relativt förskonade men i och med ökad e-handel av läkemedel har problematiken expanderat. På nätet uppskattas det finnas ca 35 000 webbsidor vid varje given tidpunkt som utger sig för att vara apotek och sälja läkemedel. Så mycket som 95% är inte lagliga och risken för att få hem förfalskade läkemedel om man handlar från dessa webbsidor är hög. Det är därför viktigt att kunna identifiera ett godkänt apotek på nätet för att handla godkända läkemedel.

I låg- och medelinkomstländer har forskningen fokuserat på att säkra de legala försörjningsleden samt identifiera förfalskade läkemedel. I höginkomstländer är försörjningsleden säkra men här saknas kunskap om de som köper läkemedel utanför de legala kanalerna och varför de väljer att göra det, medvetet eller omedvetet.

Det övergripande syftet med den här avhandlingen är att beskriva handeln av läkemedel på nätet i höginkomstländer samt att utvärdera nuvarande kunskapsläge avseende e-handel av läkemedel hos allmänheten och apoteksanställda. Resultaten ska kunna ligga till grund för att föreslå åtgärder och strategier för att nå en patientsäker e-handel av läkemedel.

I de två första delarbetena låg fokus på apoteksanställda i Sverige medan fokus i de två sista delarbetena låg på invånarna i höginkomstländer, Sverige och Australien.

I delarbete ett undersöktes apoteksanställdas kunskap och erfarenhet av förfalskade läkemedel via en digital enkät. Enkäten spreds av de dominerande apotekskedjorna till sina anställda. De allra flesta som svarade på enkäten kände till förfalskade läkemedel och majoriteten kunde identifiera ett svenskt nätapotek. Däremot var det endast en fjärdedel som angav den obligatoriska EU-symbolen för godkända nätapotek som ett sätt att identifiera ett godkänt europeiskt nätapotek. Cirka hälften uppgav att de fått frågor om eller visats läkemedel som inte köpts på den svenska legala marknaden senaste året vilket visar att allmänheten köper läkemedel via andra inköpskanaler och sen ber om råd på landets apotek. När enkäten genomfördes, våren 2020, svarade två tredjedelar av deltagarna att de inte hänvisade kunderna till andra inköpsställen om de själva inte kunde expediera det förskrivna läkemedlet. Det här innebär en risk för att individen till exempel googlar och köper sitt läkemedel från ett icke-godkänt apotek på nätet med risken att få hem ett förfalskat läkemedel. Apotekspersonalen som svarade på enkäten efterfrågade mer information om förfalskade läkemedel.

I delarbete två valdes deltagarna ut medvetet. Det var önskvärt med olika bakgrund för att få med så många synvinklar av förfalskade läkemedel som möjligt. Eftersom deltagarna var medvetet utvalda kan deras kunskap inte generaliseras till alla farmaceuter utan kan snarare användas för att öka kunskapen kring förfalskade läkemedel inom professionen. Farmaceuterna intervjuades en och en och intervjuerna analyserades noggrant fortlöpande under tiden nya intervjuer genomfördes. När ingen ny information framkom i intervjuerna genomfördes ytterligare två intervjuer för att vara på säkra sidan att all viktig information framkommit. Farmaceuterna förmedlade risksituationer som kan leda till osäkra läkemedelsinköp på nätet, situationer som förebygger osäkra läkemedelsinköp samt åtgärder som de tror kan förbättra situationen ytterligare. Bland annat såg de risker när tillgängligheten av läkemedel var begränsad, till exempel när ett läkemedel var restnoterat eller att individen som skulle använda det hade begränsade ekonomiska resurser. De lyfte även risken för att individer söker andra inköpskanaler om de

upplever att de inte varit delaktiga i beslutsprocessen i vården, till exempel inte blivit lyssnade på. Deltagarna ansåg att myndigheter gör ett gott jobb för att förebygga att förfalskade läkemedel kommer in i de legala försörjningsleden och att de själva som farmaceuter önskar att de kunde göra mer för att öka tillgängligheten av läkemedel. I nuläget kände de sig vingklippta av regelverk och ekonomiska incitament för apoteksbranschen trots att de både ansåg sig ha viljan och förmågan att öka tillgängligheten av läkemedel. De framhöll också att kommunikation och samarbete mellan apotek och vårdgivare har stora förbättringsmöjligheter.

I delarbete tre undersöktes allmänhetens, 18–79 år, köpvänor av läkemedel på nätet. Undersökningen genomfördes tre år i rad i samarbete med Kantar, tidigare SIFO. Varje år tillfrågades minst 2000 svenskar och resultaten visar att varannan person som deltog hade köpt läkemedel på nätet det senaste året men endast var tionde kunde identifiera ett godkänt nätapotek. De flesta köpte receptfria läkemedel med eller utan samtidigt köp av receptbelagda läkemedel. De flesta hade en preferens för att handla på ett öppenvårdsapotek eller via nätet men var tionde uppgav att de handlade mer läkemedel på nätet nu än för ett år sen vilket indikerar att e-handeln av läkemedel fortsatt ökar. De fördelar deltagarna såg med nätapotek var att man kunde handla när som helst på dygnet, att läkemedlen var billigare (receptfria läkemedel) samt att man undvek kringkostnader som till exempel drivmedel. Det framhölls också att man slapp gå in på apotek där man uppfattade att risken för att smittas av en infektion var ökad samt att näthandel gjorde så att man köpte sina läkemedel i tid och på så vis hade bättre framförhållning. Vi tolkar de två första anledningarna, bekvämlighetsaspekter och ekonomiska aspekter som fördelar för individen. De två sistnämnda anledningarna med eventuellt minskad smittspridning och bättre framförhållning ser vi som möjliga aspekter för att spara på vårdens resurser. Deltagarna lyfte även risker med att handla på nätet och nämnde då bland annat förfalskade läkemedel och risken att lokala apotek försvinner. Det framkom att lägre ålder, kvinnligt kön och högre utbildningsnivå var associerade med näthandel av läkemedel. Studien var inte designad för att svara på varför det var så, utan kunde endast visa ett samband.

Det fjärde delarbetet genomfördes i Australien i syfte att samla in data från ett annat höginkomstland än Sverige för att ge en jämförelse. Personer boende i Australien som var 18 år eller äldre hade möjlighet att delta. Information om studien spreds via Facebook och genomfördes vid ett enstaka tillfälle. Antalet deltagare var lägre än i delarbete tre vilket innebär att jämförelser mellan grupper är svårare att genomföra. Färre personer än i Sverige hade köpt läkemedel på nätet senaste året, ca en tredjedel i delarbete fyra jämfört med varannan i delarbete tre. Cirka hälften kände till säkerhetsaspekter kopplade till näthandel av läkemedel och bland annat uppgavs risken för förfalskade läkemedel, att man inte använder vårdens och apotekens kompetens när man handlar på eget bevåg på nätet samt risken för identitetskapning på nätet. Även här var det vanligast att man köpte receptfria läkemedel. Vi hade lagt till frågor om köp av receptbelagda läkemedel utan recept

och cirka 10% av alla som köpte läkemedel på nätet uppgav att de hade köpt receptbelagda läkemedel utan recept. Även här såg vi ett samband med lägre ålder och e-handel av läkemedel samt att deltagarna oftast hade en preferens för antingen öppenvårdsapotek eller nätapotek. Högre andel uppgav att de handlade mer på nätet nu än för ett år sen jämfört med den svenska studien.

Sammantaget visar de fyra delarbetena att många handlar läkemedel på nätet men att kunskapsluckor finns när det gäller säkra inköp av läkemedel på nätet. Näthandel erbjuder fördelar för både individ och samhälle men även risker. I höginkomstländer som Sverige är begränsad tillgänglighet av läkemedel en riskfaktor tillsammans med ett icke personcentrerat bemötande i vården. Farmaceuter har både möjlighet och kompetens för att öka tillgängligheten av läkemedel men är i nuläget begränsade av det lagliga ramverket. Ett ökat samarbete mellan läkemedelsanvändare, apotek och vård skulle troligen gagna alla inblandade, inte minst läkemedelsanvändarna.

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Epilogue

I became a PhD student in late 2019. Since then, my absolute opinion is that the debate about substandard and falsified medications has risen on the societal agenda. I am not suggesting that this is due to my work or personality, but I believe it highlights the importance of the subject. I am proud if I have touched a few people during discussions or with my lectures. My goal is that no one buys substandard or falsified medications online by accident.

During my PhD studies, I have felt immensely privileged. I have been treated with so much respect and humility, despite my juniority. People have shared their experience with me and invited me to discussions. They have listened to my opinions and given me theirs. Always friendly. Due to the interdisciplinary work my PhD time included, I have evolved as a human being. Seeing things from a different perspective always gives new insights.

As a side effect, my time as a PhD student has made me think a lot about communication and collaboration. It has made me think about what role pharmacies and pharmacists have and can have. If my thesis can be inspirational in other areas, not only regarding access to high-quality medicines, it would be a blessing. I believe pharmacists are an underutilised force in our society. This underutilisation needs to be given quite a lot of thought, otherwise we will waste resources. In my opinion, we need to discuss what role a pharmacist in a community pharmacy has and how that role can evolve and maybe be different in other workplaces with other conditions. These discussions can fly high if they are conducted with respect to all stakeholders, where everyone truly listens to one another. Using the knowledge of pharmacists will benefit all stakeholders in the field of pharmaceuticals, not least the individuals in need of medicine. As always, there is more that can be improved!

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AMELIE PERSSON is a clinical pharmacist at Skåne University Hospital. Her thesis describes individuals' online purchasing habits of medicine in a high-income setting, and evaluates the knowledge among the public and the pharmacy employees about safe online purchases of medicines. The studies show that online purchases of medicines are common and that knowledge gaps regarding safe online purchases of medicines exist. Overall, increasing knowledge about safe online purchases of medicines in society may help to save resources for individuals and healthcare, as well as increase medication safety by using the advantages and avoiding the risks when purchasing medicines online.



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