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A review of medicines reuse: thematic analysis and metaphors of return economies

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Highlights

Medicines reuse is reviewed out of the supply chain context.

Metaphors of reuse are proposed as circularity and shareness.

Behavioural aspects dominate emerging literature on reuse.

Circular economy is a poor metaphor for medicines reuse.

Sharing/collaborative economy are fruitful metaphors of reuse.

Abstract

This paper provides a literature review on medicines reuse explaining how this phenomenon has evolved and has being re-interpreted in academic research. Literature review in combination with a descriptive and a qualitative thematic analysis was employed to answer two questions: (i) How the medicines returns phenomenon has been documented and discussed? (ii) To what extent the critical literature on circular and sharing/collaborative economies can be taken as metaphors for the advancement of knowledge to better understand the complexities of medicines returns? After the selection of 125 papers, 10 hubs of collaboration were identified in this research field with early work on reuse stemming from the UK. From the thematic analysis, three outcomes emerged. The first relates to the problem of wastage versus costs and affordability, and the role of stockpiles and misplacement of leftover medicines. The second arises from a chronological description of the selected studies. Using a timeline, recurring debates were identified: prescription costs/sharing; reuse in evolutionary perspective of rational use; affordability and avoidance of wastes; and the role of pharmacists and care in the community/solidary pharmacies. The third outcome delivers metaphors linking critical aspects of circular and sharing/collaborative economies with concepts and situations of medicines reuse. It was found that the circular economy, which is still far from consumer reality, offers a limited contribution as a metaphor for medicines reuse, while sharing/collaborative economy reflects current practices that can be understood as access giving, thus interpreted as a form of affordability.

Keywords: medicines reuse, circular and sharing economies, community and solidary pharmacies, metaphors.

Introduction

The return of medicines which have not expired and remain sealed or not fully consumed (in end-of-use condition), has been the subject of academic study at least since the end of the 1990's when scholars warned of the large amounts of intact contents that were then sent to non-profit organisations, in order to help persons that could not afford such

products (Mariarcher et al., 1998). Research in several countries has been conducted to investigate the determinants of medicines wastage in homes, infirmaries, clinics, hospitals, and similar places that people use to leave leftovers of such goods (Langley et al., 2005, in UK; Braund et al., 2009, in New Zealand; Thawani et al., 2014, in India; Lv et al., 2021, in China). Excessive stocks formed after purchasing (Mackdrige et al., 2007), irrational prescribing (Çelik et al., 2013), patient death (West et al., 2014), patient stopping medication, and prescription change (Smejkalová et al., 2018) are all mentioned as the main causes of leftover medicines, but it is difficult to isolate each cause as the context, regulatory aspects, place of use, and patient profiles are different.

The rising costs of medicines to individuals and governments cannot be ignored. In the five last years, the price of pharmaceuticals has risen around 20% in OECD countries, 26% in the US, and 40% in Germany (Gamba, 2022). Alshemari et al. (2021) observe that the global costs of purchasing medication have grown around 141% in a decade, reaching USD 1.25 trillion in 2019. Countries such as Greece suffer one of the highest costs associated with purchase of medication in the European Union (EU) (Yfantopoulos, 2008). In Japan, at least 20 billion yen per year were considered to be avoidable losses two decades ago if rational medicines use had been fully applied (Kutsuma et al., 2004). In Brazil, little is known about stockpile formation, discharge procedures, affordability and informal recirculation in this field. Exceptions are scattered investigations at regional or local scales (Gargano et al., 2019).

The theme of medicines returns for a new consumption cycle is still marginal in the literature of Pharmaceutical Supply Chains (PSC) except where framed under the pursuit of cost optimisation (Taleizadeh et al., 2020). However, this situation has rapidly changed. In 2018, researchers began to formalise concerns not only on a working conceptualisation on medicines reuse (Alhamad et al., 2018) but on the possibility of framing medicines as a target of the circular economy (Viegas et al., 2019; Alshemari et al., 2021) and sharing (Viegas et al., 2021) or even informal economies running in the public sector locally (Viegas et al., 2022). This new perspective opens space to critically depict the economies of returns - Circular Economies (CE) and Sharing/Collaborative Economies (SCE) - as metaphors for medicines reuse, since the idea of a metaphor is taken as a form of representing the world through shifting the interpretive status (Tseng and Chuang, 2022).

It is widely known that practices such as prescription sharing (PS) (Sheridan et al., 2014), prescription costs sharing (PCS) (Levy, 1992), overstocking and medicines wastage (West et al., 2014) are neither new nor unexplored. Nonetheless, to the extent of the knowledge of this research, such practices are still rarely studied from the point of view of the CE/SCE.

This paper adopts a qualitative-constructivist approach in order to review the literature on medicines returns using a three-step approach. It firstly covers the contradictory problem of wastage versus costs and availability/placement of leftovers or reusable medicines. A timeline of the reviewed studies shows how the research in the field has evolved, highlighting the tendency to focus on behavioural issues in the debate. Finally,

it introduces the CE/SCE concepts and considers their use as metaphors that shed light on medicines returns solutions from the perspective of reuse. The main research question is: How has the medicines returns phenomenon (for a new consumption cycle) been documented and discussed? As a consequence, it is also asked: To what extent can the critical literature on CE and SCE be taken as metaphors to better understand the complexities of medicines returns? The study, thus, intends to unveil what is known on the phenomenon of medicines returns beyond the productivistic perspective of optimisation in pharmaceutical supply chains (PSC). It also aims to depict an agenda of circularity/shareability/collaboration from the perspective of medicines reverse flows. It is structured as follows. After the methodological section (2), the results and discussions are presented in section 3, in four steps as explained in the methodology. Final remarks, limitations, and recommendations for future studies are presented in section 4.

2 Methodological approach

The methodological approach developed for this study took into account the difficulties to select adequate research strategies because the theme of medicines returns is so broad, and it involves different situations and actors across diverse regulatory contexts. According to Seuring and Müller (2008), identifying principal concepts and categories of analysis is recommended in sustainable supply chain review investigation. However, in the current study, the allusion to the ordinary PSC is less important than the emphasis on sustainability, which is implied in the idea of returns of products for reuse. Thus, this review proposes a metaphorical construction as “integrated thoughts” (Tseng and Chuang, 2022: 193) that considers different perspectives on the medicines reuse issues integrated with critical ideas from CE and SCE.

Firstly, a literature review was performed using the Web of Science (WoS) and Scopus databases from June to July 2022 employing 21 search strategies as described in Figure 1. Such strategies were taken as reasonable to investigate the issue of medicines returns from diverse perspectives that involve contexts of use and surplus stocks, prescription issues, places of returns, and pharmaceutical care. The expressions also covered critical aspects of CE and SCE, and the relationships of such economies with the medicines returns phenomena. As these relationships are understudied, recent work that introduces such perspectives, published in an international workshop on sustainability, was added. The criteria chosen for the decisive selection was the potential contributions of the identified papers to answer the research questions.

After reading the selected articles, the main contents and the chronological unfolding of the collected literature were examined. A descriptive analysis of the more prolific authors and their provenance as well as the networks of authorships, were presented. Then, a content analysis was performed through the identification of themes. Thematic analysis focused on the analytical relevance of themes, their meanings, and how they are developed – as described by Vaismoradi et al. (2016). According to these scholars, themes are latent – they can be attributes or elements that make sense for the researcher in the organisation of content analysis. Additionally, categories are explicit descriptors that support the development of themes. It is difficult to objectively distinguish between themes and categories. A subject of analysis can be considered as an objective category under a broader theme, but when framed using a deeper perspective of discussion, for the advancement of knowledge in a given field of study, a category can be taken itself as a theme in construction (Vaismoradi et al., 2016). This dynamic was considered in the current research. Thus, in the organisation of this study, three themes were defined: (i) the problem of costs versus affordability, the localisation of used medicines, ill-defined concepts and evidence of changes in this context; (ii) the chronological evolution of returns studies; (iii) the CE/SCE as metaphors to understand advances related to the returns issues. Figure 2 shows the research questions, summarises the search strategies, selected studies, and describes the themes and respective categories. Each theme corresponds to a subsection of the results.

It is noteworthy that some categories of this second theme (affordability, wastage, reuse) were already presented as part of the first theme. They were revisited to enhance understanding of their significance in the evolution of the medicines returns debate. Also the knowledge gaps added to the solidary pharmacies category mirrors issues of the “evolutionary” studies (category of the third theme), thus a bond is indicated in Figure 2 at the level of both categories. The third theme was a discussion on CE/SCE categories from the perspective of medicines reuse. More than showing critical aspects of such returns economies, the third theme opened space to discuss CE and SCE also as categories represented as metaphors in the field of medicines returns.

3 Results and discussion

In the next subsections (3.1 to 3.4), results and respective discussions of this review are presented. Each subsection after 3.1 corresponds to a theme divided into categories.

3.1 Descriptive analysis

The reviewed studies show prolific knowledge production on medicines returns mainly from countries such as the UK, the US, New Zealand, the Netherlands, and India. Figure

3 presents the number of papers by country, based only on the affiliation of the first author.

Ten hubs of collaboration were identified, with the respective studies and number of citations captured from Google Scholar in October 2022. Taking them in chronological order, the first one is headed by Mackridge with two articles with Marriott, and with Marriott and Langley (UK) about returned and unused medicines (both in 2007, with 105 and 3 citations respectively). The second and the third hubs refer to studies on prescription medication sharing (PS), authored by Goldsworthy (from the US), which heads two articles on this subject, in 2008 (with 125 citations) and 2009 (77), and has Mayhorn as co-author in both papers. The third network (from Australia) is led by Ellis (in 2009, 58 citations; and in 2011, 19) with Mullan co-authoring both works.

The fourth significant set of partnerships appear from 2014 to 2019 guided by Beyene with fellows from New Zealand, mainly Aspden and Sheridan. The studies of this hub are also addressed to the issue of PS, with the following number of citations: 83 (2014), 23 (2016), 6 (2019a), 10 (2019b), and 8 (2019c). With the same subject of study, Markotic (from Bosnia) delivered two studies: in 2016 (9 citations) in association with Puljak (Croatia), and in 2018 (8 citations), with another 13 colleagues from Croatia, including Puljak.

Bekker (from the Netherlands), in the sixth group, has two contributions, in 2017 and 2018 (both with 29 citations), in a network with Gardarsdottir, Egberts, Bouvy, and van den Bemt. These authors investigate redispensation and wastage of medicines.

Studies bringing new perspectives on reuse were boosted through the network of Alhamad, in the seventh hub. This researcher guided four publications: the first in 2018 (24 citations), with Patel and Donyai – all authors affiliated in UK institutions; the second in 2020 (10 citations), with Donyai (Jordan), and Alhamad also linked to the UK and Jordan institutions; the third (6 citations) in 2020 as well, when Alhamad appears affiliated to both UK and Jordanian institutions, and Patel and Donyai to UK universities; and the fourth (13 citations) in 2021, with the same authorship and affiliation as the second one. Within this hub, Donyai (2021, 3 citations)

headed a publication on medication reuse with McCrindle, Hui and Sherrat (all from the UK). Indeed, Hui is the main author of two publications on packaging (2020b, 21 citations) and sensor technologies for medicines quality tracking (2020a, 16 citations) with colleagues from the UK – both papers include Donyai, McCrindle and Sherrat as co-authors.

The eighth network is represented by three articles of Viegas (Brazil) and Bond (UK) in co-authorship with Bertolo and different colleagues from Brazil. The main authors of this group and other collaborators presented a review of end-of-use and end-of-life medicines suggesting the idea of recirculation in 2019 (45 citations), and their following studies, with other authorship (2021 and 2022, no citations) were published in the proceedings of the International Workshop on Advances in Cleaner Production, trying to address the

phenomenon of medicines reuse in Brazil as a type of CE/SCE, and informal economy in the municipal public sector.

The two remaining hubs were guided by Ertz and by Kirchherr, respectively, but they do not refer to medicines, rather than to concepts and classification on CE/SCE that help to understand the reality of the medicines returns. Such studies were selected given their theoretical contribution to the investigation about the ways in which medicines returns for reuse can be institutionalised. Ertz and colleagues from Canada provided ideas and classificatory structures on SCE (2018, 144 citations) and on CE (2019, 27 citations). Kirchherr and co-authors from the Netherlands focused on concepts and framework of the CE (2017, 4007 citations) and the way principles of the CE can be employed (2019, 107 citations). A scheme showing the networks of relationships comprising 98 out of 125 revised references, with focus on medicines returns/reuse, and CE/SCE, is provided in Figure 4. The remaining 27 references do not characterise collaboration networks.

3.2 First theme: the problematic of costs, affordability, reused medicines localisation, wastage

This theme covers four categories: imbalances between costs and acquisition capacity; wickedly placed stocks of medicines; ill-defined concepts that surround medicines returns; evidence of changes in understanding and framing this problem.

3.2.1 Imbalances between costs and acquisition capacity

The rising costs of medicines adversely affects the acquisition capacity of governments and individuals. Pharmaceutical purchasing represent the third-largest expenditure item in health care spending in the OECD countries (Gamba, 2022). British researchers already highlighted the high amounts spent on medicines purchasing by the National Health System – around USD 332 million in 2009 (Alhamad et al., 2020). Production disruption due to pandemics and other external causes raises questions about the resilience of the PSC (Patil et al., 2021).

Acquisition capacity, in the context of medicines, is mainly equated to affordability. There are different understandings of affordability. Abbas et al. (2020) frame it as a part of healthcare in the convergence of availability (the product is available to the patient), accessibility (it is in an accessible place), and acceptability (the patient accepts the product). Magadzire et al. (2014) includes in this list the accomodation factor: when the product offered is aligned with the practical circumstances of the patient. In summary, the focus here is the payment capacity as affordability.

3.2.2 Wickedly placed medicines

The imbalance between increasing costs of acquisition and undermining paying capacity runs simultaneously with the phenomenon of excessive stockpiles of medication in residences, infirmaries, clinics and hospitals – a massive amount of unexpired medicines

that end up being improperly disposed of. Such poor management of potentially reusable medicines has long been documented in many countries. Mariarcher et al. (1998) found that 51% of household medications in Great Britain were unused – more than 75% intact or almost intact. A similar situation was reported in community pharmacies within the UK (Mackridge and Marriot, 2007), and New Zealand (James, 2009). Also, in homes of Saudi Arabia (Al-Syiabi and Al-Ryiami, 2007), Iran (Foroutan and Foroutan, 2014; Jafarzadeh et al., 2021), Indonesia (Pramestutie et al., 2021), India (Begum et al., 2021), Malaysia (Wang et al., 2021), and Ghana (Opore-Ado et al., 2021). Even among nurses or nursing students there are high rates (78% or above) of excessive stocks, as reported by Bashatah and Wajid (2020) in Saudi Arabia. Bonanno (2021), based on estimates from the Health Ministry, observed that Greek citizens were sitting on billions of euros of medications in 2012. Lee and Schommer (2022) reported that 80% of US households keep stored medication for the treatment of chronic diseases.

The lack of standards for the management of purchased medicines in the majority of countries (Tong et al., 2011) is indicated as one of the causes of incorrect destination or inertia regarding the discharge of medicines. The current review found a diversity of causes and contexts involved in the phenomenon of stockpiles, and summarised the results in the Figure 5.

3.2.3 Ill-defined concepts that surrounds medicines returns

Householders have a great responsibility in defining the destination of a significant amount of unused medicines. However, they do not always have clear means and proper knowledge to make adequate choices. The difficulty in differentiating between unused and waste medicines is a significant concern.

Wang et al. (2021: 1) defines unused medicines as those “no longer consumed by the intended users or patients”. Çelik et al. (2013: 162) state unused medicine as that which “is purchased, whether according to a prescription or not, but which is not administrated”. According to Lv et al. (2021: 1) “[u]nused medicine is a medicine that is still before its expiration date, but is no longer taken before its expiration date, has been forgotten in the corner of the family medicine box, and is likely to become an expired medicine”. However, there is no clarity about the concept of medicine waste (West et al., 2014). It can be a purchased over-the-counter product, not totally consumed, or a dispensed one (Çelik et al., 2013). Alhamad et al. (2020: 2), aligned with the understanding of the World Health Organisation (WHO), that states that medicines wastes include “expired, unused, spilt, and contaminated pharmaceutical products, drugs, vaccines and sera”. Under this perspective, unused or no longer consumed medication should be not used anymore.

Another polemic concept is of medicine reuse. Alhamad et al. (2018: 233) offered a working definition but recognised that “[r]euse and recycle remain largely unexplored because unused medicines are not currently permitted to be reused in the UK”. These scholars concluded that the reuse concept remains dependent on addressing people’s concerns, perceptions and behaviours. According to Donyai et al. (2021) reuse can be

framed in diverse contexts, as the reintroduction of the consumption of the medicines brought by the patient to a hospital, or the recycling of medicinal components or packaging in future manufacturing processes, or the repurposing of old drugs for new conditions (Sindhu and Murugan, 2020). Further meanings offered by Donyai et al. (2021) are: redispensing, redistributing, and reverse flow. McRae et al. (2021) add to this list re-issuing and recycling as synonymous, disregarding the idea of recycling as physical and/or chemical transformation, as do Toh and Chew (2017). Campos et al. (2021) consider reuse through the possibility of medicines reassignment in the context of public health entities that transfer part of their batches (excess to demand) to other health entities that identify supply shortcomings. Thus, the concept of medicines reuse is still blurred (Donyai et al, 2021).

3.2.4 Evidence of changes in framing the problem

As observed from the difficulties to reach consensus regarding the reuse concept, there is no common view with respect to reintroducing used (not expired) medicines in a new consumption cycle. In many countries, health regulatory aspects undermine such debates because laws or regulatory instruments follow the understanding of WHO, equating used medicines as wastes. Nonetheless, the awareness on the amounts of not expired stocks of idle medicines has engaged the minds of scholars to rethink this situation. “We consider it appropriate to reopen the debate on the potential for re-using these medicines in developing countries where medicines are not widely available and also within the UK” (Mackridge et al, 2007: 258). Xie and Breen (2014) have also endorsed this idea since the costs involved in the process of redispensing could be acceptable. Historically, little research was produced on this issue (Bekker et al., 2018), but this situation has rapidly changed since 2018. Donyai et al. (2021) highlight that the practice of reusing medicines is a matter of time due to the large amounts of medicines wastage in UK.

3.3 Second theme: timeline of the studies, main issues and evolution

In this subsection, a chronological perspective of the reviewed articles is provided under three categories that emerged from the content analysis: PCS and PS; reuse as an evolutionary debate involving medicines rational use (MRU), medicines affordability (MA) and medicines wastage (MW) reversibility; and pharmacists' role and care (PR/PC) in the context of the community/solidary pharmacies (CSP).

Figure 6 represents the distribution of the reviewed papers according to the sequence of their publication. CE/SCE are weakly represented as incipient issues to be integrated in the prospective discussion on the future of medicines reuse.

3.3.1 PCS and PS

Medicines users can share the costs of buying these types of products, or sharing the use of the products as a common good – although the latter is controversial in terms of health

risks (Alhomoud, 2020), and regulatory compliance (MacFadyen et al., 2001), or even as a conceptual reality (as presented in the debate in subsection 3.4). An early study on PCS retrieved by this research is Levy's (1992: 220), that refers to this practice as "copayments, coinsurance, or deductibles" applied to healthcare systems. Thirty years ago, Levy (1992) observed that PCS could reduce the utilisation of pharmaceuticals in the US leading users to avoid such types of expenditure. This finding was confirmed by Gibson et al. (2005). Research conducted by Noyce et al. (2000) on the comparative effects of PCS in the UK, France, Italy, Germany, the Netherlands, and Austria found that the costs to patients would be higher in some nations and lower in others, thus a consensus did not exist regarding PCS. Goedken et al. (2010) examined the effects of PCS between patients in different insurance situations in the US, and concluded that higher costs are not associated with lower prescription use. Doran et al. (2011), however, indicated that PCS would compromise medicines affordability in Australia. Emmerick et al. (2017) found that the increasing costs of sharing represented a barrier to the popular pharmacy program of chronic diseases medication in Brazil. Mohan et al. (2021) argued that the PCS negatively impacts the elderly in Ireland. Also, a meta-review of Guindon et al. (2022) found that the costs of health services would increase with low drugs costs sharing in Canada. From these studies, PCS shows itself as a controversial practice, very dependent on the health procurement systems.

PS, understood as borrowing, lending, or co-using medicines already in circulation, is not recommended practice by scholars. Ellis and Mullan (2009) reported it as a misbehaviour, although very common among elderly persons in Australia (Ellis et al., 2011). Loans of medications were also reported by Goldsworthy et al. (2008) in the US as a risky but usual behaviour, especially between adolescents (Goldsworthy et al., 2009), and students in Ireland (Goulding et al., 2011).

Lending (giving) or borrowing (taking) of prescription medicines is increasingly reported (Gascoyne et al., 2014). PS are likely to happen when types of medicine are widely known and used (Dohn and Pilkington, 2014), mainly between members of the same family (Markotic et al., 2018; Renny et al., 2019), specifically among youths (Obol et al., 2018). Limited access to medication and sociocultural factors also incentivise PS behaviours (Beyene et al., 2016; Markotic and Puljak, 2016).

The prevalence of large amounts of leftover medicines gives opportunities for borrowing or lending (Beyene et al., 2019a). Concerns on missing doses (Beyene et al., 2019b), persuasion, expectation of product expiry (Beyene et al., 2019c) are common justifications for PS. According to Song et al. (2022: 1) "the reported prevalence of prescription medication lending and borrowing varies by country, ranging from 6% to 23% and from 5% to 52%, respectively". Figure 7 shows the evolution of PCS and PS reviewed articles.

3.3.2 Reuse as an evolutionary aspect of rational use, affordability, and wastage

The ideas around medication reuse have been reclassified in the advancement of knowledge production on medicines rational use (MRU), affordability (MA) and wastage (MW). Figure 6 shows medicine reuse (MR) as an umbrella to MA, MW, and MRU.

Investigations on MRU are presented in studies of Langley et al. (2005), Mackridge and Marriott (2007), Mackridge et al. (2007), Çelik et al. (2013), Thawani et al. (2014), Willeboordse et al. (2014), and Weir et al. (2019). Socioeconomic status can influence MRU (Çelik et al., 2013), but knowledge about the products, respective prices, and treatment procedures are also very relevant (Thawani et al., 2014). Other influencing aspects are patients' participation in medicines choices (Willeboordse et al., 2014) and the intervention of pharmacists (Weir et al., 2019). Figure 8 illustrates the number of studies about PS and MRU, and Figure 9 shows the comparison between MR and MW reviewed articles.

The affordability category (MA) is initially mentioned as a problem affecting the poor, therefore raising an ethical responsibility of the PSC to voluntarily address chronic demands (Leisinger, 2009). Further on, studies included aspects such as physical access to, and availability of, products (Magadzire et al., 2014). The review of Abbas et al. (2020) on MA reasserts the strong relationships between affordability with prices, sharing agreements (PCS) and the importance of more comparative studies in PCS. Figure 10 presents a quantitative summary of MA and MW reviewed studies.

The medicines wastage problem is historically investigated in a fragmented way at the local scale (Mariarcher et al., 1998, Zargazardeh et al., 2005, Ayele and Mamu, 2018). The global assessment of the wasted medicines returns for disposal provided by Tong et al. (2011) shows the confused situation regarding the orientation of consumers on how to deal with leftover medication. Ignorance caused by limited dissemination of the laws on correct destination perpetuates misconduct about losses avoidance (Ariffin and Zakili, 2019). Studies designed to achieve reductions in wastage after a practical intervention (Abahussain and Ball, 2007; Koyanagi et al., 2013) show limited positive results. The problem of treatment abandonment or non-adherence receives little investigation (Chen and Chen, 2015; Smejkalová, 2018).

Tackling losses is highly influenced by household storage as indicated by Jafarzadeh et al. (2021) in their review of the global situation of medicines which are domestically stockpiled. The turnaround from wasting to effective, socioeconomic and ecological, use should involve social media campaigns encouraging the returns through crowdfunding (Begum et al., 2021).

Behavioural inclination to reuse medicines, combined with corresponding research on technical and economic feasibility, has attracted the attention of scholars in recent years. This has culminated in a set of studies that can be labelled as “evolutionary” – because they depart from simple waste awareness to deepen the discussion in diverse stakeholders' arenas on the possibilities of reuse through the interpretive change – recognising the significance of reuse – and through the evolution of tools and devices that enable this change. Such studies (as of Alhamad et al., 2020 and others detailed in

subsection 3.4.2) cover compartmental, attitudinal, cognitive aspects, and likely technical solutions related to the product quality assurance or package attributes.

3.3.3 Pharmacists role/care (PR/PC) and community/solidary pharmacies (CSP)

The understanding of the medicines reuse deployment and dissemination requires a careful examination of the pharmacists' role and alternative institutions where they can work – as the community or solidary pharmacies. Pharmaceutical care refers to the responsibilities of pharmacists in dispensing drugs and following their administration in order to assure the quality of the treatment to a patient (van Mil and Schulz, 2006). Murad et al. (2017) criticise an entirely task-oriented relationship between pharmacists and medication users and instead argue the merits of the development of self-management strategies addressed to patients. According to Bužančić et al. (2021) even deprescription should be part of pharmacists' role in the monitoring of patients.

While retail pharmacies are spaces for dispensation of medicines, community pharmacies are places where medication users receive comprehensive orientation on their use (Kauling et al., 2013), and solidary ones provide services including the reception of surplus medicines and subsequent distribution prior to expiry (Viegas et al., 2021). Solidary pharmacies enable the possibility of reintroducing a used medicine in a subsequent consumption cycle after professional quality inspection and under medical prescription. This approach, although legally forbidden in many countries, has been informally practised through different structures. In Greece, the GivMed initiative, launched in 2016, illustrates an effective scheme linking persons able to give out their surplus medicines using a digital platform to input data that will serve as information to those potential receivers that require medical products they cannot pay for (Alhamad and Donyai, 2020). Similar initiatives were reported by Grasso and Galvin (2010) – a gift giving medication program existing since 1994 in British Columbia, Canada, that inspired the creation of the Supporting Initiatives to Redistribute Unused Medicine (SIRUM) in the US in 2006. Costa et al. (2018) mentioned the Abem Program in Portugal, a pharmacy-based solidarity network between the third sector and other organisations to raise funds for providing free-of-charge medicines to low-income persons. Such programs differ from GivMed basically in organisational structure – the way the Greek program manage digital resources to engage persons – and regarding the stage of the life cycle product that is redispensed. While SIRUM and Abem operate exclusively with new products, GivMed and other redispensing programs accept used, not expired, and visually inspected medication (Islam et al., 2017).

Redispensing medications programs are also working with used not expired products in the Kingdom of Brunei since 2006 (Chauhan et al., 2021). Another way of reusing medicines is the reassignment of unopened packs exclusively among health services, as reported by Lázaro et al. (2020) in Spain, and by Campos et al. (2021), in Brazil. Figure 11 brings a quantitative comparison between studies about pharmacists' role/care and community/solidary pharmacies.

3.4 Third theme: discussion and repositioning of the CE and SCE criticism as metaphors of medicines reuse

This subsection considers critical aspects of the CE and SCE and the way they can be linked to the “evolutionary” studies on medicines reuse to depict metaphors of circularity and sharing in medicines reuse contexts.

3.4.1 Criticisms of CE and SCE

The CE brings as a main idea the advocacy that economic growth can be maintained because natural resources will be managed appropriately to support this growth (Kirchherr et al., 2017). In this sense, CE expresses logical contradictions due to disregarding the physical limits of nature (Hart and Pomponi, 2021). The proposal of a centric governance (Corvelec et al., 2022), and the lack of regulatory aspects in the majority of the countries (Mangla et al., 2018) are hurdles to the performance of CE. Despite being focused on business models (Lahti et al., 2018), CE is seen as a constructivist movement towards sustainability (Genovese and Pansera, 2020) that requires adaptive learning (Marra et al., 2018; Kirchherr and Piscicelli, 2019). However, the capacity to integrate social actors (Sauvé et al., 2016), and to meet the psychological needs of consumers (Singh and Giacosa, 2019) are significant gaps within the CE. Another barrier referred to is feasibility at the local scale (Ddiba et al., 2020). Furthermore, CE is addressed to recycling more than to reusing or repurposing (Inigo and Blok, 2019). It remains unclear how CE can be consolidated (Niskanen et al., 2020). Questions on how society can adopt CE are still open (Chizaryfard et al., 2021).

The CE agenda should incentivise pro-environmental behaviours (Ertz et al., 2019) that would lead the users to product lifetime extension through reutilisation, donations, borrowing and lending, for instance. These are also characteristics of the SCE. Nonetheless much confusion exists around the concepts of CE and SCE.

A diverse body of scholars understand sharing economy as a wide range of collaborative practices enabled by the gig platforms (Ma et al., 2019; Akin et al., 2021) that combine markets and civil society acts (Fraanje and Spaargaren, 2019), in order to allow the recirculation of under-utilised goods (Andreoni et al., 2020). It is a complex, disruptive phenomenon (Gurău and Ranchhood, 2020). Sánchez-Pérez et al. (2021) deem sharing as an old practice (involving gifting through direct exchanges) but sharing economy as a recent phenomenon is also called collaborative economy, collaborative consumption, peer economy, peer-to-peer sharing, access economy. Both sharing and collaborative economies are access-type of economies (Gössling and Hall, 2019).

According to Ertz and Leblanc-Prolux (2018), sharing economy is an inaccurate expression, because the real phenomenon is people sharing goods, not acting economically. This perspective separates the interactions between persons from the economic outcomes of sharing. Belk (2014: 1569) considers sharing as “acts and

processes of distributing what is ours to others for their use and/or the acts and process of receiving or taking something from others to our use”. When sharing takes place, there is neither ownership receiving nor ownership transferring – therefore, sharing is a form of consumption that usually involves practices performed with closed persons, and acts of borrowing or lending are considered “borderline cases of sharing” (Belk, 2014: 1596).

Collaborative consumption, on the other hand, occurs when a group of persons coordinate the acquisition of a good, or the distribution of a resource, using a fee or compensation (Belk, 2014). This assumes diverse forms such as sharing, bartering, lending, trading, renting, swapping, gift giving - which can also be characterised as second hand or sequential sharing, with permanent transferring of the ownership (Yrjöla et al., 2021). In post-consumption activities, collaborative consumption meets typical acts of the CE as reusing, repurposing and recycling (Barbosa and Fonseca, 2019). Figure 12 represents the main CE criticism, SCE ideas, and commonalities between these types of economies.

3.4.2 “Evolutionary” studies on medicines reuse: possibilities and hurdles for reuse

There is a wave of recent research dedicated to unveiling and detailing the barriers and possible solutions for medicines reuse. They have in common the existing legal obstacles to reach this aim and the paucity of data at local scales. These studies are here named “evolutionary” because they surrounded the problem from a variety of stakeholders, theories and scenarios that indicated a diverse range of opportunities to medicines recirculation.

Health professionals deem feasible the reverse flows for a new consumption cycle when packages are unopened, undamaged and with expiry date as equal or above six months (Bekker et al., 2018). Alhamad et al. (2018), when asked how people conceptualise the reuse of medicines, found that interviewees consider some disadvantages, such as the possibility of counterfeit or errors, but the majority believe in the technical capacity of the pharmacists to assure the quality of returned products, and that economic and environmental benefits would justify the returns. The same authors investigated the most common types of returned medicines using data from 26 countries from 2002 to 2020, and provided detailed information on what to observe in terms of quality criteria: humidity, physical shape, and tampering (Alhamad et al., 2020).

Beliefs and norms influence the willingness of medication reuse, and people are prone to embrace the reuse of medicines (Alhamad and Donyai, 2020). Medicine reuse as behaviour is defined as “accepting prescribed medication with more than six months of shelf-life remaining that, as verified by a pharmacist, had been kept untampered for less than three months, under normal storage conditions and in an original sealed blister pack, by another patient before being returned to a community pharmacy” (Alhamad and Donyai, 2021: 8). Chauhan et al. (2021) concluded that patients are more inclined to see medicines as common goods than as strictly regulated products unable to be re-harnessed. Nonetheless, a considerable work towards the improvement of population awareness is necessary to achieving the success of returns initiatives (Lv et al., 2021), because the

knowledge and perception on the problem are uneven. McRae et al. (2021) observe that people tend to rely on the quality of the returned goods when they are checked by the pharmacists, tampered and with its packaging still intact.

A reasonable set of requirements for structuring the returns should include incentives to patients to deliver their medication surplus, as well as incentives for extra work of pharmacists, besides the creation of legal support and the development of specific social norms (Hui et al., 2020a). The introduction of packaging sensors technologies (Hui et al., 2020b; Lam et al., 2021) would significantly increase the adherence to reused medication. However, implementation costs are barriers, and further research about package material looping is necessary (Salmenperä et al., 2022).

Although the research on medicines reuse has qualitatively advanced in the last five years, many gaps remain when the whole picture of the CE and SCE is taken in account. There are scant studies explicitly mentioning or proposing the integration of the CE principles and practices in medicines returns (Viegas et al., 2019; Alshemari et al., 2020), or the ideas of SCE in such respects (Viegas et al., 2021; Viegas et al., 2022). The present review has shown how the medicines returns phenomenon (for a new consumption cycle) has been documented and discussed in its diverse perspective, answering the first research question. It remains open the question “To what extent the critical literature on circular and sharing/collaborative economies can be taken as metaphors for the advancement of knowledge to better understand the complexities of medicines returns?” The next subsection addresses this issue.

3.4.3 CE and SCE critical literature as metaphors for medicines reuse

As seen in previous subsections, medicines reuse comprises a wide range of activities. Metaphors are “embodied thoughts” (Tseng and Chuang, 2022:193) that help to organise the comprehension about how a given phenomenon works. In the current research, critical aspects of CE and SCE are taken as leverages of metaphors to depict the medicines returns phenomena.

Medicines returns out of the routes of PSC are products loops that imply circularities, but do not characterise a CE as a proposal of decoupling natural resources use from economic development (Kirchherr et al., 2017). Thus, the usual concept of CE is not a good metaphor for medicines reuse. From the same perspective, the idea of SCE as a type of economy based on gig-platform intermediation (Akin et al., 2021) does not mirror the ways in which sharing medicines occur – mainly through informal means (Beyene et al., 2014). However, shareability is a possible metaphor to describe the forms through which people share prescriptions or prescription costs. Therefore, the metaphors of CE and SCE addressed to medicines returns can be built in fragmented ways.

CE lacks regulation and it is practically non existent at local scales (Ddiba et al., 2020), while medicines returns are based in local institutions such as community/solidary pharmacies (Viegas et al., 2021), or take place between individuals, informally (Obol et al., 2018), or through solidary initiatives of non-profit intermediaries (Islam et al., 2017).

Therefore, in a regulatory context, CE is definitely not an appropriate metaphor for medicines reuse out of PSC. Another pitfall in taking CE as fully adequate to represent medicines reuse relies on the social aspects, including urban spaces for circularities (Verga and Khan, 2022). The majority of CE critical studies describe it as unable to integrate social actors (Inigo and Blok, 2019), and to fulfil psychological needs of consumers (Singh and Giacosa, 2019). As this review has shown (in subsection 3.4.3), the “evolutionary” studies that attempt to deepen the understanding of the willingness of people to accept the institutionalisation of medicines reuse are underpinned by behavioural theories. Thus, to achieve a circular society (Chyzafard et al., 2021) with respect to medicines reuse, much advancement is necessary to CE statutes and practices.

On the other hand, both CE and SCE target product life extension (Ertz et al., 2019), through reuse or recycling, for instance, or refusing wastage. CE (with emphasis on reuse) or SCE (through several types of movements for valuing used products) contemplate objectives of harnessing used medicines. In this aspect, CE and SCE fit as metaphors of medication reuse.

The debate around the sharing and the collaborative concepts is very fruitful to represent phenomena such as PCS and PS as detailed in this review. Firstly, as a mature practice (Sánchez-Pérez et al., 2021), that enables physical exchanges, sharing happens as PS, when people give (lend) medicines prescribed exclusively for them, or take (borrow) medicine prescribed to someone else (Gascoyne et al., 2014). Such informal movements are metaphorically well represented in the sharing consumption. However, they do not represent a sharing economy itself, as cautioned by Ertz and Leblanc-Prolux (2018), because no economic purpose is behind the sharing act. A view expressed by Belk (2014) is relevant to this metaphor. If ownership is not transferred in sharing as this author argues, then not all types of medicines reuse are exactly sharing acts; borrowing and lending medicines, for instance, can be described as “borderline cases of sharing” (Belk, 2014: 1596). When the ownership is transferred, a gift giving situation takes place (Ertz and Leblanc-Prolux, 2018), although it could be interpreted as sequential sharing (Yrjöla et al., 2021), with no monetary exchanges. Regardless of these details, the sharing acts reflect the access giving that can be understood as affordability (Abbas et al., 2020).

The potential of CSE as a metaphor for medicines reuse is also fulfilled with respect to the collaboration. According to Belk (2014), collaborative consumption happens when people gather efforts and resources to coordinate the acquisition of goods that will be consumed in collaboration. Therefore, collaborative consumption can be sharing, bartering, lending, trading, renting, swapping, gift giving, reuse, and recycling. PCS is a type of collaborative economy for medicines consumption, regardless of the indicated disadvantages (Mohan et al., 2021).

Other feasible metaphors of SCE in the cases of medicines reuse relates to the spaces and knowledge exchanges involved in the reverse flows. With respect to spaces, they can be physical, offered by local public institutions such as the solidary pharmacies (Viegas et al., 2021), or mix physical and non-physical (digital) experiences, such as GivMed (Alhamad and Donyai, 2020). The idea of promoting campaigns to medication returns

through crowdfunding, using digital means (Begum et al., 2021) could arise as an opportune metaphor in terms of SCE. Knowledge exchange in the digital world could be addressed to capacity building in the field of pharmaceutical care (Kauling et al., 2013).

4 Final remarks, limitations and recommendations

This paper performed a review on medicines returns out of the ordinary context of the PSC employing 21 search strategies and selecting 125 studies to describe how this phenomenon has evolved. The research adopted a qualitative-constructivist approach to investigate themes on medicines returns that were deployed in categories. It described in detail the problem of medicines wastage, costs, affordability and recent evolution regarding the behavioural aspects of medicines reuse acceptance. A metaphorical construction that considered different perspectives of medicines reuse issues under CE and SCE criticism was proposed to understand to what extent the critical literature on CE and SCE can be taken as metaphors to the knowledge advancement in relation to the complexities of medicines returns.

The quantitative analysis results showed that prolific knowledge production on medicines returns come mainly from the UK, the US, New Zealand, the Netherlands, and India. The hubs of research collaboration in this field were identified, comprising 98 out of 125 studies. The main results of the qualitative analysis indicate that CE is not a good metaphor for medicines reuse, and that SCE showed itself as a more effective metaphorical resource to the medicines reuse concepts, activities, and structures in the physical and digital worlds.

This study can open doors to future frameworks for circularity and collaboration in the context of reusable medicines, using metaphors as cognitive tools to represent a given structured reality (CE, SCE, for instance) in terms of ordinary phenomenon (such as medicines reuse) that lacks an organised approach. It has as a main limitation the difficulties to summarise the wide range of aspects implied in reuse outside the conventional context of the PSC, considering that medicines reuse is still a controversial debate, and the practices of reuse are widely informal and relatively unstructured. Future studies can reframe the metaphors introduced here in the context of the PSC. Metaphors can be employed to clarify and translate particularities of the recirculation and sharing of medicines from general to local contexts, therefore, they can serve as leverages to introduce norms for CE and SCE at local scales, performing as bridges for a sustainable transition in the dialogue between civil society and the PSC organisations.

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References

- Abahussain, E.A., Ball, D.E. 2007. Disposal of unwanted medicines from households in Kuwait. **Pharm World Sci** 29:368–373, DOI 10.1007/s11096-006-9082-y.
- Abbas, N., Hasan, S.S., Curley, L., Babar, Z.U.D. 2020. Access to medicines – a systematic review of the literature. **Research in Social and Administrative Pharmacy**, V 16, Issue 9: 1166-1176, <https://doi.org/10.1016/j.sapharm.2019.12.009>.
- Akin, D., Jakobsen, K.C., Floch, J., Hoff, E. 2021. Sharing with neighbours: Insights from local practices of the sharing economy. **Technology in Society**, Vol. 64, 2021, 101481, <https://doi.org/10.1016/j.techsoc.2020.101481>.
- Alhamad, H., Patel, N., Donyai, P. 2018. How do people conceptualise the reuse of medicines? An interview study. **International Journal of Pharmacy Practice** : 232-241, doi: 10.1111/ijpp.12391.
- Alhamad, H., Donyai, P. 2020. Intentions to “Reuse” Medication in the Future Modelled and Measured Using the Theory of Planned Behavior. **Pharmacy**, 8, 213; doi:10.3390/pharmacy8040213.
- Alhamad, H., Patel, N., Donyai, P. 2020. Towards Medicines Reuse: A Narrative Review of the Different Therapeutic Classes and Dosage Forms of Medication Waste in Different Countries. **Pharmacy**, 8, 230; doi:10.3390/pharmacy8040230.
- Alhamad, H., Donyai, P. 2021. The Validity of the Theory of Planned Behaviour for Understanding People’s Beliefs and Intentions toward Reusing Medicines. **Pharmacy**, 9, 58. <https://doi.org/10.3390/pharmacy9010058>
- Alhomoud, F. 2020. ‘Sharing may not be caring’ – Prescription medication sharing among adults in Saudi Arabia. **International Journal of Pharmacy Practice**, 28: 255–266, doi: 10.1111/ijpp.12592.
- Alshemari, A., Breen, L., Quinn, G., Sivarajah, U. 2020. Can We Create a Circular Pharmaceutical Supply Chain (CPSC) to Reduce Medicines Waste? **Pharmacy**, 8, 221; doi:10.3390/pharmacy8040221.
- Alsheri, A.A., Ishaki, A.A., Nami, H.A., Cara, A.K., Fasih, M.J., Dossary, I.A., Maqsood, B. 2019. Evaluation of Medicine Return from Wards to Inpatient Pharmacy in Tertiary Care Hospital. **Lat. Am. J. Pharm.** 38 (4): 712-8, ISSN 2362-3853 (on line ed.).
- Al-Siyabi, K., Al-Riyami, K. 2007. Value and Types of Medicines Returned by Patients to Sultan Qaboos University Hospital Pharmacy, Oman. **Sultan Aaboos University Medical Journal**, V 7, N 2: 109-115, Sultan Qaboos University.
- Andreoni, V. 2020. The Trap of Success: A Paradox of Scale for Sharing Economy and Degrowth. **Sustainability**, 12, 3153; doi:10.3390/su12083153.

Ariffin, M., Zakil, T.S.T. 2019. Household Pharmaceutical Waste Disposal in Selangor, Malaysia -Policy, Public Perception, and Current Practices. **Environmental Management**, <https://doi.org/10.1007/s00267-019-01199-y>.

Ayele, Y., Mamu, M. 2018. Assessment of knowledge, attitude and practice towards disposal of unused and expired pharmaceuticals among community in Harar city, Eastern Ethiopia. **Journal of Pharmaceutical Policy and Practice**, 11:27, <https://doi.org/10.1186/s40545-018-0155-9>.

Barbosa, B., Fonseca, I. 2019. A phenomenological approach to the collaborative consumer. **Journal of Consumer Marketing** 36/6: 705–714, DOI 10.1108/JCM-11-2017-2468.

Bashatah, A., Wajid, S. 2020. Knowledge and Disposal Practice of Leftover and Expired Medicine: A Cross-Sectional Study from Nursing and Pharmacy Students' Perspectives. **Int. J. Environ. Res. Public Health**, 17, 2068; doi:10.3390/ijerph17062068.

Begum, M., Rivu, S.F., Al Hasan, M., Nova, T.T., Rahman, M., Alim, A., Uddin, S., Islam, A., Nurnahar, Tabassum, N., Moni, M.R., Roselin, R., Das, M., Begum, R., Rahman, S. 2021. Disposal Practices of Unused and Leftover Medicines in the Households of Dhaka Metropolis. **Pharmacy**, 9, 103, <https://doi.org/10.3390/pharmacy9020103>.

Bekker C.L., Gardarsdottir H., Egberts, T.C., Bouvy, M.L., van den Bemt, B.J. 2017. Redispensing of medicines unused by patients: a qualitative study among stakeholders. **Int J Clin Pharm**. 39(1):196-204, doi: 10.1007/s11096-017-0424-8, Epub 2017 Jan 9. PMID: 28070689.

Bekker, C.L., van den Bemt, B.J.F., Egberts, A.C.G., Bouvy, M.L., Gardarsdottir, H. 2018. Patient and medication factors associated with preventable medication waste and possibilities for redispensing. **International Journal of Clinical Pharmacy** 40: 704–711, <https://doi.org/10.1007/s11096-018-0642-8>.

Belk, R. 2014. You are what you can access: Sharing and collaborative consumption online. **Journal of Business Research**, Vol. 67, Issue 8: 1595-1600, <https://doi.org/10.1016/j.jbusres.2013.10.001> .

Beyene, K.A., Sheridan, J., Aspden, T. 2014. Prescription Medication Sharing: A Systematic Review of the Literature. **American Journal of Public Health**, V 104, N 4: e-15-e-26.

Beyene, K., Aspden, T., Sheridan, J. 2016. Prescription medicine sharing: exploring patients' beliefs and experiences. **Journal of Pharmaceutical Policy and Practice** , 9:23, DOI 10.1186/s40545-016-0075-5.

Beyene, K., Aspden, T., Sheridan, J. 2019 a. Prevalence and predictors of medicine saving and future prescription medicine sharing: findings from a New Zealand online

survey. **International Journal of Pharmacy Practice**, 27: 166–174, doi: 10.1111/ijpp.12480.

Beyene, K., Aspden, T., McNeill, R., Sheridan, J. 2019 b. Modifiable risk factors for prescription medicine sharing behaviours. **Research in Social and Administrative Pharmacy**, V 15, Issue 2: 154-163, <https://doi.org/10.1016/j.sapharm.2018.04.005>.

Beyene, K., Aspden, T., Sheridan, J. 2019 c. Using the Behaviour Change Wheel to explore potential strategies for minimising harms from non-recreational prescription medicine sharing. **Research in Social and Administrative Pharmacy**, V 15, Issue 2: 130-144, <https://doi.org/10.1016/j.sapharm.2018.04.001> .

Bonanno, L. 2021. The Work of Pharmaceuticals in Austerity Burdened Athens. Modes and Practices of Care in Times of Crisis. **Ethnos Journal of Anthropology**, <https://doi.org/10.1080/00141844.2021.2013282>.

Braund R., Gn, G, Matthews, R. 2009. Investigating unused medications in New Zealand. **Pharm World Sci**. Dec 31(6):664-9, doi: 10.1007/s11096-009-9325-9, Epub 2009 Aug 26. PMID: 19707885.

Bužančić, I., Dragović, P., Pejaković, Markulin, L., Ortner-Hadžiabdić, M. 2021. Exploring Patients' Attitudes Toward Deprescribing and Their Perception of Pharmacist Involvement in a European Country: A Cross Sectional Study. **Patient Preference and Adherence** 2021, 15: 2197-2208, doi: 10.2147/PPA.S323846. PMID: 34588769; PMCID: PMC8476111.

Campos, E.A.R., ten Caten, C.S., de Paula, I.C. 2021. End-of-use and end-of-life medicines—insights from pharmaceutical care process into waste medicines management. **Environmental Science and Pollution Research** 28: 58170–58188, <https://doi.org/10.1007/s11356-021-14661>.

Çelik, E., Şencan, M.N., Clark, M.P. 2013. Factors Affecting Rational Drug Use (RDU), Compliance and Wastage. **Turk J. Pharm. Sci.** 10 (1), 15-170, 2013.

Chauhan, M., Alhamad, H., McCrindle, R., Hui, T.K.L., Sherratt, R.S., Donyai, P. 2021. Medicines as Common Commodities or Powerful Potions? What Makes Medicines Reusable in People's Eyes. **Pharmacy**, 9, 88, <https://doi.org/10.3390/pharmacy9020088>.

Chen, I.-C., Chen, L.-C. 2015. A public health survey of expired and waste medicines returns in the long-term care facilities. **Int J Clin Pharm** 37: 179–287, DOI 10.1007/s11096-014-0039-2.

Chizaryfard, A., Trucco, P. Nuur, C. 2021. The transformation to a circular economy: framing an evolutionary view. **Journal of Evolutionary Economics** 31:475–504, <https://doi.org/10.1007/s00191-020-00709-0> .

Corvellec, H., Stoeell, A.F., Johansson, N. 2022. Critiques of the circular economy. **Journal of Industrial Ecology**, 26:421–432, 2022;26:421–432.

- Costa, F.A., Crisóstomo, S., Paulino, E., Martins, A.P. 2018. The social value of pharmaceutical interventions, the Portuguese contribution to sustainable development. **International Journal of Clinical Pharmacy** 40: 937-941, <https://doi.org/10.1007/s11096-018-0685-x>.
- Ddiba, D., Andersson, K., Koop, S.H.A., Ekener, E., Finnveden, G., Dickin, S. 2020. Governing the circular economy: Assessing the capacity to implement resource-oriented sanitation and waste management systems in low- and middle-income countries. **Earth System Governance**, Vol.4, 2020, 100063, <https://doi.org/10.1016/j.esg.2020.100063> .
- Dilip, C., Sayed, M.S., Sameer, P.T., ShesaMajeed, P.K., Shahanas, M.K. 2020. Economic burden of unused medicines and its causes in households of Perinthalmanna region. **Clinical Epidemiology and Global Health**, V 8, Issue 2: 356-360, <https://doi.org/10.1016/j.cegh.2019.09.002> .
- Dohn, M.N., Pilkington, H. 2014. Sharing Medicine: The Candidacy of Medicines and Other Household Items for Sharing, Dominican Republic. **PLOS ONE**, www.plosone.org., V 9, Issue 6: e101007.
- Donyai, P., McCrindle, R., Hui, T.K.L., Sherratt, R.S. 2021. Stakeholder Views on the Idea of Medicines Reuse in the UK. **Pharmacy** 2021, 9, 85, <https://doi.org/10.3390/pharmacy9020085>.
- Doran, E., Robertson, J., Salkeld, G. 2011. Pharmaceutical Benefits Scheme cost sharing, patient cost consciousness and prescription affordability. **Australian Health Review**, 35: 37–44, 10.1071/AH10902 0156-5788/11/010037, <https://www.publish.csiro.au/AH/pdf/AHv35n1toc> .
- Ellis, J.C., Mullan, J. 2009. Prescription medication borrowing and sharing: risk factors and management. **Australian Family Physician**, 38(10), 816-819, PMID: 19893823, <https://ro.uow.edu.au/medpapers/3>.
- Ellis, J., Mullan, J., Worsley, T. 2011. Prescription medication hoarding and borrowing or sharing behaviours in older residents in the Illawarra, New South Wales, Australia. **Australian Journal on Ageing** 457: 119-123, DOI: 10.1111/j.1741-6612.2010.00457.x.
- Emmerick, I.C.M., Campos, M.R., Luiza, V.L., Chavesm L.A., Bertoldi, A.D., Ross-Degnanm D. 2017. Retrospective interrupted time series examining hypertension and diabetes medicines usage following changes in patient cost sharing in the 'Farmácia Popular' programme in Brazil. **BMJ Open**: e017308. Doi:10.1136/bmjopen-2017-017308.
- Ertz, M., Leblanc-Proulx, S. 2018. Sustainability in the collaborative economy: A bibliometric analysis reveals emerging interest. **Journal of Cleaner Production**, Vol. 196: 1073-1085, <https://doi.org/10.1016/j.jclepro.2018.06.095>.
- Ertz, M., Leblanc-Proulx, S., Sarigöllü, E., Morin, V. 2019. Advancing quantitative rigor in the circular economy literature: New methodology for product lifetime

- extension business models. **Resources, Conservation & Recycling** 150: 104437, <https://doi.org/10.1016/j.resconrec.2019.104437>.
- Foroutan B., Foroutan R. 2014. Household storage of medicines and self-medication practices in south-east Islamic Republic of Iran. **East Mediterr Health J.**, 20(9): 547-53. PMID: 25343467.
- Fraanje, W., Spaargaren, G. 2019. What future for collaborative consumption? A practice theoretical account. **Journal of Cleaner Production** 208: 499-508, <https://doi.org/10.1016/j.jclepro.2018.09.197> .
- Gamba, S., Jakobsson, N., Svensson, M. 2022. The impact of cost-sharing on prescription drug demand: evidence from a double-difference regression kink design. **The European Journal of Health Economics**, <https://doi.org/10.1007/s10198-022-01446-w>.
- Gargano, L.P., Almeida, A.C., Ruas, C.M., Lima, M.G. 2019. Disposal of Unused Medicines in Primary Health Care in Brazil: Cost and Profile. **Lat. Am. J. Pharm.** 38 (4): 685-90, ISSN 2362-3853 (on line ed.).
- Gascoyne, A., Beyene, K., Stewart, J., Aspden, T., Sheridan, J. 2014. Sharing prescription medicines: results of a survey of community pharmacy clients in Auckland, New Zealand. **Int J Clin Pharm** 36:1268–1276, DOI 10.1007/s11096-014-0031-x.
- Genovese, A., Pansera, M. 2020. The Circular Economy at a Crossroads: Technocratic Eco-Modernism or Convivial Technology for Social Revolution? **Capitalism Nature Socialism**, doi: 10.1080/10455752.2020.1763414.
- Gibson, T.B., Ozminkowski, R.J., Goetzel, R.Z. 2005. The Effects of Prescription Drug Cost Sharing: A Review of the Evidence. **The American Journal of Managed Care**, V 11, N 111: 730-740, <https://www.ajmc.com/view/nov05-2205p730-740> .
- Goedken, A.M., Urmie, J.M., Farris, K.B., Doucette, W.R. 2010. Impact of cost sharing on prescription drugs used by Medicare beneficiaries. **Research in Social and Administrative Pharmacy** 6: 100–109, doi:10.1016/j.sapharm.2010.03.003.
- Goldsworthy, R.C., Schwartz, N.C., Mayhorn, C.B. 2008. Beyond Abuse and Exposure: Framing the Impact of Prescription-Medication Sharing. **American Journal of Public Health**, V 98, N 6: 115-1121, doi:10.2105/AJPH.2007.123257.
- Goldsworthy, R.C., Mayhorn, C.B. 2009. Prescription Medication Sharing Among Adolescents: Prevalence, Risks, and Outcomes. **Journal of Adolescent Health** 45: 634–637, doi:10.1016/j.jadohealth.2009.06.002.
- Gössling, S., Hall, M. 2019. Sharing versus collaborative economy: how to align ICT developments and the SDGs in tourism? **Journal of Sustainable Tourism**, <https://doi.org/10.1080/09669582.2018.1560455>.

- Goulding, E., Murphy, M., Di Blasi, Z. 2011. Sharing and borrowing prescription medication: a survey of Irish college students. **Ir J Med Sci** 180:687–690, DOI 10.1007/s11845-011-0698-0.
- Grasso, C., Galvin, D. 2009-2010. The Medicine Return Project in Washington State. **Journal of the American Society on Aging**, Generations: Journal of the American Society on Aging 33, N 4: 92–94, <https://www.jstor.org/stable/26555716>.
- Guindon, G.E., Fatima, T., Garasia, S., Khoe, K. 2022. A systematic umbrella review of the association of prescription drug insurance and cost-sharing with drug use, health services use, and health. **BMC Health Services Research** 22: 297, <https://doi.org/10.1186/s12913-022-07554-w>.
- Hart, J., Pomponi, F. 2021. A Circular Economy: Where Will It Take Us? **Circular Economy and Sustainability**, <https://doi.org/10.1007/s43615-021-00013-4>.
- Hui, T.K.L., Mohammed, B., Donyai, P., McCrindle, R., Sherratt, R.S. 2020a. Enhancing Pharmaceutical Packaging through a Technology Ecosystem to Facilitate the Reuse of Medicines and Reduce Medicinal Waste. **Pharmacy**, 8, 58, doi:10.3390/pharmacy8020058.
- Hui, T.K.L., Donyai, P., McCrindle, R., Sherratt, R.S. 2020b. Enabling Medicine Reuse Using a Digital Time Temperature Humidity Sensor in an Internet of Pharmaceutical Things Concept. **Sensors**, 3080; doi:10.3390/s20113080.
- Inigo, E.A., Blok, V. 2019. Strengthening the socio-ethical foundations of the circular economy: Lessons from responsible research and innovation. **Journal of Cleaner Production** 233: 280-291, <https://doi.org/10.1016/j.jclepro.2019.06.053> .
- Islam, M.N., Zavin, A., Srabanti, S., Ferdous, C.N., Suha, S.A., Afroze, L., Shawon, N., Refath, N.S. 2017. GiveMed: A Webportal for Medicine Distribution among Poverty-stricken People. **IEEE Region 10 Humanitarian Technology Conference (R10-HTC)** 21 – 23 Dec, Dhaka, Bangladesh, 978-1-5386-2175-2/17.
- Jafarzadeh, A., Mahboub-Ahari, A., Najafi, M., Yousefi, M., Dalal, K. 2021. Medicine storage, wastage, and associated determinants among urban households: a systematic review and meta-analysis of household surveys. **BMC Public Health**, 21: 1127, <https://doi.org/10.1186/s12889-021-11100-4> .
- James, T.H., Helms, M.L., Braund, R. 2009. Analysis of Medications Returned to Community Pharmacies. **Annals of Pharmacotherapy**, <https://doi.org/10.1345/aph.1M209>.
- Kauling, G.P., Cerettam L.B., Schwalm, M.T., Dagostin, V.S., Soratto, M.T. 2013. Utilização de medicamentos: limites e possibilidades das orientações dos Agentes Comunitários de Saúde às famílias [Drug use: limits and possibilities of the instructions Communitarian Health Agents give to families]. **O Mundo da Saúde**, V. 37, N. 1: 44-55, DOI: 10.15343/0104-7809.20133714455.

- Kirchherr, J., Reike, D., Hekket, M. 2017. Conceptualizing the circular economy: An analysis of 114 definitions. **Resources, Conservation & Recycling** 127: 221-232, <http://dx.doi.org/10.1016/j.resconrec.2017.09.005> .
- Kirchherr, J., Piscicelli, L. 2019. Towards an Education for the Circular Economy (ECE): Five Teaching Principles and a Case Study. **Resources, Conservation & Recycling** 150, 104406, <https://doi.org/10.1016/j.resconrec.2019.104406> .
- Koyanagi, K., Kubota, T., Kobayashi, D., Kihara, T., Yoshida, T., Miisho, T., Saito, Y., Uchigoshi, H., Takaki, S., Shimazoe, T. 2013. SETSUYAKU-BAG Campaign Investigation of Leftover Drugs Retained by Outpatients and Promotion of Proper Reuse Leftover Drugs to Reduce Medical Expenses. **Yakugaku Zasshi** 133 (1) 1215-1221.
- Kutsuma, N., Yamaura, K., Nakayama, M., Namiki, M., Akiba, K., Kimura, S., Ueda, H., Numajiri, S., Kobayashi, D., Morimoto, Y. 2004. Practice for Promoting Proper Use of Reusing the Leftover Medicines in the Outpatients of the Chronic Diseases. **Yakugaku Zasshi** 124 (6): 335-364.
- Lahti, T., Wincent, J., Parida, V. 2018. A Definition and Theoretical Review of the Circular Economy, Value Creation, and Sustainable Business Models: Where Are We Now and Where Should Research Move in the Future? **Sustainability** 10, 2799; doi:10.3390/su10082799.
- Lam, Y., McCrindle, R., Hui, T.K.L., Sherratt, R.S., Donyai, P. 2021. The Effect of Quality Indicators on Beliefs about Medicines Reuse: An Experimental Study. **Pharmacy**, 9, 128, <https://doi.org/10.3390/pharmacy9030128>
- Langley, C., Marriott, J., Mackridge, A., Daniszewski, R. 2005. An Analysis of Returned Medicines in Primary Care. **Pharmacy World and Science**, V. 27: 296-299, DOI: 10.1007/s11096-005-0354-8.
- Lázaro, R.M., Castro, L., Molinero, A., Acosta, J. 2020. Soluciones tecnológicas de las farmacias comunitarias al desabastecimiento de medicamentos: aplicación del modelo colaborativo en red y 'big data' [Technological solutions from the communitary pharmacies to the medicines shortage: application of the collaborative network model and 'big data']. **Farmacéuticos Comunitarios**. 2020 13; 12 (4): 37-46, doi:10.33620/FC.2173-9218.004.05.
- Lee, S., Schommer, J.C. 2022. Medication Use and Storage, and Their Potential Risks in US Households. **Pharmacy** 2022, 10, 27, <https://doi.org/10.3390/pharmacy10010027>.
- Leisinger, K.M. 2009. Corporate Responsibilities for Access to Medicines. **Journal of Business Ethics**, 85:3–23, Springer, DOI 10.1007/s10551-008-9944-4.
- Levy, R.A. 1992. Prescription Cost Sharing Economic and Health Impacts, and Implications for Health Policy. **PharmacoEconomics** 2 (3): 219-237, 1170-7690/92/0009-0219.

- Lv, J., Liu, X., Lay, S. 2021. The Impact of Consequences Awareness of Public Environment on Medicine Return Behavior: A Moderated Chain Mediation Model. **Int. J. Environ. Res. Public Health**, 18, 9756. <https://doi.org/10.3390/ijerph18189756>.
- Ma, Y., Rong, K., Luo, Y., Wang, Y., Mangalagu, D., Thornton, T.F. 2019. Value Co-creation for sustainable consumption and production in the sharing economy in China. **Journal of Cleaner Production**, Vol. 208: 1148-1158, <https://doi.org/10.1016/j.jclepro.2018.10.135>.
- Mackridge, A.J., Marriott J.F. 2007. Returned medicines: waste or a wasted opportunity? **J Public Health (Oxf)**, 29(3):258-62, doi: 10.1093/pubmed/fdm037. Epub 2007 Jun 19. PMID: 17579236.
- Mackridge, A.J., Marriott, J.F., Langley, C.A. 2007. Unused medicines with potential for misuse or abuse in primary care. **The International Journal of Pharmacy Practice**, 15: 229-233, DOI 10.1211/ijpp.15.3.0010.
- MacFadyen, L., Eadie, D., McGowan, T. 2001. Community pharmacists' experience of over-the-counter medicine misuse in Scotland. **The Journal of The Royal Society for the Promotion of Health**, 121 (3): 185-192, doi: 10.1177/146642400112100316. PMID: 11688306.
- Magadzire, B.P., Budden, A., Ward, K., Jeffery, R., Sanders, D. 2014. Frontline health workers as brokers: provider perceptions, experiences and mitigating strategies to improve access to essential medicines in South Africa. **BMC Health Services Research**, 14: 520, <http://www.biomedcentral.com/1472-6963/14/520>.
- Mangla, S.K., Luthra, S., Mishra, N., Singh, A., Rana, N.P., Dora, M., Dwivedi, Y. 2018. Barriers to effective circular supply chain management in a developing country context. **Production Planning & Control**, 29:6, 551-569, <https://doi.org/10.1080/09537287.2018.1449265>.
- Mariacher G.G., Rota M., Hersberger K.E. 1998. Rücklauf ungenutzter Medikamente in Apotheken [Return of unused drugs to pharmacies]. **Praxis (Bern 1994)**. 1998 Oct 21;87(43):1441-3. German. PMID: 9844489.
- Markotic, F., Puljak, L. 2016. Risks associated with borrowing and sharing of prescription analgesics among patients observed by pain management physicians in Croatia: a qualitative study. **Journal of Pain Research** 9: 1143–1151, doi: 10.2147/JPR.S118945. PMID: 27942233; PMCID: PMC5138048.
- Markotic, F., Jurisic, D., Curkovic, M., Puljiz, M., Novinscak, M., Bonassin, K., Vrdoljak, D., Vojvodic, Z., Hajdarovic, P., Pekez-Pavlisko, T., Tomicic, M., Diminic-Lisica, I., Ivsic, S.F., Nejasmic, D., Miosic, I., Novak, I., Puljak, L. 2018. Sharing of prescription analgesics amongst patients in Family practice: Frequency and associated factors. **Eur J. Pain** 22: 716-727, doi:10.1002/ejp.1157.
- Marra, A., Mazzocchitti, M., Sarra, A. 2018. Knowledge sharing and scientific cooperation in the design of research-based policies: The case of the circular economy.

Journal of Cleaner Production, Vol. 194: 800-812,
<https://doi.org/10.1016/j.jclepro.2018.05.164>.

McRae, D., Gould, A., Price-Davies, R., Tagoe, J., Evans, A., James, D.H. 2021. Public Attitudes towards Medicinal Waste and Medicines Reuse in a 'Free Prescription' Healthcare System. **Pharmacy**, 9, 77. <https://doi.org/10.3390/pharmacy9020077>.

Mohan, G., Nolan, A., Moriarty, F. 2021. The Introduction of Cost Sharing for Prescription Drugs: Evidence from The Irish Longitudinal Study of Ageing (TILDA). **The Economic and Social Review**, V 52, N1: 1-40,
<https://www.esr.ie/article/view/1477>.

Murad, M.S., Spiers, J.A., Guirguis, L.M. 2017. Expressing and negotiating face in community pharmacist-patient interactions. **Research in Social and Administrative Pharmacy**, V 13, Issue 6: 1110-1126, <https://doi.org/10.1016/j.sapharm.2016.10.003> .

Niskanen, J., Anshelm, J., McLaren, D. 2020. Local conflicts and national consensus: The strange case of circular economy in Sweden. **Journal of Cleaner Production** 261, 121117, <https://doi.org/10.1016/j.jclepro.2020.121117> .

Noyce, P.R., Huttin, C., Atella, V., Brenner, G., Haaijer-Ruskamp, F.M., Hedvall, M.-B., Mechtler, R. 2000. The cost of prescription medicines to patients. **Health Policy** 52: 129–145, PII: S0168-8510(00)00066-X .

Obol, J.H., Akera, P., Atim, P.O., Awor, S., Wanyama, R., Moi, K.L., Bodo, B., Odong, P.O., Omony, E.O., Oria, H., Musoke, D., Kaducu, F. 2018. Prevalence of borrowing and sharing prescription medicines and associated socio-demographic factors: findings from COBERS health centres in northern Uganda. **BMC Pharmacology and Toxicology**, 19:17, <https://doi.org/10.1186/s40360-018-0206-5>.

Opare-Addo, M.N.A., Marfo, A.F.A., Owusu-Daaku, F.T. 2021. Disposal of leftover and expired medicines by community pharmacies and their clients in Ghana. **Waste Management & Research** 1–7, DOI: 10.1177/0734242X221084060.

Patil, A., Madaan, J., Shardeo, V., Charan, P., Dwivedi, A. 2021. Material convergence issue in the pharmaceutical supply chain during a disease outbreak. **The International Journal of Logistics Management**, DOI 10.1108/IJLM-11-2020-0425.

Pramestutie, H.R., Hariadini, A.L., Ebtavanny, T.G., Illahi, R.K., Ilmi, S.N. 2021. Managing unused, damaged, and expired medications: Knowledge and attitudes among people of Malang, Indonesia. **Journal of Applied Pharmaceutical Science** , V 11 (09): 102-109, DOI: 10.7324/JAPS.2021.110912.

Renny, M.H., Thaker, R.H., Dayan, P.S. 2021. Frequency of and Factors Associated with Prescription Medication Sharing Within Families. **Pediatric Emergency Care**, 1; 37 (12): 599-605. doi: 10.1097/PEC.0000000000001804. PMID: 32773430.

Salmenperä, H. Kauppi, S., Dahlbo, H., Fjäder, D. 2022. Increasing the Circularity of Packaging along Pharmaceuticals Value Chain. **Sustainability** 14, 4715.
<https://doi.org/10.3390/su14084715>.

- Sánchez-Pérez, M., Rueda-López, N., Marín-Carillo, M.B., Terán-Yépez, E. 2021. Theoretical dilemmas, conceptual review and perspectives disclosure of the sharing economy: a qualitative analysis. **Review of Managerial Science**, <https://doi.org/10.1007/s11846-020-00418-9> .
- Sauvé, S., Bernard, S., Sloan, P. 2016. Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research. **Environmental Development**, Vol. 17: 48-56, <https://doi.org/10.1016/j.envdev.2015.09.002>.
- Seuring, S., Müller, M. 2008. From a literature review to a conceptual framework for sustainable supply chain management. **Journal of Cleaner Production** 16: 1699-1710, doi:10.1016/j.jclepro.2008.04.020.
- Sindhu, S., Murugan, S. 2020. Challenges and Opportunities in Repurposing of Drugs: Mini Review. **Bangladesh Journal of Medical Science**, V 19, N 3: 365-371, DOI: <https://doi.org/10.3329/bjms.v19i3.45851>.
- Singh, P., Giacosa, E. 2019. Cognitive biases of consumers as barriers in transition towards circular economy. **Management Decision**, Vol. 57, N 4: 921-936, DOI 10.1108/MD-08-2018-0951.
- Smejkalová J.K.J.K.J.K.T.A.L. 2018. Wastage of medicines and its financial impact on the healthcare system in the Czech Republic. **Ceska Slov Farm**. 18; 67 (5-6):192-199. English. PMID: 30871324.
- Song, S., Kim, S., Shin, S., Lee, Y., Lee, E. 2022. Evaluation of Prescription Medication Sharing Among Adults in South Korea: A Cross-Sectional Survey. **Front. Pharmacol.**, Sec. Drugs Outcomes Research and Policies, <https://doi.org/10.3389/fphar.2022.773454>.
- Taleizadeh, A.A., Haji-Sami, E., Noori-daryan, M. 2020. A robust optimization model for coordinating pharmaceutical reverse supply chains under return strategies. **Annals of Operations Research** 291: 875–896, <https://doi.org/10.1007/s10479-019-03200-7>
- Thawani, V.R., Gharpure, K.J., Sontakke, S.D. 2014. Impact of medicine-related information on medicine purchase and use by literate consumers. **Indian Journal of Pharmacology**, V. 46, Issue 4: 420-424.
- Tong, A.Y.C., Peake, B.M., Braund, R. 2011. Disposal practices for unused medications around the world. **Environment International**, V 37, Issue 1: 292-298, <https://doi.org/10.1016/j.envint.2010.10.002>.
- Toh, M.R., Chew, L. 2017. Turning waste medicines to cost savings: A pilot study on the feasibility of medication recycling as a solution to drug wastage. **Palliative Medicine**, V 31(1) 35–41, DOI: 10.1177/0269216316639798.
- Tseng, M.-Y.; Chuang, S.-W. 2022. Metaphor and creativity in the act of making her heart flutter: Toward a cognitive-emotive perspective. **Journal of Pragmatics** 191: 194-210, <https://doi.org/10.1016/j.pragma.2022.01.013> .

- Vaismoradi, M., Jones, J., Turunen, H., Snelgrove, S. 2016. Theme development in qualitative content analysis and thematic analysis. **Journal of Nursing Education and Practice**, V 6, N 5: 100-110, <http://dx.doi.org/10.5430/jnep.v6n5p100>.
- Van Mill, J.W.F., Schulz, M. 2006. A Review of Pharmaceutical Care in Community Pharmacy in Europe. **Harvard Health Policy Review**, V 7, N 1: 155-168, ISSN: 1533-774X, https://issuu.com/harvardhealthpolicyreview/docs/2006_spring_pharma .
- Verga, G.C., Khan, A.Z. 2022. Space Matters: Barriers and Enablers for Embedding Urban Circularity Practices in the Brussels Capital Region. **Front. Built Environ.**, Sec. Urban Science, <https://doi.org/10.3389/fbuil.2022.810049>.
- Viegas, C.V., Bond, A., Vaz, C.R., Bertolo, R.J. 2019. Reverse flows within the pharmaceutical supply chain: A classificatory review from the perspective of end-of-use and end-of-life medicines. **Journal of Cleaner Production**, Vol. 238, 117719, <https://doi.org/10.1016/j.jclepro.2019.117719> .
- Viegas, C.V., Bond, A., Pedrozo, E.A., Silva, T.N., Bertolo, R.J. 2021. Beyond Circularity: The Reverse Flows of Medicines in Brazilian Solidary Pharmacies as Collaborative Consumption. In: Giannetti, B.F.; Almeida, C.M.V.B.; Agostinho, F. (editors): *Advances in Cleaner Production, Proceedings of the 10th International Workshop*, Ferrara, Italy. November 11th, 2021, http://www.advancesincleanerproduction.net/10th/jpegs/capa_livro_10th.png .
- Viegas, C.V., Bond, A., Coimbra, M., Sartori, A.A. T., Bertolo, R.J. 2022. Informal Economy and Data Availability: Understanding the Recirculation of Medicines in Brazil. In: Giannetti, B.F.; Almeida, C.M.V.B.; Agostinho, F. (editors): *Advances in Cleaner Production, Proceedings of the 11st International Workshop*, Florence, Italy, June, 2022, http://www.advancesincleanerproduction.net/11th/files/proceedings_11th.pdf .
- Wang, L.S., Aziz, Z., Chik, Z. 2021. Disposal practice and factors associated with unused medicines in Malaysia: a cross-sectional study. **BMC Public Health** 21:1695, <https://doi.org/10.1186/s12889-021-11676-x>.
- West, L.M., Diack, I., Cordina, M., Stewart, D. 2014. A systematic review of the literature on ‘medication wastage’: an exploration of causative factors and effect of interventions. **Int J Clin Pharm** 36: 873–881, DOI 10.1007/s11096-014-9981-2.
- Weir, K.R., Bonner, C., McCaffery, K., Naganathan, V., Carter, S.M., Rigby, D., Trevena, L., McLachlan, A., Jansen, J. 2019. Pharmacists and patients sharing decisions about medicines: Development and feasibility of a conversation guide. **Research in Social and Administrative Pharmacy**, V 15, Issue 6: 682-690, <https://doi.org/10.1016/j.sapharm.2018.08.009> .
- Willeboordse, F, Hugtenburg, J.G., Schellevis, F.G., Elders, P.J.M. 2014. Patient participation in medication reviews is desirable but not evidence-based: a systematic literature review. **British Journal of Clinical Pharmacology**, 78:6 / 1201–1216, DOI:10.1111/bcp.12398.

- Xie, Y., Breen, L. 2014. Who cares wins? A comparative analysis of household waste medicines and batteries reverse logistics systems. The case of the NHS (UK). **Supply Chain Management: An International Journal** 19/4: 455–474, DOI 10.1108/SCM-07-2013-0255.
- Yfantopoulos, J. 2008. Pharmaceutical pricing and reimbursement reforms in Greece. **Eur J Health Econ** 9:87–97, DOI 10.1007/s10198-007-0061-6.
- Yrjölä, M., Hokkanen, H., Saarijärvi, H. 2021. A typology of second-hand business models. **Journal of Marketing Management**, 37:7-8, 761-791, <https://doi.org/10.1080/0267257X.2021.1880465>.
- Zargarzadeh, A.H., Tavakoli, N., Hassanzadeh, A. 2005. A Survey on the Extent of Medication Storage and Wastage in Urban Iranian Households. **Clinical Therapeutics**, V. 27, N 6: 970-978, doi:10.1016/j.clinthera.2005.06.023.
- Zhang, L., Atari, M., Schwarz, N., Newman, E.J., Afhami, R.2022. Conceptual metaphors, processing fluency, and aesthetic preference. **Journal of Experimental Social Psychology**, Vol. 98, 104247, <https://doi.org/10.1016/j.jesp.2021.104247>

Journal Pre-proof

Figure 1 – Key expressions, search strategies and number of recovered and selected papers

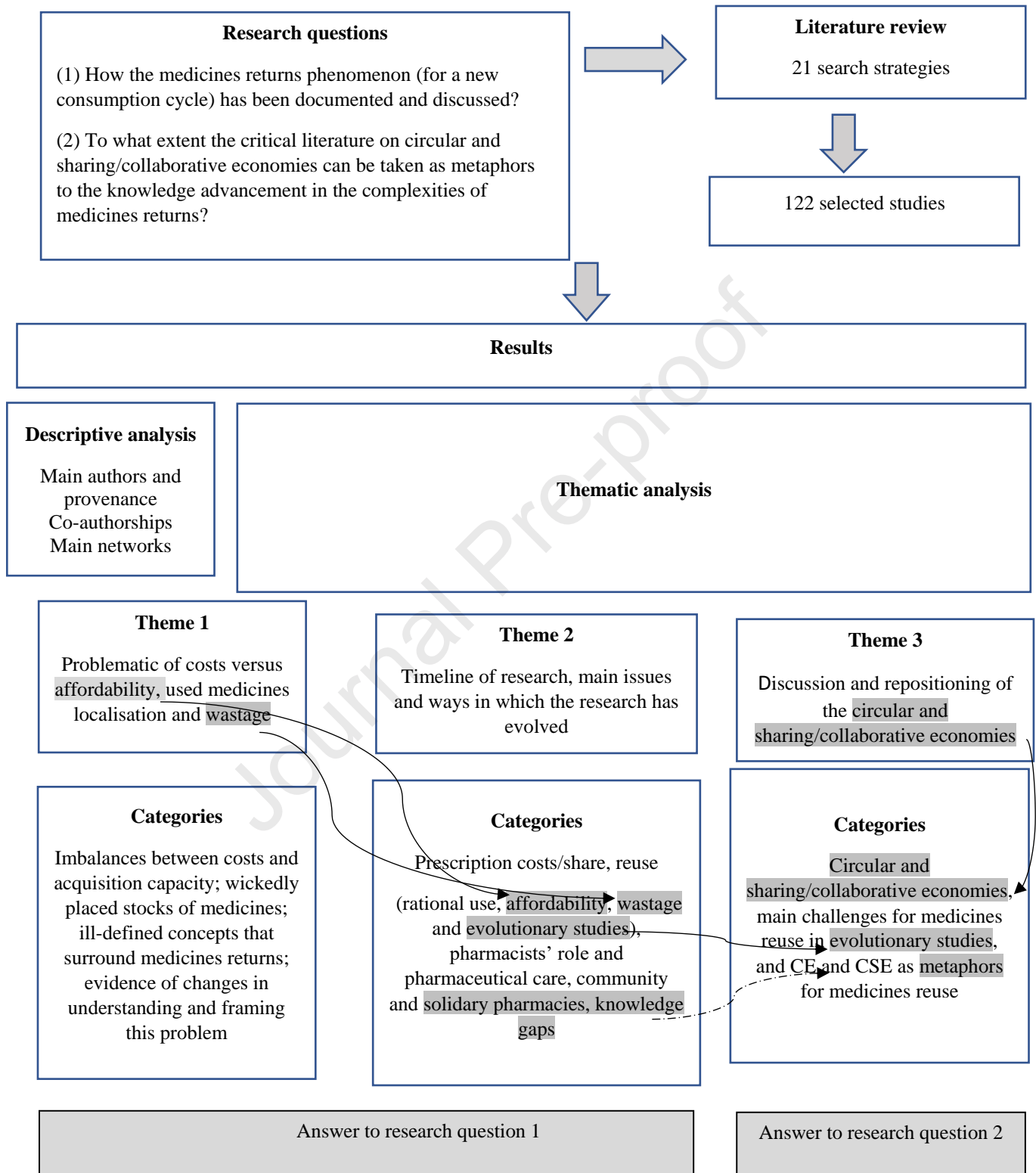
Search strategy	Sources Key expressions	WoS		Scopus		Selected from both WoS and Scopus
		Net results	Selected	Net Results	selected	
#1 (all fields)	“medicines return*”	13	13	144	32	27
#2 (all fields)	“medicines” AND “circular economy”	15	5	2,868	0	9
#3 (title + abstract + keywords)	“medicines” AND “circular economy”	N/A	N/A	56	9	
#4 (all fields)	“medicines” AND “circular*”	127	5	192,002	20	11
#5 (all fields)	“medicines” AND “circularity”	N/A	N/A	3,363	0	
#6 (title + abstract + keywords)	“medicines” AND “circular*”	N/A	N/A	3,238	12	
#7 (title)	medicines” AND “circularity”	N/A	N/A	85	3	
#8 (all fields)	“circular economy” AND “criticism”	11	2	432	25	7
#9 (all fields)	“sharing economy” AND “criticism”	6	0	301	17	9
#10 (all fields)	“medicines” AND “sharing”	547	46	197,414	0	21
#11 (title + abstract + keywords)	“medicines” AND “sharing”	N/A	N/A	7,295	0	
#12 (all fields)	“shar* medicines”	N/A	N/A	71	21	
#13 (title +abstract+ keywords)	“medicines shar*”	N/A	N/A	150	11	
#14 (all fields)	“shar*” AND “prescription”	2,801	32	113,948	0	26
#15 (title + abstract + keywords)	“shar*” AND “prescription”	N/A	N/A	6,814	0	
#16 (title)	“shar*” AND “prescription”	N/A	N/A	128	29	
#17 (all fields)	“leftover medicin*”	19	18	48	29	5
#18 (all fields)	“solidar*” AND “pharmac*”	89	11	5,799	0	5
#19 (title + abstract + keywords)	“solidar*” AND “pharmac*”	N/A	N/A	153	23	
#20 (all fields)	“comunitar*” AND “pharmac*”	16	2	6,246	0	3

#21 (title + abstract + keywords)	“comunitar*” AND “pharmac*”	N/A	N/A	278	40	
(*) Out of databases	“solidary pharmacy” AND “circular economy” AND “sharing economy”	N/A	N/A	N/A	2	2
FINAL RESULTS						125

(*) Added results from emerging research published in the International Workshop on Advances in Cleaner Production (2021-2022).

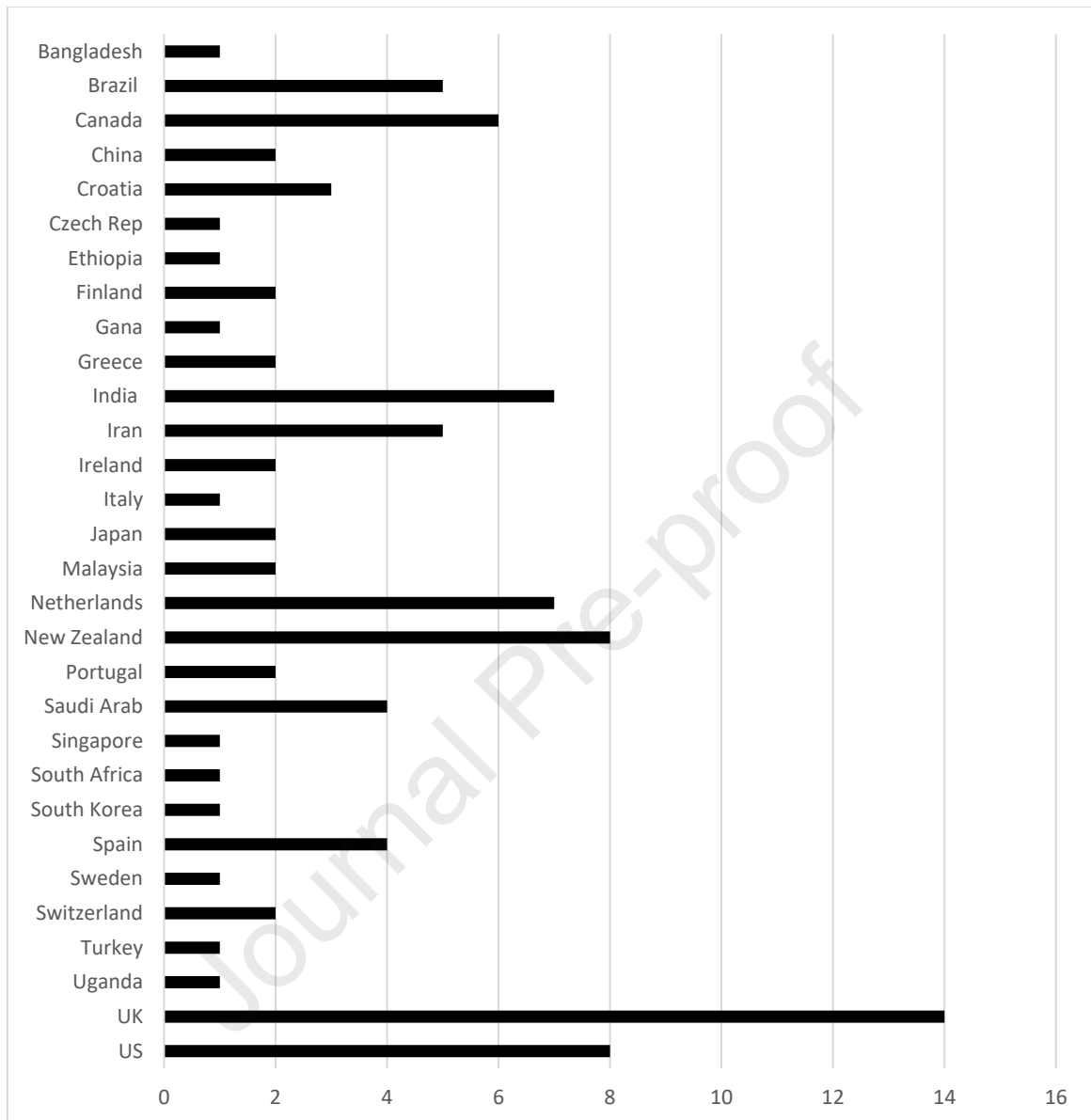
Journal Pre-proof

Figure 2 – Research design



Journal Pre-proof

Figure 3 – Papers by country considering first authors only



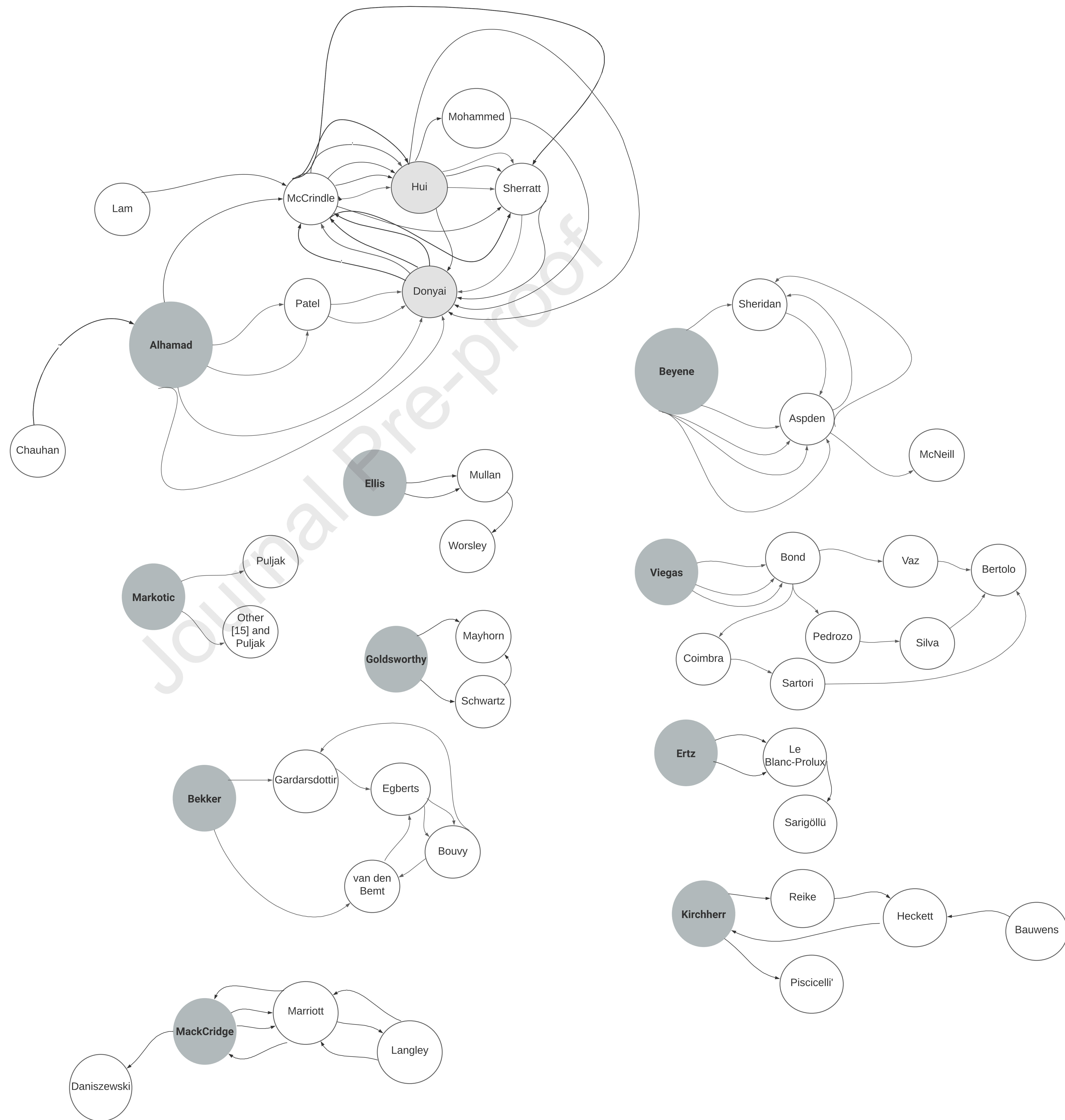
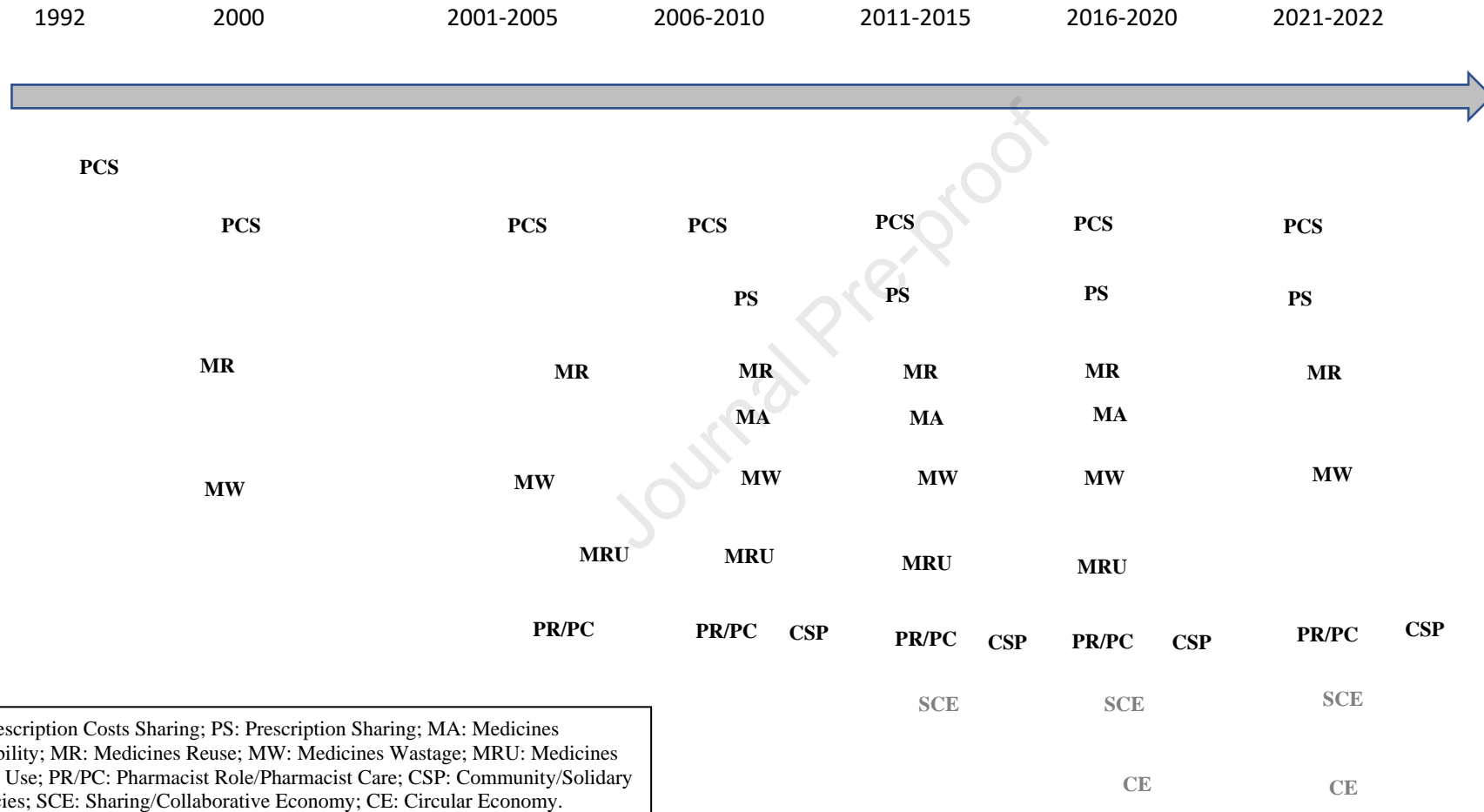


Figure 5 – Contextual classification of the main reasons for medicines wastage

Main reasons	Description	References
Patients' and /or physician's attitudes and recommendation	Stop medicines use	Mackridge et al. (2007)
	Excessive stocks	Mackridge et al. (2007); James et al. (2009)
	Medicines surplus	James et al. (2009)
	Medicines storage	Kauling et al. (2013)
	Leftover medication	Langley et al.(2005)
Physician's determination with secondary causes related to patient	Prescription change	Langley et al. (2005); Al-Syiabi and Al-Ryani (2007); Mackridge et al. (2007);
	Treatment change	Al-Syiabi and Al-Ryani (2007); Braund et al. (2009); James et al. (2009)
	Frequent visits to physician	Al-Syiabi and Al-Ryani (2007);
	Improper treatment	Chen and Chen (2015)
	Medication discontinuing	Alshemari et al. (2019)
	Non adherence to treatment	James et al. (2009); Emmerick et al. (2017)
	Low adherence to treatment	Bekker et al. (2017)
	Gap between the periods of use and the rejection of medication	Lv et al. (2021)
Patient attitudes	Self medication	Kauling et al. (2013)
	Poor compliance to treatment	Smejkalová et al. (2018); Begum et al. (2021)
	Inappropriate use of medicines	
	Medication discharge without care	Alshemari et al. (2019); Dilip et al. (2020)
	Discordance on treatment	Čelik et al. (2013)
Patient and/or treatment determinants	Gap between the medicine periods of use and rejection	Lv et al. (2021)
	Patient death	Mackridge et al. (2007); West et al. (2014)
	Need for chronic disease treatment	Lee and Schommer (2020)
Physician	Irrational prescription	Zargazardeh et al. (2005)
	Overprescription	Lv et al. (2021); Donyai et al. (2021)
Physician and/or pharmacist	Lack of orientation on medicine intake	Kauling et al. (2013)
	Extra dose dispensing	Alshemari et al. (2019)
Pharmacist	Lack of control in dispensing	Smejkalová et al. (2018)
Product	Short expiry date	Braund et al. (2009); West et al. (2014)
	Inadequate package	Bekker et al. (2017)

Figure 6 - Timeline of research in medicines reuse in the context of sharing, wastage, affordability, rational use, and pharmaceutical care/role



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Figure 7 – Prescription costs sharing (PCS) X Prescription sharing (PS)

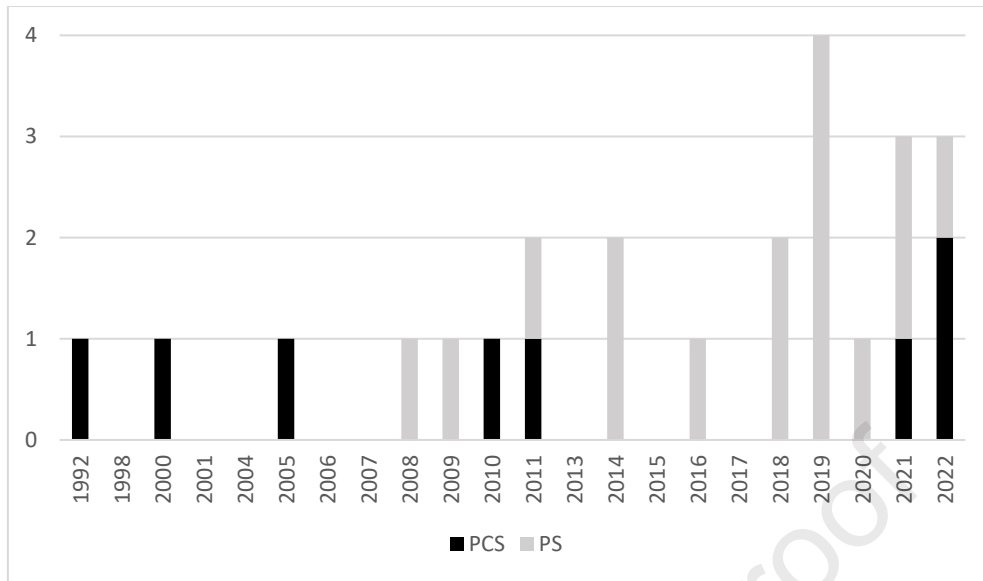


Figure 8 - Prescription sharing X Medicines Rational Use

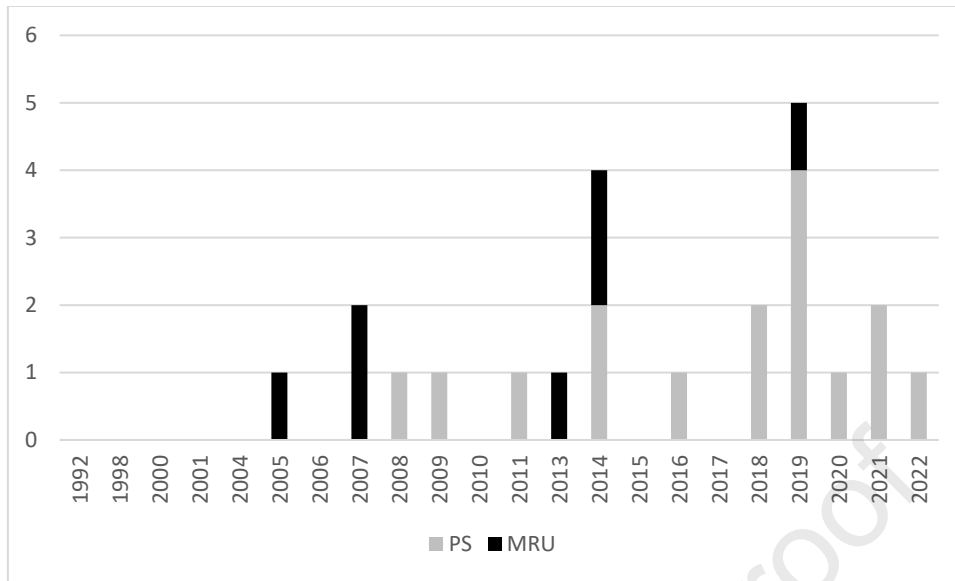


Figure 9 – Medicines reuse X Medicines wastage

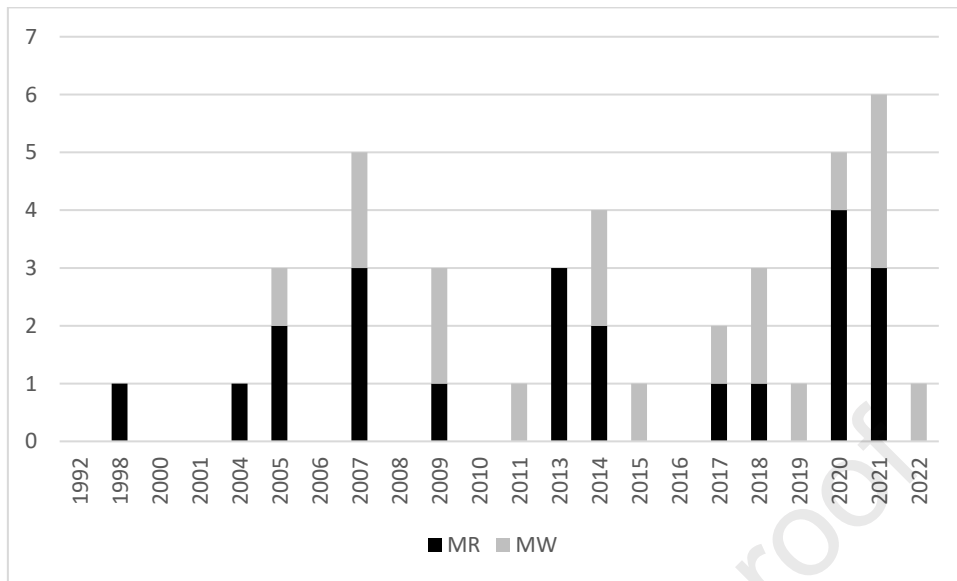


Figure 10 – Medicines affordability X Medicines wastage

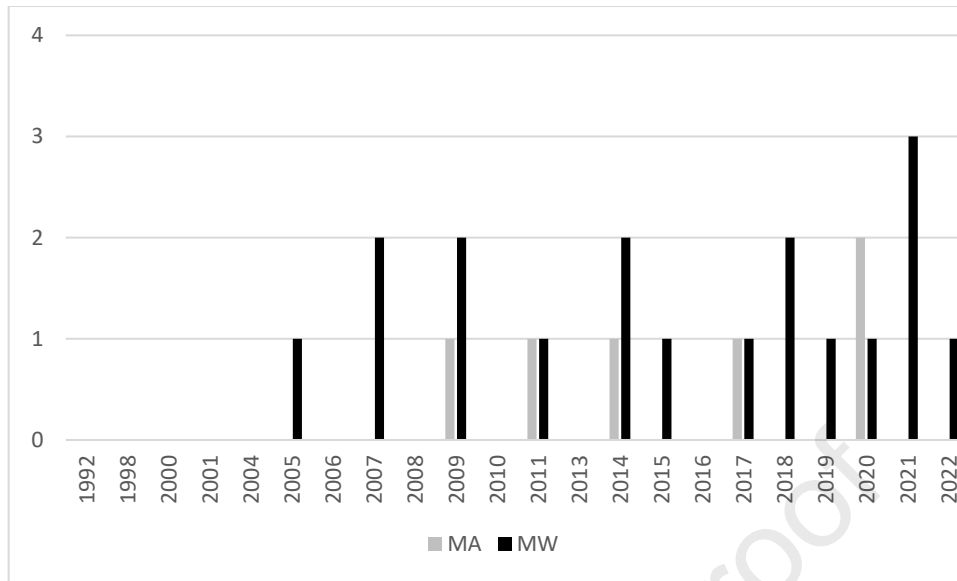


Figure 11 – Pharmacists role/care X Community/solidary pharmacy

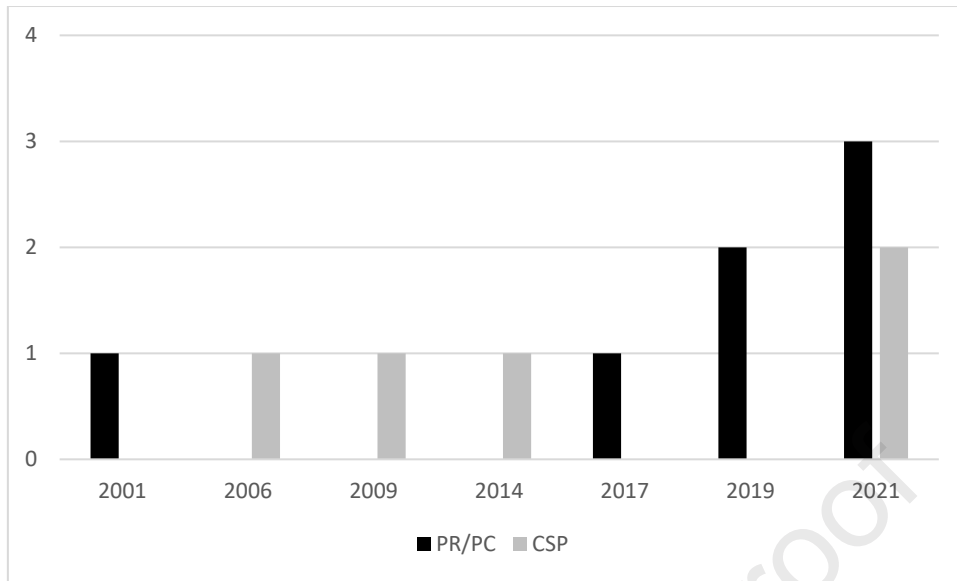
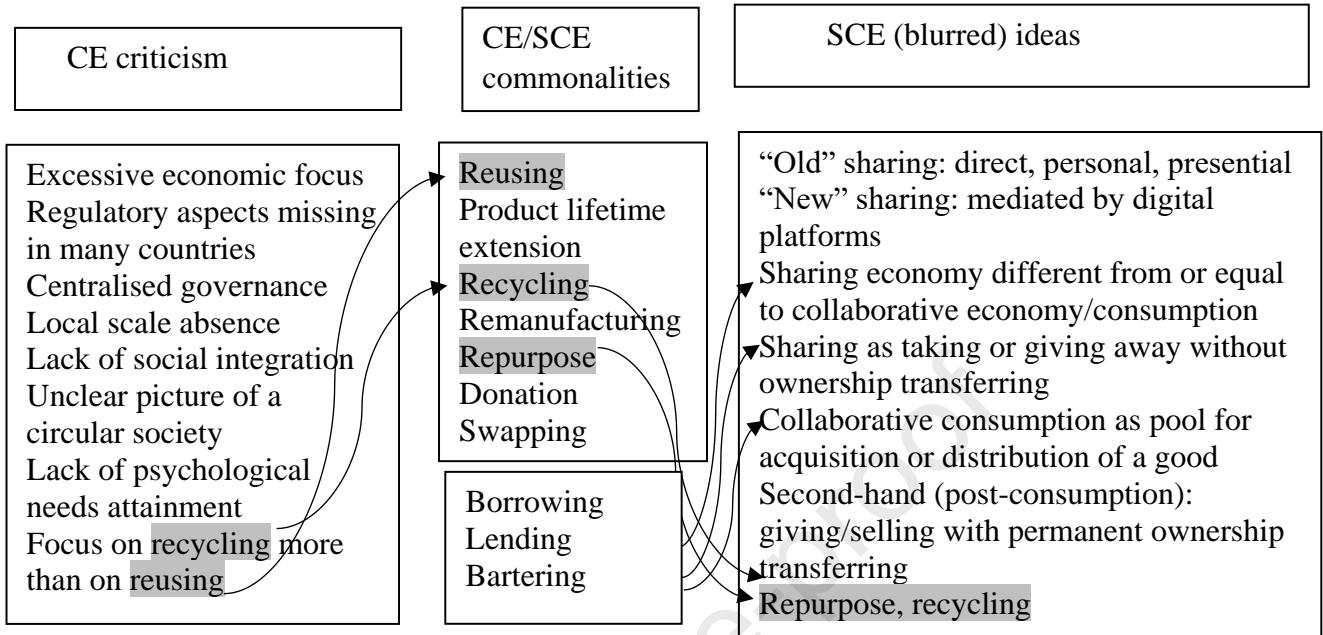


Figure 12 – Circular, Sharing/Collaborative Economies/Consumption – Critical Comparison



Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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