

Consumers' access to information about medicine prices and availability as an enabler of last mile medicine access: A scoping review

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Abstract

Information about where medicines are in stock and how much they cost facilitates consumers' timely access to affordable medicines by enabling price comparisons and the identification of stockists. Our aims were to: (1) Review how consumer access to price and availability information is engaged within the Medicine Access discourse and (2) identify factors associated with the existence of interventions that provide consumers with medicine availability and price information. We conducted two scoping reviews. We reviewed 26 medicine access and pharmaceutical system strengthening frameworks to assess how they conceptualise information access. We then reviewed four interventions that provide consumers with availability and price information to identify the factors associated with these interventions' existence. We found that in the medical access discourse, information is mainly cast as helpful to entities that ensure medicine access for populations. Information as an enabler of medicine procurement for consumers/households is less emphasised. We then identified the following eight factors that facilitate consumer access to reliable medicine price and availability information: the recognition of a medicine access problem that can be mitigated by consumer access to information; cross-sectoral collaboration; the willingness of medicine sellers to disclose their inventory information; having information quality control measures; appropriate incentives for intervention adoption; enabling legal environments; systems of pooling information; and access to digital information technology infrastructure. We recommend that more theoretical and implementation attention ought to be directed at how medicine price and medicine availability information can empower individual consumers to make sound purchasing decisions.

Keywords

Access to medicines, pharmaceutical systems strengthening, access to information, consumers, frameworks, review, scoping

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Background

Information as an enabler of timely medicine access

The importance of medicines in global health and development is well-established. Concepts and paradigms which have shaped global health discourse and underpinned health and development policy in over 150 countries^{1–8} all include access to medicines (ATMs) as a critical element.

'ATM' is *'having (medicines) continuously available and affordable at public or private health facilities or drug*

*outlets that are within one hour's walk of the population.'*⁹ 'Access' considers the timeliness (1 h) and (continuous)

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supply, for at least two reasons. First, some medicines' therapeutic effects depend on timely administration. Second, the continuous adherence to chronic treatment positively affects health outcomes.¹⁰ It is accepted that timely and continuous access to affordable medicines and indeed wider pharmaceutical systems strengthening (PSS),¹¹ is facilitated by information access. However, a preliminary examination of prominent ATM and PSS frameworks revealed that these frameworks emphasise information as a tool to empower governments and organisations to procure medicines for populations or communities. Less emphasis is placed on information as a decision-making tool for consumers as they search for affordable medicines for themselves along the last mile. (The 'last mile' here denotes where the consumer interacts with the point of care such as a community pharmacy. 'Consumers' means individuals or households purchasing medicines for their own use). Just as national-level medicine data can obscure important inequities at lower levels of organisation,¹² engaging with 'information' as a purely macro-level decision-making tool could potentially obscure micro-level access problems that consumer information could mitigate.

Why information about medicine prices and availability is important for consumers/households

Sustainable Development Target 16.10¹³ calls for the guaranteeing of individuals' access to information as a step towards building more inclusive societies. Information about where particular medicines are in stock and how much they cost facilitates consumers' timely access to affordable medicines in several ways. First, price information enables consumers to compare costs.¹² Price information provided to prescribers is also associated with lower prescription costs.^{14,15} Second, information about medicine availability facilitates the swift identification of the pharmacies where these medicines are in stock at the time they are needed.¹⁶ Patients' lack of real-time information about where specific medicines are available and affordable is one key example of market failure in pharmaceutical systems¹⁷ and a cause of medicines underutilisation.¹² Real-world evidence of the need for information about where to purchase medicines affordably exists. For instance, in Zimbabwe, a Southern African Lower Middle-Income Country, severe medicine shortages^{18–21} and price variations across pharmacies^{22,23} make it worthwhile for consumers to compare prices and to find out which pharmacies have particular medicines in stock. Furthermore, Direct-to-Consumer Pharmaceutical Advertising regulations¹⁶ in Zimbabwe prohibit pharmacies from broadcasting details of the prescription medicines they have in stock, or the prices thereof. The pharmacy that has a specific medicine that is in short supply everywhere else, for instance, is prevented from legally broadcasting this fact. Patients or their caregivers, therefore, have to travel from one pharmacy to another enquiring about medicine availability and price at each stop, until

they find a pharmacy able to fill their prescription at an affordable price. Door-to-door searches for medicines increase the transaction costs of accessing medicines and undermine the effectiveness of time-sensitive treatments. Moreover, during pandemics that require people to minimise mobility and face-to-face contact (e.g. the novel Coronavirus disease (COVID-19)),²⁴ door-to-door searches potentially place consumers and pharmacy personnel at elevated risks.

As the need exists, it is unsurprising that real-world interventions that provide consumers with information about where certain medicines are in stock and the prices thereof, are emerging through the efforts of private sector, governments, civil society and health professionals—signalling a growing recognition of the need to inform consumers.

The aim and contribution of this article

It has been recognised that medicines information, notably the kind that enables patients to know where to access medicines and the kind that enables them to compare prices, is underprovided.^{12,17} It has been recommended that this be remedied, especially in low- to middle-income countries (LMICs).¹² Yet, guidance regarding how this can be achieved is still lacking. Given the importance of providing patients with real-time information about where specific medicines are available at an affordable price, this article addresses two research questions:

- To what extent is consumers' access to real-time information about where specific medicines are available at affordable prices, addressed in existing frameworks for ATM and PSS? A scoping review of ATM and PSS frameworks was therefore done and reported in this article, to formally review if and how patient access to information is attended to in the medicine access discourse.
- What factors are associated with the establishment and sustainability of interventions that provide individual consumers with information about medicine availability and prices? A scoping review of these interventions was therefore done and reported in this article, to draw out insights into what promoted their emergence and persistence.

We advance the medicines access discourse in two ways. First, we call for the inclusion and more explicit enunciation of consumers' access to medicine availability and price information within the corpus of ATM frameworks. This is important because frameworks and well-defined constructs, (which tend to be conceived for specific purposes²⁵), orient the attention of global health actors, guide research and policy, communicate priorities and inform interventions.^{5,11,25,26} What is not included in a framework risks getting overlooked. Second, we propose health system factors that are associated with the provision of medicine price and availability information to individual consumers.

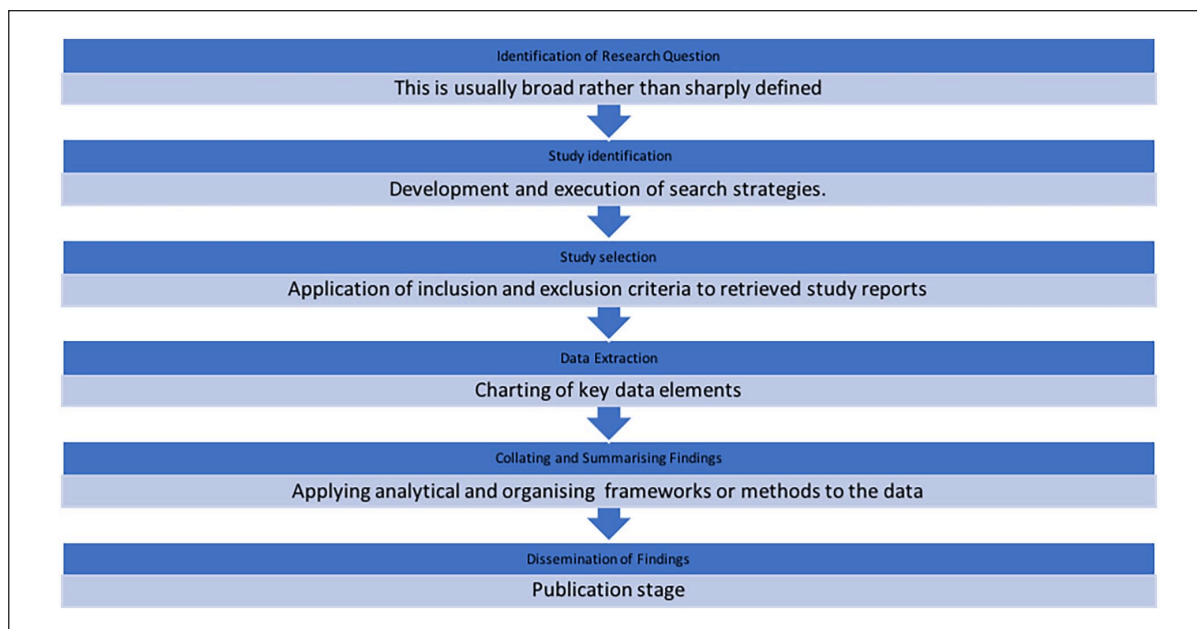


Figure 1. Scoping review steps by Armstrong et al.²⁸

Methods

Study design

Two scoping literature reviews were conducted. The review protocol was not registered with PROSPERO because PROSPERO did not accept scoping review protocols at the time this work was conducted.

Scoping reviews are literature reviews that are appropriate when the goal is to:

- explore a nascent or unfamiliar field, or one that comprises diverse literature that is located in diverse domains (e.g. in peer-reviewed journals, grey literature sources and or commercial and media sites),
- map a highly populated research area,
- uncover research or knowledge or conceptual gaps in a subject area.^{27,28}

The scoping review was considered an appropriate study design for this work because ‘Access to Medicine’ is a highly researched subject and the medicine access literature comprises diverse documents that are located in diverse domains (such as peer-reviewed journals and grey literature produced by inter-governmental, non-governmental or commercial organisations). Preliminary reading had suggested the existence of a gap in the medicine access discourse, that is the under-representation of information as a decision-making tool for consumers as they search for affordable medicines for their own use. Systematically characterising this gap, if it indeed existed, required the scoping review study design. Furthermore, the subject of tools that assist patients with medicine availability and price information, appeared nascent, with some

implementation literature located in diverse sources. Mapping this field and identifying relevant literature therefore was also suited to a scoping review.

The first review identified ATM frameworks plus recommendations and guidelines for PSS. This was done to assess the extent to which consumer access to price and availability information is attended to in the ATM discourse. The second scoping review identified interventions that provide individual consumers with price and availability information with the view to infer factors that enable the establishment and persistence of these interventions. The methodological framework for conducting scoping reviews advanced by Arksey and O’Malley²⁷ and Armstrong et al.,²⁸ and depicted in Figure 1, guided both reviews. This framework spells out that the scoping process involves research question identification, identifying relevant studies, study selection, charting the data, collating, summarising and disseminating the findings, and consultation throughout the process with colleagues and organisations knowledgeable about the subject of the scoping review.

The section below describes how the scoping review methodological steps for both reviews were executed.

Scoping review 1: review of ATM and PSS frameworks

Identification of research question. The research question for this review was: To what extent is consumers’ access to real-time information about where specific medicines are available at affordable prices, addressed in existing ATM and PSS frameworks? This was considered as an important question to answer in order to gauge the extent to which citizens’ access to on-demand information about medicine availability and price was recognised in ATM and PSS theory.

Literature identification. Frameworks that conceptualise ATM as well as sets of recommendations for PSS were identified over a 4-year period using the following strategies:

1. In 2017, when the literature search began, Google and Google Scholar searches using the key phrases ‘access to medicines framework’ and ‘pharmaceutical system strengthening’ were first conducted to identify systematic reviews of ‘access to medicines’ and ‘pharmaceutical system strengthening’ frameworks. No filters were applied. Two reviews^{11,25} were identified as relevant. To avoid unnecessary duplication of search work in academic literature databases, forward and backward citation tracing of these highly cited systematic reviews was done. This iterative process resulted in the identification of 18 relevant unique publications.^{5,12,17,26,29–42}
2. Using the keywords and phrases ‘Access’, ‘medication use’ and ‘medication management’ ‘transparency’ ‘medicine information’, grey literature was searched for and retrieved from the websites of prominent organisations that work on ATM and PSS. Organisations whose websites were searched were: the World Health Organization (WHO), the United States’ International Development agency, the Access to Medicines Foundation, the World Bank and Management Sciences for Health (MSH). No filters were applied. Four additional unique publications were identified as a result of this strategy.^{43–46}
3. Relying on alerts from the E-drug listserv (<http://lists.healthnet.org/mailman/listinfo/e-drug>), a global mailing list subscribed to by one of the authors. This listserv delivers news and notifications of new publications in the area of essential medicines. One unique publication was identified through an E-drug notification.⁴⁷
4. Pursuing leads on potentially relevant authors and publications, based on personal communications from colleagues, also proved useful for identifying published ATM frameworks. These works^{48–50} were identified this way.
5. Reference tracing in all included frameworks led to the identification of four additional publications.^{3,7–9}

Literature identification continued until the end of the year 2020.

Study selection and application of inclusion criteria. Table 1 outlines the inclusion and exclusion criteria for the first scoping review (review of ATM and PSS frameworks). The PRISMA Chart (Figure 2) shows the progression from initial publication identification to finalisation of the set of publications reviewed.

Data extraction and charting of key data elements. Publications which met the inclusion criteria were read iteratively. The sections that referred to the role of information in ATM

or PSS were identified and summarised. The findings from this exercise are presented in Table 2 in the Results section. Table 2 in the Results sections also shows the elements extracted from each publication: Author and year of publication, purpose of publication and how that publication frames the role of information in ATM or PSS.

Data handling and synthesis. The qualitative data charted was inspected for trends in how authors of frameworks conceptualise the role of information in ATM or PSS. Effort was then devoted to finding any mention of the value of price and availability information for patients. Conclusions were then drawn about how authors of frameworks conceptualise the role of information in ATM or PSS. Conclusions were also then drawn about the extent to which attention is paid to patient access to information as a theme.

Scoping review 2: review of interventions that provide individual consumers with information about medicine availability and prices

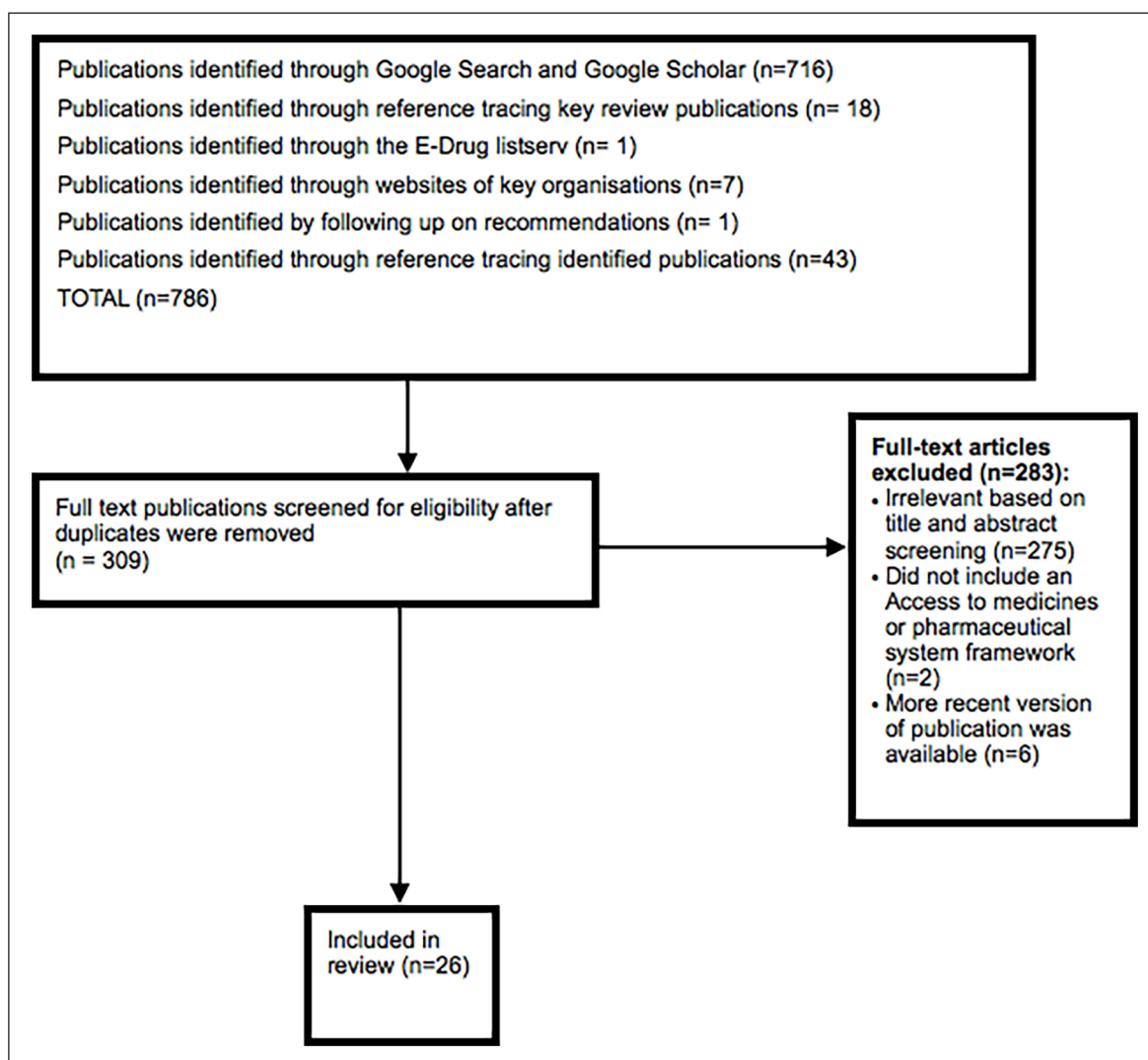
Identification of research question. We were interested in answering the broad question: What factors are associated with the establishment and sustainability of interventions that provide individual consumers with information about medicine availability and prices?

Literature identification. Medline, Embase, PsycInfo, Global Health CABI, Scopus and ProQuest Dissertations and Theses Global, were searched. Searches were run on 29 December 2020. The search strings used for isolating the literature are attached as Supplemental File 1: Search Strategy for Scoping review 2 and were reviewed by all authors. It was known that the area of medicines availability and price information interventions was one of some implementation activity, despite being relatively under-documented in peer-reviewed journals. Therefore, the search included non-academic literature sources. Searches were conducted on webpages and within data repositories of organisations that have been cited as funders of medication-related information technology projects in developing countries by Konduri et al.⁵¹ and Jahangirian and Taylor.⁵² Google and Google Scholar searches of projects identified from grey literature reports and academic articles were performed using the intervention names as search terms. This was to identify information contained in blogs, news articles and on the interventions’ promotional websites. Non-academic literature sources carry a risk of being unreliable. Attempts to mitigate the risk of analysing unreliable accounts were therefore made in the following ways:

1. The interventions reported in the included non-academic literature sources were also reported in peer-reviewed journal articles or a doctoral academic thesis. Therefore, we could be confident that the intervention existed and were being implemented as the non-academic sources reported.
2. The non-academic sources included were:

Table 1. Inclusion and exclusion criteria for scoping review I.

Category	Included	Excluded	Illustration
Publication type	Peer-reviewed or grey literature publications	Grey literature publication for which a peer-reviewed version of the same was available	Hafner and Walkowiak ³⁰ was excluded because Hafner et al. ¹¹ was available.
Date	Published after 1977 (when a taxonomic definition of 'access' was first put forward in peer-reviewed literature)	A publication for which a more recent version was available	For example, Management Sciences for Health ⁴¹ was excluded because Management Sciences for Health ³³ was available. Medicines Transparency Alliance ³⁴ was excluded because World Health Organization ⁴⁴ (WHO) was available.
Content	<ul style="list-style-type: none"> Contains an original framework/ model for conceptualising Access to Medicines, written in English or Spanish Contains recommendations for strengthening whole pharmaceutical systems generally, without focusing on specific aspects of the pharmaceutical system, written in English or Spanish 	–	

**Figure 2.** PRISMA chart for scoping review I (review of access to medicines (ATM) and pharmaceutical system strengthening (PSS) frameworks).

- One news article⁵³ (which was corroborated by several peer-reviewed articles) [e.g. Yuan et al.⁵⁴ and Chen⁵⁵].
 - One document issued by a for-profit company that is implementing one of the interventions reviewed (this document, which details the intervention's main elements, was produced to fulfil a statutory requirement.⁵⁶ The risk of this document containing unreliable information still existed but was considered minimal).
 - Two documents issued by the Government of Peru (which is implementing one of the interventions reviewed).^{57,58}
 - Several documents published by or through the WHO which describe the same intervention that the Peruvian government documents describe.^{43,44,59}
3. The contents of these non-academic sources were not used to assess or make judgements about the impact or effectiveness of the interventions.

Study selection and application of inclusion criteria. Eligible reports were those that mentioned interventions used to provide consumers with information about where particular medicines or other health products were available and the prices thereof, in countries of any income level. Although the initial plan was to focus only on LMICs, the paucity of reports from this setting justified the expansion of the eligibility criteria. The post hoc finalisation of inclusion criteria can be imperative in the context of a review that scopes an emerging or unfamiliar field.²⁷ Publications or documents were excluded if they provided insufficient detail about the intervention's workings, its implementation or establishment. Reports were also excluded if the full-text versions could not be retrieved. Only reports that were in English and Spanish were included. No publication date limits were applied for this second scoping review. All authors reviewed the included interventions. The PRISMA diagram (Figure 3) depicts how the search and selection of reports for this review proceeded.

Data extraction and charting of key data elements. Consistent with the scoping review methodological guidelines,^{27,28} data extraction and charting to enable the identification of commonalities, gaps and themes, was done. The following elements were extracted and charted on a spreadsheet for each intervention identified:

1. Intervention description
2. For each source of information: Author(s), year of publication and type of publication
3. Country where intervention was implemented
4. Problem(s) the programme aimed to address/impetus for intervention establishment
5. Type of organisation involved in implementation
6. Factors that made the implementation possible and/or sustainable

Data handling and synthesis. An inductive thematic analysis of the data was carried out to illuminate the factors that were common to the interventions in the reviewed sources. During meetings, authors discussed the validity of each theme. A narrative summary of the charted data was then produced.

Results

Summary of findings

Twenty-six ATM frameworks and sets of recommendations for PSS, conceived for different agendas or global health priorities or programmes, were reviewed during the first scoping review. All of them identified different types of information as critical to achieving ATM and rational medicine use globally, at country level or at organisation level. There was however extremely limited engagement with the role of information as an enabler of timely medicine access at household level. Where the subject of medicines information for consumers has been engaged with, the focus has tended to be on how healthcare providers must supply consumers with information about the appropriate *use* of medicines (after those medicines have been acquired). This finding answered the first research question which was: To what extent is consumers' access to real-time information about where specific medicines are available at affordable prices, addressed in existing frameworks for ATM and Pharmaceutical Systems Strengthening?

In the second scoping review, four interventions that facilitate consumers' ATM price and availability information were reviewed. These interventions, documented in the 19 reports reviewed, were implemented in four different countries (Peru, Taiwan, the United States of America and Zimbabwe). The factors that were associated with these intervention's emergence and persistence were identified as: the recognition of a medicine access problem that can be mitigated by consumer access to information; cross-sectoral collaboration; the willingness of medicine sellers to disclose their inventory information; having information quality control measures; appropriate incentives for intervention adoption; enabling legal environments; systems of pooling information and access to digital information technology infrastructure. This finding answered the second research question, which was: What factors are associated with the establishment and sustainability of interventions that provide individual consumers with information about medicine availability and prices?

How information is conceptualised in theoretical frameworks

Table 2 shows the different documents that conceptualise ATM and PSS strategies. Table 2 also summarises how each document casts the role of information in ensuring ATM and strengthening pharmaceutical systems.

Table 2. How information is conceptualised/cast in existing ATM and PSS frameworks.

Author	Aims of the framework or programme about which the framework was authored (as described by authors)	How information in the context of medicines access or PSS, is cast
Access to medicines frameworks (n = 11)		
1 Penchansky and Thomas ⁴²	To propose and test the validity of a taxonomic definition of access, one that disaggregates the broad and ambiguous concept into a set of dimensions that can be given specific definitions and for which operational measures might be developed	<ul style="list-style-type: none"> • Information (knowledge) about the cost of health services is a factor when considering affordability. • Knowledge about where to access health services is defined as a measure of patient satisfaction with access.
2 Centre for Pharmaceutical Management ²⁶	To identify an operational definition of “access to Essential Drugs, Vaccines, and Health Commodities” and propose testable indicators to measure it	<ul style="list-style-type: none"> • Information is defined as something to be collected from various sources including households and private sector, and NGOs, in order to inform the measurement of access indicators. • Presence of a consumer information service at health facilities and presence of good sources of drug information for health workers at health facilities were defined as measurable indicators of access.
3 WHO ³⁹	To guide and coordinate collective action on access to essential medicines	<ul style="list-style-type: none"> • Information about medicine prices, supplied through regional and international price services, is defined as an enabler of affordability when governments, non-governmental organisations, donor agencies are procuring medicines for populations. • Information (about medicines) is also incorporated into the definition of ‘essential medicines’ as a necessary accompaniment to the actual essential medicines.
4 Obrist et al. ³²	To present a framework for analysis and action to explore and improve access to healthcare in resource-poor countries, in the context of livelihoods.	<ul style="list-style-type: none"> • Local knowledge is one of the factors influencing whether people seek treatment in drug shops or through other healthcare services.
5 Frost and Reich ³⁷	To better understand and more effectively plan for success in the introduction of new technologies to help fight the diseases of the global poor.	<ul style="list-style-type: none"> • Information (especially about the price, quality and safety of products from different suppliers and information about how to use the medicine appropriately) is cast as a key enabler of adoption and acceptance of a medicine or health technology by both individuals and governments. • Information helps to lower the information asymmetry between buyers and sellers of the medicine or health technology.
6 Management Sciences for Health ³³	This resource is a tool published to contribute to ensuring universal access to quality medicines and health technologies and their appropriate use.	<ul style="list-style-type: none"> • Recognises that information about medicines is required by all medicine users (health workers and consumers). • The provision, through drug information centres or bulletins, and the sharing of sound, independent non-promotional and comparative medicines information is recognised as a necessary factor in the promotion of rational medicine use and medicine affordability for governments, other procurers of medicines and other healthcare decision-makers. • Yet, information is a resource that tends to be underprovided by private markets because it is a public good, it impacts on commercial and professional interests, and socio-cultural norms, values and practices. • Access to information is defined as a key determinant of patient adherence to treatment which should be provided at the point of dispensing medicines.

(Continued)

Table 2. (Continued)

Author	Aims of the framework or programme about which the framework was authored (as described by authors)	How information in the context of medicines access or PSS, is cast
7	Bigdeli et al. ²⁵ <ul style="list-style-type: none"> • To embed ATM in the wider health system strengthening debate, because a systems approach to improving ATM seeks to ensure that policies are more effective generates longer-term equitable and sustainable results. • To review ATM barriers and define at which level of the health system they occur. 	<ul style="list-style-type: none"> • Information on price, source and quality of medicines procured, distributed and used in health sectors of low- to middle-income countries (LMICs) was conceptualised as a facilitator of access to medicines and its lack, as an inhibitor of access. • The supply of this information is considered a task that is beyond the health sector alone, requiring cross-sector local and international collaborative efforts.
8	Systems for Improved Access to Pharmaceuticals and Services (SIAPS) ³¹ Tran et al. ⁵⁰ <p>To improve access to quality pharmaceutical products and effective pharmaceutical services through systems strengthening for lasting positive health outcomes.</p> <p>To describe the deficiencies in the current LMIC supply chains that limit access to effective cardiovascular disease medicines and discuss existing solutions that are translatable to other low-resource settings to address these deficiencies.</p> <p>To consider the issue of access to health and medicines, insulin in particular, using the lens of 'society as a three-legged stool' in which governments, civil society and private sector, all play a role in ensuring access to medicines.</p>	<ul style="list-style-type: none"> • The supply of (unspecified) information related to medicines and patients, supports decision-making and is a component of the SIAPS approach. • The graphic of the SIAPS framework also depicts relationships among five health systems building blocks which include 'Information' • Information is defined as being critical to forecasting patient demand for medicines, • Information systems were also cast as entities that improve medicine availability at health facilities through improving real-time communication, inventory management and procurement • Information from health technology assessments ensure that rational choices are made about which insulins can be made available in a country. • Price information transparency is considered one of the interventions for making insulin more accessible (possibly through enhancing private sector accountability) • Knowledge about the experiences of diabetic patients generated through social media, research and clinical management encounters, help insulin-access advocacy efforts • Governments have a responsibility to ensure the public is provided with information on regulation of emerging therapies
10	Beran et al. ⁴⁹ <p>To provide an evidence-based framework for evaluating access to medicine using a system approach, with indicators disaggregated by inputs, outputs and outcomes (n = 15)</p> <p>To discuss ways of ensuring the rational use of drugs, in particular through improved knowledge and flow of information, and to discuss the role of marketing practices in this respect, especially in developing countries.</p>	<p>Information provision about benefits, side effects, use of medicines at the point of dispensing is conceptualised as one of the indicators of access.</p> <p>Impartial information on the cost and efficacy, selection (or rejection) and use of drugs for health workers, patients and policymakers was conceptualised as an essential component of national medicine policies. Information was also cast as an integral part of a medicine (without information, medicines are mere chemical entities). This information ought to be provided by health workers, governments, the WHO and widely representative consultative groups, mass media, consumer groups, through formularies and bulletins in accessible and socio-culturally appropriate formats or through advertising that adheres to set ethical criteria.</p> <p>Information on cost of medicines was posited as being a decisive factor for choice.</p>
11	Afzali et al. ⁴⁸	
12	PSS strengthening models and recommendations (n = 15) WHO ⁴⁶	

(Continued)

Table 2. (Continued)

Author	Aims of the framework or programme about which the framework was authored (as described by authors)	How information in the context of medicines access or PSS, is cast
13 Laing et al. ⁴⁰	To provide ten recommendations to improve use of medicines in developing countries	Among the recommendations, the provision and acquisition of objective (non-promotional) information about medicine use to and by consumers and consumer groups, health workers, governments, academic and professional organisations, were listed. Public education or advertising (information dissemination) about drugs must include explicit statements about potential risks of medicines
14 WHO ⁷	To provide guidance on how to develop a national medicines policy framework	National medicine policies should include: commitments to regulation of information and advertising, international exchange of information, provision of unbiased information, provision of price information, publishing price information on raw materials and finished products.
15 Rational Pharmaceutical Management Plus Programme ³⁸	To help health system planners and managers to think through how to ensure the effective and efficient functioning of the pharmaceutical system within the context of health sector reform.	Unbiased information informs the selection, procurement, distribution, use of medicines and the monitoring of pharmaceutical system performance.
16 WHO ⁵	To clarify and strengthen WHO's role in health systems in a changing world and to promote common understanding of what a health system is and what constitutes health systems strengthening.	Information on international medicine prices is listed among the necessary inputs for health systems to achieve equitable access to essential medical products, vaccines and technologies of assured quality, safety.
17 Miralles ³⁶	To provide an overview of contemporary health systems issues related to improving access to essential medicines	<ul style="list-style-type: none"> • Information is crucial for making rational decisions regarding medicine selection, demand quantification, supplier selection, distribution, availability and use. • Improving information flow to healthcare providers and patients/consumers including use of newer low-cost technologies is critical for rational medicine use and choice of treatment, which is characteristic of a functional pharmaceutical system. • Systems for managing this information should be based on an appropriate design and plan that takes into account the available technological, financial, geographic or human resources as well as stakeholder needs.
18 WHO ³⁵	To discuss each health system building block, identifying a set of indicators and related measurement strategies within a health system to monitor service delivery	Information on facility infrastructure, equipment and supplies, support systems, management systems, the availability of essential medicines, medicine prices, adequacy of conservation conditions, affordability, expenditure, prescribing and dispensing habits, and presence of guidelines, providers' adherence to standards, pharmaceutical policies and practices related to regulation, selection of essential medicines, as well as procurement and use, enables the monitoring of pharmaceutical systems.
19 Roberts and Reich ¹⁷	To facilitate a better understanding of all that goes on in the pharmaceutical sector and using a set of analytical tools that are combined into an overall, structured methodology for developing, adopting and implementing reform proposals.	Objective information provision is cast as a necessary (although inadequate) factor that mitigates information asymmetry (in terms of product characteristics, quality and benefits), one of the most serious roots of buyer-side market failure in both local and international pharmaceutical systems. Information provision is therefore one of the targets ripe for policy reform in pharmaceutical sectors.

(Continued)

Table 2. (Continued)

Author	Aims of the framework or programme about which the framework was authored (as described by authors)	How information in the context of medicines access or PSS, is cast
20	<p data-bbox="339 1591 360 1619">To:</p> <ul data-bbox="363 1123 571 1619" style="list-style-type: none"> <li data-bbox="363 1123 384 1619">• deal with the challenges of achieving equitable access to essential medicines, <li data-bbox="387 1123 408 1619">• call for a 'systems approach' to position medicines within the complexity of any health system, <li data-bbox="411 1123 432 1619">• call for greater accountability of stakeholders, and <li data-bbox="435 1123 571 1619">• stimulate fresh thinking among decision-makers, researchers, civil society and development partners. 	<p data-bbox="339 240 464 1066">Information is cast as an essential decision- and policy-making and monitoring resource that is distributed throughout health systems under the custody and control of different stakeholders. Therefore, medicines information between different stakeholders ought to be made a key determinant for strengthened pharmaceutical systems, particularly in LMIC health systems, in pursuit of Universal Health Coverage.</p>
21	<p data-bbox="579 1123 651 1619">To contribute to health systems strengthening and prevent corruption by promoting good governance in the pharmaceutical sector.</p>	<p data-bbox="579 272 651 1066">Information transparency amongst pharmaceutical stakeholders (manufacturers, regulators, healthcare providers and consumers) is seen as a way to make pharmaceutical systems less vulnerable to corruption and facilitate decision-making regarding medicines</p>
22	<p data-bbox="659 1123 754 1619">To address the information asymmetries and lack of information in pharmaceutical systems, with a focus on medicines selection, procurement, prices, availability, quality, promotion and use.</p>	<ul data-bbox="659 187 754 1066" style="list-style-type: none"> <li data-bbox="659 187 679 1066">• Information about symptoms and information to enable decisions about when and where to seek quality, affordable medicines and knowledge about the correct medicine use are described as resources that patients and their caregivers require. <li data-bbox="683 187 754 1066">• Information transparency and information-sharing within a pharmaceutical system are deemed necessary prerequisites for better policies and ultimately improved access to medicines.
23	<ul data-bbox="778 1123 938 1619" style="list-style-type: none"> <li data-bbox="778 1123 850 1619">• To advance the current thinking about pharmaceutical systems by building upon existing approaches to understand and strengthen health systems. <li data-bbox="853 1123 938 1619">• To articulate definitions of the pharmaceutical system, PSS and the system components to guide measurement of PSS. 	<p data-bbox="778 187 938 1066">Timely and reliable information is considered critical in the measurement of PSS efforts. It supports decision-making and is essential to all the other components of pharmaceutical systems. The other components being: pharmaceutical products and related services; policy, laws and governance; regulatory systems; innovation, research and development, manufacturing, and trade; financing and human resources.</p>
24	<p data-bbox="946 1123 1090 1619">To mark 30 years since the landmark since the 1985 Nairobi Conference on Rational Drug Use by assessing progress achieved, remaining challenges, lessons learnt and how essential medicines policies can be harnessed to promote Universal Health Coverage and contribute to the global sustainable development agenda.</p>	<p data-bbox="946 187 1042 1066">Real-time collection, supply and monitoring of objective (non-advertising) information on medicine patents, pricing, quality, availability, pharmacovigilance, household expenditure, regulatory agency performance, usage are all recommended as necessary but not sufficient interventions for improving medicines access and rational use for both health systems and individuals.</p>
25	<p data-bbox="1098 1123 1193 1619">To propose an approach to identifying key information across the pharmaceutical system that can help policymakers and other stakeholders strengthen accountability and we illustrate its application.</p>	<p data-bbox="1098 187 1193 1066">Information is considered a prerequisite for accountability by enhancing stakeholders' participation in pharmaceutical systems. In particular, three classes of information that are necessary to facilitate accountability are: (i) standards and commitments; (ii) decisions and results and (iii) consequences and responsive actions.</p>
26	<p data-bbox="1201 1123 1249 1619">To provide ten recommendations to improve pharmacy practice in LMICs</p>	<p data-bbox="1201 187 1273 1066">Promoting independent medicines information for consumers and healthcare professionals through the development of a national medicines information strategy, is recommended to improve pharmacy practice and improve patient health outcomes.</p>

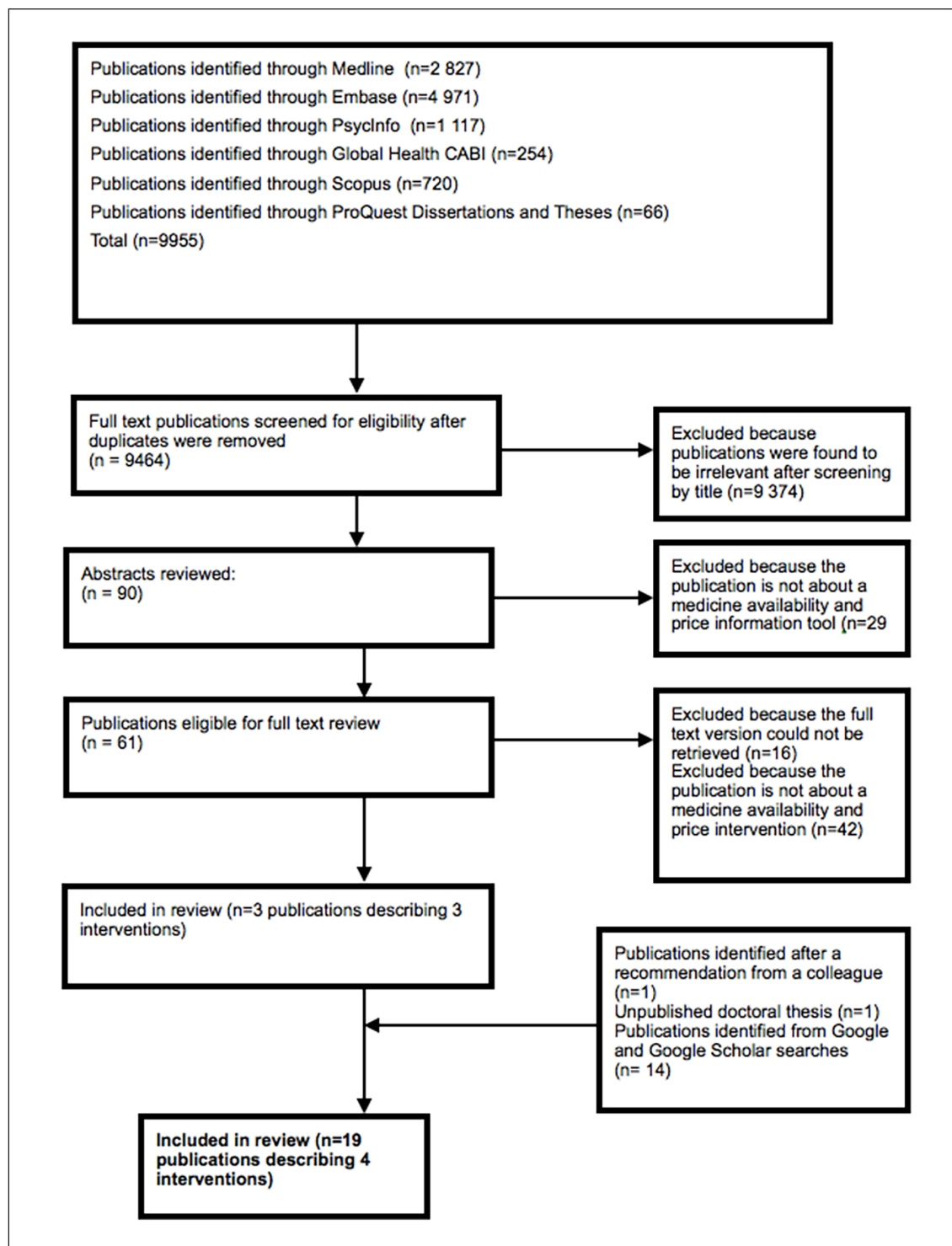


Figure 3. PRISMA for scoping review of interventions providing consumers with medicine availability and price information.

Factors associated with the provision of medicines availability and price information to consumers

Table 3 summarises the main details of the four interventions that facilitate consumers' ATM price and availability information. Each report was iteratively read and a

thematic analysis, focusing on identifying the factors that were associated with the intervention's emergence and persistence was done (Figure 4).

Recognition of a systemic access-related problem. The impetus for each intervention identified (Table 3) was a systemic problem related to the availability or prices of

Table 3. Interventions supplying consumers with information about medicine availability and prices at named location.

Intervention	Year started	Intervention details
1. Medicines Price Observatory (MPO) (Peru) ^{43,44,57-61}	2010	The MPO is a government-run intervention established through legislation, following a multi-stakeholder agreement brokered by the Medicines Transparency Alliance. The Medicines Transparency Alliance was funded by the United Kingdom's Department for International Development. There are wide medicine price variations across retail pharmacies in Peru. The MPO site, whose data is updated by pharmacies, lists medicine prices by pharmacy location to allow consumers to identify where medicines are available and their prices.
2. GoodRx TM (USA) ^{56,62-66}	2011	GoodRx TM is a for-profit organisation founded by technology entrepreneurs who use patented proprietary technology and contracts entered into with consolidated pharmacy networks, to find medicine prices at different outlets. There are wide medicine price variations across retail pharmacies in the United States. GoodRx TM provides medicine prices by pharmacy location to allow consumers to identify where medicines are sold cheapest. GoodRx TM also distributes price discount coupons redeemable at the point of purchase at thousands of participating pharmacies.
3. Mask-Map apps (Taiwan) ^{64,65}	2020	This intervention initially organically arose from citizen action on a social networking application (LINE). Later evolved into stand-alone apps backed by pharmacy inventory data that is supplied by the government. In response to a high demand for face masks in Taiwan during the COVID-19 pandemic, the apps notify citizens of the pharmacy locations that have masks in stock, and the quantity available.
4. WhatsApp groups for pharmacists (Zimbabwe) ⁶⁷	2015	The WhatsApp groups arose organically, rather than by design, to become peer communities for Zimbabwean pharmacists. Apart from social networking, these groups, many of which host over 250 pharmacists each, are used by pharmacists to crowdsource on behalf of patients, information about where particular medicines and pharmacy products are available in stock, as well as the prices thereof. Pharmacists then relay this information to their patients. This crowdsourcing function addresses the problem precipitated by factors which together potentially encumber the timely access to medicines for individuals: widespread medicine shortages and advertising rules in Zimbabwe that prohibit pharmacies from broadcasting (advertising) details of their medicines to the lay public.

¹Several more applications identical to GoodRxTM exist in the United States. However, only GoodRxTM was reviewed because: it is the pioneer and market leader. It is also the application for which substantive literature, other than promotional material, was found. GoodRxTM has been documented in both peer-reviewed and grey literature.

²This intervention pertains to masks rather than medicines, it was included because masks were considered health products and were accessible from pharmacies. The intervention embodied the principle of consumer access to information, which is the focus of this article.

pharmacy products. In Peru, the sustained increase in medicine prices and out-of-pocket spending on medicines drove efforts to increase price transparency to empower consumers to make more informed purchasing choices.⁴⁴ In the United States, the variation in prescription medicine prices across pharmacies motivated the establishment of price comparison tools exemplified by GoodRxTM.⁵⁶ The heightened demand for face masks in Taiwan during the Coronavirus disease pandemic led people to develop digital tools to help consumers identify pharmacies where masks could be accessed.^{53,55} Finally, medicine price variation and the erratic availability of medicines across Zimbabwean pharmacies, coupled with advertising regulations that encumbered pharmacies' ability to broadcast details of their inventory to consumers, were associated with the persistence of the pharmacists' WhatsApp group communities where availability information is routinely shared and price information is solicited.⁶⁷

Product sellers disclosing their inventory information. Medicine availability and price information interventions

depend on the accessibility of medicine sellers' inventory and price information. This can be through medicine sellers uploading their information to a government-run, publicly accessible and searchable website, for example, in Peru;^{43,44,57,59} using proprietary technology operated by medicine price comparison businesses, for example, in the United States;⁵⁶ linking pharmacy information systems to a central mainframe, for example, in Taiwan^{53,54,68,69} or as in Zimbabwe, having pharmacists participate on the WhatsApp communities of practice, responding to medicine availability and price queries posted there.⁶⁷

Information quality control. When pharmaceutical service providers are compelled to disclose information, there may be an incentive to report inaccurately.⁶⁷ Ways of safeguarding the quality of inventory and price information disclosed by medicine sellers are integral to any plan to provide reliable consumer information. In Peru, civil society monitors prices, availability and quality of medicines in communities.^{59,61} GoodRxTM⁵⁶ reports that its proprietary technology checks and triangulates the price

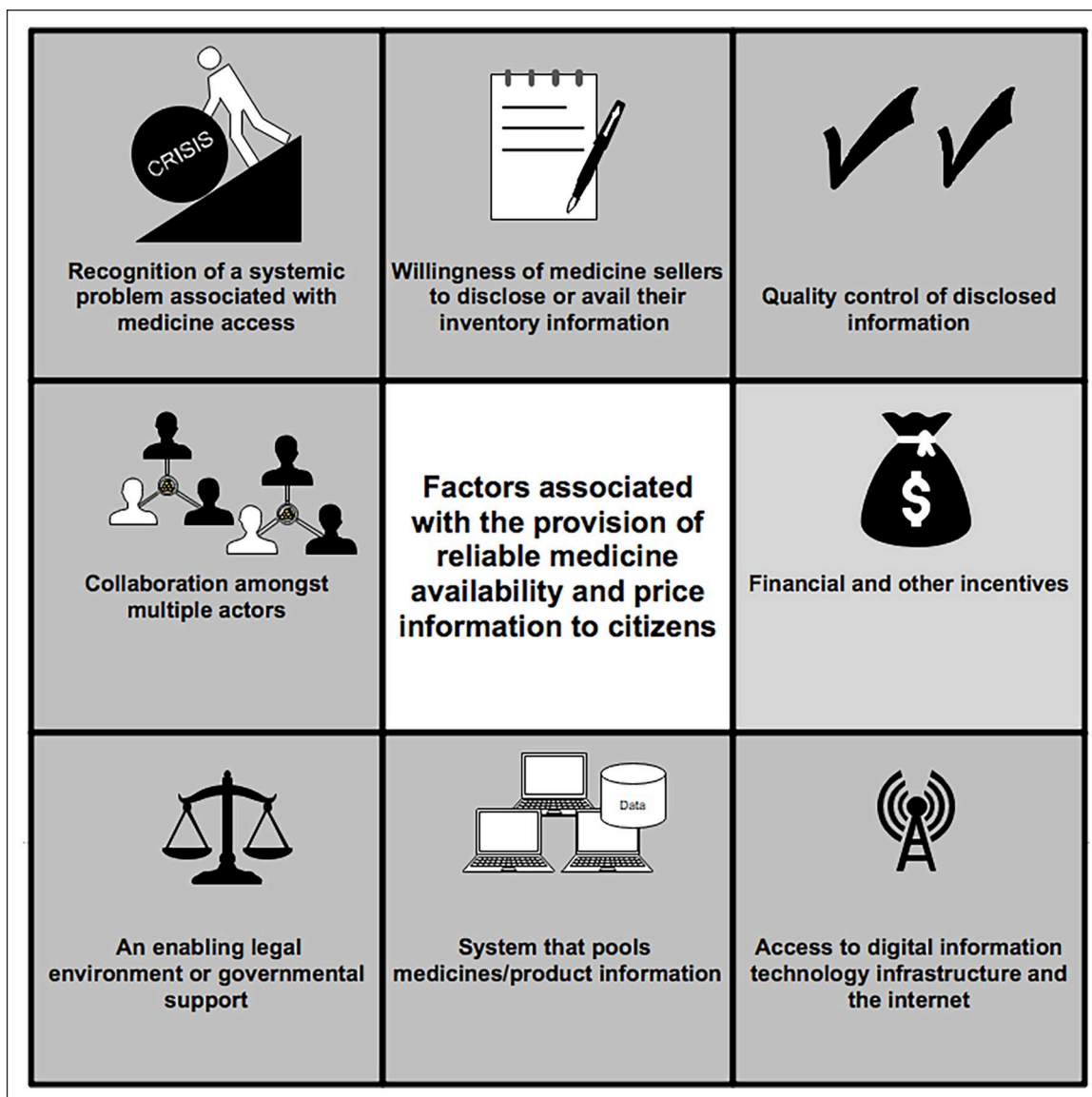


Figure 4. Factors associated with the provision of medicines availability and price information to consumers.

information that it provides. Finally, following Taiwanese citizens and residents' reliance on crowdsourced social media mask availability information, the government began to supply real-time pharmacy mask inventory information, to facilitate access to information that's more reliable.⁵³

Collaboration amongst multiple actors. Medicine price and availability information interventions are typically the result of collaborative actions, with different actor groups in a society taking up different roles. These roles include: advocacy and drawing attention to the need for an intervention, for example, citizens or bilateral development partners,^{43,44,53} approving, developing, funding and leading the intervention's implementation, for example, governments, private for-profit entities, software developers,^{53–56}

supplying the medicine and price information required to drive the interventions⁶⁷ or monitoring/verifying the information disclosed.⁶¹

An enabling legal environment or governmental support. The interventions reviewed in this article owe their existence to permissive legal environments or government endorsement. In Peru, for instance, new legislation was promulgated to establish the Medicine Price Observatory⁵⁸ and mandated all medicine sellers to regularly submit their price information to the Medicines Price Observatory (MPO) Peru.⁵⁷ In the United States, the legal environment is considered liberal with respect to pharmaceutical advertising.⁷⁰ Interventions like GoodRxTM can be implemented there with minimal advertising-related legal impediments. The WhatsApp groups used by Zimbabwean

pharmacists to indirectly communicate availability and price information to consumers operated with the implicit endorsement of medicine regulatory officers, some of whom were active members of these WhatsApp communities themselves.⁶⁷ The Taiwan face mask apps were developed following encouragement by the government, using real-time mask inventory information provided by the same government.^{53,54}

Incentives. Incentives for both the consumers and providers of medicine availability and price information encourage the adoption of interventions that provide this information. For consumers, the prospect of accessing products quicker and more affordably, can be a powerful incentive for adoption. GoodRxTM incentivises consumers by offering them medicine discount coupons in addition to providing them with medicine prices and the pharmacy locations where these medicines are available. Although some pharmacies can lose revenue by dispensing medicines at discounted prices to bearers of GoodRxTM coupons,⁶⁴ and although there are concerns about the data protection policies of companies that supply discount coupons,⁶³ some pharmacists consider the potential increased traffic from coupon customers, a benefit.⁶⁴ Finally, participation on the Zimbabwean WhatsApp groups has several benefits for pharmacists. These benefits include: opportunities for socio-professional networking, opportunities to increase revenue by indirectly advertising their inventory and access to crowdsourced knowledge about a wide range of practice-related subjects.⁶⁷

A system that pools/crowdsources information. All medicines information interventions considered in this article rely on online systems of pooling medicines/product information. For instance, the Peruvian Ministry of Health manages a database (the MPO database) centrally. As already mentioned, Taiwan operates a single-payer National Health Insurance (NHI). The NHI-contracted pharmacies' information systems are linked to the NHI mainframe. Therefore, the Taiwanese government superintends over a central online location where mask inventory information from NHI-contracted pharmacies updates in real time. This information is then provided to the public through apps and websites. GoodRxTM and similar tools in the United States consolidate availability and price information from multiple pharmacies and deliver it from a single digital platform. The Zimbabwean WhatsApp groups are convergence sites for hundreds of pharmacists.⁶⁷ They act as informal pooling digital locations where multiple pharmacists' inventory information can be accessed.

Access to digital information technology infrastructure and the Internet. Medicine availability and price information pooled from a large number of pharmacies can be dynamic and voluminous. Medicine availability and price information therefore lends itself to management by digital tools

and transfer via the Internet. All the four interventions reviewed herein were Internet-based and could only be accessed via digital communication devices.

Discussion

Consumer ATM availability and price information is critical to facilitating patients' timely access to affordable medicines. Through two scoping reviews, we sought to assess the extent to which this is recognised in extant ATM theory and discourse. We also sought to uncover factors that tend to be associated with the development and persistence of interventions that provide consumers with medicine price and availability information. Our analysis revealed that the role of information in the achievement of medicine access and PSS goals is universally recognised in ATM literature. However, consistent with our pre-study hypothesis, information in the context of ATM is mainly conceptualised as a resource that enables macro-level planning and monitoring by governments, or as a resource that organisations and practitioners involved in medicine management can use to make rational choices. The ATM and PSS frameworks and models turned up by our review do not adequately capture and engage with the role of information as a decision-making tool for individual medicine seekers. It could be argued that if medicine availability and affordability of medicines is ensured at the macro-level, it will necessarily be guaranteed at the micro-level thereby negating the need for consumers to have access to price and availability information. However, in reality, market and government failures at the macro-level undermine ATM at the micro-level.^{17,33} The resulting price variations and the uneven distribution of medicine stocks across pharmacies and drugstores in a health system then justify providing consumers with information that will help them with price comparisons and with locating pharmacies/drugstores that have particular medicines in stock.

It is concerning that access to price and availability information by consumers is overlooked in ATM theory. It is concerning because, as Table 2 shows, ATM frameworks are usually developed specifically for particular aims.²⁵ ATM frameworks signal global health priorities and influence decisions about where attention is focused. What is excluded from frameworks, therefore, risks exclusion from the implementation agenda. Indeed, the lack of any mention of medicine price and availability information for consumers in the vast majority of ATM and PSS frameworks coincides with the following observation from this article's second scoping review: very few implementation cases exist of tools developed to assist consumers in timeously locating sources of affordable medicines and other medical devices typically found at pharmacies.

Despite the limited number of examples of medicine availability and price information tools aimed at individual consumers, they exhibit considerable diversity as far

as types of actors that are driving the intervention implementation is concerned. In the United States, it is private corporations (exemplified by GoodRx) that are providing access to consumer price and availability information. In Peru, the MPO was established by the government, following processes brokered by the Medicines Transparency Alliance, a multi-stakeholder initiative. In Taiwan, it was the civil society of netizens that developed Maskmap apps with governmental support. In Zimbabwe, the WhatsApp groups used as a source of real-time price and availability information are products of action by healthcare professionals (pharmacists). This observation demonstrates that the under-provision of availability and price information to consumers is problematised from the perspectives of actors in diverse sectors. This bodes well for collaboration,⁷¹ one of the factors consistent with the successful establishment of platforms that supply medicine availability and price information to consumers.

The simplistic visual representation of the factors associated with the provision of medicine availability and price information to consumers (Figure 4), should not be allowed to belie the complexity associated with getting all these eight factors to align. Achieving each of them can potentially require years of skilfully navigating socio-political landscapes while managing financial, human and information resources. For example:

- The recognition of an access-related systemic problem requires people to problematise the crisis, possess agenda-setting power or at least have access to entities that have agenda-setting power.⁷² Examples of such agenda-setting entities include, government, private sector businesses or civil society.
- The willingness of medicine sellers to disclose or avail their inventory information depends on how they perceive the costs and benefits of such disclosure.⁶⁷ Clarifying the incentives or demonstrating the benefits for medicine sellers is key.
- Ways of safeguarding the quality of inventory and price information disclosed by medicine sellers are integral to any plan to provide reliable consumer information. However, the sheer volume of rapidly changing data reported by diverse sources can threaten the feasibility of effective information quality control plans.⁷³ This challenge can be managed by implementing risk-based verification models, where information from unreliable information suppliers is verified more rigorously than information from sources that are routinely reliable.
- Coming up with the right incentives for pharmaceutical system actors to adopt certain innovations or behave in particular ways requires contextual and institutional analyses to understand the subjective perspectives of stakeholders.³³

- Most governments regulate the flow of medicines information to consumers. On one hand, direct-to-consumer pharmaceutical advertising (DTCPA) laws can limit the ways in which medicine sellers can communicate details of their inventory and prices.^{16,70} On the other hand, legal coercion may facilitate the disclosure of inventory information by pharmaceutical service providers. An enabling legal environment or other governmental support is necessary to successfully deliver a medicines price and availability information tool. Yet, it may take years of lobbying to create.⁷⁴ It is however possible; in Zimbabwe for instance, courts of law were used to successfully lobby for the acceptance of a medicine price and availability information proposal.⁷⁵
- Information pooling systems or centralised information systems may be at odds with the common new public management philosophy, which favour decentralised systems more.⁷⁶ However, decentralised systems need not prohibit the crowdsourcing activities that are necessary for running medicines information services.
- Ensuring equitable access to digital information technology infrastructure and access to the Internet demands considerable financial investment and the political will to leverage technology for socioeconomic development.⁷⁷ Yet, this too can be achieved even by governments in low-income countries.⁷⁵

Finally, it is worth highlighting that the pursuit of the goal of providing consumers with medicine availability and price information may be associated with potential pitfalls that must be mitigated or guarded against. Here, we discuss three that are related to patient safety, social inequalities as well as information governance.

Patient safety

Tools that point consumers towards pharmacies that have particular medicines in stock, have the potential to drive patients towards pharmacies that dispense medicines of unverifiable quality. Even licenced pharmacies have been shown to stock substandard medicines.⁷⁸⁻⁸⁰

Social inequalities

Digital health interventions have the potential to bridge inequalities in health systems. For instance, telemedicine tools allow physically inaccessible patients to access medical care remotely.^{81,82} However, digital health interventions also have the potential to widen health inequalities,⁸³ especially in Africa's developing countries.⁸⁴ National level of economic development and geographic location, level of education, poor computer skills, literacy skills, including health literacy, age, ability to pay for the

technology, ethnicity, economic status all shape one's engagement with digital health interventions.^{83,85,86} Likewise, digital tools that disseminate information about where particular medicines are available have both the potential to facilitate quicker access to affordable medicines for some patients, and the potential to widen pre-existing inequalities. For consumers to effectively use medicine price and availability tools, they would need to have access to the Internet and Internet-enabled devices. They would also need to be medically literate enough to be able to decode their own prescriptions or be assertive enough to demand that their healthcare providers clarify the contents of their written prescriptions. This means that demographic groups lacking medical literacy and/or Internet access can be excluded from potentially useful information services.

Information governance

The application of digital information management tools to healthcare-related processes raises data privacy and security concerns.^{87–89} For instance, data privacy and security concerns were raised about the selling of patient data to third parties by private sector firms like GoodRx, which run digital platforms to inform patients about the prices of medicines at different pharmacies in the United States. In addition to providing this obviously useful information to citizens, these firms then also offer discount coupons that citizens can redeem as they purchase medicines. It is in exchange of these coupons that these firms collect and store patients' data.⁶⁴ On the WhatsApp groups used by Zimbabwean pharmacists, pictures of patients' prescriptions were shared in order to find out the pharmacies that were able to dispense the medicines on the prescriptions. Although the WhatsApp group rules required that the patient name and other personal details be concealed before a prescription picture was posted onto the groups, some pharmacists neglected to do this. Social media, although convenient for social communication, is not secure enough for the transmission of health information.⁹⁰ In some jurisdictions, healthcare professionals have been investigated by regulators for inappropriately transmitting health information via social media.⁹¹

Limitations

Consistent with the methodological framework for conducting scoping reviews, we did not discount reports based on a critical appraisal of quality. We included all documents turned up by our scoping review that reported on the intervention of interest. In coming up with the factors associated with the provision of medicines availability and price information to citizens, we then relied only on these reports, many of which were mostly positive and did not shed light on adoption or implementation challenges or the lack thereof. Moreover, only four interventions were

identified through this scoping review. As similar interventions emerge and become reported in critical and balanced ways, the set of factors we advanced in this article will likely be modified. Second, we focused our review on content written in English or Spanish. It is possible that this might explain the low number of interventions discovered during the second scoping review.

Conclusion and recommendations

The role of information as an enabler of ATM is well-recognised. However, information is almost always conceptualised as a decision-making resource for governments, policymakers and organisations in their quest to ensure access to affordable medicines for whole populations and communities. In ATM discourse, information is less often cast as a decision-making aid for consumers as they seek to find out where to access specific medicines affordably. We recommend that more focused attention be directed at how medicine price and medicine availability information can empower individual medicine consumers to make sound purchasing decisions. Digital innovations that aim to directly or indirectly supply consumers with real-time information about where particular pharmacy products are in stock, as well as the price thereof, have begun to emerge. Their success however turns on governments, civil society, private sector and medicine sellers, working in concert to:

- identify the value of transparency and information access at every level of the pharmaceutical system,
- promote legal environments, information quality control protocols and incentive frameworks that are conducive for the equitable access to reliable consumer information and
- build and sustain the requisite digital information management infrastructure.

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Author contribution(s)

Dudzai Mureyi: Conceptualisation; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Writing – original draft.

Shingai D Gwatidzo: Formal analysis; Methodology; Validation; Writing – review & editing.

Celia MJ Matyanga: Formal analysis; Methodology; Validation; Writing – review & editing.

Availability of data and materials

All data generated or analysed during this study are included in this published article (and its Supplemental Information File).

Declaration of conflicting interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: The first author is a pharmacist currently researching and developing an intervention that aims to provide citizens with medicine availability and price information and has recently received funding from the Government of Zimbabwe to develop this intervention. The Government of Zimbabwe had no role in the design of this study and collection, analysis, and interpretation of data, in writing the article or the decision to publish. The remaining authors declare that they have no conflict of interest.

Ethical approval

This article reports the carrying out of two literature reviews. No animal or human studies were carried out. No secondary analysis of data collected from humans was carried out. Therefore ethics approval was not sought.

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Human rights

This article reports the carrying out of two literature reviews. No human studies were carried out. No secondary analysis of data collected from humans was carried out. Our work did not have human rights implications.

Informed consent

This article reports the carrying out of two literature reviews. No animal or human studies were carried out. No secondary analysis of data collected from humans was carried out. Therefore informed consent was not sought.

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Supplemental material

Supplemental material for this article is available online.

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