Behavioural Factors Influencing Antiviral Stockpiling and Distribution: A Scoping Review

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Questions

● *Primary question*: What behavioural factors influence the stockpile management and distribution of antiviral medications against respiratory viruses associated with severe disease?
● *Secondary question*: What are potential differences in community-based distribution versus hospital distribution of antivirals against respiratory viruses associated with severe disease?

Executive summary

Background

- Pandemic preparedness guidelines advising the stockpile and use of antiviral medications have been in place since the World Health Organisation's 1999 Influenza Pandemic Preparedness Plan (Shindo et al., 2025).
- While technical and logistical considerations are central to optimal stockpile and distribution planning, decisions around how antivirals are managed are also influenced by behavioural factors.
- Behavioural factors that may influence antiviral medication stockpiling and distribution include the perceptions, emotions, and decision-making processes that shape how individuals, such as policymakers and healthcare professionals, manage antivirals.
- Despite the importance of these behavioural factors, to our knowledge, no previous evidence synthesis has examined stockpiling and distribution of antivirals through a behavioural science lens.
- This review of behavioural factors that may influence antiviral stockpiling and distribution decisions seeks to support best practices for promoting the effective, timely, and equitable deployment of antivirals.

Box 1: Our approach

We conducted a scoping review. The protocol for this review is available on OSF: https://osf.io/9c5rm/overview?view_only=c5d830774fcf48dd852416cab6f01edf

Outcome measures: Behavioural factors influencing the distribution and stockpiling of antiviral medication.

Databases Searched: Web of Science, CINAHL, PsychINFO, Medline, and Embase.

Timeframe: 1988-March 5th, 2026.

Eligibility Criteria (Appendix, *Table S1)*: *Population*: All countries; *Setting:* Pandemic and non-pandemic; and *Study Designs:* Cohort studies; Case-control studies; Observational studies; Quasi-experimental studies; Experimental studies; Randomized control trials; Case report; Case series; Qualitative studies; Mixed methods; Modelling studies.

Data extraction: We extracted barriers and facilitators from each study using the Theoretical Domains Framework. One reviewer extracted data, which was validated by an independent reviewer.

Critical appraisal: We assessed risk of bias using the MMAT (Hong et al., 2018; Appendix, *Table S5*).

Summaries: We summarise the evidence by presenting 8 domains of behavioural barriers and facilitators to optimal decision-making for antiviral stockpiling and distribution.

Findings from the included studies were mapped onto the Theoretical Domains Framework (TDF), which is a commonly used tool to understand and assess the multi-level barriers and facilitators for a behaviour (i.e., stockpiling and distribution antivirals). It also allows for the future mapping of the barriers and facilitators to the development of interventions to facilitate that behaviour.

Recommendations for decision-makers

While the following recommendations provide preliminary considerations for informing strategies to improve the equitable and effective stockpiling and distribution of antivirals, they should be interpreted with caution due to the limited evidence currently available.

- Establish a strategy for regularly updating and communicating guidelines around antiviral distribution during pandemics and consider a centralised method of disseminating national-level guidance (e.g., at the federal instead of provincial level).
- Consider expanding the role of pharmacists for the distribution of antivirals.
- Alternative distribution strategies, including telehealth and local rapid-distribution strategies, may be particularly important for improving equitable access to antivirals.
- Guidance to prevent undue influence from conflicting government organisations and pharmaceutical companies could be developed, including increasing awareness of the tactics and strategies used by pharmaceutical manufacturers to evoke fear in practitioners, experts, and policy makers and influence their decision-making.
- Obtain further research that specifically addresses antiviral distribution through public health models.
- Develop appropriate personal protective equipment distribution and instruction to healthcare professionals involved in antiviral distribution to reduce feelings of fear related to contracting an illness.

Overview of evidence

Facilitators included (see Table 1 and appendix: Table S6):

- Pharmacists expressed confidence in their ability to effectively implement the stockpiling and distribution of antivirals;
- Public preferences for pharmacy-based antiviral distribution;
- A desire for equity-focused goals that aimed to improve access for high-risk and underserved populations; and
- Locally responsive distribution strategies that were based on collaborative approaches, including pharmacist-led models and telehealth strategies, were viewed as beneficial to the effective distribution of antivirals.

Barriers included (see Table 1 and appendix: Table S6):

- During active pandemics, changing guidance around antiviral distribution created confusion among decision-makers;
- Operational changes that may be needed to address staffing shortages and administrative hurdles, which were reported to affect distribution efficiency during a number of (but not all) pandemic response efforts;
- Undue fear created by lobbying pressure from pharmaceutical companies;
- Conflicting policies between different governmental organisations;
- The fear of both a lack of access to adequate procurement of antivirals and the fear of a large-scale pandemic were reported as potentially impacting stockpiling decision-making;
- The fear of contracting an illness from being a part of the distribution chain; and
- Decision-makers may not have had an accurate understanding of the negative consequences and risks associated with delayed procurement or adequate stockpiling.

Knowledge gaps

There are multiple knowledge gaps within the literature including:

- A lack of governmental and health authority decision-maker perspectives;
- A lack of data around behavioural domains associated with skills, identity associated with one's social/professional role and identity, reinforcement, intentions, memory, attention and decision processes, and behavioural regulation;
- A limited number of primary empirical studies that have investigated behavioural factors associated with antiviral stockpile and distribution among decision-makers; and
- Only one article was conducted in Canada. The predominance of evidence from the United States (5 out of 8 articles) may limit the applicability of findings to the Canadian healthcare context.

Findings

Flow of included studies

A total of 3,837 articles were initially retrieved and after removing duplicates, 2,587 articles were title and abstract screened by a minimum of two reviewers independently, with 102 articles (one additional article was obtained from a related review on antiviral use) being full-text appraised (appendix: Figure 1). Eight articles met all inclusion criteria (Appendix, Table S1). Two articles were survey-based cross-sectional studies and six were qualitative or mixed-methods studies (appendix: Table S4). Three of the articles were informed by decision-makers involved in antiviral stockpiling and distribution, however, the remaining available information originates from the wider community and pharmacists. A list of studies excluded during full text screening is available in the appendix (appendix: Table S3). The search strategy used for each of the five databases is available (appendix: Table S2).

Table 1

Overview of the Behavioural Domains Corresponding to each Article

	TDF domains							
First author, publication year Setting	**1. Knowledge**	**4. Beliefs about capabilities**	**5. Optimism**	**6. Beliefs about Consequences**	**9. Goals**	**11. Environmental context and resources**	**12. Social influences**	**13. Emotion**
Fain, 2014 Community	0	0	0	0	0	2	0	0
Heimonen, 2021 Community	0	0	0	0	0	2	0	0
Hunter, 2012 Decision makers and experts	2	0	0	0	0	2	0	0
Pongcharoensuk, 2012 Mixed (community, hospital and other settings)	0	0	0	0	0	1	1	0

SteelFisher, 2018a Community pharmacy	0	2	1	0	0	4	0	1
SteelFisher, 2018b Community	0	0	0	3	0	4	0	0
Vilhelmsson, 2018 Decision makers and experts	0	0	0	4	0	0	1	1
Workneh, 2025 Decision makers and experts	0	0	0	0	1	0	1	0
Total studies	**1**	**1**	**1**	**2**	**1**	**6**	**3**	**2**
Total no. of times noted	**2**	**2**	**1**	**7**	**1**	**14**	**4**	**2**

Note. The domains are based on the Theoretical Domains Framework (TDF) (Atkins et al., 2017).

Detailed findings for each TDF domain

The following findings are a synthesis of the behavioural barriers and facilitators identified in the literature that may influence the stockpile management and distribution of antiviral medications against respiratory viruses associated with severe disease. These findings address the primary question by identifying the behavioural factors that may affect decision-making and implementation related to antiviral stockpiles and distribution systems. The secondary question, which sought to identify potential differences in community-based distribution versus hospital distribution of antivirals could not be adequately addressed because of the limited available evidence.

1. Knowledge: This domain corresponds to an individual's awareness of or scientific rationale for the stockpiling and distribution of antivirals.

None of the articles included in this scoping review reported a lack of scientific knowledge regarding the effectiveness of antivirals as a barrier; however, changing guidelines were considered to have the potential to undermine the appropriate distribution of antivirals.

1.1. Changes in guidelines (Barrier)

According to Hunter et al. (2012), evolving guidance during pandemics created confusion among decision-makers. During the 2009 H1N1 pandemic, Hunter et al. (2012) found that "changing guidance made it difficult for [public health policymakers] to determine appropriate recipients."

2. Beliefs about capabilities: This domain corresponds to individuals' confidence in their ability to effectively support antiviral stockpiling and distribution.

Based on the articles from this review, we identified one facilitator and one barrier relating to this domain that was associated with distribution but none relating to stockpiling. Although pharmacists generally reported high levels of confidence in their ability to play their part in the

distribution of antivirals, inadequate operational support was perceived as limiting their capacity to do so effectively.

2.1. Pharmacy capabilities (Facilitator)

Most pharmacists interviewed by SteelFisher et al. (2018a) reported having confidence in their ability to participate in pandemic influenza response activities, and many identified pharmacy-level structural or service features that could help manage the flow of patients and reduce crowding. These factors were viewed as facilitators that could support effective distribution via pharmacies in future pandemic situations.

2.2. Insufficient operational support (Barrier)

Although pharmacists felt that they had the capability to assist in the distribution of antivirals during pandemics, "Relatively few pharmacists felt that their pharmacies had access to operational supports that could logically facilitate participation" (SteelFisher et al., 2018a).

3. Optimism: This domain reflects positive expectations regarding the benefits and success of antiviral distribution systems.

Based on articles from this review, we identified one facilitator relating to optimism.

3.1. Pharmacists support (Facilitator)

Pharmacists showed strong optimism toward a proposed alternative distribution model that would expand the role of pharmacies in antiviral distribution of antivirals (SteelFisher et al., 2018a). "The vast majority thought it was a good idea (85% of surveyed participants) and a good thing for the pharmacist profession (84% of surveyed participants)" (SteelFisher et al., 2018a). Nearly all participants anticipated that it would enhance the role of pharmacists in public health emergencies and improve relationships with patients. A substantial proportion also expected strengthened collaboration with public health agencies and physicians, although fewer expressed strong certainty about these relational improvements.

4. Beliefs about consequences: This domain corresponds to individuals' perceptions of the expected consequences of antiviral stockpiling and distribution.

Based on articles from this review, we identified one facilitator and one barrier. Public trust in pharmacies was viewed as facilitating antiviral distribution; however, perceived pharmaceutical industry influence was overall considered a barrier to stockpiling decisions.

4.1. Trust in public pharmacies (Facilitator)

Public preferences for pharmacy-based antiviral distribution were influenced by the anticipated consequences of different dispensing settings (SteelFisher et al., 2018b). Many participants preferred pharmacies over public health clinics because they trusted pharmacy staff and believed pharmacies would have a sufficient stockpile of antivirals (SteelFisher, 2018b). The public also expected pharmacies would have better crowd control during distribution. However, relatively few viewed pharmacies as providing safer or more effective antivirals, suggesting that trust and operational considerations were more influential than perceptions of medication quality.

4.2. Undue commercial influence (Barrier)

Vilhelmsson and Mulinari (2018) described instances in which a pharmaceutical company lobbied political and public health decision-makers during antiviral procurement. According to pandemic response group members interviewed by Vilhelmsson and Mulinari (2018), a

pharmaceutical manufacturer urged decision-makers to rapidly agree to a procurement agreement, stating that antivirals would be allocated on a "first-come, first-served basis", and implying that failure to sign by a specified date meant the company could not guarantee substantial quantities in the near future. Vilhelmsson and Mulinari (2018) also reported on allegations that an antiviral manufacturer promoted antivirals sales by claiming Denmark's stockpile was insufficient compared with those of other countries, thereby increasing the country's vulnerability to a major influenza outbreak. According to one Danish decision-maker interviewed by Vilhelmsson and Mulinari (2018), a pharmaceutical company indicated that governments who purchase substantial quantities of the antiviral would receive a special offer to be placed earlier in the queue of governments receiving the first procurements. Although the impact is difficult to verify, most members of the Danish core pandemic committee perceived that pharmaceutical lobbying about potential consequences of inadequate stockpiling influenced the volume of antivirals purchased for stockpiling (Vilhelmsson & Mulinari, 2018), which suggests that pharmaceutical company interests may have impacted decisions that were expected to be guided by research evidence and public health priorities.

5. Goals: This domain reflects the priorities and desired outcomes that guide antiviral distribution.

Based on articles from this review, we identified one facilitator relating to goals. Prioritising equitable access for high-risk populations was identified as an important goal supporting the distribution of antivirals.

5.1. Health equity (Facilitator)

Equitable access, including the prioritisation of high-risk populations, was identified as a key goal for antiviral distribution (Workneh et al., 2025). Among jurisdictional representatives in Canada, this included strategies to improve access for First Nation communities by adapting eligibility criteria, such as reducing age requirements for access to antivirals. Equity considerations also informed efforts to establish access points closer to First Nation communities and improve timely access to antivirals in long-term care facilities (Workneh et al., 2025). These examples illustrate how broader equity goals were translated into specific future antiviral distribution approaches.

6. Environmental context and resources: This domain corresponds to external factors and environmental conditions that may influence antiviral stockpiling and distribution behaviours.

Based on articles from this review, we identified facilitators related to virtual and rapid distribution, risk tolerance, local provisions, and community-based approaches. We also identified barriers related to antiviral costs and staffing resources. Overall, community-oriented approaches were perceived as supporting timely antiviral access and limited resources were perceived as being a barrier to effective distribution.

6.1. Virtual and rapid distribution (Facilitator)

According to Heimonen et al. (2021), telehealth-supported prescribing facilitated antiviral distribution by removing the need for in-person healthcare visits. The availability of rapid antiviral delivery reduced delays between symptom onset and antiviral access. For instance, based on an intervention study in the Seattle-area, 87.5% of home deliveries occurred within 3 hours from the time of baloxavir marboxil prescription (Heimonen et al., 2021).

6.2. Risk tolerance (Facilitator)

According to public consultations, there was a willingness to accept modest risks associated with distributing antivirals via community groups or first responders if such approaches increased timely access to treatment for a larger proportion of the population (Fain et al., 2014). A key risk that was perceived with distributing antivirals without face-to-face consultations related to increased legal liability (Fain et al., 2014). This distribution approach reflected support for resource arrangements that prioritised accessibility and public health benefit over the possibility that some individuals may unnecessarily take advantage of stockpiled antivirals.

6.3. Local provisions (Facilitator)

Access to local pharmacies and hospital clinics was identified as an important facilitator of antiviral distribution (SteelFisher et al., 2018a). According to SteelFisher et al. (2018a), 79% of participants preferred obtaining antivirals from pharmacies rather than public health clinics because they were perceived to be more convenient and accessible. Pharmacies with greater staffing capacity, including pharmacists, interns, and technicians, were also considered better equipped to support antiviral distribution. In addition, rural pharmacies were considered to have greater readiness to provide antiviral delivery services during a pandemic. Overall, pharmacies were viewed as favourable distribution sites because of their convenient locations, shorter wait times, and more flexible operating hours than public health clinics.

6.4. Community approach (Facilitator)

The general population generally endorsed the use of trusted community members to collect prescribed antivirals from pharmacies and deliver them to individuals recovering at home (Fain et al., 2014). Family members, friends, neighbours, and other community contacts were viewed as effective intermediaries for ensuring timely access to antivirals for patients who were isolating (Fain et al., 2014). This approach may facilitate faster and more efficient distribution of antivirals to individuals recovering at home while reducing unnecessary contact for healthcare professionals with potentially contagious individuals.

6.5. Antiviral costs (Barrier)

The cost of antivirals was identified as an important barrier to optimal decisions being made about the distribution of antivirals. Pongcharoensuk and colleagues (2012) reported that policymakers' decisions regarding antiviral procurement were shaped more by economic imperatives than by public health research evidence. Among the public, cost considerations influenced preferences for distribution settings: when antivirals were available free of charge through both pharmacies and public health clinics, approximately three-quarters (74%) of participants indicated that they would prefer to access them though a pharmacy (SteelFisher et al., 2018b). However, concerns about potentially higher costs at pharmacies, compared to other settings, were also identified as a major reason for avoiding pharmacy-based distribution (SteelFisher et al., 2018b).

6.2. Staffing resources (Barrier)

Although the distribution of antivirals through local health departments may be more efficient, shortages of staff created operational barriers to antiviral distribution. Indeed, Hunter et al. (2012) found that local health departments reported persistent challenges related to staffing shortages and administrative hurdles, which reduced distribution efficiency during pandemic response efforts (Hunter et al., 2012).

7. Social influences: This domain corresponds to interpersonal influences that may help to explain how stockpiling and distribution decisions were made.

Based on articles from this review, we identified a facilitator related to collaborative practices among and between organisations. In addition, we identified barriers related to perceived manufacturer influence and government decision-making pressures.

7.1. Multilateral collaborative practices (Facilitator)

Strong interprofessional and interorganisational collaboration was identified as a key resource supporting antiviral distribution. Indeed, improved collaboration between regional medical officers of public health and pharmacy leaders allowed for the identification of gaps in distribution (Workneh et al., 2025). Furthermore, partnerships between public health authorities, pharmacists, physicians, and nurses in a medical advisory committee were credited with preventing the depletion of Paxlovid stockpiles (Workneh et al., 2025).

7.2. Perceived manufacturer's influence on specialists (Barrier)

Perceived pharmaceutical influence on antiviral stockpiling decisions was described as occurring though interactions with medical practitioners. For instance, following the 2009 H1N1 pandemic, one member of the Danish pandemic committee reported receiving pressure from infectious disease specialists to increase antiviral stockpiles and interpreted this pressure as potentially reflecting pharmaceutical industry interests (Vilhelmsson & Mulinari, 2018). One participant indicated that "there was great pressure from many colleagues in the medical field to buy more antivirals, but I think it was a kind of lobbyism from the industry" (Vilhelmsson & Mulinari, 2018).

7.3. Government decision-making hierarchies (Barrier)

Intra-govermental pressures were identified asa potential barrier to optimal purchasing of antivirals within government decision-making organisations. Specifically, Pongcharoensuk et al. (2012) reported that the Thai Ministry of Finance "dominated the public health debate" and discussions regarding how much antivirals should be stockpiled. Although Pongcharoensuk et al. (2012) did not specify the resulting procurement decision or whether it led to over or under-stockpiling, the findings suggest that financial priorities may influence decisions that would otherwise be guided by public health decision-makers.

8. Emotion: This domain corresponds to emotional responses that influence antiviral stockpiling.

The key barriers focused on fear as the principal emotional limitation to optimal stockpiling. No facilitators were identified in the literature that corresponded to the emotion-focused domain, and no articles were identified that discussed emotions as affecting the distribution of antivirals.

8.1. Fear of personal repercussions (Barrier)

Despite being willing to contribute to an alternative distribution system that included pharmacies, 71% of pharmacists were worried about the risk of carrying the influenza virus to their families. This worry was greater among younger pharmacists and those who had children (SteelFisher et al., 2018a). Additional concerns about personal repercussions represented a perceived barrier to the implementation of an alternative distribution system (SteelFisher et al., 2018a). For example, 81% of pharmacists surveyed by SteelFisher et al. (2018a), were worried that an alternative distribution system may result in antiviral shortages that would frustrate patients. These findings suggest that successful pharmacy-based distribution of antivirals may

require strategies to address concerns around occupational and personal risks undertaken by pharmacists.

8.2. Fear of major outbreak (Barrier)

Fear of a major outbreak was also reported as influencing stockpiling decisions by potentially amplifying perceptions of vulnerability and increasing a country's stockpiling needs. Decision-makers described how comparisons with other countries' stockpiles and warnings about inadequate preparedness contributed to pressure for the additional procurement of antivirals (Vilhelmsson & Mulinari, 2018). For example, Norway's procurement decisions were reportedly referenced as justification for why Denmark should increase its own stockpile. These findings suggest that perceived fear, potentially caused by comparisons between countries, may have contributed to precautionary purchasing that was not fully determined by a country's scientific evidence and public health priorities.

TDF domains that were not represented in the literature

- **Skills**: This domain corresponds to individual's abilities acquired though the experience of making decisions around the stockpiling and distribution of antivirals.
- **Social/professional role and identity:** This domain corresponds to barriers and facilitators for the stockpiling and distribution of antivirals that could be impacted by the set of behaviours considered appropriate for a specific work title or position.
- **Reinforcement:** This domain corresponds to factors that increase or decrease the probability of behaviours related to the stockpiling and distribution of antivirals through anticipated or experienced rewards or other consequences.
- **Intentions:** This domain corresponds the individuals' conscious decisions or plans to engage in specific behaviours related to the stockpiling and distribution of antivirals.
- **Memory, attention, and decision processes:** This domain corresponds to individuals' ability to retain information, focus on important aspects of the environment, and make effective decisions regarding the stockpiling and distribution of antivirals.
- **Behavioural regulation:** This domain corresponds to strategies used to monitor or manage behaviours related to the stockpiling and distribution of antivirals.

Limitations

To our knowledge, this is the first evidence synthesis to investigate behavioural factors influencing the stockpiling and distribution of antivirals. Although this review provides valuable insights into the behavioural facilitators and barriers to effective stockpiling and distribution, several limitations should be considered when using this report.

- First, the available evidence was limited in both the number and diversity of primary articles on the topic of antiviral stockpiling and distribution. Specifically, the evidence identified may have overrepresented the perspective of pharmacists and the general public. Future research is therefore needed to establish the perspectives of a wider variety of healthcare professionals (e.g., nurses, physicians), emergency planners, policymakers, and government health authority decision-makers. In addition, future research may seek to prioritise the perspectives of populations at greater risk, including people who are immunocompromised or have complex multimorbidity, underserved populations, and those experiencing heightened vulnerability due to intersecting identities or unfavourable social determinants of health. Capturing qualitative and focused quantitative data from a variety of interested parties from

different local and national settings that are representative of different healthcare professions and health authorities could be an ideal method of addressing this limitation.

- Second, the evidence included in this review was heterogeneous in terms of populations, countries, healthcare systems, and considered both pandemic and non-pandemic contexts, thus making consistent definitive findings hard to generate. Additional evidence is therefore needed to better understand how these moderating factors could impact decisions around the stockpile management and distribution of antivirals.
- Finally, the evidence base was largely composed of older studies, with only two articles published since the start of the COVID-19 pandemic. Therefore, the findings of this review may not reflect the current context of antiviral distribution and stockpiling of Canada.

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