MAPPING A COMPLEX GLOBAL SUPPLY CHAIN

MEDICINES SUPPLY

RESILIENCE GROUP

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MEDICINES SUPPLY RESILIENCE GROUP

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EXECUTIVE SUMMARY

There are over 1 billion medicines supplied to patients in the community every year.

These medicines are produced through a complex supply chain, that crosses many different sectors.

The supply chain is global in nature, with many different factors impacting it.

With interconnected sectors, a change in one stage can impact up and down the supply chain.

With such a complex supply chain, ensuring resilience is key to making sure patients have access to the vital medicines they need.

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INTRODUCTION

Ensuring patients have reliable access to essential medicines is a critical component of a safe, effective and resilient healthcare system.

This report outlines how medicines reach patients in Great Britain, describing the end-to-end supply chain from global sourcing and manufacturing through to prescribing, dispensing and final supply. It highlights the extent to which the UK relies on complex international networks, operating within tight regulatory and economic constraints, and illustrates how disruption at any point can have rapid and widespread consequences.

It is intended to support informed policy discussion on how medicines supply resilience can be strengthened in the interests of patients, the NHS and wider public health.

The global medicines supply chain can be divided into six separate stages:

1. Sourcing Raw Materials
2. Active Ingredient and Final Dosage Form Manufacturing
3. Global and Domestic Distribution
4. Community Pharmacy Procurement
5. Prescribing & Patient Demand
6. Supply to Patient

Each stage of the global medicines supply chain is its own sector with complex and unique challenges, often spread across different countries. For example, wholesale distributors represent a separate industry between manufacturers and pharmacies. Every stage is interdependent on the others.

The details in this report focus on the over 1 billion NHS prescription medications dispensed by community pharmacies in Great Britain every year. Understanding and supporting each stage of this supply chain is vital for overall medicines security.

Over-the-counter (OTC) medicines (purchased by the public), secondary care (hospital supplies) and private sector prescriptions have different considerations and are not described here. However, many of the principles still apply.

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1. SOURCING RAW MATERIALS

The journey of medicine manufacturing does not begin at the creation of the medicine in a manufacturing facility. Components used to make the medicine must be sourced, often from entirely separate sectors across different nations.

There are many different components needed to make a medicine. These generally fall into three main categories:

- Active pharmaceutical ingredients (APIs) – the part that effects the body
- Excipients – used to make the medicine or stabilise ingredients
- Intermediate ingredients and catalysts – part of the production process

Many of these components must also be manufactured themselves. These components come from raw materials known as 'key starting materials' (KSM). KSMs can be harvested from natural sources (such as the quinine extracted from the bark of the cinchona tree). Alternately they are synthesised through industrial processes (for example aspirin is produced from phenols and benzene derivatives, which come from petrochemicals).

This means before a pharmaceutical company can begin manufacturing the final medicine, materials must be sourced from other industries. Any disruption in the growing and harvesting or extraction and synthesis, can significantly impact downstream manufacturing and reduce supply. Disruption can also come in the form of sudden trade barriers for seemingly unrelated products and services, increasing the price of key ingredients.

China supplies a very large portion of key starting materials (KSM) in the global pharmaceutical supply chain – in particular, it supplies the vast majority of the KSM demand of India, who are in turn a significant exporter of finished APIs to the global market. [1] Smaller proportions are supplied by industries around the world, including petrochemical and industrial salts manufacturing.

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Problems that can occur:

Material Quality – Any extraction/refining/manufacturing failures resulting in poor quality outputs which may not meet regulatory criteria laid out in certificates of analysis (CoAs). Could also occur due to discovered falsification of CoAs. Batch failures of APIs can cause significant delays to final product manufacturing.

Geopolitical Risk – Overreliance on individual nations and regions leads to vulnerability in the event of deterioration in international relations. With the increasing rise of protectionism (particularly tariffs) in the current global context, this is becoming a more permanent barrier rather than simply a risk of sudden, flashpoint emergencies.

Regulation:

UK regulatory lead: MHRA
Global interfaces: FDA, EMA, exporting country authorities, WTO trade rules

Good Manufacturing Process (GMP) – while the GMP regulations from the MHRA are primarily concerned with APIs and the finished product which is produced in or imported to the UK, compliance with GMP also has requirements for KSM usage (e.g. full traceability, testing, formal risk assessments)

Import/export compliance – medicines destined for the UK, manufactured elsewhere, may have materials sourced from another country. Import/export compliance at each stage, from customs regulation to fees and tariffs, is important.

Material Traceability – the entire manufacturing process usually involves material and industrial contribution from multiple nations. As the product passes through this chain, country-of-origin documentation must be updated.

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2. ACTIVE INGREDIENT AND FINAL DOSAGE FORM MANUFACTURING

Pharmaceutical companies use KSMs to manufacture the final dosage form of any given medicine. This is a multi-step process:

1. **API production:** The KSMs are used to formulate APIs through chemical synthesis or bio-processing (using genetically coded bacteria to produce biological compounds for extraction).

2. **Finished Dosage Form (FDF) manufacturing:** FDF manufacturing is often complex and multi-faceted. The APIs, excipients and intermediate ingredients and catalysts are combined and processed into final form of the medicine (tablets, liquids, injectables etc). This part of the process includes any necessary sterilisation.

3. **Packaging:** Medicines packaging is critically important, not just in the information it often holds (who made the contents, when and where it was made, and when it expires) but also to ensure the medicines are stored and protected until they reach the patient, often many thousands of miles away and several months later. Packaging requires its own supply of materials, subject to many of the same complexities as the medicine.

Manufacturing failures of APIs, FDFs or packaging materials, whether domestically or abroad, can cause sudden supply issues, drastically reducing the availability of medicines and impacting market prices. China is a key exporter of APIs globally and India is a key producer of FDFs – particularly for generic medicines (medicines for which the patent has ended, allowing any organisation to manufacture it), which account for most of the NHS medicines used in the UK.

UK trade balance

The financial value of UK pharmaceutical exports nearly matches the nations imports. The make-up of these imports and exports reflects how global supply chains operate. UK domestic manufacturing produces small quantities of more novel, complex and expensive products. Conversely, overseas manufacturing accounts for a large volume of the medicines used in the UK.

It is estimated approximately **80% of prescribed NHS medicines are generics** (medicines outside of patent and produced by different manufacturers), [2] and of these around **75-80% are manufactured overseas**. [3] This equates to approximately 878 million items of the 1.463 billion items dispensed in Great Britain by community pharmacy in 2024/25.

Problems that can occur:

Manufacturing Failures – batch or entire process failures can cause sudden temporary limitations of supply. These can have several causes – equipment breakdown, labour shortages/disputes etc. The concentrating of manufacturing sites can increase the risk of significant impact when issues are environmental or labour related.

Operational Barriers – complex and expensive industrial process mean that there can be delays in ramping up production to meet any shortages or sudden spikes in demand. Similarly, if production is scaled back (for instance due to lowered demand), it can take time to restart.

Labelling and Packaging Errors – batches are earmarked for specific export markets and must meet packaging and labelling requirements. Errors can cause batch recalls, and differing market requirements leads to friction when trying to divert medicines.

Regulation:

UK regulatory lead: MHRA
Global interfaces: FDA, EMA, exporting country authorities, WTO trade rules, ICH

Good Manufacturing Practice – the production of API and final form medicines is under strict supervision via GMP regulation. This includes 'Rules and Guidance for Pharmaceutical Manufacturers and Distributors (Orange Guide) 2022' etc. This means that there is testing of ingredients that make up the medicine before they are even made and then strict requirements on how the product is made, what testing and controls are in place and then testing at the end to ensure the product meets it finished product specification.

Product and site regulation – Manufacturing Authorisations and site licensing must be acquired to supply a medicine to the UK. Responding quickly to spikes in demand (where licenses are not currently in use) can be challenging.

Labelling and packaging compliance – batches for the UK must meet MHRA labelling and packaging requirements. This includes patient information leaflets, which currently must be paper copies.

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3. GLOBAL AND DOMESTIC DISTRIBUTION

Global distribution

Medicines produced overseas are brought to the UK for onward distribution (subject to an implementation period). Most international shipping is transported across the ocean via cargo ships, as this is the cheapest form of transportation. Time-sensitive deliveries, such as some biologics and vaccines, must be transported via aeroplane to reduce transit times and avoid spoiling. EU imports can be delivered via lorry and ferry.

Note – domestically manufactured medicines skip this step, however it is likely that there will still be a need to import KSMs, APIs, excipients and packaging etc from global supply chains.

Some pharmaceutical companies distribute their products directly, but mostly this is done by wholesale distributors. Wholesalers purchase medicines in bulk, store them in warehouses, then transport them to pharmacies, hospitals and other healthcare providers as needed.

UK distribution

Once medicines are in the UK, they are transported to regional warehouses by wholesale distributors, usually via the UK road and rail networks. Medicines are stored at these locations until they are needed. Storage space is limited, meaning there is a careful balance between the demand for medicines held and the import of replacement batches of medicines.

The UK medicines distribution network ensures that there is sufficient stock of all medicines to meet the UK's needs and that it is distributed to where it is required in a timely, and efficient manner. However, sometimes there is variation in medicine supply, and some areas experience local shortages, requiring the government or NHS to assist with allocation.

Problems that can occur:

Global transportation tends to be very efficient and resistant to failures. **Only 5% of medicine supply issues** are attributable to transportation and logistics, which includes domestic distribution.

Whilst the likelihood of disruption is low, due to the scale of movement at this stage, the impact of disruption is significant. If geopolitical developments or accidents close off a vital

supply route – such as the Suez Canal – medicine supply can be instantly and dramatically reduced to large parts of the global market, with little ability to source alternative supply.

- **Logistical and transportation risks** – cold-chain failures can spoil batches of delicate medicines, and delays or capacity constraints with cargo shipping and air freight can lead to spoiled batches or localised shortages.
- **Security Risks** – while uncommon, the risk of theft and tampering poses additional security risks. Furthermore, the risk of falsification adds additional regulatory and security burden for legitimate exports.
- **Geopolitical disruption** – similar to manufacturing risks, pandemics, wars, trade disputes and shipping disruption (as well as key infrastructure failures, such as canals or airports) can lead to sudden disruption.

Regulation:

UK regulatory lead: MHRA, HMRC, Home Office (Controlled drugs)
Global interfaces: WHO and EU authorities (medicines specific), International Maritime Office

Licencing - companies importing, distributing and selling medicines must all have a valid and correct licence.

A – Wholesale dealer's licence: needed to import medicines from approved country lists
B – Manufacturer's licence: needed to import medicines from counties not on these above lists

Medicines regulation

- Medicines must be licenced by the MHRA via 'UK Marketing Authorisations' (MA's). Products must then be manufactured and tested under this MA and 'Good manufacturing process' (GMP).
- Each batch imported must be certified to meet this by a 'Qualified Person (QP)'. Not all jurisdictions recognise QP certification of medicines from other jurisdictions
- Importers must have a 'Responsible Person (import)' (RPi) verifying the above and taking responsibility for the records proving its authenticity and compliance with GMP.
- This verifies identity, strength (potency), purity, and stability, with specific tests for biologicals like vaccines checking for contaminants such as viruses or toxins. Batch testing is essential for patient safety, product efficacy and supply chain integrity. Whilst uncommon, batch failures can have a significant impact on global availability.

Good distribution practice – transportation of medicines under regulation and supervision, guidelines set out by MHRA in the 'Rules and Guidance for Pharmaceutical Distributors "Green Guide"'.

Controlled drug regulations – specific checks on controlled substances as directed by Home Office. Yearly permits are required for wholesale distributors to handle controlled drugs issued by the Home Office – disruption may occur if there are delays to the issuing or revalidation of these permits.

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4. COMMUNITY PHARMACY PROCUREMENT

Pharmacies ensure that they have adequate stock for dispensing medicines to local populations. To optimise access for patients pharmacies purchase most medicines from distributors in anticipation of prescriptions, rather than waiting for prescriptions to be presented. In a similar way to manufacturers and wholesalers, they forecast how much of each medicine they are likely to need, and balance this against how often they will receive deliveries. Pharmacies will not want to hold more stock than they will supply as this ties up cash that could be invested elsewhere in delivering patient care.

Each year the NHS in England spends around £9bn on the medicines supplied in primary care. The payment for procurement is dependent on a complex system of legislation, national contractual frameworks and regulatory bodies.

- Pharmacies are private businesses and purchase medicines using their own money (based on forecasts) on behalf of the NHS
- NHS prescribed medicines are supplied to patients free of charge, however there is a levy to be paid for each prescribed medical item, unless the patient is exempt from paying the levy. For example, in England patients aged 60 years or over do not pay the prescription levy. Wales and Scotland do not charge any residents a prescription levy.
    - England only: Pharmacies collect the levy from patients. The money is passed straight to the NHS. The pharmacy does not benefit from collecting the fee.
    - England only: Whilst there is a levy due for each item supplied, 90% of all NHS prescribed medicines are supplied to citizens who are exempt from paying the levy.
- The pharmacy then reclaims the cost of the medicines it has supplied from the NHS.

The cost pharmacies can reclaim for supplying each medicine is set out in the Drug Tariff, updated monthly. Pharmacies are incentivised to buy the best priced medicines for the NHS through the 'Retained Margin' system. The NHS and DHSC monitor the prices paid by pharmacies for the medicines and compare this to the tariff prices paid. The difference between these two prices is known as margin. The pharmacy network in England is collectively allowed to retain £900m of margin each year. This is a key component of how pharmacies are funded. In 2014 the retained margin was set at £800m, when 977million items were supplied at a cost of £7.9bn. In 2024/25 the margin was £850m for 1.16bn items at a cost of £9.6bn. Pharmacies are having to supply medicines for the NHS on ever reducing margins, despite the significant inflationary increases in general operating costs.

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At times, especially if there are any supply issues, a pharmacy may not be able to source a medicine at a price near to or below tariff price. However, the NHS terms of service mean the pharmacy still needs to obtain the medicine with reasonable promptness, even if it means purchasing it for more than they will be paid. This can cause cash flow issues, even if price concessions are later implemented.

In recent years the use of complex algorithms and AI to improve buying margins have led to an increased volume of medicines being procured in response to price fluctuations. This in turn has a material impact on the ability of wholesalers to forecast demand. Due to the very low margins that all parts of the supply chain are now operating under, changes in procurement behaviour across the system can lead to shortages for patients as speculative buying can mean that stocks are not available when and where they are needed.

Problems that can occur:

Wholesaler access – if certain pharmacies (for example in remote geographical areas) can only access a few wholesalers, supply risks are not spread sufficiently, and the network becomes more vulnerable to shortages if problems occur.

Operational barriers – inaccurate demand forecasting, or inefficient/slow reporting of demand spikes to wholesale distributors and other importers, can slow the reaction to, or increase the severity of, shortages.

Economic incentives – low margins can disincentivise stocking of particular medicines, preferencing higher-profit alternatives. Wholesalers and pharmacies may also bulk-purchase medicines to protect their local populations during the initial stages of shortages, exacerbating them.

Drug Tariff – if reimbursement prices do not adequately reflect market prices, pharmacies cannot afford to stock medicines and 'shortages' occur despite sufficient stock being produced.

Regulation:

UK regulatory lead: GPhC, NHS England, DHSC, CMA

Pharmacy and wholesaler licencing – wholesale distributors must be licensed to import and sell approved medicines. Only pharmacies with an NHS contract, registered with the GPhC can supply NHS prescriptions.

NHS Drug Tariff – pharmacies will only be reimbursed for purchased stock according to the Drug Tariff, updated each month, not necessarily the actual market price of the medicine

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5. PRESCRIBING AND PATIENT DEMAND

Medicines are prescribed by clinicians for patients and then dispensed by a pharmacy. Unforeseen spikes in patient demand or prescriber behaviours can create shortages as available stock is used more quickly than forecast. A spike in demand can occur from changes to prescribing habits (e.g. local formularies or changes to national guidance), shortages of a similar alternative medicine or changes in public awareness of specific medicines or conditions. It is often the case that demand-led shortages can originate in an entirely separate country and still affect the UK.

NHS Business Services Authority collates prescribing data to help identify trends in prescribing. There is a fine balance of data sharing to ensure that this itself doesn't drive behaviours to over order and amplify the supply issue.

Private healthcare *– not all medicines supplied in the UK are prescribed by the NHS. Private prescriptions are becoming more commonplace and, for example, the recent surge in demand for private weight loss medicines, can impact the wider medicines supply chain.*

Problems that can occur:

Demand Signal Failures – demand spikes can cause significant shortages, particularly when there is poor or untimely communication of this to prescribers, or upstream in the supply chain to increase imports/manufacturing.

NICE Guidance – when NICE guidance is changed, manufacturers may need time to respond to the demand increase this can cause.

Local formulary changes – with no national formulary, local variations (particularly when changing) can cause localised demand pressures.

Private demand – Private demand, off-label use surges and media-driven demand spikes have seen certain medicines become expensive or unavailable for NHS use. This can also cause OTC medicine to become unavailable for public purchase.

Regulation:

UK regulatory lead: GMC, NICE, NHSE, CQC, some global guidelines also enforced Prescribing Standards – appropriate and safe prescribing practices outlined by NICE, including substitutes/alternatives and when to consider them.

Formulary and Commissioning – both national and local governance determines local prescribing practice, and this can significantly shape demand.

Patient data protection – GDPR influences how patient data is stored and who can access it, impacting on data sharing for demand spikes given open-source real-time data sharing may risk breaching confidentiality.

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6. SUPPLY TO PATIENT

The final stage in the supply chain is ensuring the patient receives their medicine. This is usually either through in person collection (patient/carer/representative collects medicine from a community pharmacy) or medicines are delivered to the patient's home perhaps through a postal delivery service.

Typically, it is only at this stage in the supply chain that the patient will learn about any disruption to the supply of their medicines. The pharmacy is at this end of the supply chain, and unfortunately by this point there are limited options if the medicines the patient needs is not available. In specific circumstances for prescription medicines subject to a 'serious shortage protocol' (SSP) the pharmacy can supply an alternative medicine. In most cases, where an SSP is not in place, the pharmacy will support the patient to obtain medicines from other pharmacies who may still have stock or refer them back to their clinician who may then decide to prescribe an alternative.

Pharmacies can access information about medicines shortages through the Medicines Supply Tool hosted on the Specialist Pharmacy Services (SPS) website. Work is underway to enable SPS medicines supply tool information to be available to GPs at the point of prescribing. This should help ease the pressure on patients, pharmacists and prescribers in dealing with existing shortages, but will not improve the root cause of the medicines supply chain issues.

Problems that can occur:

'Last-mile' failures – where national supply is strong there can still be reports of shortages. These can be due to local supply issues, unexpected pharmacy closures, or adverse weather creating acute shortages.

Economic realities – when reimbursement prices do not adequately reflect market prices, pharmacies can be faced with difficult trade-offs to make between supplying to patients, contractual obligations to the NHS and ensuring the financial viability of their business.

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Regulation:

UK regulatory lead: GPhC, MHRA, NHSE, CQC

Safe dispensing and professional standards – dispensing practices, including innovations in practice such as emerging home delivery services, must be compliant with GPhC standards.

NHS Terms of Service – contractual standards community pharmacies are upheld to for requirements such as dispensing in a timely manner. Enforced through contracting decisions.

Substitution rules – Serious Shortage Protocols offer alternatives during shortages Pharmacovigilance – Pharmacists must participate in recording and reporting adverse drug reactions

Recall and returns – if medicines are defective, expired or recalled, pharmacists must remove them from stock and handle them according to MHRA guidelines.

SUMMARY

This report provides an overview of the medicines supply chain supporting over one billion prescription items dispensed annually by community pharmacies in Great Britain, highlighting its global, highly interconnected nature and the risks inherent at each stage.

From sourcing raw materials and overseas manufacturing through distribution, pharmacy procurement, prescribing behaviour and final supply to patients, disruptions in any one area can rapidly affect availability across the system. The report illustrates how regulatory complexity, economic pressures, geopolitical risk and demand volatility combine to challenge resilience, underscoring the importance of coordinated action across the supply chain to safeguard patient access to essential medicines.

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[1] Richardson, E. (2026). Global Key Starting Materials (KSMs) and Registered Starting Materials (RSMs) Market Size, Share & Trends Analysis 2026-2032. [online] Pmarketresearch.com. Available at: https://pmarketresearch.com/chemi/key-starting-materials-ksms-and-registered-starting-materials-rsms-market/ [Accessed 19 Mar. 2026].

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[3] BGMA (2020). Strengthening the resilience of the global supply chain. [online] British Generics Manufacturers Association. Available at: https://www.medicinesuk.com/static/assets/BGMA_global_supply_chain.pdf [Accessed 19 Mar. 2026].

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The MSRG brings together representatives from all parts of the supply chain, covering manufacturing, wholesaling and community pharmacy.

Members include: AAH Pharmaceuticals, Community Pharmacy (CPE), Healthcare Distribution Association (HDA), Medicines UK, National Pharmacy Association (NPA) and Proprietary Association of Great Britain (PAGB).

The Group has also been attended by representatives from the following organisations, who have participated in discussions but do not act as decision-makers on MSRG policy positions or endorse the MSRG's external publications or its recommendations:

- Department of Health and Social Care
- Medicines and Healthcare Regulatory Agency (MHRA)
- NHS England
- NHS Nottingham and Nottinghamshire

The MSRG is currently sponsored by AbbVie, Accord and Viatris.

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The MSRG is hosted by the Company Chemists' Association (CCA), the trade association for multiple pharmacies across Great Britain.

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