

WORLDWIDE HEPARIN SHORTAGE

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BACKGROUND

Heparin (Figure 1) is an anticoagulant that prevents platelets from forming clots in a large proportion of hospitalized patients, many of whom are immobile for extended periods and are at a higher risk of developing thrombosis. Heparin helps reduce the risk of clotting in patients with atrial fibrillation and is administered to those with PE and DVT. Heparin acts by activating antithrombin, which prevents the conversion of fibrinogen to fibrin, thereby increasing the effectiveness of this process by almost 1000-fold. Heparin is derived from the mast cells in the intestines of pigs (porcine heparin), or, less commonly, from the lungs of cows (bovine heparin). The crude extract of heparin is purified, treated, and isolated into its different forms. Side effects of heparin may include difficulty with clotting, internal bleeding, or, in rare cases, thrombocytopenia. Patients need to be monitored carefully.

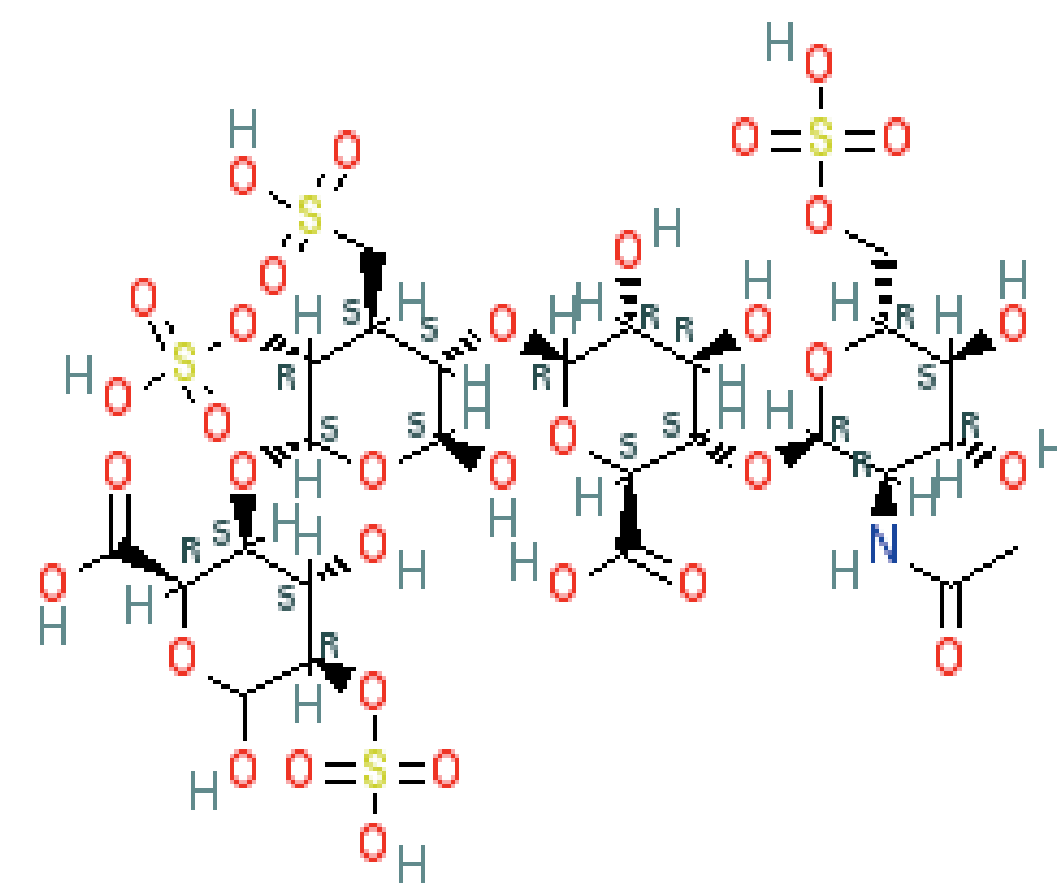


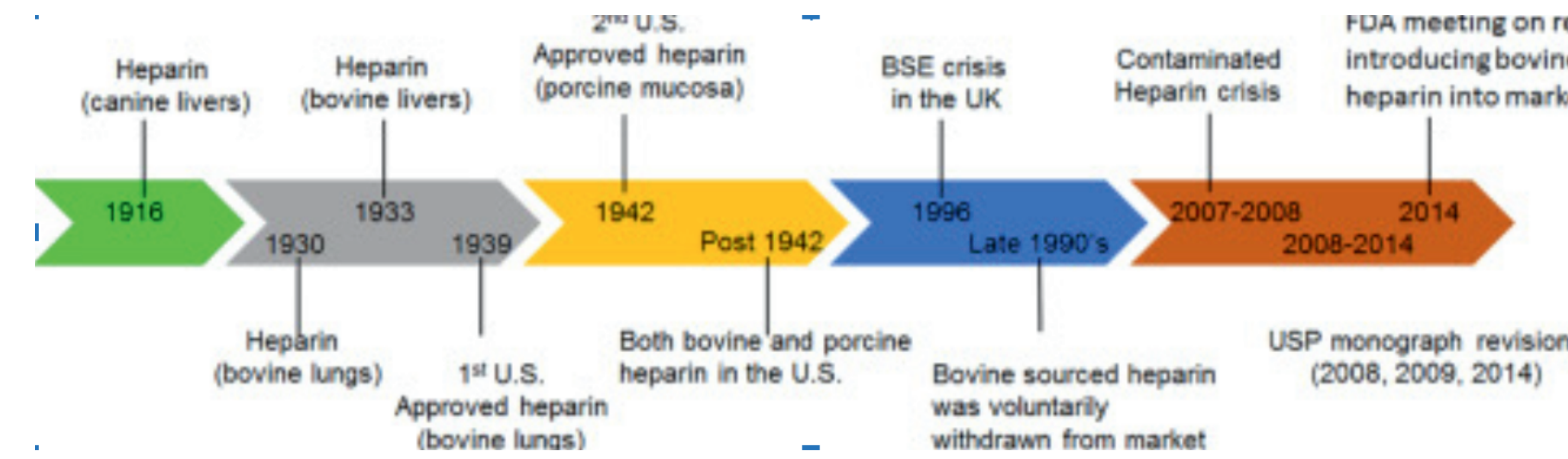
Figure 1. Chemical Structure of Heparin

HISTORY

The timeline (Figure 2) outlines key milestones in heparin's history from its discovery in 1916 to 2014, highlighting changes in sources, major safety crises, and regulatory actions affecting its production and market availability.

Heparin became the focus of global concern when reports of a potential shortage began surfacing as early as 2010, with clinicians such as Dr. Cian P. McCarthy of Massachusetts General Hospital warning of substantial supply shortages. The crisis further intensified in 2018 following a major outbreak of African Swine Fever in China, which decimated pig populations, the primary source of Heparin. By late 2019, hospitals worldwide were facing inflated costs and limited inventory, prompting emergency conservation protocols and renewed interest in alternative anticoagulants. Ultimately, the shortage emphasized the global medical community's overdependence on Chinese pig sources and underscored the urgent need for diversified sourcing (including bovine and synthetic options) to ensure future supply stability.

Figure 2. Timeline of Heparin Development, Regulation, and Market Events (1916-2014)



CAUSES

African Swine Fever (ASF) is a large dsDNA virus that is incredibly harmful to pigs (up to 100% mortality rate). ASF caused a decimation of the number of pigs available for producing heparin and, therefore, caused a shortage of heparin.

Figure 3 shows the decline in global hog slaughter from 2010 to 2020, with a sharp drop in China's production following the 2018 African swine fever outbreak, raising concerns about potential heparin shortages. China is one of the world's largest providers of heparin and thus, the deaths of the pigs have caused an immense amount of harm to global heparin supplies. Manufacturing slowdowns, rising demand, and logistical bottlenecks further intensified the issue.

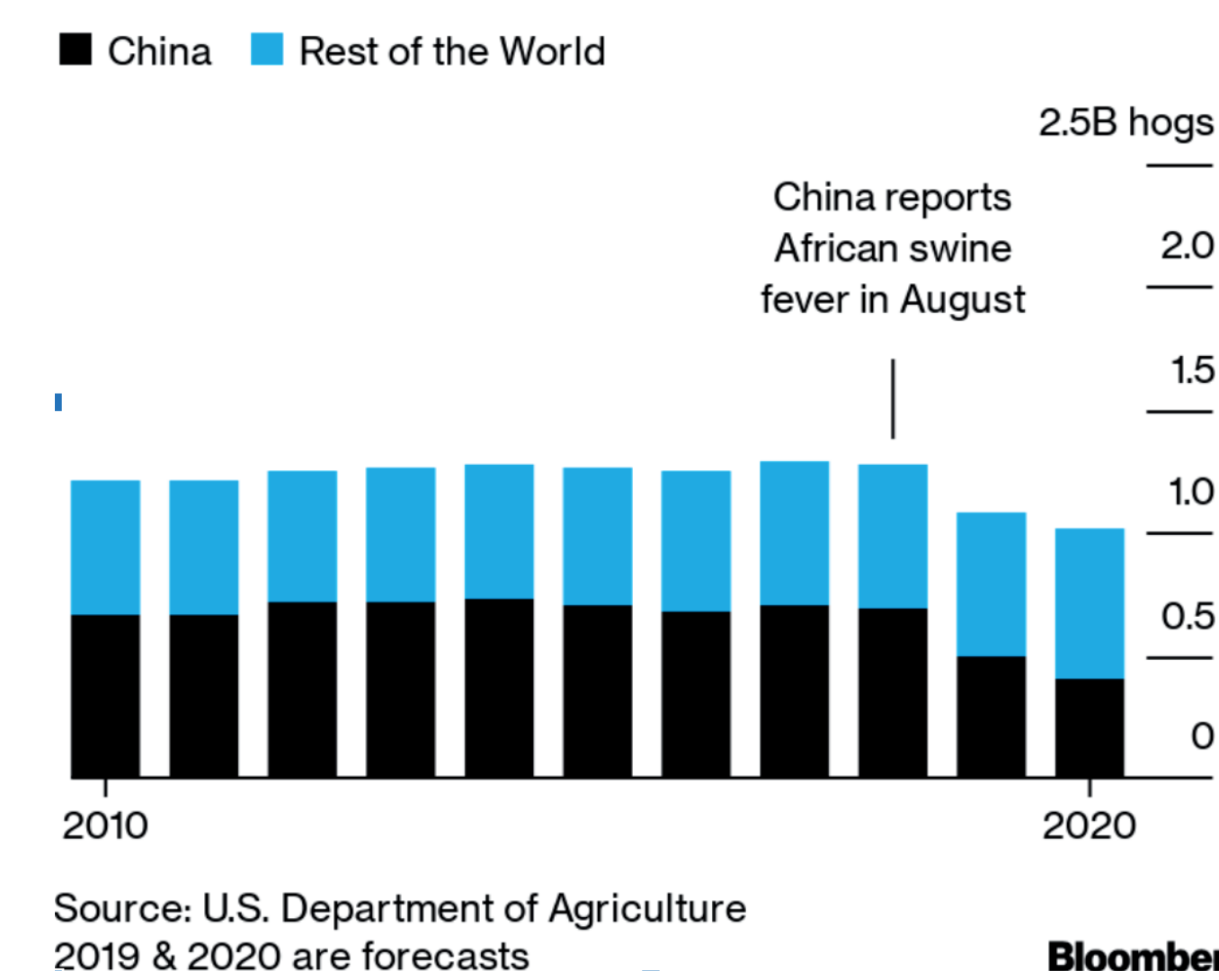
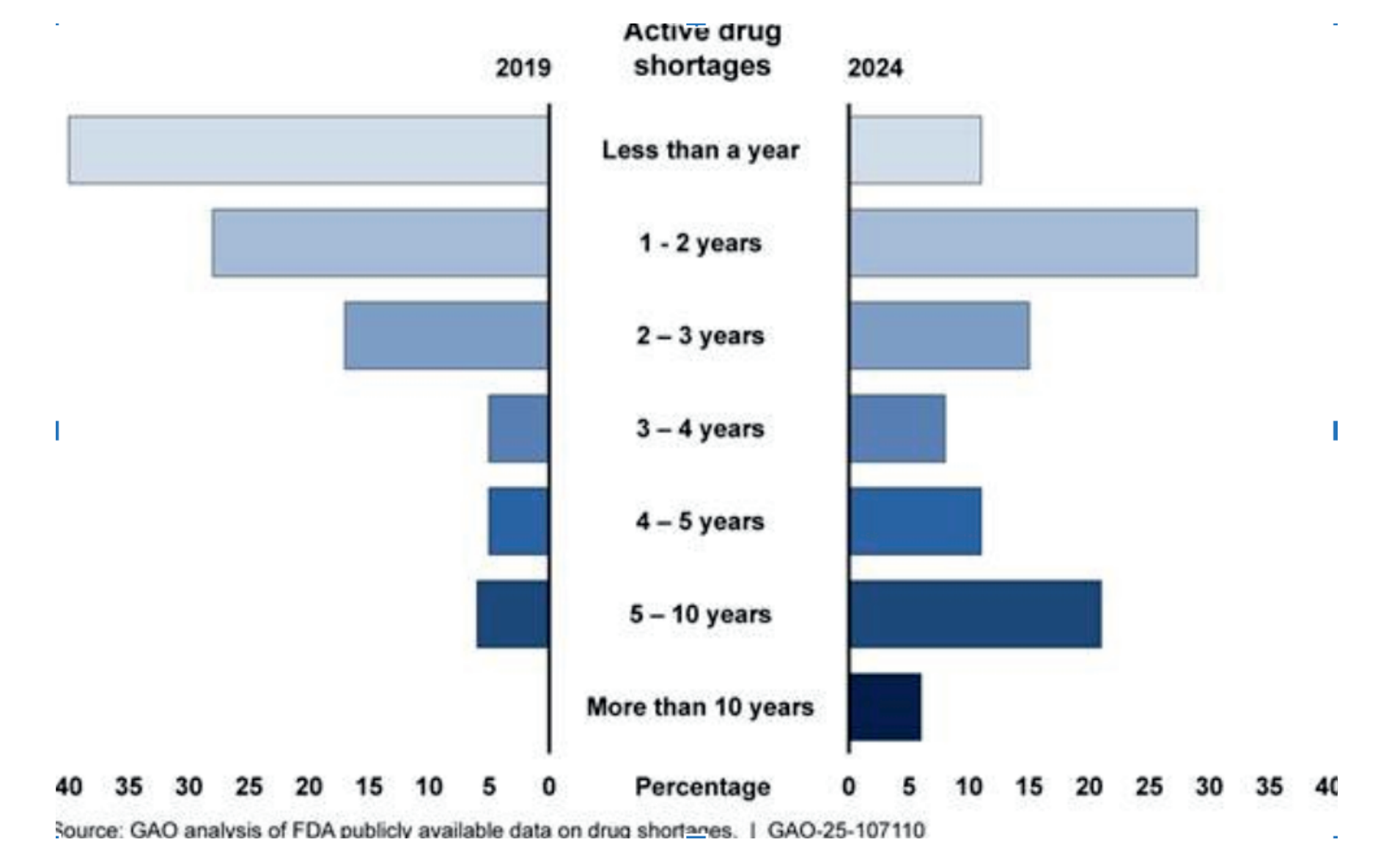


Figure 3. Global Decline in Annual Hog Slaughter Following African Swine Fever Outbreak

CONSEQUENCES

The heparin shortage has had several devastating consequences. Surgeries were often delayed. Even when alternatives were used, error rates rose by 150% due to altered protocols in medical facilities and a lack of familiarity with the alternatives. Heparin alternatives are expensive, and therefore, physicians and hospitals are reluctant to use them. As a result, overall anticoagulant use drops dramatically. To combat the shortage, proposals have been made to impose tariffs on Chinese heparin, which would make it more unaffordable. Figure 4 compares the duration of active drug shortages in the U.S. between 2019 and 2024, showing a decline in short-term shortages and a marked increase in shortages persisting five years or longer.

Figure 4. Duration of Active Drug Shortages, 2019 vs. 2024



PROPOSED SOLUTIONS

To combat the shortage in the short term, institutions have established conservation protocols. Substituting alternatives such as LMWH when possible, and establishing a system with cases labeled A through D to represent their need for heparin. This approach spreads the supply over a longer period, but it is not sustainable, as the supply of heparin will eventually run out. Use of bovine-sourced heparin, which derives the compound from cows instead of pigs. It is an encouraging alternative, but is limited currently by regulatory approval and slow manufacturing. Synthetic heparin is a possibility, but it is currently in early-phase trials. Diversify the supply chain of heparin. The shortage highlighted a key problem with heparin manufacturing: it all comes from one place - China - so the impairment of even a couple of sources of heparin was crippling.

CONCLUSIONS

Heparin is a life-saving anticoagulant used regularly in hospitals to prevent blood clots in patients with conditions such as Afib, DVT, and PE. The ASF devastated China's pig population, an essential source of heparin, in 2018. Physicians and hospitals were beginning to experience the effects of the stress caused by the massive global demand for heparin. Manufacturing slowdowns and overdependence on China for raw materials worsened the crisis, leaving providers scrambling for alternatives. Surgeries were delayed, and hospitals saw increased errors of up to 150% when using unfamiliar alternatives. Institutions established priority systems to conserve heparin, utilizing alternatives such as LMWH when feasible. These were temporary solutions, not long-term fixes. Experts are exploring bovine-sourced and synthetic heparin, though both face regulatory and production hurdles. The crisis exposed the need for global diversification in sourcing to avoid another bottleneck in the future.