

Narrative Review

Healthcare Supply Chain Resilience for an Ageing Population in Nepal: A Narrative Review

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Abstract

Background: Nepal's population is ageing quickly. The 2021 census counted 2.97 million people aged 60 and above — 10.2% of the population, up 38.2% from 2011. That shift is putting real pressure on the health system, and the supply chains behind it — medicines, assistive devices, cold-chain products — remain fragile.

Aim: This narrative review pulls together the evidence on healthcare supply chain resilience and asks what it means for older adults in Nepal.

Methods: In this narrative review, searched articles from PubMed, Scopus, Google Scholar, and reports from WHO, MoHP, DoHS, and the United Nations, then synthesised the literature narratively around population ageing, supply chains, health system resilience, disaster preparedness, and healthcare access.

Results: Nepal's healthcare supply chain struggles with difficult terrain, transport problems, procurement delays, fragmented logistics, weak inventory management, workforce shortages, and disaster risk. Older adults feel these problems most, since they depend on uninterrupted medicines and long-term care. Decentralisation and digital initiatives offer some opportunities, but governance, forecasting, and emergency planning still need work.

Conclusion: A resilient supply chain is not optional — it is part of what healthy ageing and universal health coverage actually require in Nepal. Better procurement, logistics, digital systems, emergency planning, and coordination across government levels would meaningfully improve care for older adults.

More Information

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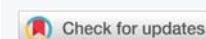
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Keywords: Healthy ageing; Healthcare supply chain; Health system resilience; Older adults; Nepal; Essential medicines; Logistics; Universal health coverage



Introduction

Population ageing is reshaping societies everywhere, and South Asia — Nepal included — is no exception [1]. Nepal's 2021 census puts the share of people over 60 at 10.2%, nearly three million people, up from 8.1% in 2011 [2–4]. The pace is striking: the ageing index climbed from 23.3 to 36.7 in a single decade, and the older population is growing three to four times faster than the population as a whole [2,3]. Falling fertility, longer life expectancy, and heavy labour migration are driving this shift, and migration in particular leaves many older Nepalis without younger family members nearby to help [5].

This creates new kinds of health demand. Chronic conditions — hypertension, diabetes, lung disease, joint problems — become the dominant burden, and unlike acute

illness, they call for continuous access to medicine rather than one-off care. Meeting that demand depends on a supply chain that can reliably deliver medicines, diagnostic supplies, and assistive devices.

Supply chain resilience simply means keeping essential goods moving, in ordinary times and in crises [6]. COVID-19 showed that even wealthy countries can struggle with this [6]. In a country like Nepal, the vulnerabilities are more structural: procurement delays are routine, inventory systems are weak, and the terrain itself works against reliable delivery [7,8]. Disruption is not the exception here — it is closer to the default.

The same pressures are visible elsewhere in Asia. By 2050, one in five Indians will be over 60, and more than three-quarters of India's older population already lives with



a chronic condition [9]. Southeast Asian countries are seeing similar trends [10].

International evidence on supply chains built specifically for older populations is still thin. Wright and colleagues describe redundancy, supplier diversification, and digital visibility as the core ingredients of resilience, but their framework was built for general crisis preparedness, not the kind of continuous, repeat dispensing that chronic disease care in older age requires [6]. WHO's Decade of Healthy Ageing names reliable access to medicines and assistive technology as a pillar of age-friendly health systems, but it does not go as far as prescribing how the supply chain itself should be designed for older users [11]. That gap is part of why this review leans so heavily on Nepal- and South Asia-specific evidence — the wider literature has not fully caught up with the demographic shift it will eventually need to address.

Three questions guide this review. First, how do supply chain weaknesses affect older adults disproportionately? Second, which vulnerabilities matter most — pharmaceutical logistics, last-mile delivery, disaster preparedness, or social security? Third, what resilience strategies actually fit Nepal's federal structure and limited resources? We treat these as four connected pieces of one problem: building a supply chain that works for Nepal's ageing population.

Methods

A narrative review was conducted using PubMed, Google Scholar, NepJOL, ScienceDirect, and websites of WHO, UNICEF, HelpAge International, and UNCDF. Search terms included "healthcare supply chain," "supply chain resilience," "essential medicines," "older adults," "elderly," and "Nepal." The search ran from January 2026 to April 2026.

Relevant peer-reviewed, English-language studies addressing healthcare supply chains, health-service access, ageing, and related issues in Nepal were included. Relevant reports from major organisations and selected international literature were also considered to provide broader context. Studies focused only on clinical outcomes, commentaries without substantive evidence, and publications before 2010 were excluded unless they were foundational to the topic. Only literature relevant to the objectives of this narrative review was included in the final synthesis. Sources were cross-checked against publisher pages or DOI resolvers.

Conceptual framework: healthcare supply chain resilience

At its core, supply chain resilience means keeping services running without interruption [6]. Drawing on lessons from COVID-19, SARS, and past natural disasters, researchers point to a few recurring features. Redundancy means keeping buffer stock instead of relying on just-in-time procurement. Diversification means not depending on a single supplier. Digital infrastructure gives managers real-time visibility into

inventory and demand [6]. Put together, a resilient system looks ahead rather than simply reacting.

This matters especially for older adults, who depend on continuous medication — even a brief gap can do real harm. They also rely on mobility aids, hearing devices, and vision aids, products with longer lead times that often depend on donations rather than routine procurement [12,13]. A full picture has to cover pharmaceuticals, devices, disaster response, and the financial side too: the social security allowance shapes whether older adults can actually afford what the supply chain provides.

Nepal's ageing population and rising health system demand

Nepal's older population is growing faster than the population overall, and Bagmati Province has the highest share of older residents. Ageing is more advanced in the Hills and Mountains than in the Tarai [2]. Life expectancy sits around 71–72 years [2,3]. Disability — especially mobility and vision loss — is common, and falls are a leading cause of injury and functional decline among older adults worldwide [14,15]. Studies from western and central Nepal report high rates of hypertension, diabetes, heart disease, respiratory illness, and musculoskeletal disorders, often layered on top of one another. In rural Gandaki Province, seven in ten older respondents had at least one chronic condition [16].

These numbers matter for supply chains because chronic disease management means delivering the same medicines to the same people, month after month. A stock-out that is a minor inconvenience for acute care becomes a direct threat for someone managing hypertension or diabetes. Nepal's federal transition adds another layer: procurement and distribution now sit with provincial and local governments, and their capacity varies widely [8].

Pharmaceutical supply chain and last-mile delivery

Weaknesses in the pharmaceutical supply chain show up again and again. A 2024 qualitative study across six Bagmati districts found procurement delays behind most medicine shortages, made worse by weak logistics information systems, unrealistic forecasting, and manual inventory tracking [7]. A 2026 study of Sankhuwasabha and Kavrepalanchowk found much the same story — procurement delays, poor storage, undertrained staff, and forecasting that did not match reality. Getting medicines through during monsoon season is especially hard, since landslides regularly cut off roads [8]. These are not uniquely Nepali problems; similar patterns turn up across low- and middle-income countries [17].

India offers a comparable picture. PATH's assessment of public health supply chains across nine Indian states found unreliable forecasting, inconsistent warehouse practices, patchy data, and workforce shortages [18].



For older adults, these weaknesses translate into real consequences. Medicines for chronic conditions need to arrive predictably, and the rural Gandaki study found that unavailable medicine was a stronger predictor of reduced health service use than distance or transport [16]. In interviews, older residents described receiving expired or ineffective medicines — and often blamed themselves, citing their own lack of literacy or bargaining power, rather than the system [16].

Procurement is only half the problem. Even once medicines reach a district warehouse, getting them the rest of the way is its own challenge. A qualitative study in central Nepal found real barriers even in accessible municipalities — affordability, poor communication, long waits, and no geriatric training among health workers [19]. In remoter districts, transport dominates everything else [19].

A mixed-methods study in Parbat district makes the stakes concrete. Ninety percent of older respondents walked to health facilities along dangerous mountain trails, and some described community members dying en route to hospital, carried in a bamboo basket [16]. Statistical modelling confirmed that medicine availability and facility proximity were the strongest predictors of whether people sought care at all [16]. An earlier study in Pokhara-Lekhnath found similar patterns [20]. Findings like these raise a genuine question about whether Nepal's health system is keeping pace with its ageing population [21].

There is a social dimension too. Older Nepalis often report loneliness and thin social support, a pattern that echoes broader findings on isolation among ageing populations elsewhere [22-26]. In practice, it is usually an adult child or spouse who collects medicines or accompanies an older relative to the clinic — and labour migration is steadily eroding that support, weakening the last link between the supply chain and the patient [5].

Cold chain, medical equipment, and device logistics

Some products need an unbroken cold chain — insulin, vaccines, diagnostic reagents. Mountainous terrain, monsoon-damaged roads, and inconsistent power all work against that [27,28]. The Department of Health Services reports familiar problems: equipment upkeep, power cuts, and inadequate temperature monitoring [27].

Older adults also depend on assistive devices — wheelchairs, hearing aids, spectacles — supplied through a patchwork of government provision, NGO donations, and private purchase. After the 2015 earthquake, humanitarian reports flagged lost glasses and mobility aids as a significant unmet need among older survivors [13]. Any resilience framework that only looks at pharmaceuticals would miss this entirely.

Disaster vulnerability and supply chain resilience

Disasters make all of this worse. After the 2015 Gorkha earthquake, HelpAge International reported that older adults bore a disproportionate share of the impact, largely because of reduced mobility, and that diabetes medication was simply unavailable in the aftermath [12,29]. Humanitarian assessments estimated that 650,000 older adults needed aid, with chronic disease medicines and replacement mobility aids among the most pressing unmet needs [13].

Most of the evidence on disaster-related disruption still centres on that one earthquake. Going forward, though, the bigger recurring hazard is probably climate-related rather than seismic. Regional assessments describe rising landslide and flash-flood risk across the Hindu Kush Himalaya as glacial melt and monsoon rainfall intensify, and mountain road networks — Nepal's main supply corridors — are particularly exposed [30]. Nepal has already seen severe monsoon flooding in recent years that cut roads and disrupted health services over an even wider area than the earthquake did. Unlike a single earthquake, this kind of disruption comes back every monsoon season, which argues for standing seasonal contingency plans rather than a response built only around the 2015 model.

The United Nations has acknowledged that older people are routinely left out of emergency planning [31]. Research in Sindhupalchok and Kavre found that socio-economic status, kinship, caste-ethnic identity, and age together shape how vulnerable someone is to disaster [32]. A cross-sectional study found that self-efficacy, spirituality, and social support predicted psychological resilience among older disaster survivors [33].

A geriatric-specific disaster supply chain would need pre-positioned buffer stocks of chronic disease medicines, supplier agreements for rapid restocking, a registry of older adults and their medication needs, and a reserve of assistive devices. Based on the sources reviewed here, none of this appears to be formally in place, though this review did not systematically audit disaster-preparedness plans and cannot rule out unpublished or subnational provisions.

Social security allowance as a parallel supply chain

Older Nepalis rely on a financial supply chain too: the government's Old Age Allowance, paid from age 70 (60 in Karnali and among Dalit communities) [34,35]. This allowance is often what makes healthcare accessible at all — without it, many older adults cannot afford transport, consultation fees, or medicines [36, 37]. About two million people receive it, backed by an annual budget of roughly Rs. 90 billion [35].

Historically, disbursement went through local administrative bodies that knew beneficiaries personally. That



built trust, but it also meant delays, leakages, and inconsistent verification [34]. Digitisation is shifting things toward bank and mobile-based payments, though rural beneficiaries without a bank branch or digital literacy are being left behind [34]. Evidence suggests the allowance genuinely improves healthcare access and quality of life, but only when payments are timely and adequate [33].

Thinking of allowance disbursement as its own kind of supply chain is useful, because the parallels with the clinical one are real. Both rely on reliable last-mile delivery. Both are vulnerable to elite capture. And both appear to fail the same people hardest — older adults in remote, mountainous districts — though that is based on single-district evidence, not a nationally representative picture.

Regional context: nepal in comparative perspective

Is any of this unique to Nepal? Not really. A scoping review of elderly caregiving in Bangladesh, India, and Pakistan found much the same pressures: weak rural healthcare, too few trained geriatric professionals, heavy reliance on informal care, and transport barriers [1]. India has fewer than a thousand certified geriatricians for over 150 million older citizens [9]. A qualitative study in Bangladesh found high out-of-pocket costs, a shortage of caregivers, and time-distance barriers of its own [38]. Sri Lanka faces comparable challenges [40].

These parallels suggest Nepal's problems reflect a wider regional pattern rather than something unusual to the country. What is more distinctly Nepali is the geography — hill and mountain terrain compounds every last-mile problem, and the federal transition adds a layer of governance complexity most neighbouring countries do not navigate in quite the same way.

Toward a resilience framework

A resilience framework for Nepal's ageing population needs four things: supply redundancy, source diversification, digital visibility, and anticipatory planning [6].

Redundancy for chronic disease medication should be a priority at the district and municipal level — medicine unavailability was independently linked to reduced health service use [16], so buffer stock closer to the point of care matters.

Diversification means looking beyond national-level sourcing. Federalism has pushed responsibility down to local government, but capacity varies a lot from place to place [7,8], which makes partnerships with private suppliers and humanitarian organisations worth pursuing.

Digital logistics systems remain a persistent gap [7,8]. They let managers track inventory and forecast demand — and an ageing population's medication needs are unusually predictable, which makes them well suited to data-driven forecasting. Any system built for this needs to work across every level of government, not just the top.

Disaster preparedness needs a geriatric-specific layer: contingency stock of chronic disease medication and replacement assistive devices [12,13], backed by pre-positioned supplies, supplier agreements, patient registries, and clear lines of responsibility.

Community-based last-mile delivery could lean on Female Community Health Volunteer (FCHV) networks, which already play a central role in maternal and child health. Whether they could take on medicine delivery to older adults is worth testing. India's Drug and Vaccine Distribution Management System (DVDMS) shows what digitisation can do for a supply chain at scale [18] — though workforce capacity matters just as much as the technology; even the best system still needs skilled people running it [18].

Policy recommendations

The Ministry of Health and Population and provincial health directorates should prioritise digitising logistics management systems, building on what Bagmati Province and Sankhuwasabha/Kavrepalanchowk have already learned [7,8]. That means real-time inventory tracking, forecasting based on population age structure, stock-out alerts, and systems that talk to each other across government tiers.

Local governments should set minimum buffer stock requirements for the chronic disease medications older patients depend on most. Getting there means a baseline assessment, a buffer level calculation — two weeks of normal demand, for example — and a dedicated budget line. That two-week figure follows standard public-health logistics practice, where buffer stock typically runs one to four weeks depending on resupply lead time; here it reflects the resupply delays documented in the Bagmati and Sankhuwasabha/Kavrepalanchowk studies discussed earlier [7,8], not a Nepal-specific costing exercise, so it should be checked against local consumption data before anyone adopts it. The accompanying 5–10% procurement-budget estimate follows the same logic — two weeks of buffer works out to roughly 4% of annual demand, and the 5–10% range leaves room for wastage, price swings, and the fact that not every essential medicine currently holds even a minimal buffer. It is an order-of-magnitude planning figure, not a formal costing study, and a proper costing exercise still needs to happen before it is used for budgeting. Financing responsibility sits mainly with municipal and provincial governments, since routine procurement for health posts and primary hospitals was devolved to these tiers under Nepal's federal structure. Because local revenue is limited, the added cost would in practice hinge on federal conditional or equalisation grants for health — and the Ministry would need to clarify whether buffer-stock financing adds to existing transfers or has to be absorbed within what is already allocated.

Disaster management authorities should build a geriatric-specific component into national disaster plans:



pre-positioned stock in disaster-prone districts, supplier agreements for rapid restocking, a registry of older adults and their medication needs, and regular simulation exercises.

Digitising the Social Security Allowance should come with accommodations for beneficiaries with limited mobility or digital literacy — continued physical disbursement, home delivery or proxy collection, and simpler documentation.

These recommendations could feed directly into Nepal's Geriatric Health Service Strategy and the 2025 National Population Policy [4]. None of this is free: implementation faces real financial constraints, workforce shortages, and governance friction, and new investment means trade-offs elsewhere. External funding from WHO, the World Bank, or bilateral donors may help, but staff still need training in logistics and geriatric care. Coordination failures between federal, provincial, and municipal government are already a direct cause of procurement delays [8], so any resilience framework has to be explicit about which level of government funds, staffs, and sustains each piece.

Limitations

This review is narrative, not systematic, and that limits how far its conclusions travel. Most Nepal-specific evidence comes from single-district or single-province studies, which limits generalisability. We could not find quantitative supply chain data broken down by patient age. Publication bias is a real risk, given that the author has published extensively on ageing in Nepal. We excluded non-English sources, which may have missed relevant Nepali-language grey literature. Some of the evidence predates Nepal's federal transition, and the regional comparison is meant to be indicative rather than comprehensive. Where this review leans on single-district studies or the 2015 earthquake response, those findings should be read as illustrative of the vulnerabilities Nepal's ageing population faces — not as nationally representative conclusions.

Conclusion

Nepal's ageing population is placing sustained demands on a supply chain with well-documented weaknesses in procurement, inventory management, and last-mile delivery. Older adults need uninterrupted access to chronic disease medication and assistive devices, and that need is compounded by rural geography, disaster exposure, and a social security system that is still finding its footing. Building real resilience means investing across several fronts at once: procurement reform, digital logistics infrastructure, disaster preparedness, community-based delivery, and social security reform. In the end, the health and independence of Nepal's older citizens depend on supply chain reliability just as much as on clinical care — which makes this a genuine pillar of healthy ageing and universal health coverage, not a side issue.

Use of artificial intelligence: The author used AI for editing of the article and language.

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