

Strengthening infection control in Singapore's nursing homes: Lessons, limitations, and the road ahead

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In this issue of the *Annals*, Sun et al. contribute to a growing body of evidence supporting preventive and systems-based interventions in nursing homes (NHs).¹ As populations age and healthcare systems shift towards community-based and preventive care models, NHs have become an increasingly important component of healthcare delivery. In Singapore, where the proportion of residents aged 65 years and above is projected to rise from approximately 16% to one-quarter of the population by 2030, this trend carries particular urgency. Strengthening care in these settings has implications not only for patient outcomes but also for health system sustainability, particularly through reducing healthcare-associated infections, avoidable hospital admissions, and unnecessary utilisation of acute hospital resources.

Existing literature has consistently shown that proactive interventions, including standardised care processes and coordinated service delivery between NHs and acute care systems, can reduce avoidable transfers to hospitals. In a systematic review by Graverholt et al., interventions such as advance care planning, enhanced access to specialist services, and structured clinical pathways for lower respiratory tract infections were associated with reduced hospital admissions.² In Singapore, similar principles have guided efforts to strengthen integration between acute hospitals and long-term care facilities. The Empower Nursing Homes And improve staNdsards of CarE (ENHANCE) programme by Sengkang General Hospital in Singapore demonstrate how structured partnerships can improve preventive care delivery in the community.³ ENHANCE incorporated tools including the National Early Warning Score, teleconsultation, clinical care pathways, and staff training aimed at improving NH staff capacity to assess and manage acutely unwell residents on site, thereby reducing hospital transfers.

Sun et al. extend previous work through emphasis on infection prevention and control (IPC) as a core strategy for reducing infectious disease burden and avoidable hospital transfers in NHs. Through improved access to specialist support, structured IPC measures, and standardised clinical practices, the Infectious

Diseases Community Programme (IDCP) was associated with improved NH IPC capacity and reductions in methicillin-resistant *Staphylococcus aureus* (MRSA) acquisition and inappropriate fever-related transfers. These findings are consistent with international evidence demonstrating that effective IPC programmes in long-term care facilities require multicomponent approaches incorporating staff education, surveillance systems, hand hygiene, environmental cleaning, antimicrobial stewardship, and strong organisational support.⁴ This is important in NHs, where communal living environments and frequent healthcare encounters as well as limitations in staffing, infrastructure, and IPC expertise increase the risk of infectious disease transmission and inconsistent implementation of IPC practices.

The reported 33.6% relative reduction in new MRSA acquisitions ($P < 0.001$) is both statistically significant and clinically meaningful given the burden of multidrug-resistant organisms (MDROs) in long-term care settings and the frequent movement of residents between hospitals and NHs, which influences transmission dynamics across the wider healthcare system.⁵ Underpinning these outcomes was a structured, 3-tiered training programme in which 1260 staff across all 20 participating NHs were trained across 37 sessions, incorporating a train-the-trainer component designed to sustain IPC capacity beyond the programme period. Notably, influenza vaccination coverage exceeded 90% of residents, with 7 of 9 NHs achieving at least 80% coverage among both residents and healthcare workers. This represents a substantial improvement from baseline and reflects the programme's concurrent work to address consent barriers, knowledge gaps, and cost-related obstacles to vaccine uptake.

Of note, 2 facilities, labelled NH E and NH F, demonstrated post-implementation increases in MRSA acquisition rates. The authors attribute these findings to limited baseline data, later programme onboarding, smaller sample sizes, and unmeasured confounders including differing resident case-mix and staffing variability. These discordance highlight that IPC programme effectiveness is not uniform across facilities,

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and early, comprehensive programme integration is key to achieving consistent outcomes. Identifying and addressing such heterogeneity will be essential as similar programmes are considered for broader implementation.

Beyond individual IPC programme components, the findings align with growing evidence supporting horizontal IPC strategies, which aim to reduce transmission broadly across multiple organisms rather than targeting a single pathogen.^{4,6} Such strategies include hand hygiene, environmental cleaning, staff education, antimicrobial stewardship, surveillance, and standardised barrier precautions—all of which feature as components of the IDCP. These approaches are relevant in NHs, where residents have increased infection risks and MDRO exposures due to multiple comorbidities, frequent healthcare exposure, and prolonged stays. The influential cluster-randomised PROTECT trial by Huang et al. demonstrated that a multicomponent IPC intervention combining targeted decolonisation strategies, chlorhexidine bathing, enhanced barrier precautions, and staff education significantly reduced MDRO prevalence and hospitalisations in NHs.⁶ While decolonisation represents a targeted vertical IPC strategy rather than a strictly horizontal approach, the PROTECT trial reinforces the complementary value of bundling universal precautions with staff education—an approach that mirrors the logic of the IDCP.

In Singapore, Healthier SG reflects a broader shift in national strategy towards preventive care, integrated population health, and chronic disease management.⁷ However, while Healthier SG has focused primarily on the above, long-term care facilities have received comparatively less attention despite accounting for substantial healthcare resource utilisation.⁸ NHs increasingly care for residents with greater clinical complexity and higher-acuity needs, making IPC capacity in these settings critical to broader health system resilience. Yet, sustaining IPC programmes at NHs require long-term institutional investment in workforce development, surveillance systems, institutional infrastructure, and IPC governance—strategies outlined by the World Health Organization's Global Report on Infection Prevention and Control.⁹ Notwithstanding the challenges of competing operational demands, the role of NHs within the healthcare system must therefore be more explicitly recognised. Central to this is the Agency for Integrated Care (AIC), which plays a pivotal role in overseeing quality standards, funding, and workforce development in Singapore's NH sector. Given that most of Singapore's NHs are operated by voluntary welfare organisations—which face distinct staffing constraints and funding

structures compared to hospital-linked facilities—any strategy for sustaining and scaling programmes such as the IDCP must account for these heterogeneous operating environments. Embedding IPC outcomes as measurable quality indicators within AIC's accreditation and oversight framework would represent a meaningful and sustainable institutional step forward.

The IDCP also incorporated an antimicrobial stewardship (AMS) component, through which an antimicrobial-choice guideline was developed collaboratively with primary care physicians, infectious disease specialists, and pharmacists. This aligns with Singapore's National Action Plan on Antimicrobial Resistance and reflects growing international evidence demonstrating that AMS in long-term care settings can be feasible and clinically beneficial.¹⁰ The programme's Fever and Desaturation Pathway additionally incorporated assessment of Advance Care Plans (ACPs) and Preferred Plans of Care in hospital transfer decisions—a dimension that intersects with Singapore's National Strategy for Palliative Care and highlights the importance of expanding ACP penetration in NHs as a complementary strategy to reduce inappropriate transfers.¹¹

Beyond clinical interventions, sustainable IPC programmes depend on robust surveillance and data systems. The study demonstrates how routinely collected healthcare data can be leveraged to support IPC monitoring and evaluation, including detecting trends and assessing intervention outcomes. By using data already captured through electronic medical records and national reporting systems, the study illustrates how existing data can generate meaningful process and outcome indicators for quality improvement. Looking ahead, integration of NH IPC surveillance data with Singapore's National Electronic Health Record, could enable more timely outbreak detection and real-time monitoring of IPC quality indicators at a system level.

The study highlights several important directions for future research. Formal health economic evaluation is needed to assess the cost-effectiveness and long-term financial sustainability of the IDCP model, which is essential for sustainable programme adoption in resource-constrained settings. Research employing implementation science frameworks—such as stepped-wedge cluster-randomised designs—could seek to identify which components of the multicomponent programme contribute most to improved outcomes, enabling resource-limited facilities to prioritise effectively. Cross-cluster evaluation across Singapore's 3 regional healthcare clusters would assess the generalisability and scalability of the hospital-NH partnership model. Finally, studies examining the

impact of staff turnover on IPC programme sustainability, and evaluating interventions, such as digital microlearning modules and cascade training approaches, are essential to ensuring durable implementation beyond the programme period.

Overall, the study by Sun et al. provides timely evidence supporting multicomponent IPC interventions in NHs. The findings underscore the value of preventive and collaborative approaches to infection control in long-term care facilities and highlight the central role NHs play within integrated healthcare systems in ageing societies. As Singapore navigates the epidemiological and fiscal challenges of a rapidly ageing population, the IDCP model offers a pragmatic and scalable framework—one that warrants broader national attention, formal health economic evaluation, and integration within Singapore's broader health policy architecture.

Ethics statement

Not applicable, as no study participants were recruited.

Declaration

The authors declare they have no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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REFERENCES

1. Sun L, Smitasin N, Salada BMA, et al. A multicomponent control programme in nursing homes in Singapore. *Ann Acad Med Singap* 2026;55:OnlineFirst.
2. Graverholt B, Forsetlund L, Jamtvedt G. Reducing hospital admissions from nursing homes: a systematic review. *BMC Health Serv Res* 2014;14:36.
3. Liew YH, Yang Y, Lim SXY, et al. Enhancing care in nursing homes: Qualitative insights from the ENHANCE programme. *Ann Acad Med Singap* 2024;53:758-61.
4. Smith PW, Bennett G, Bradley S, et al. SHEA/APIC guideline: infection prevention and control in the long-term care facility. *Am J Infect Control* 2008;36:504-35.
5. Chow A, Lim VW, Khan AS, et al. MRSA transmission dynamics among interconnected acute, intermediate-term, and long-term healthcare facilities in Singapore. *Clin Infect Dis* 2017;64:S76-81.
6. Huang SS, Septimus E, Kleinman K, et al. Targeted infection prevention in nursing homes and reductions in multidrug-resistant organisms and hospitalisations. *N Engl J Med* 2023;388:1403-14.
7. Ministry of Health, Singapore. Healthier SG White Paper. September 2022. <https://www.healthiersg.gov.sg/resources/white-paper>. Accessed 5 June 2026.
8. Quah WC, Leong CJ, Chong E, et al. Unplanned hospitalisations among subsidised nursing home residents in Singapore: insights from a data linkage study. *Ann Acad Med Singap* 2024;53:657-69.
9. World Health Organization. Global Report on Infection Prevention and Control. 23 May 2022. <https://www.who.int/publications/i/item/9789240051164>. Accessed 5 June 2026.
10. Ministry of Health, Singapore. National Action Plan on Antimicrobial Resistance 2023–2027. https://isomer-user-content.by.gov.sg/18/47d5e456-b123-45e6-a744-8afc2d98d5af/NSAPv2_Final_12Nov2025_for%20publication.pdf. Accessed 5 June 2026.
11. Ministry of Health, Singapore. 2023 National Strategy for Palliative Care. 1 July 2023. <https://www.moh.gov.sg/others/resources-and-statistics/reports-2023-national-strategy-for-palliative-care-report>. Accessed 5 June 2026.