

Enhancing Pneumonia Management in Long-term Care through Early Detection and AI-Enabled
Care Decisions

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Executive Summary

Pneumonia poses a significant health risk in long-term care (LTC) facilities, leading to high morbidity and mortality among older adults. This policy brief explores the potential benefits of integrating Artificial Intelligence (AI) and Natural Language Processing (NLP) within Electronic Health Records (EHRs) to enhance pneumonia management. While preliminary evidence suggests potential advantages, further research is required to validate the efficacy of these technologies. Key recommendations include funding for research, establishing ethical and regulatory frameworks, and ensuring compliance with existing privacy laws to support AI adoption in LTC settings.

Introduction

Pneumonia remains a leading cause of morbidity and mortality in long-term care (LTC) facilities, disproportionately affecting older adults due to advanced age, frailty, and multiple comorbid conditions (Grunier et al., 2010). Data suggest that pneumonia accounts for 10-18% of all hospitalizations among older adults, with an average hospital charge of approximately \$10,000 per admission (Muder, 2000a; Muder, 2000b; Grunier et al., 2010).

The economic burden of pneumonia extends beyond direct hospital costs. According to the Ontario Burden of Infectious Disease Study (ONBIDS), pneumonia is responsible for approximately 1,954 deaths and 252,473 healthcare utilization episodes annually in Ontario, with costs per case ranging from \$1,836 to \$8,993 (O'Reilly et al., 2023). Among nursing home residents, pneumonia is a leading cause of potentially avoidable hospitalizations (PAH), often leading to complications such as delirium, nosocomial infections, and functional decline (Grunier et al., 2010).

LTC residents face a markedly higher risk of developing pneumonia, with incidence rates estimated at one case per 1,000 days of care—ten times higher than for older adults living in the community (Muder, 2000b). Managing pneumonia in LTC settings is especially challenging due to residents' advanced age, complex health profiles, and the communal nature of these facilities, which can facilitate the spread of infections (Neilson et al., 2022; Jump et al., 2018). This brief explores the potential of AI and NLP to enhance early detection and personalized care for pneumonia, thereby improving health outcomes and reducing healthcare costs.

CIHI, 2014

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Pneumonia has long been recognized as a significant health challenge within LTC facilities, particularly affecting the older adult population who are more susceptible due to advanced age and comorbidities. Despite various strategies aimed at managing this condition – ranging from vaccination programs to enhanced infection control measures – pneumonia remains a leading cause of mortality. The Canadian Institute for Health Information (CIHI, 2014) reported that one in three seniors in LTC will make emergency department (ED) visits once in their lifetime, with a quarter of these visits deemed potentially avoidable or preventable.

Current Perspectives on the Issue

Identifying atypical pneumonia in older adults demands specialized clinical expertise due to the frailty and complex health profiles of this population. Recent studies emphasize the continuing challenge of diagnosing pneumonia in LTC residents, where traditional symptoms may be absent or atypical. For instance, a study by Guion et al. (2023) highlighted those residents transferred to

ED with suspected pneumonia often presented with non-specific symptoms such as dyspnea and fatigue, complicating timely diagnosis. Similarly, Falcone et al. (2018) found that malnutrition and acute changes in mental status were significant predictors of pneumonia among nursing home residents, underscoring the need for prompt and accurate detection.

Building on these insights, NLP has emerged as a potential tool to bridge gaps in early pneumonia detection by automating the extraction of information from unstructured clinical notes, identifying patterns and subtle early signs that might be overlooked in routine assessments. Recent research has demonstrated the potential of NLP in various domains; for example, Pan et al. (2023) demonstrated that NLP techniques could accurately identify cerebrovascular disease from EHR with high sensitivity and specificity, suggesting similar applicability for detecting pneumonia. Additionally, Bali et al. (2022) validated an NLP algorithm capable of detecting chronic cough in clinical notes, an essential precursor to respiratory conditions like pneumonia. While these studies show promise, further research is needed to confirm the impact of NLP on improving pneumonia detection in LTC settings, necessitating ongoing investigation and validation.

Policy Recommendations

1. Conduct Further Research to Establish Evidence of Efficacy

Implementing AI and NLP technologies to facilitate more precise early detection and individualized care for pneumonia should be supported by a strong body of evidence. Evidence on the application of NLP technologies to pneumonia detection is currently insufficient, necessitating research on their efficacy.

Allocate Funding: Provide financial support for research and development initiatives focused on adapting AI and NLP technologies for LTC environments. Specific budget allocations should be directed towards conducting studies on LTC residents with pneumonia and assessing the effectiveness of these technologies in reducing hospital transfers and readmissions, enhancing patient engagement, and improving staff satisfaction.

Establish Ethical and Regulatory Frameworks: Develop and enforce regulations that govern the ethical use of AI and NLP technologies in healthcare settings, including LTC facilities. This will ensure patient privacy, data security, and algorithmic transparency while promoting innovation and technology adoption.

2. Ensure Compliance with Bill C-27

Bill C-27 is designed to safeguard patient privacy and encourage the ethical use of technology, thereby enhancing confidence in AI/NLP systems and protecting patient information (House of Commons, 2022).

Develop Regulatory Guidelines: Develop clear regulatory guidelines outlining the ethical and legal requirements for the use of AI and NLP technologies in healthcare, including LTC facilities. These guidelines will address issues such as patient consent, data privacy, and algorithmic transparency.

Enforce Compliance: Establish mechanisms for monitoring and enforcing compliance with regulatory requirements outlined in Bill C-27. This will include conducting audits, issuing fines for non-compliance, and providing support and guidance to LTC facilities to address any gaps in compliance.

Provide Education and Training: Offer education and training programs for healthcare providers and LTC staff on the ethical use of AI and NLP technologies and compliance with

regulatory requirements. Education and training initiatives will help raise awareness of legal and ethical considerations and ensure that LTC facilities are equipped to implement AI and NLP solutions responsibly.

3. Implement Government Actions to Support AI Integration

Although immediate widespread implementation is premature, preparing for future integration of AI and NLP technologies in LTC facilities is essential. This preparation includes pilot programs, developing interoperability standards, and ensuring that smaller or rural facilities are not left behind.

Pilot programs: Implement pilot programs in selected LTC facilities to test the efficacy and logistics of integrating AI and NLP technologies. These programs should be closely monitored and evaluated to gather data on effectiveness and areas for improvement.

Support for smaller facilities: Ensure that financial and infrastructural support is available for smaller or rural LTC facilities to prepare for future technology integration. This includes grants for upgrading technological infrastructure and training staff.

Conclusion

Implementing AI and NLP in LTC facilities demands a united approach, combining government support, ethical practices, and engagement from all stakeholders to overcome challenges in technology integration and privacy. Crucial to this initiative is the development of feedback mechanisms and a method to evaluate the impact of these technologies, ensuring they meet the evolving needs of healthcare and remain centered on patient care.

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