# Electronic Health Information Exchange among Adult Day Services: Findings from the National Study of Long-Term Care Providers

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## *Abstract*

Our study provides the first robust empirical evidence on the use of electronic health information exchange in Adult Day Services Centers using nationally representative survey data.

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# Original Manuscript

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## Summary Statement

Our study provides the first robust empirical evidence on the use of electronic health information

exchange in Adult Day Services Centers using nationally representative survey data.

**Electronic Health Information Exchange among Adult Day Services: Findings from the National Study of Long-Term Care Providers**

**Keywords**: Electronic Health Information Exchange, Adult Day Services, Organizational characteristics

## INTRODUCTION

Electronic Health Information Exchange (HIE) plays a pivotal role in enhancing patient safety and care coordination through the accurate and timely sharing of patients' health records[1]. Since the introduction of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009, there has been a marked increase in the adoption of HIE technologies across hospitals[2] and physician clinics[3]. However, the long-term care sector has been slow in adopting HIE practices[4,5]. While the adoption of HIE in hospitals and physician offices is monitored on a national level[2,3], the extent of its implementation in the long-term care sector, including residential nursing homes and home care services, remains poorly understood[5]. This gap is especially evident in Adult Day Services (ADS)[6], community-based long-term care services playing a crucial role in providing post-acute care and managing chronic conditions among older adults in community settings. This study aims to assess the current state of HIE in ADS, using nationally representative data, and to identify key organizational characteristics that influence its adoption.

## METHODS

The data for this study were obtained from the 2018 National Post-acute and Long-term Care Study (NPALS), a cross-sectional repeated survey by the National Center for Health Statistics (NCHS)[7]. The survey was administered to directors or knowledgeable staff members at Adult Day Services Centers (ADSCs). Out of the initial 6,361 ADSCs in the sampling framework, 1,367 were determined to be eligible, and 672 of them completed the provider questionnaire, resulting in a weighted response rate of 50%. After adjusting for eligibility and non-response, the final estimated national representative sample consisted of 4,200 ADSCs.

HIE was assessed as whether the adult day services center's computerized system support electronic health information exchange with either physicians or pharmacists. Various organizational

characteristics were evaluated as potential factors associated with HIE adoption, including ownership status, Medicaid licensure, Medicaid reimbursement percentage, ADSCs location, capacity, occupancy rate, years of establishment, and the availability of computer capabilities for functions such as patient information recording, or whether ADSC used Electronic Health Records (EHR) beyond accounting and billing purposes.

Logistic regression analyses were conducted to assess the likelihood of ADSCs adopting HIE, utilizing two sequential models to examine their association with adoption. The goodness-of-fit for the models was assessed using the Nagelkerke pseudo R-square. The statistical software used for analysis was SPSS version 28, which incorporated complex survey weights to account for the sampling design. Missing data, which were minimal (less than 3% across all variables), were handled using listwise deletion, and no issues of multicollinearity were identified. Statistical significance was set at $p < .05$ for two-tailed tests.

## RESULTS

In the fully weighted sample, among 4,164 ADSCs, 711 (17.1%) had adopted HIE practices. The logistic regression analyses, as presented in Table 1, revealed several significant predictors of HIE adoption within ADSCs. In Model 1, these predictors included ADSCs' capacity, proximity to other healthcare providers, years of establishment, for-profit status, and the percentage of Medicaid patients they served. The introduction of computer capabilities into Model 2 bolstered the model's goodness-of-fit, indicated by Nagelkerke pseudo R-squared increasing from 0.075 to 0.331. Notably, the ability to view imaging reports was associated with a more than nine-fold increase in the likelihood of HIE adoption. Similarly, the capacity to order prescriptions and record clinical notes was linked to more than a three-fold increase in the likelihood of adoption. Additionally, recording medications and allergies, being in proximity to other healthcare providers, and using EHR were associated with more than a two-fold increase in the likelihood of HIE adoption. Interestingly,

ADSCs with higher capacity, Medicaid authorization, and the ability to record participant problems and view lab results exhibited a slightly reduced likelihood of adopting HIE practices.

Table 1: Ordinal Logistic Regression of HIE Exchange among ADSC (n=4,164)

| | Model 1 | | | | Model 2 | | | |
|---|---|---|---|---|---|---|---|---|
| | Exp(B) | 95% C.I.for EXP(B) | | *Sig.* | Exp(B) | 95% C.I.for EXP(B) | | Sig. |
| ADSC Capacity | | | | | | | | |
| 25 or fewer participants | | | | <.001 | | | | <.001 |
| 26-50 participants | 0.85 | 0.66 | 1.11 | 0.23 | 0.56 | 0.41 | 0.76 | <.001 |
| 51 or more participants | 1.37 | 1.08 | 1.74 | 0.01 | 0.64 | 0.47 | 0.86 | 0.00 |
| Center location near other health services (yes) | 2.22 | 1.84 | 2.68 | <.001 | 2.26 | 1.81 | 2.82 | <.001 |
| Years of establishment | | | | | | | | |
| Less than 10 years | | | | <.001 | | | | 0.16 |
| 10-19 years | 0.67 | 0.54 | 0.83 | <.001 | 0.79 | 0.62 | 1.01 | 0.06 |
| More than 20 years | 0.51 | 0.41 | 0.65 | <.001 | 0.83 | 0.63 | 1.08 | 0.17 |
| Occupancy rate (85 percent or higher) | 1.12 | 0.92 | 1.36 | 0.26 | 0.91 | 0.73 | 1.13 | 0.39 |
| ADSC Status (For-profit) | 0.71 | 0.58 | 0.86 | <.001 | 1.00 | 0.79 | 1.26 | 1.00 |
| Medicaid authorization or set-up (Yes) | 0.83 | 0.66 | 1.03 | 0.09 | 0.66 | 0.51 | 0.85 | 0.00 |
| Medicaid Payment Percentage | 1.01 | 1.01 | 1.01 | <.001 | 1.01 | 1.00 | 1.01 | <.001 |
| Computer Capability | | | | | | | | |
| Record participant demographics | | | | | 1.36 | 1.02 | 1.81 | 0.04 |
| Record clinical notes | | | | | 3.14 | 2.34 | 4.22 | <.001 |
| Record participant medications and allergies | | | | | 1.98 | 1.41 | 2.77 | <.001 |
| Record participant problem | | | | | 0.52 | 0.38 | 0.71 | <.001 |
| Record individual service plan | | | | | 1.17 | 0.86 | 1.59 | 0.31 |
| View lab results | | | | | 0.48 | 0.28 | 0.84 | 0.01 |
| View imaging reports | | | | | 9.39 | 5.42 | 16.28 | <.001 |
| Order prescription | | | | | 3.68 | 2.56 | 5.30 | <.001 |
| Electronic Health Record | | | | | 1.62 | 1.27 | 2.05 | <.001 |
| Constant | 0.13 | | | <.001 | 0.51 | | | <.001 |
| R | | 0.075 | | | | 0.331 | | |

## DISCUSSION

Our results offer valuable insights into HIE practices within ADSCs and the organizational factors

associated with them. Utilizing nationally representative data, we observed that 17.1% of ADSCs had HIE practices in 2018. Significant organizational predictors uncovered in this study offer insights to policymakers and healthcare stakeholders in formulating strategies to enhance HIE adoption in community-based long-term care services.

The presence of advanced computer capabilities was closely linked to a notably higher probability for adopting HIE. Key functionalities contributing to this include the capacity to access imaging reports, prescribe medications electronically, and document clinical notes, medications, and allergies. Additionally, the utilization of EHR was also significantly correlated with the implementation of HIE practices. These capabilities suggest a holistic and integrated approach to managing electronic health data, reflecting the core objectives of HIE and emphasizes the crucial role of robust information technology infrastructure in the operations of ADSC, facilitating their engagement with HIE.

Another notable predictor was the location of ADSCs to other healthcare providers. ADSCs located near other healthcare facilities were more likely to adopt HIE practices. This could indicate the influence of peer networks and the opportunities for collaboration and care coordination that arise when ADSCs are situated in close proximity to other healthcare providers, highlighting the importance of geographic factors in the adoption of HIE.

ADSCs with greater capacity, for-profit status, with computer capability to record participant problems and view lab results exhibited a slightly reduced likelihood of adopting HIE practices. These unexpected results may warrant further investigation to understand the nuances of HIE adoption in different ADSCs contexts. It's important to acknowledge the limitations of this study, including its cross-sectional nature and the absence of cost considerations in HIE adoption. Further research is warranted to comprehensively explore the range of obstacles and impediments that ADSC encounter during the integration of Health Information Exchange (HIE) technologies. Conclusively, this investigation contributes significant insights into the organizational determinants that influence

the adoption of HIE systems among ADSCs. A deeper understanding of elements such as technological infrastructure and geographic proximity to fellow healthcare providers can be instrumental in formulating targeted strategies. These strategies are pivotal in augmenting the adoption of HIE technologies within ADSCs, thereby potentially elevating the standard of care provided to the elderly population in community settings.



## AUTHOR CONTRIBUTIONS

All authors planned the study. Yawen Li, Jay Chok, Geoffrey Cui analyzed the data and verified statistical analyses. Yawen Li and Jay Chok wrote the manuscript, and Kenneth Shultz and Don Roosan provided feedback for substantial revisions.

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## CONFLICT OF INTEREST

The authors have no conflicts.

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