# Analysis of Aggregate Medicare Fee-for-Service Data in R3[2] Intervention and Control Sites

Prepared for

Hebrew Senior Life

by

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## Executive Summary

This summary reports on service utilization among Medicare fee-for-service residents living in buildings served by the $R3^2$ program and residents living in control sites. It is the second of two reports focused on an analysis of 36 months of quarterly aggregated healthcare utilization data provided by Healthcentric Advisors on health care utilization measures—hospital inpatient, emergency department, observation stay, and 30 day readmission—comparing these two groups. The data covered an experience period of 18 months prior to and after program implementation. The $R3^2$ intervention site buildings were evaluated against (1) the original five control buildings; (2) a control group comprised of buildings that are known to have service coordinators, and; (3) a group of buildings known not to have service coordinators.

Our analysis focused on the difference-in-differences between pre- and post- $R3^2$ utilization trends in the intervention and control groups. That is, we evaluated whether and by how much any differences in utilization changed over time across sites. Statistically significant utilization changes over time were attributed to the "$R3^2$ effect". Because data was provided on an aggregate building-wide basis and not an individual resident basis, we could only measure the "$R3^2$ effect" among residents in an entire building and not only among residents who directly participated in the $R3^2$ program – a particularly conservative approach to the analysis. Key findings include:

- The $R3^2$ program is having a very strong and positive impact on inpatient hospitalization rates compared to control sites. We found a a:
    - 16% decline in inpatient hospitalization rate among residents;
    - 25% decline in total hospital admission days per beneficiary;
    - 12% decline in the average number of hospital days, and;
    - 22% decline in hospital admission payments per beneficiary.
- While the $R3^2$ program's reduction in emergency department admission rates appeared to be smaller compared to that observed in control sites, regression analysis, which adjusted for the overall older age of residents in the $R3^2$ buildings, showed a 6.7% greater rate of decrease in admission rates for the $R3^2$ sites compared to all control group sites. Further, there was a 12% decline in emergency department admission payments per beneficiary among $R3^2$ sites compared to an insignificant 4% decline in control sites.
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- The $R3^2$ program was also associated with a significant decline (23%) in the hospital observation visit rate per beneficiary and a slight net decline of (3%) in beneficiary visit payments for observation visits.

- Unadjusted 30-day hospital readmissions rates in R3[2] buildings declined over the period from 10.3% to 8.0% -- a 22% decline compared to increases in unadjusted 30-day hospital readmission rates observed across control sites.

The information in this report will supplement self-report data and ambulance transfer data reported elsewhere.

Background

One key performance indicator for the R3[2] program is its impact on the utilization of selected health care services. More specifically, a key aim of the intervention is to reduce transfers to hospitals, emergency rooms and long-term care facilities, as well as to reduce the use of ambulance services. No individual-level claims data has been readily available on the use of acute care services. Aggregate data ambulance utilization, however, has been provided directly by the ambulance companies serving R3 building sites as well as a group of control sites. Analysis of this data is reported elsewhere. The research team has also been able to obtain aggregate service utilization data on residents insured by traditional Medicare (who comprise an estimated 90% of building residents) in both the intervention and control sites. This was made possible through collaboration with the local Quality Improvement Organization (QIO) Healthcentric Advisors, the Medicare Quality Innovation Network-Quality Improvement Organization (QIN-QIO) contractor for New England.[1] Healthcentrics provided aggregate service utilization data for both the intervention and control sites for an 18-month period prior to the implementation of new protocols to the R3 program, henceforth referred to as the R3[2] intervention, and for an 18 month period after the R3[2] program was initially launched. Although these data have certain limitations (described below), they do allow the research team to measure potential impacts of the R3[2] program on selected health service utilization parameters.

Purpose

The purpose of this analysis is to use the aggregate healthcare utilization data provided by the QIO to analyze the impact of the R3[2] program on a variety of health care utilization measures.

Data and Method

*Data*

Healthcentric Advisors obtained a complete beneficiary file for all Medicare beneficiaries in the state of Massachusetts and then narrowed the dataset down to the specific addresses that were provided by the research team for both the R3[2]intervention buildings and the multiple control buildings (explained below). The data covered two distinct 18-month periods:

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[1] A Quality Improvement Organization (QIO) is a group of health quality experts, clinicians, and consumers organized to improve the quality of care delivered to people with Medicare. These organizations, operating under the auspice of the Centers for Medicare and Medicaid Services, bring Medicare beneficiaries, providers, and communities together in data-driven initiatives that increase patient safety, make communities healthier, better coordinate post-hospital care, and improve clinical quality. They have direct access to Medicare claims data and work with organizations by providing access and analysis to that data when it is designed to assist stakeholders. For more information see: https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/qualityimprovementorgs/index.html

- Pre-Intervention Period: 7/1/2017 – 12/31/2018 (original R3 program period)
- Post Intervention Period: 1/1/2019 – 6/31/2020 ($R3^2$ program period)

The QIO provided quarterly data for the relevant period for all traditional Medicare beneficiaries -- that is, those enrolled in fee-for-service (FFS) Medicare who lived in the $R3^2$ and control buildings. This included not just the number of Medicare FFS residents, but also their aggregate service utilization during the period. By definition, this means that the analysis was unable to incorporate information on individuals enrolled in Medicare Advantage plans. Data from Hebrew SeniorLife (HSL) staff suggest that less than 20% of residents in these buildings are enrolled in managed care plans and that there is no reason to assume that this figure varies substantially for participants in the $R3^2$ program. The aggregated data includes information on the following outcome measures:

- Hospital admission rates per beneficiary;
- Total hospital admission days per beneficiary;
- Average length of hospital stays (days);
- Hospital admission payments per beneficiary;
- Emergency department admission rates per beneficiary;
- Emergency department payments per beneficiary;
- Hospital observation visit rates per beneficiary;
- Hospital observation visit payments per beneficiary;
- Hospital readmission rates per beneficiary;

It is important to note that data was provided on an aggregate building-wide basis and not an individual-level basis. This means that we cannot link service utilization data to specific individuals but rather, the data reflects service utilization for all residents of the building over the time period. Consequently, we were unable to focus our analyses on $R3^2$ program participants only; all residents in the buildings were included in the analyses, whether or not they participated in $R3^2$. The QIO was unable to provide individual data, both to assure privacy protection and to maintain compliance with Center for Medicare and Medicaid Services (CMS) regulations regarding Health Insurance Portability and Accountability Act (HIPAA) privacy provisions.[2]

The data structure has significant implications for the types of analysis that we could conduct. The first (as noted above) is that in the $R3^2$ intervention sites, the data covered individuals who enrolled in the intervention as well as those who did not. Thus, we measured the impact of the $R3^2$intervention on the entire building including both $R3^2$ participants and non-participants. Across the $R3^2$ intervention sites, roughly 33% of building residents participated in the program. This means that almost two thirds of the data ascribed to intervention sites included people who did not participate in the $R3^2$ program, although they too may have benefitted from the

[2] For more information on HIPAA see: https://www.govinfo.gov/content/pkg/PLAW-104publ191/pdf/PLAW-104publ191.pdf

onsite presence of the program. Second, because this data cannot be linked to individuals, we were not able to control for any significant differences in the socio-demographic and health characteristics of residents living in the R3$^2$ intervention and control buildings. This makes it difficult to rule out alternative explanations for any observed differences between the groups. It also makes it difficult to conclude that when we do not find differences between the groups, the R3$^2$ intervention is not having an effect.

The number of comparison group sites for the analysis has been expanded beyond the five comparison group sites recruited for the initial evaluation. We do this to assure that the sample is large enough to conduct meaningful analyses. Along with staff at Hebrew SeniorLife, we reviewed data tabulated by the Massachusetts Department of Housing and Community Development and identified three distinct categories of control groups:

(1) Control Group 1: The original control/control group buildings;
(2) Control Group 2: Buildings that are known to have service coordinators;
(3) Control Group 3: Buildings that are known not to have service coordinators.

Table 1 highlights the specific buildings and the average number of residents included in each of the three control buildings as well as in the R3$^2$ intervention group.

Table 1: Specific Buildings by Analytic Grouping

| R3$^2$Intervention Group (n=1,200 residents) | Control Group 1 (n=1,100 residents) | Control Group 2 (n=5,012 residents) | Control Group 3 (n=3,100 residents) |
|---|---|---|---|
| • Cohen CCB 112 | • Framingham Green | • Birdle Path Apts | • Colonial Village |
| • Danesh CCB 100 | • Jack Satter House | • Blackstone | • Eva White Apts |
| • Fireman | • Seabury Heights | • Blake Estates | • George Welch |
| • Goldman CCB 1550 | • The Moorings | • Campello High Rise | • Keystone |
| • TVAB Kent | • Wollaston Manor | • Clement A O'Brien | • McCauley Murray Lewis |
| • TVAB Pearl | | • Costanzo Pagnano | • South Cove Apts |
| • TVAB Village | | • Franklin Square (Newton) | |
| • Unquity House | | • Franklin Square (Tremont) | |
| • Winter Valley | | • Genesis - Brighton | |
| | | • Kenmore Abbey | |
| | | • Manning Tower | |
| | | • Quincy Tower | |
| | | • Southern 1000 Artery | |
| | | • Union Towers 1 | |

APTs: Apartments, CCB: Center Communities of Brookline, TVAB: The Village at Brookline.
Sample sizes are as follows: R3$^2$ Intervention N= 618, Control 2 N= 323, Control 3 N= 1010, Control 4 N= 214

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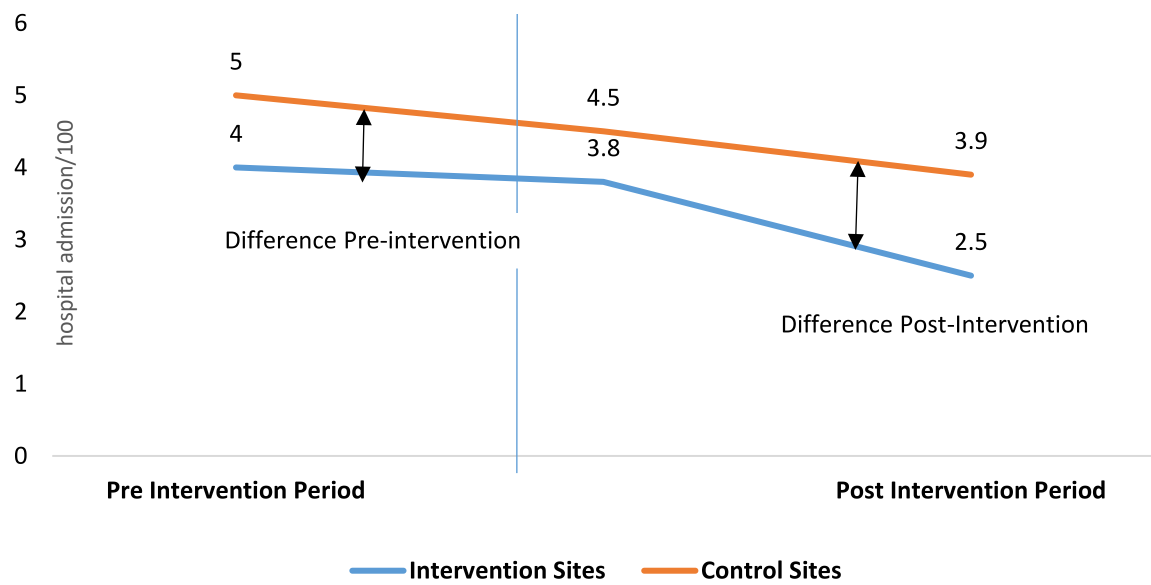
Control buildings were selected to match characteristics of the intervention sites, five of which were low-income and two of which were mixed-income sites. Control Group 1 includes one mixed-income site, while Control Group 2 includes sites where low income is a criterion for residency. Control Group 3 also includes low-income housing. Thus, although the buildings could not be matched based on detailed socio-demographic characteristics, nearly all fall into the category of low-income senior housing.

*Method*

The analysis aims to determine whether the R3² intervention had any effect on the service utilization metrics listed above, but (as discussed) is constrained by the type of data provided by the QIO. A key assumption behind attributing changes in outcomes to the R3² intervention is that, in the absence of R3², any changes (differences) in service utilization would have stayed consistent with pre-R3² trends (ie, show no differences between these trends).[3] Thus, we focus on the difference-in- differences between pre- and post- R3² trends in the intervention and control groups for each of the service utilization metrics. If the difference-in-differences is statistically significant, then pending any alternative explanation, we attribute it to the "R3² effect". Figure 1 below illustrates the conceptual framework for the analysis.

Figure 1: Conceptual Framework for Analysis




Our evaluation methodology is based on an Intent-to-Treat (ITT) study design, where we conduct analyses using all residents who were targeted for the R3² intervention rather than only those who engaged or participated in R3². This approach avoids the selection bias that

[3] Wooldridge J. Econometric analysis of cross section and panel data. Cambridge, MA: MIT Press, 2001.

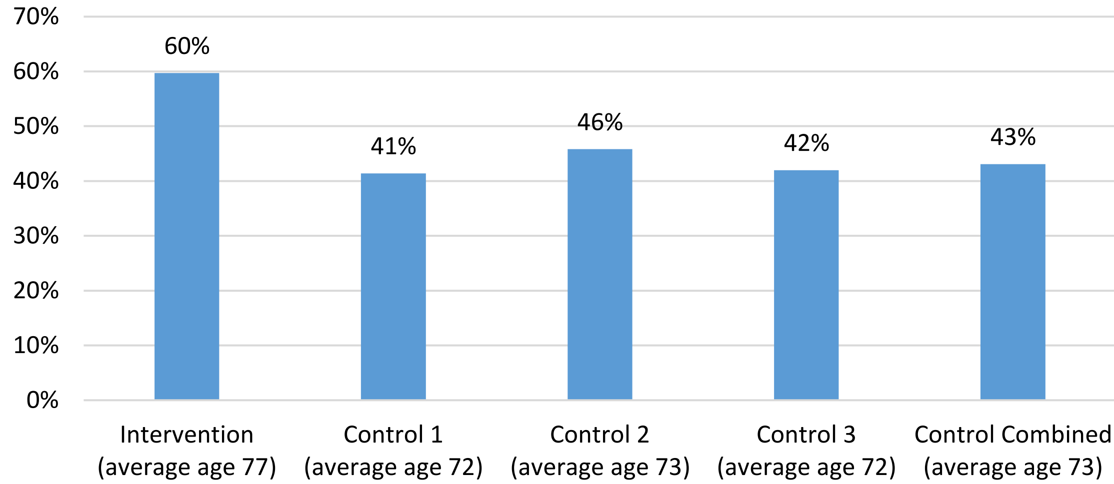
arises by analyzing members who agree to participate in the program. However, by its very nature, an ITT methodology is a conservative approach to measuring program impacts because of dilution effects: those who participated in the program and those who did not are treated similarly and compared to individuals in the control buildings. Thus, for example, if the intervention led to a 20% reduction in hospitalizations among enrollees, but enrollees only comprise 10% of the target population, then the aggregate data will show a 2% reduction in hospitalizations for the building (assuming that there are no changes in hospital utilization among the non-enrolled population). Consequently, this study design is much more susceptible to Type II error – the failure to detect an impact when one is present. While this analytic method is not perfect, it is the most appropriate for the data we have. Along with the self-reported changes in health care usage and the detailed ambulance data, we are comfortable that together, all three sources of information will allow us to draw empirically valid conclusions about $R3^2$ program impacts.

<u>Results</u>

In this section, we present findings for each of the utilization parameters provided by the QIO. In addition to comparing aggregate results for the $R3^2$ intervention and control groups pre- and post-$R3^2$ implementation, the data enables us to control for age differences across residents in the intervention and control buildings. We do this by conducting ordinary least squares (OLS) regression analyses on selected outcomes variables; our control variable is the percentage of building residents over age 75[4]. We make this adjustment only when the analysis does not yield statistically significant differences between the intervention and control sites. In such instances, we then conduct the regression analysis to determine if adjusting for age yields different results. As shown in Figure 2 below, there are major differences in the proportion of older residents in the $R3^2$ buildings versus those in control sites. On average, residents in $R3^2$ buildings are four to five years older than residents in the control sites. Given the strong relationship between age and health care utilization, other variables held constant, one would assume greater health services use in $R3^2$ buildings compared to control sites.

[4] This was one of the variables that the QIO was able to provide on an aggregate building-wide basis for each of the sites.

Figure 2: Percent Residents 75 and older




Because the analysis focuses on determining whether the size of the difference pre- and post-R3² implementation is statistically significant, the regression coefficients can be somewhat complicated to interpret.[5] Results on each of the utilization parameters are presented for the R3² intervention group and each of the three control groups and, where appropriate, this is followed by the regression findings for that parameter.

***Inpatient Hospitalization***

Figure 3 shows the adjusted rate of Inpatient Hospital Admissions per beneficiary based on the total number of admissions. These rates do not reflect the percentage of admissions for each beneficiary, but rather the percentage of total number of admissions per total number of beneficiaries in each group. These results show that there is a significant decline (16%) in the inpatient hospitalization rate among residents in R3² buildings over the period (even without adjusting for age differences). The only other statistically significant decline over the period is for residents in control group three (no service coordinator) buildings a 5% decline. When aggregating across all control sites, the impact of the R3² program is more pronounced: **a 16% decline compared to a 6% increase** in admission rate making for an overall effect of 22%. This is a particularly strong result given that the residents in the R3² sites are older than are residents in controls sites. Note that on an aggregate basis both the pre- and post- changes for each group are statistically significant as is the difference in the magnitude of the change between the R3² intervention site and the aggregated control sites.

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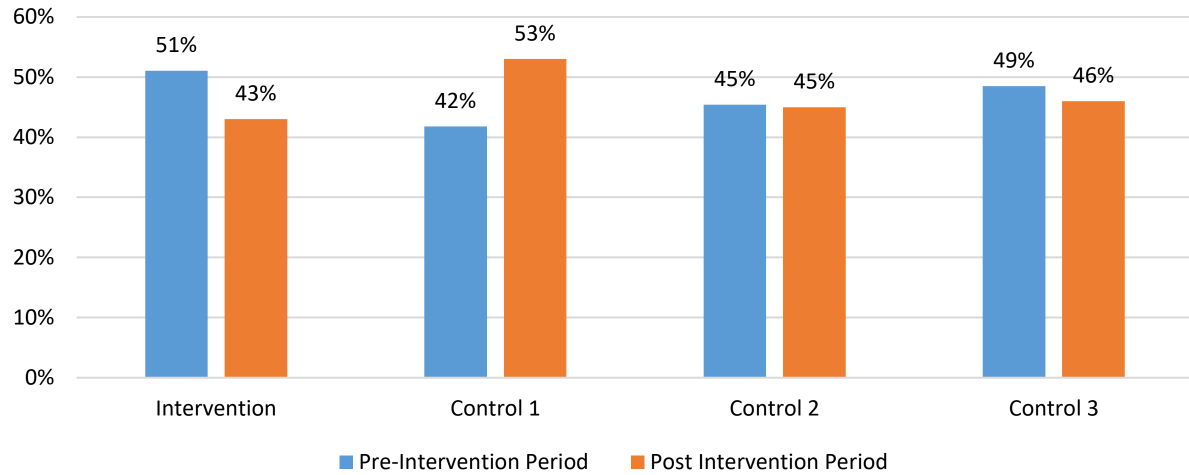
[5] In essence, the regression coefficient represents the actual size of any observed difference and not whether the difference is positive or negative. The dependent variable that was measured across all of the utilization variables was the difference in the difference between the pre- and post-intervention period. Thus, for example, we looked at whether there was a statistically significant difference in the change over time in the difference between pre- and post-intervention emergency department admission rates between the intervention and control groups. For the purposes of the regression analysis, all of the three control groups were collapsed into one aggregated group.

Figure 3: Hospital Admission Rate Per Beneficiary




Note: Differences are statistically significant at the p<0 .05 level.

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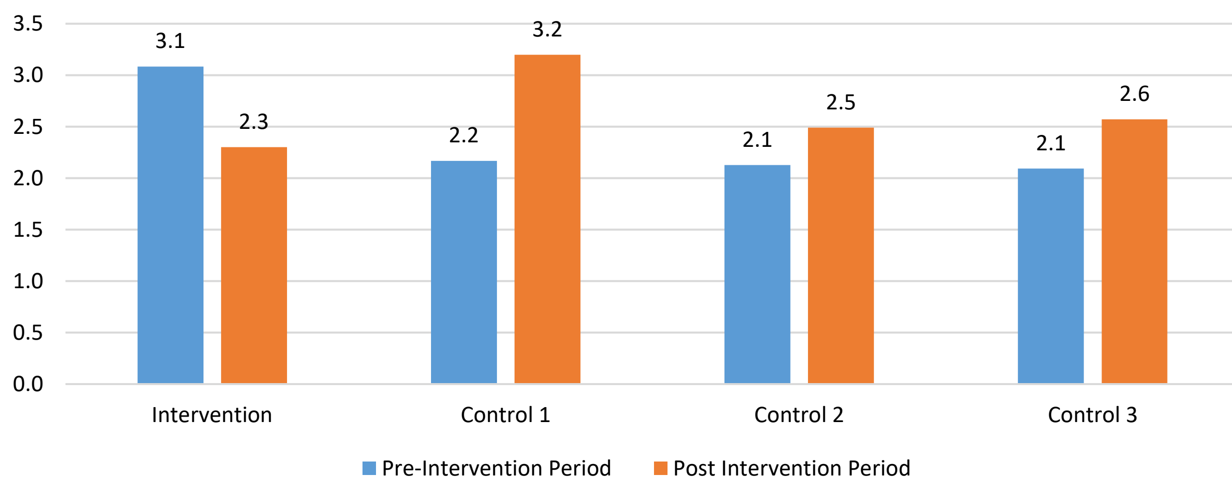
We also examined other measures of hospital utilization, including the total hospital admission days per beneficiary and the average length of hospital stays. Once again, we found very strong results for residents in $R3^2$ buildings. Figure 4 shows that there was a 25% decline in the total hospital admission days per beneficiary in $R3^2$ buildings compared to increases among residents in controls site buildings. In fact, the average increase in control sites was 29%.

Figure 4: Total Hospital Admission Stays (Days per Beneficiary)




Note: Differences are statistically significant at the p<0.05 level.

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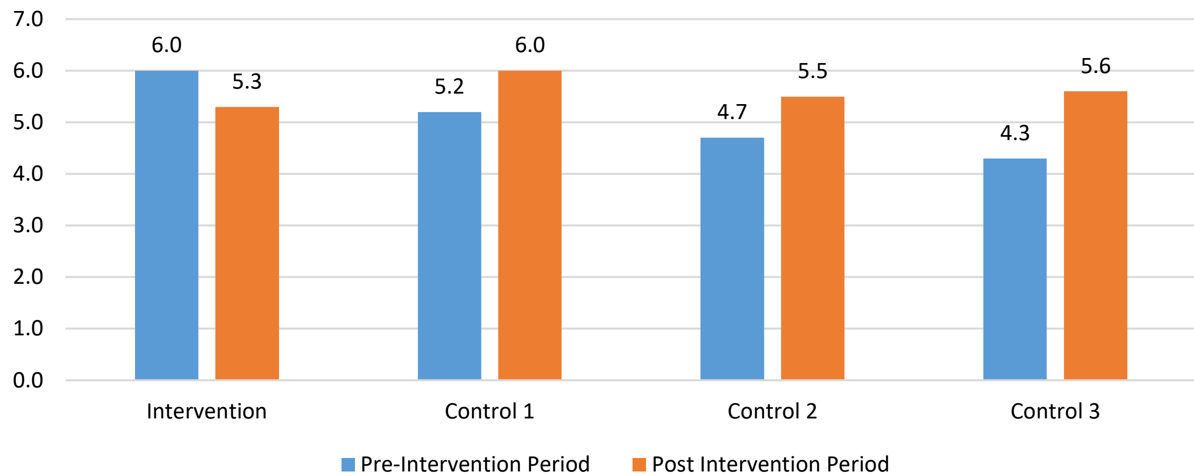
Figure 5 presents information on the average length of the hospital stay. Among residents in the R3[2] buildings, there was a 12% decline in the average number of hospital days whereas for residents in control sites, there was a 14% increase over the period.

Figure 5: Average Length of Hospital Stays (Days)




Note: Differences are statistically significant at the p<0.05 level.

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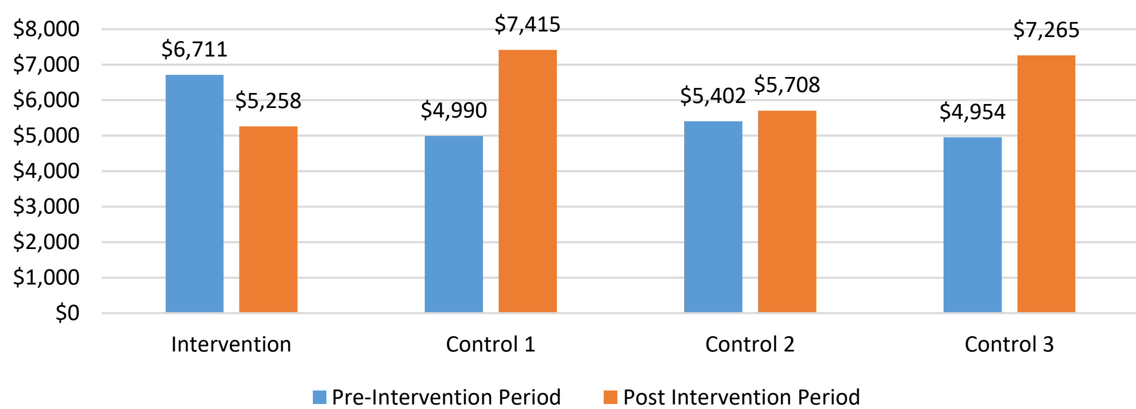
Finally, we look at the average sum of hospital admission payments per beneficiary across the sites (Figure 6). Not surprisingly, we find that there has been a significant decrease in R3[2] buildings -- $6,711 to $5,258 decline over the period (a 22% decline). Across the controls sites, the average sum of admission payments per beneficiary has increased quite a bit – an average increase of 33%.

Figure 6: Sum of Hospital Admissions Payments (Per Beneficiary)




Note: Differences are statistically significant at the p<0.05 level.

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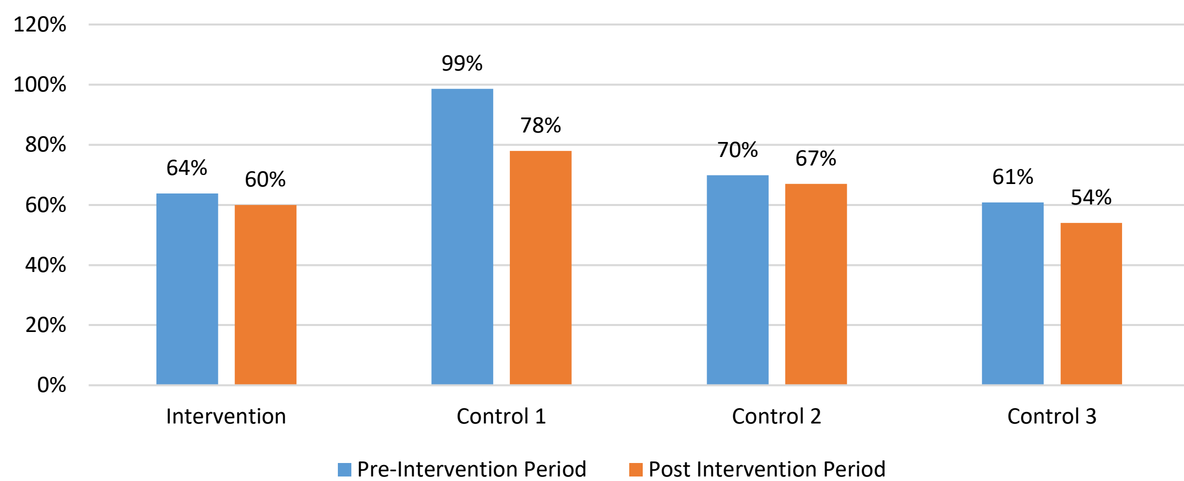
***Emergency Department Utilization***

Figure 7 shows the adjusted rate of emergency department (ED) admissions per beneficiary based on the total number of admissions. These rates do not reflect the percentage of admissions for each beneficiary, but rather the percentage of total number of admissions per total number of beneficiaries in each group. The use of aggregate data for ED admissions means that we cannot know whether a few beneficiaries are having many admissions or whether the number of admissions is spread out over many beneficiaries. Figure 7 shows that ED admissions declined over the period for all groups, with an average decline of 6% in R3[2] buildings compared to a 14% decline in combined controls sites. The decrease in the ED admission rate in R3[2] buildings was less than what was recorded in control site 1 (original control buildings) and control site 3 (no service coordinators), but greater than what was found in control site 2 (service coordinators). Thus, while there was a decline in the ED admission rate, when viewed across all sites, the program was found to be less successful in the simple bivariate analysis than the control sites. This is driven in large degree by the outlier experience of control site 1 (original control buildings). It is also important to note that this initial analysis does not control for age differences between intervention and control sites.

Figure 7: Emergency Department Admission Rate per Beneficiary




Note: Differences are statistically significant at the p<0.05 level.

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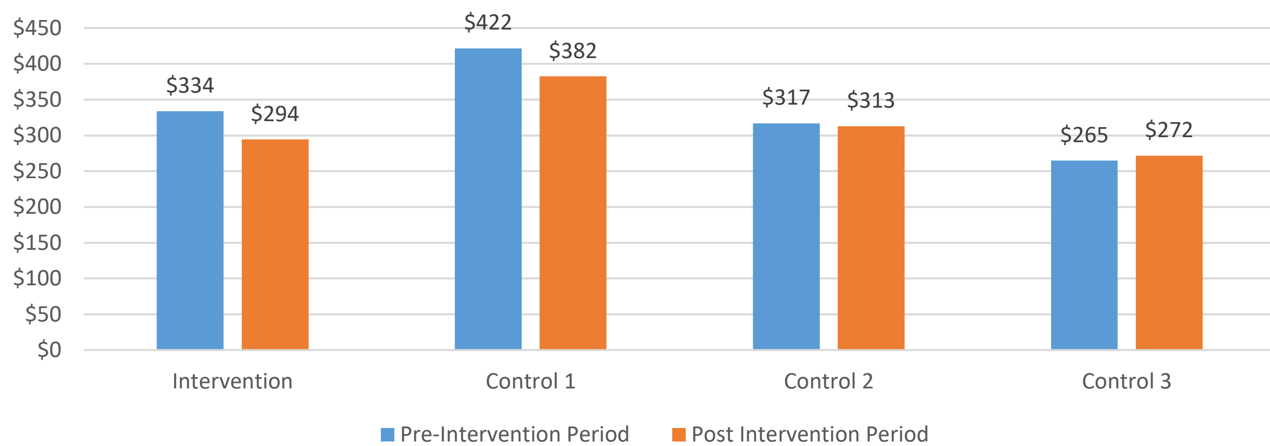
This is the only outcome variable that did not show a conclusive positive R3[2] program impact in the simple bivariate analysis. For that reason, we also thought it prudent to understand how the older age of residents in the R3[2] buildings compared to the younger age residents in control sites factored into the observed change in ED admission rates over the period. Regression results showed that when controlling for age, the rate of decrease in ED admission rate over the period was 6.7% greater for R3[2] buildings than the combined control sites (*B*= 6.71, p <0.01). Put another way, when accounting for the older age of the R3[2] residents, the effect size of the decline recorded in ED admission rates over the period was 6.7% greater for the R3[2] sites than the control sites, indicating a positive result.

Figure 8 summarizes the ED admission payments per beneficiary and shows that the R3[2] showed a 12% decline compared to a 9% decline in control site 1 (original control buildings) and no statistically significant decline in the other two control sites. When aggregating results across the three control sites, we find that there is no statistically significant decline in admission payments per beneficiary.

Figure 8: Sum of Emergency Department Admissions Payemnts (Per Beneficiary)




Note: Differences are statistically significant at the $p<0.05$ level.

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### *Hospital Observation Stay Utilization*

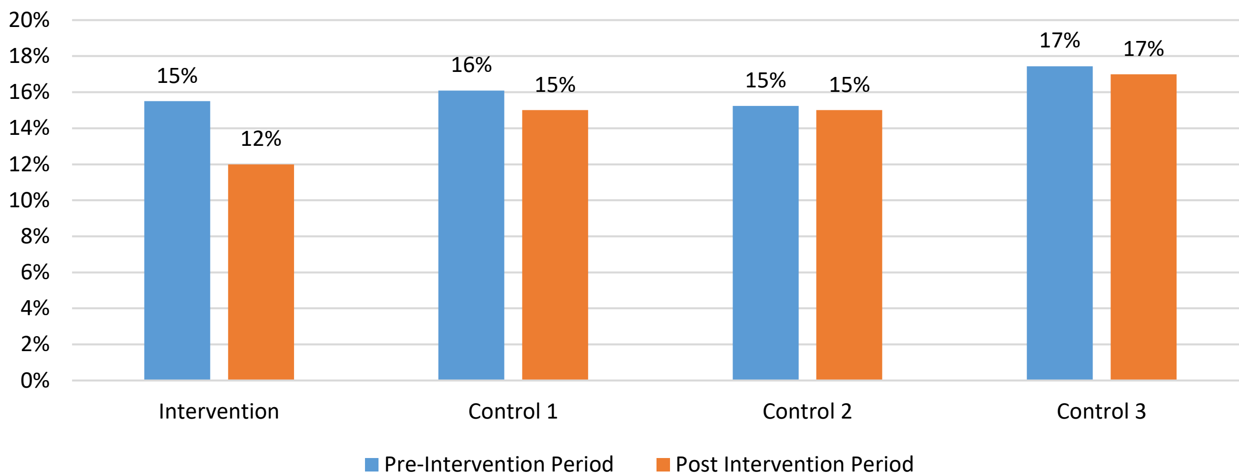
Outpatient overnight observation stays at the hospital actually measure hospitalizations but are tracked separately for billing purposes. The QIO was able to obtain information on this form of inpatient hospital use over the period. A physician can order “observation services” to decide whether an individual should be admitted to a hospital on an inpatient basis or can be discharged. During observation status, the patient is considered an outpatient.

However, interpreting what “observation status” means, in terms of health systems effectiveness, is not easy: people who receive observation services typically --but not uniformly -- enter through the ED: they may be referred by their community physicians for observation status, or may be classified as such at the tail end of a hospital stay. The increase in hospital observation days could, therefore indicate that physicians are more likely to refer directly from the community; it may reflect the nature of the admission referral from the emergency room;

or it could be related to differences in coding practices across the hospitals to which people are referred.

Figure 9 shows the adjusted rate of outpatient overnight observation stays per beneficiary based on the total number of stays. These rates do not reflect the percentage of stays for each beneficiary, but rather the percentage of total number of stays per total number of beneficiaries in each group. As shown, there has been a significant decline (23%) in hospital observation visit rate per beneficiary in R3[2] buildings compared to control sites – none of which recorded a significant decline. Although not shown in the figure, there was also a 23% decline in the sum of hospital observation visit payments per beneficiary over the period – from $369 to $271. Again, no such changes were recorded for the control sites.

Figure 9: Hospital Observation Visit Rate Per Beneficiary




Note: Differences are statistically significant at the $p<0.05$ level.

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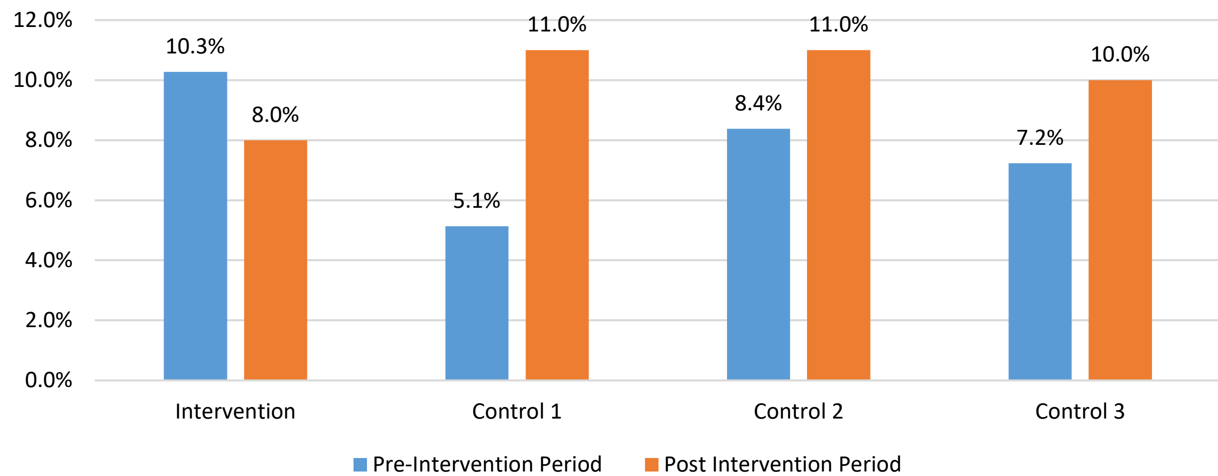
### ***Thirty-Day Hospital Readmission Rate per Beneficiary***

In recent years, there have been substantial efforts to reduce hospital readmissions rates. In fact, CMS has implemented the Hospital Readmission Reduction Program (HRRP), which is a Medicare value-based purchasing program that lowers payments to Inpatient Prospective Payment System (IPPS) hospitals with too many readmissions.[6] Readmissions have fallen dramatically over the past decade due to a variety of programs implemented across the health system.[7] Figure 10 compares the unadjusted thirty-day hospital readmission rate per

[6] For more information please see: https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/value-based-programs/hrrp/hospital-readmission-reduction-program.html
[7] For more information see: http://www.medpac.gov/docs/default-source/reports/jun18_ch1_medpacreport_sec.pdf

beneficiary and shows a strong effect in R3[2] buildings, which recorded a 22% decline in rates – from 10.3% to 8.0% over the period. By contrast, there were statistically significant increases in thirty-day admission rates across all of the control sites.

Figure 10: Thirty Day Hospital Readmission Rate Per Beneficiary




Note: Differences are statistically significant at the $p<0.05$ level.

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<u>Conclusions</u>

The results of our analyses suggest that even when using a conservative evaluation methodology – an Intent-to-Treat approach (ITT) – residents in R3[2] buildings are using hospital resources far less than are residents in the control sites. Given both the consistency of results as well as the magnitude of effects, the buildings implementing the program have significant and positive reductions in health care utilization and costs, compared to sites that are not implementing the program. The findings of this analysis are consistent with the hypothesis that having staff more involved and dedicated to resident care, and coordinating closely with community services as well as the emergency response providers, can lead to lower demand for high cost hospital care and fewer emergency department visits. Given the 16% decline in hospital admissions, along with a 22% decline in hospital admission payments per beneficiary, the program costs of having the on-site R3[2] team can easily be cost justified in terms of the medical savings generated by the efforts of the team.