



Performance Outcome Measurement Project

# Risk Factors for Nursing Home Placement Among Older Americans Act Service Recipients

## Summary Analysis of Data from Five Sources

Dwight B. Brock, Ph.D.  
Beth Rabinovich, Ph.D.  
Jacqueline Severynse, B.S.  
Robert Ficke, M.A.

December 19, 2011

Westat  
1600 Research Blvd.  
Rockville, MD 20850  
301-251-1500

Portions of this summary were presented at the 60th Annual Scientific Meeting of the Gerontological Society of America, San Francisco, CA, on November 19, 2007. Research supported by U. S. D. H. H. S. Administration on Aging contract No. 233-02-0087

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## Overview

As part of the Administration on Aging's Performance Outcomes Measurement Project (POMP), this report examines the effect of the receipt of Older Americans Act (OAA) services on the potential delay in nursing home placement among OAA service clients age 60 and older. The report is based on analysis of administrative service client data from Rhode Island, Georgia, North Carolina, and New York, as well as respondents to the Health and Retirement Study (HRS), a nationally representative longitudinal survey of older persons, conducted by the University of Michigan Institute for Social Research.

## Data Available for Analysis

Data available for analysis varied by state, but included the following:

- Demographics: age, gender, ethnicity, living arrangements\;
- Presence or absence of a caregiver (Georgia only);
- Medicaid eligibility (North Carolina only);
- Marital status (Rhode Island only);
- Measures of physical functioning (ADL, IADL and other measures of physical impairment);
- Health and mental status variables: self reports of incontinence, stroke, Parkinson's disease, Alzheimer's disease, and dementia (New York only);
- Other health event variables such as emergency room use (New York only).
- Receipt of OAA home-and-community-based services (see Table 1).

Table 1 lists the services included for each state.

**Table 1. OAA Services Offered by State**

<b>Service</b>	<b>Georgia</b>	<b>New York</b>	<b>North Carolina</b>	<b>Rhode Island (98-05)</b>	<b>Rhode Island (05-07)</b>
Home Delivered Meals	x	x	x		x
Home Maker	x		x		
Personal Care	x	x	x		
Respite	x				
Adult Day Care		x	x	x	x
Case Management		x		x	x
Safety Monitoring		x			
Assisted Living				x	x
Congregate Meals		x	x	x	x
Transportation		x	x		
Nursing Care in Home					
All other services				x	x

In some of the states the service variables consisted only of “yes/no” indicators of use of a particular service. In other states, the number of units of service consumed was available. In North Carolina measures of the average number of units of service received per month were calculated for those months in which a client actually received the services. In all states and in the HRS, a variable was created to indicate a count of the total number of services received by each client or respondent during the study period. The outcomes were: (1) remaining in the community, (2) permanent nursing home placement, (3) death, (4) loss to follow-up, or (5) the end of the study period. All outcomes except for permanent nursing home placement were considered “censoring” events. Thus, “survival” was defined as any outcome other than permanent nursing home placement.

Two additional variables were created for use in the models. The outcome variable “survival time” was calculated for each individual client as the difference (in months) between the date of the event (nursing home placement) or censoring (by death, movement out of the study area, end of the study period, or other loss to follow-up) and the date the client entered the service system. A “total services” variable was created for each individual by counting up the total number of services received by that individual during the study period.

## **Statistical Methods**

We conducted time-to-event analyses (time to nursing home placement) using proportional hazards regression models. Modeling of time to event for nursing home placement was guided by a number of prior studies in the literature which suggested the use of Cox proportional hazard models (Cox,

1972; SAS PROC PHREG, SAS Institute, 2007) as the most appropriate statistical approach (see, for example, McCann et al., 2005, Friedman et al., 2006). Selection of predictor variables also relied on prior literature (for example, Foley et al., 1992 and Miller and Weissert, 2000) as well as empirical evaluation of the model fits, plausibility of the selected variables and analytical judgment.

The next sections of the report provide state-specific detail. General discussion and conclusions are provided in the last section of this report.

## The Data Sets

The **first data set** consisted of an Excel file of service client administrative records from the Rhode Island Department of Elderly Affairs (DEA) covering the time period **December 1998 through December 2005**. Creation of an analytic file suitable for use with the SAS software for conducting the proportional hazard modeling (SAS PROC PHREG) required several processing steps. First, the data were converted from Excel to SAS format. Next, because the administrative file contained multiple records per client (as many as 23 records per person because of multiple services provided to each client), it was necessary to merge the multiple records per person into a single record and de-duplicate the redundant information (such as demographics, functional status measures, and so on). Additional editing of data involved cleaning dates of entry into and exit from the service system to insure that no inconsistencies in the dates remained in the data set. Finally, the data were checked to make sure that data values lay within expected ranges, and that coding was logical and valid.

Several other data quality issues and assumptions were dealt with during the data preparation phase prior to conducting the analyses. First, in cases where multiple records for a given individual provided different dates for nursing home placement (the primary outcome variable in these analyses) we made the assumption that the earliest placement date recorded applied to the case. Second, in cases where an individual had more than one assessment of functional status, the most recent ADL and IADL scores were used in the analysis. Third, the large amount of missing data for marital status precluded its use as a control variable in the analytical models. Fourth, “survival time” was calculated for each individual client as the difference (in months) between the date of the event (nursing home placement) or censoring (by death, movement out of the study area, end of the study period, or other loss to follow-up) and the date the client entered the service system. In cases where the client entered the service system prior to the beginning of the study period, the starting date was truncated at the beginning of the study period (December 1998). Finally, a “total services” variable was created for each individual by counting up the total number of services received by that individual during the study period.

The **second data set** is similar to the first in scope and content, but with a few differences. First, this data set is populated with a different set of clients from the first data set. Second, the data set is more recent, but was limited to the 33-month period from **January 2005 through September 2007**. This was due to the inability of the DEA vendor to process more recent data in time to meet DEA's requirements. Third, this data set includes a separate indicator variable for home delivered meals, which was not available in the first data set. Fourth, because of the small number of clients receiving assisted living, it was necessary to combine that service into the "all other" category. Otherwise, the editing and other data preparation activities were similar to those applied to the first data set.

## Summary of Results for Data Set 1

### Missing Data

Note first that there are varying amounts of missing data, depending on which variable was tabulated. Age is complete for all clients, but the other variables are incomplete as indicated by smaller totals in the table. The number of clients missing each variable is noted with an asterisk; the reason this is done is to preserve the proportions among the clients who reported the variable. For example, of the slightly more than 14,000 clients who have non-missing ethnicity, 12,680 are White, non-Hispanic. Thus, approximately 90% of the clients with non-missing ethnicity are White. If this percent were recalculated using the full 21,269 records on the file, the percentage falls to 60% White, which is not truly representative of the population.

### Descriptive Statistics

Descriptive statistics for the first data set (1998-2005) are provided in **Table 2**. The most frequent age range in this population is between 80 and 89 (41%). A majority of the clients are female (71%) and White, not Hispanic (90%). Among clients with complete data on living arrangement, almost half (47%) live alone. Surprisingly, of the clients with complete data on ADL and IADL function, more than half have no ADL or IADL limitations (59% and 52%, respectively). The overwhelming majority of clients received three or fewer services during the study period. The nursing home placement rate was only 1.1% over the entire study period, but the mean "survival time" in the community was only 17.3 months, although the variability in survival time was large (standard deviation 18.8 months). All of the above data suggest a population with demographic characteristics

not unlike other older populations, but one at relatively low risk of nursing home placement overall during this time period.

## **Proportional Hazards Modeling**

To help sort out the effects of these different factors on the relative risk of nursing home placement during the study period in a higher risk population, we limited the proportional hazards analysis to those individuals with one or more ADL limitations and fitted models using the demographic characteristics, living arrangement and functional status as control variables and examining the effects of the various measures of service use as the principal predictors of placement.

Results of the initial modeling, summarized in **Table 3**, showed that, controlling for demographics and functional status, there was statistically significant lowering of the risk of nursing home placement with the increased use of services among the more frail Rhode Island clients (that is, those with one or more ADL limitations). Since the Rhode Island data sets included only service recipients, the reference group for the total services variable was the group receiving only one service.

## **Use of Services**

Additional models fitted to the data set included individual service indicators for adult day care, assisted living, general case management, congregate meals, and all other services, each in combination with the total services count. None of those individual indicators was significant when included in the same model with the control variables and the total services variable.

The interpretation of the finding for the total services variable is that the risk of nursing home placement was decreased for those clients receiving more than one service compared to the clients receiving only one service. Further, since none of the individual service indicators was significant in these analyses, the analysis suggests that it is the total program of services that is most important in lowering the risk of placement in this client population and not any one particular service.

Furthermore, as shown in **Table 4**, there was a persistent increase in time to nursing home placement (in months) with increased number of services used. Whereas these survival time

estimates are descriptive in nature and were not adjusted for other risk factors, they do suggest a reinforcement of the main result that risk of nursing home placement is lowered, suggesting longer “survival time” in the community. Or put another way, the increased use of home- and community-based services appears to delay the time to nursing home placement in this service client population.

It is interesting to note that race/ethnicity was strongly predictive of increased risk of nursing home placement for persons of other race/ethnic groups than white, non-Hispanic. This result is in contrast to results from other states where the non-white race/ethnic groups were at lower risk of placement in places where there was a significant effect of race/ethnicity. In addition, as shown below, the effect of race/ethnicity on risk of nursing home placement was not significant in the second Rhode Island data set.

As shown in **Table 4**, there was a persistent increase in mean “survival times” (in months) in the community with increases in the total number of services used. Whereas these survival time estimates are descriptive in nature and were not adjusted for other risk factors, they do suggest a reinforcement of the main result that risk of nursing home placement is lowered, suggesting longer “survival time” in the community. Or put another way, the increased use of home- and community-based services appears to delay the time to nursing home placement in this service client population.

## Summary of Results for Data Set 2

### Descriptive Statistics

Descriptive statistics for the second data set (2005-2007) are provided in **Table 5**. As with the first data set, there are varying amounts of missing data, depending on which variable was tabulated. Age, ADL, and IADL are complete for all clients (total N = 9,091), but the other variables are incomplete as indicated by smaller totals in the table. Again, the number of clients missing a particular variable is noted with an asterisk. The most frequent age range in this population is again between 80 and 89 (45%). A majority of the clients are female (73%) and White, not Hispanic (90%). Among clients with complete data on living arrangement, more than half (52%) live alone. Approximately half of the clients have no ADL limitations, but a majority (59%) has at least one IADL limitation, and 56% have two or more IADL limitations. As in the first data set, the overwhelming majority of clients received three or fewer services during the study period. The nursing home placement rate for this group was substantially higher at 6.7% over the study period, but the mean “survival time” in the community was also higher in this group, at 18.8 months, even though the study period was much

shorter. Also, the variability in survival time was smaller than for the first data set (standard deviation 12.4 months), but that is largely due to the shorter study period. These data also suggest a population with demographic characteristics similar to other older populations, but one at higher risk of nursing home placement than the population represented in the first data set.

## Proportional Hazards Modeling

Since the clients in Data Set 2 are at a higher level of frailty, as indicated by the ADL and IADL score distributions, and since the nursing home placement rate is higher in this population, we fitted the proportional hazards models to the entire cohort for this data set, rather than limiting the analysis to those with one or more ADL limitations. The results of the initial modeling are shown in **Table 6**. The effect of the total services count on reducing the risk of nursing home placement is very similar to what was found in Data Set 1; that is, controlling for demographics and functional status, there is a significant lowering of the risk of placement for those clients receiving more than one service compared to those receiving only one service. In addition, the hazard ratios are similar in magnitude and not statistically different between the two data sets.

## Use of Services

When individual service indicators were entered into the models, the results were not always consistent between the two data sets. First, the indicators for Adult Day Care and Home Delivered Meals were never significant predictors in any of the models in which they were fitted. The “Other Services” (catch-all) category behaved similarly to the Total Services count, but did not add predictive power to the models. However, Case Management and Congregate Meals had significant effects on risk of placement in opposite directions from each other. The results in **Table 7** show that Case Management significantly predicted **increased risk** of placement, whereas Congregate Meals predicted **decreased risk**. We believe that these findings reflect the fact that clients receiving Case Management represent a group at higher risk of placement to begin with, and that Congregate Meals clients start out at lower risk of placement. These suggestions were reinforced by conversations with program administrators who indicated that case managers often assist clients in getting placed in nursing homes as part of their case management duties. In the case of Congregate Meals clients, it is logical to think that they are at lower risk of placement by virtue of the fact that they are able to travel to the meal site and participate in the group activities at the site.

To test the hypotheses above regarding the effects of Case Management and Congregate Meals, we fitted a model on a reduced data set that did not include clients whose only service was Congregate Meals. Thus we used a data set of clients whose possible services included Adult Day Care, Home Delivered Meals, Case Management, and possibly Congregate Meals (but in combination with one of the above services). The total services count was updated to represent the total number of services received by this reduced set of clients. Results of that analysis showed the following:

- Adult Day Care, and Home Delivered Meals were not significant (as before)
- Case Management was no longer significant in the subgroup
- Congregate Meals were still significant, but had a weaker effect than before
- Total Services (updated) was still individually significant as a predictor of lowered risk of placement, but not in the presence of Congregate Meals ( $p = 0.13$ ). However, the hazard ratio estimate for total services remained less than 1.

Summarizing all of the above, we have the following findings from the analysis of data set 2:

- Adult Day Care and Home Delivered Meals – were never individually significant
- Case Management – appears to act as a surrogate for increased risk of placement
- Congregate Meals – appears to act as a surrogate for decreased risk of placement
- Other Services (the catch-all category) – behaves similarly to the Total Service count, but does not add to its predictive power
- Total Service count – was individually significant without other service indicators; was significant in 7 out of 9 models when paired with one or more individual service indicators

Finally, for the second Rhode Island data set, **Table 8** shows estimates of the mean survival times in the community as a function of the total service counts. Descriptively these estimates show the same pattern of increase in “survival time” for Data Set 2 as was observed in Data Set 1. Although they were not adjusted for risk factors, nor tested for statistical significance, and the sample size becomes quite modest at higher levels of service use, the patterns here suggest once again the possibility of delay in nursing home placement with increased use of home- and community-based services.

**Table 2. Descriptive Data, Rhode Island (Data Set 1- December 1998 – December 2005)**

<b>Age Category</b>	<b>Frequency</b>	<b>Percent</b>
60-69	2,158	10.1%
70-79	5,403	25.4%
80-89	8,705	40.9%
90-99	4,604	21.6%
100+	399	1.9%
<b>Total</b>	<b>21,269</b>	<b>100.0%</b>

<b>Gender</b>	<b>Frequency</b>	<b>Percent</b>
Male	5,754	28.9%
Female	14,152	71.1%
<b>Total</b>	<b>19,906</b>	<b>100.0%</b>

\*1,363 clients were missing gender

<b>Ethnicity</b>	<b>Frequency</b>	<b>Percent</b>
White, non-Hispanic	12,680	89.6%
White, Hispanic	525	3.7%
African American	718	5.1%
American Indian	34	0.2%
Asian	143	1.0%
Other	46	0.3%
<b>Total</b>	<b>14,146</b>	<b>100.0%</b>

\*7,123 clients were missing ethnicity

<b>Lives alone</b>	<b>Frequency</b>	<b>Percent</b>
Yes	9,398	47.1%
No	10,543	52.9%
<b>Total</b>	<b>19,941</b>	<b>100.0%</b>

\* 1,328 clients were missing living arrangement

<b>ADL Limitations</b>	<b>Frequency</b>	<b>Percent</b>
0	8,411	58.5%
1	1,210	8.4%
2 or more	4,762	33.1%
<b>Total</b>	<b>14,383</b>	<b>100.0%</b>

\*6,886 clients were missing ADL

<b>IADL Limitations</b>	<b>Frequency</b>	<b>Percent</b>
0	7,403	51.5%
1	241	1.7%
2 or more	6,728	46.8%
<b>Total</b>	<b>14,372</b>	<b>100.0%</b>

\*6,897 clients were missing IADL

Table 2. Descriptive Data, Rhode Island (Data Set 1- December 1998 – December 2005)  
(Continued)

Total Services	Frequency	Percent
1	12,262	57.7%
2	4,758	22.4%
3	2,219	10.4%
4	1,077	5.1%
5	520	2.4%
6	239	1.1%
7+	194	0.9%
Total	21,269	100.0%

Permanent Nursing Home Placement	Frequency	Percent
Yes	230	1.1%
No	21,039	98.9%
Total	21,269	100.0%

Survival Time	N	Mean	Standard Deviation
Months	21,269	17.3	18.8

Table 3. Rhode Island Modeling Results - Clients Age 60+ and ADL > 0 (Data Set 1)

Total Clients	Nursing home placement	Percent nursing home placement
5,256	122	2.3

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	Pr>ChiSq (p-value)**
Age	<b>1.027</b>	<b>1.003</b>	<b>1.051</b>	<b>0.0258</b>
Sex (Female)	0.892	0.571	1.393	0.6158
ADL	0.947	0.830	1.081	0.4197
IADL	1.041	0.933	1.161	0.4718
Lives Alone (Yes)	0.741	0.509	1.080	0.1194
Ethnicity (All Other vs. White, not Hispanic)	<b>5.807</b>	<b>3.973</b>	<b>8.488</b>	<b>&lt;0.0001</b>
Total Services	<b>0.772</b>	<b>0.677</b>	<b>0.881</b>	<b>0.0001</b>

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement, and > 1 indicates increased risk.

\*\* Statistically significant results are indicated by **bold italics**. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

Data Source: Rhode Island Department of Elderly Affairs

**Table 4. Rhode Island Mean Survival Times by Number of Services – Clients Age 60+ and ADL > 0 (Data Set 1)**

Number of Services	N*	Mean Survival Time	Standard Deviation
1	1894	9.1	11.5
2	1510	18.4	17.2
3	1003	26.1	18.4
4	572	29.7	19.1
5+	277	33.9	18.2

\*Note that the total N is reduced to the number actually included in the model run, and because of the reduced sample size, the catch-all category of number of services was reduced to 5+.

**Table 5. Descriptive Data Rhode Island (Data Set 2 – January 2005 – September 2007)**

Age Category	Frequency	Percent
60-69	791	8.7%
70-79	2,162	23.8%
80-89	4,051	44.6%
90-99	1,968	21.6%
100+	119	1.3%
Total	9,091	100.00%

Gender	Frequency	Percent
Male	2,389	26.8%
Female	6,517	73.2%
Total	8,906	100.00%

\*185 clients were missing gender

Ethnicity	Frequency	Percent
White, non-Hispanic	7,872	90.1%
White, Hispanic	102	1.2%
African American	209	2.4%
American Indian	21	0.2%
Asian/Hawaiian/Pac Islander	492	5.6%
Other	40	0.5%
Total	8,736	100.00%

\*355 clients were missing ethnicity

Lives alone	Frequency	Percent
Yes	4,626	52.2%
No	4,231	47.8%
Total	8,857	100.00%

\*234 clients were missing living arrangement

Table 5. Descriptive Data Rhode Island (Data Set 2 - January 2005 - September 2007)  
(Continued)

ADL Limitations	Frequency	Percent
0	4,561	50.2%
1	642	7.1%
2 or more	3,888	42.8%
Total	9,091	100.00%

IADL Limitations	Frequency	Percent
0	3,725	41.0%
1	259	2.9%
2 or more	5,107	56.2%
Total	9,091	100.00%

Total Services	Frequency	Percent
1	6,554	72.1%
2	1,813	19.9%
3	612	6.7%
4	103	1.1%
5+	9	0.1%
Total	9,091	100.00%

Permanent Nursing Home Placement	Frequency	Percent
Yes (coded as '1')	611	6.7%
No (coded as '0')	8,480	93.3%
Total	9,091	100.00%

Survival Time	N	Mean	Standard Deviation
Months	9,091	18.8	12.4

Table 6. Rhode Island Modeling Results 1 - Clients Age 60+ (Data Set 2)

Total	Nursing home placement	Percent nursing home placement
8,372	576	6.9%

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	Pr>ChiSq (p-value)**
Age	<b>1.032</b>	<b>1.021</b>	<b>1.043</b>	<b>&lt;0.0001</b>
Sex (Female)	0.859	0.710	1.039	0.1169
IADL	<b>1.304</b>	<b>1.265</b>	<b>1.345</b>	<b>&lt;0.0001</b>
Lives Alone (Yes)	0.901	0.762	1.067	0.2266
Ethnicity (All Other vs. White, not Hispanic)	0.877	0.737	1.043	0.1375
Total Services	<b>0.731</b>	<b>0.651</b>	<b>0.822</b>	<b>&lt;0.0001</b>

Table 7. Rhode Island Modeling Results 2 (an expanded model) - Clients Age 60+ (Data Set 2)

Total	Nursing home placement	Percent nursing home placement
8,372	576	6.88%

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	Pr>ChiSq (p-value)**
Age	<b>1.028</b>	<b>1.017</b>	<b>1.039</b>	<b>&lt;0.0001</b>
Sex (Female)	0.866	0.717	1.047	0.1371
IADL	<b>1.142</b>	<b>1.104</b>	<b>1.182</b>	<b>&lt;0.0001</b>
Lives Alone (Yes)	0.875	0.739	1.036	0.1202
Ethnicity (All Other vs. White, not Hispanic)	<b>1.286</b>	<b>1.045</b>	<b>1.584</b>	<b>0.0177</b>
Case Mgmt. (Yes)	<b>3.791</b>	<b>2.584</b>	<b>5.562</b>	<b>&lt;0.0001</b>
Cong. Meals (Yes)	<b>0.382</b>	<b>0.281</b>	<b>0.518</b>	<b>&lt;0.0001</b>
Total Services	0.956	0.814	1.122	0.5800

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement, and >1 indicates increased risk.

\*\* Statistically significant results are indicated by **bold italics**. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

Data Source: Rhode Island Department of Elderly Affairs

Table 8. Rhode Island Mean Survival Times by Number of Services – AGE 60+ (Data Set 2)

Number of Services	N	Mean Survival Time	Standard Deviation
1	6,554	17.6	12.7
2	1,813	20.8	11.5
3	612	24.6	10.3
4	103	23.3	10.2
5+	9	29.3	5.1

## The Data Sets

The data sets consisted of four Excel files of administrative records covering the time period **July 1, 1999 through September 30, 2005**. The first two Excel files contained data on service clients from selected Area Agencies on Aging (AAAs) in Georgia. One file contained records for clients whose outcomes were nursing home placements, and the other contained data for clients who had other outcomes (remained active in the community, died, or were lost to follow-up for any reason). The third and fourth Excel files contained records for persons on the waiting list for services in Georgia (one file for persons with nursing home outcomes and one file for persons with all other outcomes). At the beginning of the study the hope was that the waiting list files could be used as a potential comparison group for the study. Results of the evaluation of the waiting list files will be presented below.

Creation of an analytic file suitable for use with the SAS software for conducting the proportional hazard modeling (SAS PROC PHREG) required several processing steps. First, the data were converted from Excel to SAS format. Next, because the administrative files contained multiple records per client (because of multiple services provided to many clients), it was necessary to merge the multiple records per person into a single record and de-duplicate the redundant information (such as demographics, functional status measures, and so on). Similar de-duplication was applied to the waiting list files. In addition, it was necessary to merge the two client files together so that all possible client outcomes were available on the same file. Similarly, the two waiting list files were merged so that all possible outcomes were available on one file. Additional editing of data involved cleaning the dates of entry into and exit from the service system (or the waiting list) to insure that no inconsistencies in the dates remained in the data set. Finally, the data were checked to make sure that variable values lay within expected ranges, and that coding was logical and valid.

## **Client Files**

Demographic data available for each client included age, gender, ethnicity, living arrangement, marital status, income and presence or absence of a caregiver. Functional status measures in the data file included impairment scores and unmet needs scores from the revised Determination of Needs (DON-R) scale. This scale is based on 15 items similar in nature to standard ADL and IADL items with possible score values ranging from 0 – 3 for each item. Thus, the range for the total score is from 0 – 45, both for level of impairment and for amount of unmet needs. Further details of the construction and evaluation of this scale are available from the Georgia DHR Division of Aging Services (2003). Service indicator variables (that is, ‘yes/no’ indicators) were limited to home delivered meals, homemaker services, personal care, and respite care. Finally, the number of units and costs of service for each of those types of service were available for each client in the data set.

Several other data quality issues and assumptions were dealt with during the data preparation phase prior to conducting the analyses. First, in cases where multiple records for a given individual provided different dates for nursing home placement (the primary outcome variable in these analyses), we made the assumption that the earliest placement date recorded applied to the case. Second, in cases where an individual had more than one assessment of functional status, the most recent impairment and unmet needs scores were used in the analysis. Third, the large amount of missing data for marital status and income precluded their use as control variables in the analytical models. Fourth, “survival time” was calculated for each individual client as the difference (in months) between the date of the event (nursing home placement) or censoring (by death, movement out of the study area, end of the study period, or other loss to follow-up) and the date the client entered the service system. In cases where the client entered the service system prior to the beginning of the study period, the starting date was truncated to the beginning of the study period (December 1998). Finally, a “total services” variable was created for each individual by counting up the total number of services received by that individual during the study period.

## **Waiting List Files**

The waiting list files contain the same demographic, functional status and outcome data as the client file, but of course, no service data. The assumptions and editing rules applied to this data set were the same as those applied to the client file. To determine whether it would be appropriate for the waiting list file to be used as a comparison group for the client files, we conducted an evaluation of

the waiting list file for data quality and to make sure that persons on the waiting list did not become service clients and enter the client file during the study period. Data preparation and editing of the file yielded only 1,023 usable records from among the 7,275 on the original waiting list file. However, upon matching the waiting list file to the client file, it was learned that 744 individuals on that file became clients during the study period and had records on the client file. Therefore the number of “pure” waiting list persons (that is, the 279 who did not become clients) was too small to be useful as a comparison group, as only 17 of them were placed in a nursing home during the study period.

## Summary of Results

### Descriptive Statistics

Descriptive statistics are provided in **Table 9**. There is a substantial amount of missing data for last impairment score and last unmet needs score, with each scale missing data for 840 clients. However, there are very few missing data for the remaining demographics. The most frequent age range in this population is between 80 and 89 (38%). A majority of the clients are female (71%). Slightly more than half of the population is White (53%), with about 44% being African American. Among clients with complete data on living arrangement, almost half (47%) live alone. Approximately 2% of the clients have a caregiver. The overwhelming majority of clients received one service during the study period (94%). The nursing home placement rate was 7.5% over the entire study period, with a mean “survival time” in the community of 25.5 months. The mean of the last impairment score is 8.6 and the mean of the last unmet needs score is 18.7, indicating a greater degree of unmet need. In previous documentation about the DON-R impairment and unmet needs scores, Georgia noted that the unmet need for care has more bearing on the actual potential placement outside the home (Georgia DHR Division of Aging Services, 2003).

### Proportional Hazards Modeling

Results of the initial modeling, summarized in **Table 10**, showed that, controlling for demographics and functional status, there was statistically significant lowering of the risk of nursing home placement with the increased use of services among the Georgia clients. Since the Georgia data set included only service recipients, the comparison group for the ‘total services’ variable was the group

receiving only one service. The interpretation of the finding for the ‘total services’ variable is that the risk of nursing home placement was decreased for those clients receiving more than one service compared to the clients receiving only one service.

In addition, as shown in **Table 11**, there was a persistent increase in mean ‘survival times’ (in months) in the community with increases in the total number of services used. It appears that the whole program of services, as measured by the total count, is important in delaying the time to nursing home placement in this service client population.

## Expanded Analyses

Subsequent to the initial analyses, additional work examined the effects of measures of the intensity of the services received (average number of units of service received per unit of time over the study period) and costs of individual services as possible additional predictors of nursing home placement risk. Exploratory analyses revealed that when both costs and intensity measures were entered into the same model, costs were never significant predictors of the relative risk of nursing home placement. These and other considerations led to the development of a ‘final’ model for this data set as shown in **Table 12**. Results here indicate that, again controlling for demographics and functional status, the average number of home-delivered meals per month, average hours of homemaker service received per month and average hours of respite care received per month are also statistically significant predictors of decreased risk of placement. For these characteristics the comparison groups are clients receiving no units of service, because not all clients received all services in this study population. In addition, the total service count remains significant in this model, even in the presence of the intensity measures.

**Tables 13 –15** show the effects of the significant service predictors on the mean ‘survival times’ in the community for the intensity measures. First, we created four categories each for the continuous variables average home-delivered meals per month, average hours of homemaker services per month and average hours of respite care per month. Note that for home-delivered meals and homemaker services, there was an overall increase in mean ‘survival time’ for increases in the intensity of use of these services. For respite care, however, the relationship between service intensity group and mean ‘survival time’ was relatively flat, even though in the model the intensity measure significantly predicted decreased risk of nursing home placement. We speculate that this apparent contradiction may be due to the fact that: 1) these survival time means were not adjusted for other variables in the

model, or 2) respite care has only an indirect affect on the service clients themselves, since the care is provided to the caregiver and not to the client directly.

**Table 9. Descriptive Data, Georgia, Clients Aged 60+ (July 1999 - September 2005)**

<b>Age Category</b>	<b>Frequency</b>	<b>Percent</b>
60-69	642	13.9%
70-79	1,338	29.1%
80-89	1,750	38.0%
90-99	813	17.7%
100+	62	1.3%
<b>Total</b>	<b>4,605</b>	<b>100.0%</b>

<b>Gender</b>	<b>Frequency</b>	<b>Percent</b>
Male (coded as "1")	1,330	28.9%
Female (coded as "2")	3,255	70.7%
Missing	20	0.4%
<b>Total</b>	<b>4,605</b>	<b>100.0%</b>

<b>Ethnicity</b>	<b>Frequency</b>	<b>Percent</b>
White (coded as "1")	2,423	52.6%
African American (coded as "2")	2,003	43.5%
Other (coded as "3")	97	2.1%
Missing	82	1.8%
<b>Total</b>	<b>4,605</b>	<b>100.0%</b>

<b>Lives alone</b>	<b>Frequency</b>	<b>Percent</b>
Yes (coded as "1")	2,147	46.6%
No (coded as "0")	2,396	52.0%
Missing	62	1.4%
<b>Total</b>	<b>4,605</b>	<b>100.0%</b>

<b>Caregiver</b>	<b>Frequency</b>	<b>Percent</b>
Yes (coded as "1")	99	2.1%
No (coded as "0")	4,506	97.9%
<b>Total</b>	<b>4,605</b>	<b>100.0%</b>

<b>Total Services</b>	<b>Frequency</b>	<b>Percent</b>
1	4,345	94.3%
2	194	4.2%
3	54	1.2%
4+	12	0.3%
<b>Total</b>	<b>4,605</b>	<b>100.0%</b>

Table 9. Descriptive Data, Georgia, Clients Aged 60+ (July 1999 – September 2005)  
(Continued)

Permanent Nursing Home Placement	Frequency	Percent
Yes	345	7.5%
No	4,260	92.5%
Total	4,605	100.0%

Last Impairment Score	N	Mean	Standard Deviation	Range
	3,765	8.6	6.3	0 – 36

\*Last Impairment Score was missing for 840 clients

Last Unmet Needs Score	N	Mean	Standard Deviation	Range
	3,765	18.7	8.8	0 – 45

\*Last Unmet Needs Score was missing for 840 clients

Survival Time	N	Mean	Standard Deviation	Range
Months	4,605	25.5	20.7	1 – 75

Table 10. Georgia Modeling Results – All Clients Age 60+, Initial Model

Total Clients	Number Placed in Nursing home	Percent nursing home placement
3685	290	7.9%

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	(p-value)**
Age	1.014	1.001	1.027	0.0300
Sex (Female)	1.122	0.856	1.472	0.4041
Last Impairment Score ***	0.992	0.969	1.016	0.5190
Last Unmet Needs Score ***	1.043	1.026	1.061	<.0001
Lives Alone (Yes)	1.020	0.800	1.299	0.8747
Ethnicity (coded White, African American and Other)	0.628	0.498	0.792	<.0001
Caregiver (Yes)	1.570	0.798	3.089	0.1913
Total Services	0.374	0.244	0.574	<.0001

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement.

\*\* Statistically significant results are indicated by ***bold italics***. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

\*\*\*Last impairment score and last unmet needs score are measures of functional limitation that incorporate elements of both ADL and IADL activities in the Determination of Needs-revised (DON\_R) scale. Score ranges run from 0 to 45, with higher values indicating more impairment or need for care (Georgia DHR Division of Aging Services, 2003).

Data Source: Georgia Division of Aging Services - Administrative records of service recipient data from selected Area Agencies on Aging (AAAs).

**Table 11. Georgia Mean Survival Times by Number of Services – Clients Age 60+**

Number of Services	N	Mean Survival Time	Standard Deviation
1	4199	24.8	20.5
2	320	30.1	20.9
3	62	41.8	21.2
4+	24	40.7	15.2

**Table 12. Georgia Modeling Results – All Clients Age 60+, Final Model**

Total Clients	Number Placed in Nursing home	Percent nursing home placement
3685	290	7.9%

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	(p-value)**
Age	1.015	1.002	1.028	0.0224
Sex (Female)	1.072	0.818	1.406	0.6142
Last Unmet Needs Score ***	1.046	1.032	1.060	<0.0001
Lives Alone (Yes)	0.971	0.763	1.236	0.8138
Ethnicity (White, African American and Other)	0.603	0.477	0.763	<0.0001
Caregiver (Yes)	1.606	0.813	3.173	0.1726
Average home-delivered meals per month	0.930	0.911	0.950	<0.0001
Average hours per month homemaker	0.862	0.788	0.943	0.0011
Average hours per month respite	0.878	0.831	0.927	<0.0001
Total Services	0.332	0.208	0.530	<0.0001

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement.

\*\* Statistically significant results are indicated by ***bold italics***. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

\*\*\*Last unmet needs score is a measure of functional limitation that incorporates elements of both ADL and IADL activities in the Determination of Needs-revised (DON-R) scale. Score ranges run from 0 to 45, with higher values indicating more impairment or need for care (Georgia DHR Division of Aging Services, 2003).

Data Source: Georgia Division of Aging Services – Administrative records of service recipient data from selected Area Agencies on Aging (AAAs).

**Table 13. Georgia Mean Survival Time by Average Home Delivered Meals Received (Age 60+) – Based on ‘Final’ Model Sample**

Average Home-delivered Meals Received Per Month	N	Mean	Standard Deviation
0	412	17.3	18.7
>0-15	1035	16.6	18.8
16-19	1126	22.2	17.4
20-21	1205	32.9	19.7
>21	827	34.2	22.1

**Table 14. Georgia Mean Survival Time by Average Hours Homemaker Service Received (Age 60+)– Based on ‘Final’ Model Sample**

<b>Average Hours of Homemaker Service Received Per Month</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>
0	4381	25.1	20.6
>0-3	60	28.3	21.0
4-7	47	30.9	20.6
8-10	52	39.4	20.2
>10	65	33.9	21.8

**Table 15. Georgia Mean Survival Time by Average Hours Respite Care Received (Age 60+) – Based on ‘Final’ Model Sample**

<b>Average Hours of Respite Care Received Per Month</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>
0	4295	25.5	20.8
>0-7	71	27.9	22.3
8-18	80	19.8	17.2
19-28	76	27.1	17.6
>28	83	25.8	18.8

In addition to the demographic and physical functioning predictors provided by all states, North Carolina provided Medicaid claim services variables (nursing home claims, non-nursing home claims) for a subset of Medicaid eligible clients. The nursing home claim variable, “NH Medicaid”, indicates a **temporary** nursing home stay during the 27-month period of Older Americans Act (OAA) service receipt (see dates below). The non-nursing home claim variable, “non-NH Medicaid”, implies both Older Americans Act (OAA) and Medicaid non-nursing home services were received during the study period. A variable indicating if Medicaid paid for any service during the 27-month period was also present on the file. These variables were examined for possible use as additional predictors of nursing home placement in the analyses of the North Carolina data sets described below.

## The Data Sets

The **first North Carolina data set** consisted of a SAS file of all consumers ages 60 and older residing in Forsyth or Surry County, NC, who received at least one registered Home and Community Block Grant Service (HCCBG) for at least 3 months between **July 1, 2003 and September 30, 2005**. Few processing steps were required to prepare the North Carolina file for analysis, as it was already in SAS format, with one record per service client. Each client record contained all the service information for that client. In addition, the file was well documented. The data were checked to make sure that data values lay within expected ranges, and that coding was logical and valid.

In addition to survival time, we created **service-specific service receipt times** for each client to be used in the denominator when calculating average number of meals per month, average number of trips per month, average number of hours per month, and average number of days of adult day care per month. Since North Carolina provided cost information for each client, for each month, for each service, we were able to count the months with non-zero service cost. Thus, if the cost was zero for a particular month for a particular service, we know that the client did not receive that particular service that month; likewise if the cost was non-zero, we know that the client did receive

that particular service that month, resulting in a more accurate count of the number of months a particular service was received.

The **second North Carolina data set** is populated with the same set of clients as the first data set. The time period covered by the data set is the same as the first data set. This data set includes the number of units of service received for each service, for each of the 27 months of the study period. From these data the average number of units of service consumed per person per month was calculated for each relevant service. For home-delivered and congregate meals the unit was one meal. For transportation the unit was one trip. For adult day care the unit was one day. For personal care and homemaker services the unit was one hour of service.

## Summary of Results

### Descriptive Statistics

Descriptive statistics are provided in **Table 16**. Note first that there are very few missing data. The most frequent age range is between 70 and 79 (35%), although 80 to 89 year olds make up a significant portion of the clients (32%). A majority of the clients are female (72%) and White, not Hispanic (60%). About half (51%) of the clients live alone. Surprisingly, only about three percent of the clients are missing ADL or IADL function data. Among clients with complete data on ADL and IADL function, 37% have no ADL limitations, but only 10% have no IADL limitations. Half of the clients were Medicaid eligible at some point during the study period. Of the clients who were Medicaid eligible at some point, about 3% had a temporary nursing home stay before the end of the study period, and about 57% had a non-nursing-home Medicaid service claim before the end of the study. The majority of the full file of clients received only one OAA service during the study period (76%), with approximately 21% receiving two services, and only 3% receiving three or more services. The nursing home placement rate was 6.6% over the entire study period, with a mean “survival time” in the community of 17.4 months out of a maximum of 27 months in the study period. The variability in survival time was moderate (standard deviation 8.6 months).

## Proportional Hazards Modeling

Results of the initial modeling, summarized in **Table 17**, showed that, controlling for demographics and functional status, there was statistically significant lowering of the risk of nursing home placement with the increased use of OAA services among the North Carolina clients. Note that this initial modeling was done on the full file of service clients aged 60 and older. Since the North Carolina data sets included only service recipients, the comparison group for the “total services” variable was the group receiving only one service. Additional models fitted to the data set included individual service indicators for adult day care, congregate meals, home delivered meals, homemaker services, personal care, and transportation, each in combination with the “total services” count. None of those individual indicators was significant when included in the same model with the control variables and the “total services” variable. Further, additional models included the units of service received, such as average number of meals per person per month for home delivered meals and congregate meals, average hours of service per person per month for homemaker and personal care, average days per person per month for adult day care, and average number of trips per person per month for transportation. None of the average-service-per-person-per-month variables was significant.

The interpretation of the finding for the “total services” variable is that the risk of nursing home placement was decreased for those clients receiving more than one service compared to the clients receiving only one service. Further, since none of the individual service indicators was significant in these analyses, the analysis suggests that it is the total program of services that is most important in lowering the relative risk of placement in this client population and not any one particular service.

In addition, **Table 18** shows a persistent increase in mean “survival times” (in months) in the community with increases in the total number of services used. Whereas these survival time estimates are descriptive in nature and were not tested for statistical significance nor adjusted for other risk factors, they do suggest a reinforcement of the main result that risk of nursing home placement is lowered, implying longer “survival time” in the community. Or, put another way, the increased use of home- and community-based services appears to delay the time to nursing home placement in this service client population.

## Medicaid Subset Analysis

To examine the effects of Medicaid services on tenure in the community for the North Carolina clients, the data file was reduced to a subgroup of service clients aged 60 and older who were Medicaid eligible. The nursing home rate, at 11.9%, was much higher for this subgroup. The original models were rerun, this time adding the two indicator variables for Medicaid claims. The variable “NH Medicaid” indicates a temporary nursing home stay during the study period, with a return to the community before the end of the study period. The variable “non-NH Medicaid” indicates Medicaid services were received from sources other than a nursing home. Results of this modeling, summarized in **Table 19**, showed that, once again, controlling for demographics and functional status, there was statistically significant lowering of the risk of nursing home placement with the increased use of OAA services among the Medicaid eligible North Carolina clients. An additional effect was found for clients who received non-nursing home Medicaid services in conjunction with the Older Americans Act services showing a further decrease in the risk of NH placement, as both factors were statistically significant in the same model. As before, this analysis suggests that it is the total program of services that is most important in lowering the risk of placement in this client population and not any one particular service.

Similarly to the full file of clients, **Table 20** shows a persistent increase in mean “survival times” (in months) in the community with increases in the total number of OAA services used, suggesting longer “survival time” in the community.

**Table 16. Descriptive Data, North Carolina, Clients Aged 60+ (July 2003 – September 2005)**

Age Category	Frequency	Percent
60-69	430	25.5%
70-79	596	35.4%
80-89	544	32.3%
90-99	112	6.6%
100+	4	0.2%
Total	1,686	100.0%

Gender	Frequency	Percent
Male (coded as “1”)	474	28.1%
Female (coded as “2”)	1,212	71.9%
Total	1,686	100.0%

Ethnicity	Frequency	Percent
White, non-Hispanic (coded as “1”)	1,008	59.8%
African American (coded as “2”)	663	39.3%
Other (coded as “3”)	15	0.9%
Total	1,686	100.0%

Table 16. Descriptive Data, North Carolina, Clients Aged 60+ (July 2003 – September 2005)  
(Continued)

Lives alone	Frequency	Percent
Yes (coded as "1")	851	50.5%
No (coded as "0")	835	49.5%
Total	1,686	100.0%

ADL	Frequency	Percent
0	597	35.4%
1	510	30.3%
2	154	9.1%
3 or more	371	22.0%
Missing	54	3.2%
Total	1,686	100.0%

IADL	Frequency	Percent
0	157	9.3%
1	375	22.3%
2	127	7.5%
3 or more	975	57.8%
Missing	52	3.1%
Total	1,686	100.0%

Medicaid Eligibility	Frequency	Percent
Yes (coded as "1")	841	49.9%
No (coded as "0")	845	50.1%
Total	1,686	100.0%

Medicaid Nursing Home Claim*	Frequency	Percent
Yes (coded as "1")	24	2.9%
No (coded as "0")	814	96.7%
Missing	3	0.4%
Total	841	100.0%

\*845 clients were not Medicaid eligible

Non-NH Medicaid Claim*	Frequency	Percent
Yes (coded as "1")	481	57.2%
No (coded as "0")	357	42.4%
Missing	3	0.4%
Total	841	100.0%

\*845 clients were not Medicaid eligible

Total Services	Frequency	Percent
1	1,282	76.0%
2	351	20.8%
3+	53	3.2%
Total	1,686	100.0%

Table 16. Descriptive Data, North Carolina, Clients Aged 60+ (July 2003 – September 2005)  
(Continued)

Permanent Nursing Home Placement	Frequency	Percent
Yes (coded as "1")	111	6.6%
No (coded as "0")	1,575	93.4%
Total	1,686	100.0%

Survival Time	N	Mean	Standard Deviation
Months	1,686	17.4	8.6

Table 17. North Carolina Modeling Results 1 – All Clients Age 60+

Total Clients	Nursing home placement	Percent nursing home placement
1,632	107	6.6

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	Pr>ChiSq (p-value)**
<i>Age</i>	<b>1.037</b>	<b>1.014</b>	<b>1.062</b>	<b>0.0018</b>
Sex (Female)	0.872	0.566	1.342	0.5322
ADL	1.155	0.973	1.370	0.0998
<i>IADL</i>	<b>1.709</b>	<b>1.297</b>	<b>2.251</b>	<b>0.0001</b>
Lives alone (Yes)	1.338	0.897	1.995	0.1540
Ethnicity (coded as White, African American, Other)	0.653	0.419	1.016	0.0587
<i>Total OAA services</i>	<b>0.601</b>	<b>0.400</b>	<b>0.905</b>	<b>0.0148</b>

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement, and > 1 indicates increased risk.

\*\* Statistically significant results are indicated by **bold italics**. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

Table 18. North Carolina Mean Survival Times by Number of Services – Clients Age 60+

Number of Services	N	Mean Survival Time	Standard Deviation
1	1,282	16.2	8.7
2	351	21.0	7.4
3+	53	23.2	5.9

Table 19. North Carolina Modeling Results 2 – All Clients Age 60+ and Medicaid Eligible

Total Clients	Nursing home placement	Percent nursing home placement
814	97	11.9

Table 19. North Carolina Modeling Results 2 – All Clients Age 60+ and Medicaid Eligible (Continued)

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	Pr>ChiSq (p-value)**
Age	1.032	1.007	1.058	0.0108
Sex (Female)	1.010	0.637	1.604	0.9650
ADL	1.214	1.014	1.453	0.0345
IADL	1.397	1.048	1.861	0.0224
Lives alone (Yes)	0.967	0.635	1.471	0.8743
Ethnicity (coded as White, African American, Other)	0.680	0.428	1.080	0.1026
Non-NH Medicaid	0.399	0.258	0.618	<.0001
Total OAA services	0.535	0.345	0.830	0.0052

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement, and > 1 indicates increased risk.

\*\* Statistically significant results are indicated by *bold italics*. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

Table 20. North Carolina Mean Survival Times by Number of Services – Clients Age 60+ and Medicaid Eligible

Number of Services	N	Mean Survival Time	Standard Deviation
1	625	16.1	8.5
2	195	20.5	7.8
3+	26	23.5	6.3

## The Data Sets

The data sets consisted of separate SPSS files for each of four counties of all consumers ages 60 and older residing in Broome, Chautauqua, Erie, and Tompkins Counties, NY. Each eligible client received at least one service between **January 1, 2008 and June 30, 2009**. While there was only one record per person, many processing steps were required to prepare the New York files for analysis, including a substantial amount of editing. The data preparation issues involved conversion of the data to SAS format for compatibility with the modeling software, deletion of records with final outcomes that occurred before the start of the study period, deletion of records with missing final status indicators or with incomplete responses or predictor variables, and reassignment of enrollment and exit dates due to invalid values.

## Summary of Results (Descriptive statistics are provided, by county, in Tables 21 to 24)

### Descriptive Statistics

#### Broome County

There are very few missing data. The most frequent age range is between 80 and 89 (46%), with about the same number of 70 to 79 year old clients (24%) as 90 to 99 year old clients (20%). A majority of the clients are female (68%) and white (97%). Nearly two-thirds (60%) of the clients live alone. Surprisingly, less than one percent of the clients are missing ADL or IADL data. Among clients with complete data on ADL and IADL function, about 20% have no ADL limitation, but less than 1% have no IADL limitation. The distribution of total services received by clients was spread fairly evenly with 13% receiving only one service during the study period, 26% receiving two services, 26% receiving three services, 20% receiving four services, and 16% receiving five or more services. The nursing home placement rate was 5% over the entire study period, with a mean

“survival time” in the community of 13.1 months out of a maximum of 18 months in the study period. The variability in survival time was moderate (standard deviation 5.9 months).

## **Chautauqua County**

As with Broome County, there are very few missing data. As seen in Broome, the most frequent age range is between 80 and 89 (46%), with more 70 to 79 year old clients (25%) than 90 to 99 year old clients (18%). A majority of the clients are female (68%) and white (98%). Nearly two-thirds (64%) of the clients live alone. Similarly to Broome, about one percent of the clients are missing ADL or IADL data. Among clients with complete data on ADL and IADL function, a very high 43% have no ADL limitation, but only 6% have no IADL limitation. As in Broome County, the distribution of total services received by clients was spread fairly evenly with 23% receiving only one service during the study period, 16% receiving two services, 18% receiving three services, 16% receiving four services, and 27% receiving five or more services. The nursing home placement rate was 9.1% over the entire study period, with a mean “survival time” in the community of 15.3 months out of the total 18-month study period. The variability in survival time was moderate (standard deviation 4.8 months).

## **Erie County**

While still minimal, there is a higher percentage of missing data in Erie than in Broome or Chautauqua. As was the case in both Broome and Chautauqua Counties, the most frequent age range in Erie County is between 80 and 89 (45%), although 70 to 79 year old clients (26%) make up a significant proportion as well. As seen in both Broome and Chautauqua Counties, a majority of the clients are female (70%). A majority of clients in Erie are white (78%), but, unlike the other counties, there are substantial numbers of African Americans (22%). Nearly two-thirds (66%) of the clients live alone. About seven percent of the clients are missing ADL or IADL data, a higher proportion of missing data than seen in Broome or Chautauqua. Among clients with complete data on ADL and IADL function, 29% have no ADL limitation, but only 1% have no IADL limitation. The majority of clients (59%) received two services, with 19% receiving only one service during the study period, 18% receiving three services, and 5% receiving four or more services. The nursing home placement rate was 7.2% over the entire study period, with a mean “survival time” in the

community of 12.7 months out of the total 18-month study period. The variability in survival time was slightly higher than in Broome County (standard deviation 6.1 months).

## **Tompkins County**

Tompkins has the smallest number of clients, compared to the other counties (811). While still minimal, there is a higher percentage of missing data in Tompkins than in Broome or Chautauqua. As seen in the other three counties, the most frequent age range is between 80 and 89 (37%), although 70 to 79 year old clients (26%) make up a significant proportion as well. As seen in Broome, Chautauqua, and Erie, a majority of the clients are female (68%). The overwhelming majority of clients in Tompkins are white (94%). Nearly two-thirds (63%) of the clients live alone. About eight percent of the clients are missing ADL or IADL data, a higher proportion of missing data than seen in Broome or Chautauqua, but a similar proportion to Erie. Among clients with complete data on ADL and IADL function, the majority (57%) has no ADL limitation, but only 4.9% have no IADL limitation. The largest category of total services received is two services (36%), with 24% of clients receiving only one service during the study period and 21% receiving three services. The nursing home placement rate was a very low 2.0% over the entire study period, with a mean “survival time” in the community of 16.2 months out of the total 18-month study period. The variability in survival time was low (standard deviation 3.6 months).

## **Descriptive Comparison of the Four Counties**

Even though the most frequent age range for all four counties was 80-89 year olds, the age distributions of 70 to 89 year olds varied considerably from county to county (approximately 71% of clients in Broome and Chautauqua and 60 to 63% in Erie and Tompkins, respectively). Approximately two-thirds of the client population in each county was female. While the overwhelming majority of clients (at least 80%) had IADL scores of two or more, there was variation in the distribution of ADL scores. In Chautauqua and Tompkins Counties, the most frequent ADL score was 0, whereas in Broome and Erie the most frequent category was a score of two or more. For all four counties, roughly two-thirds of the clients live alone. Virtually all of the clients in the three smaller counties (Broome, Chautauqua, and Tompkins) are white (a range of 94% to 98%), while 78% of Erie’s clients are white and 22% are black. The nursing home rates were much higher for Chautauqua (9.1%) and Erie (7.2%) Counties than for Broome (5.2%) and

Tompkins (2.0%) Counties. In fact, the number of nursing home placements in Tompkins, at 16, was too small to provide reliable estimates of the risk ratios for placement in Tompkins. Therefore, modeling results are presented only for the other three counties.

## Proportional Hazards Modeling

**Modeling results are provided for Broome, Chautauqua, and Erie Counties, in Tables 25 to 27.** For the analyses discussed here, service use variables were created by calculating the average number of units of service used per person per month. For congregate meals and home delivered meals the units were meals. For transportation, the units were trips, and for case management, adult day services, and personal care the units were hours. For the personal emergency response system, the unit was possession of the device, so it behaved essentially as an indicator variable.

### Broome County

In Broome County there were 1,272 clients with usable data for the hazard modeling. The first round of modeling, using all possible predictors in the same model, indicated that the only significant predictors of nursing home placement were the average number of units of case management received per person per month, and the dementia indicator variable. Both of these variables were associated with increased risk of placement. The second round of modeling included only demographics, ADL, IADL, living arrangement, the total services count, average units of case management and the dementia indicator. Results of the second round of modeling, summarized in **Table 25**, showed an increased of nursing home placement with increased age and each increase in the count of IADL, controlling for demographics, functional status, and living arrangement. In addition, the average units per person per month of case management was a significant predictor of nursing home placement, with a hazard ratio of 1.26, indicating an **increased** risk of placement for each additional hour consumed per person per month. The dementia indicator variable was also significant, showing an increased relative risk of nursing home placement for those clients diagnosed with dementia, compared to those with no report of dementia. The hazard ratio for the total services count was less than 1, suggesting a lowered risk of placement, but the effect was not statistically significant.

## Chautauqua County

In Chautauqua County there were 1,546 clients with usable data for the hazard modeling. As in Broome, we began with a full model that included all possible predictors, and reduced the size of the model based on the predictors that were significant in the first iteration. The second round of modeling included only demographics, ADL, IADL, living arrangement, the total services count, average hours of case management received per month, and average hours of personal care received per month. Results of the second round of modeling, controlling for demographics, functional status, and living arrangement are summarized in **Table 26**. Here we see that the average hours of case management consumed per person per month is strongly significant with an estimated hazard ratio of 10.128, indicating increased risk of nursing home placement with increasing usage of the service. The additional significant results include age (hazard ratio 1.035), IADL (hazard ratio 1.208), average hours of personal care (hazard ratio 0.958), and the total services count (hazard ratio 0.878). While it appears in this model that the effects of personal care hours and the total service count are “protective” against placement (decreased risk), we believe these results to be artifactual. To examine these two variables more closely, we ran additional models that included only the base model (demographics, functional status variables, and living arrangement) plus each service variable separately. When an individual model was fitted with the base variables (age, sex, ADL, IADL, lives alone) and total services, the total services variable had a statistically significant hazard ratio of 1.150, indicating **increased** risk of nursing home placement. Similarly, when an individual model was fitted with base variables and personal care, the personal care variable had a statistically significant hazard ratio of 2.967, also indicating increased risk of nursing home placement. Clearly the effect of case management is completely overwhelming the effects of both Personal Care and Total Services in the model with multiple predictors, as indicated by the reversal of the direction of the association total services and personal care in that model. The result is what appears to be a false lowering of the risk of nursing home placement for personal care and total services in the model that contains all three service use variables.

## Erie County

In Erie County there were 4,870 clients with usable data for the hazard modeling. As in the other two counties, the analysis began with a ‘full’ model that included all the control and service use variables. The results of that initial modeling yielded a final model, which is summarized in **Table 27**. Because of the larger sample size in Erie, it was possible to detect many more effects. The final

model shows a significant increased risk for case management hours, but with a weaker hazard ratio estimate of 1.403. In addition, there appear to be “protective” effects of personal care hours and total services, which we believe to be real. When an individual model was fitted with the base variables (age, sex, ADL, IADL, lives alone) and total services, the total services variable had a statistically significant hazard ratio of 0.669, which shows a decreased risk of nursing home placement with each increase in number of services above 1. In addition, when an individual model was fitted with the base variables and personal care hours, the personal care variable had a statistically significant hazard ratio of 0.976, also indicating a decreased risk of nursing home placement. In this case, the effect of Case Management, while increasing the risk of nursing home placement a relatively small amount, did not overwhelm the predictive ability of the other variables by changing the direction of the association.

**Table 28** shows for Erie County a persistent increase in mean “survival times” (in months) in the community with increases in the total number of services used, suggesting the desirable outcome of longer “survival time” in the community. This table was produced only for Erie because Erie was the only county where the effect of total services on the risk for placement was significant in a meaningful way in the final model.

### **Comparison of the Four Counties**

Sufficient data were available for proportional hazard modeling of three of the four New York counties. In modeling time to nursing home placement controlling for demographics, functional status, and living arrangement, case management was a significant predictor of increased risk of placement in all three counties. In Broome, dementia was also a significant predictor among all the variables included in the final model. In Chautauqua, the effect of case management was sufficiently strong that it artificially changed the direction of the association between predictor and outcome for personal care and total services when analyzed with and without case management. In Erie, the effect of case management units was weaker, and did not alter the significant protective effects of personal care and total services. In Tompkins County the number of nursing home placements was so small that it was not possible to obtain reliable results from the proportional hazards model.

The results of the analyses for Broome and Chautauqua did not follow the expected pattern, based on what was learned from other states’ data. Westat has explored as many explanations as possible, given the data available to us, but nothing in the existing data sets provides any additional insight

into a better understanding of the relationships that have emerged from the latest round of modeling the New York data.

Personnel from the New York Office of Aging have indicated that policy differences across the counties in the way the service programs are administered and maintained may have contributed to the differences in the modeling results across the counties. For example, Chautauqua County places a cap on the amount of service a client can receive, whereas the other counties do not. Also, in New York case managers' duties include assisting clients in obtaining nursing home placement. In other states this is not necessarily the case. These kinds of issues are beyond the scope of the analyses described in this report, but may provide useful insights into the dynamics of at-home versus institutional long term care for older people.

**Table 21. Descriptive Data, Broome County, NY, Clients Aged 60+ (January 2008 – June 2009)**

<b>Age Category</b>	<b>Frequency</b>	<b>Percent</b>
60-69	118	9.2%
70-79	302	23.7%
80-89	592	46.4%
90-99	253	19.8%
100+	11	0.9%
<b>Total</b>	<b>1,276</b>	<b>100.0%</b>

<b>Gender</b>	<b>Frequency</b>	<b>Percent</b>
Male (coded as "1")	404	31.7%
Female (coded as "2")	870	68.2%
Missing	2	0.1%
<b>Total</b>	<b>1,276</b>	<b>100.0%</b>

<b>Ethnicity</b>	<b>Frequency</b>	<b>Percent</b>
White, non-Hispanic (coded as "1")	1,231	96.5%
African American (coded as "2")	24	1.9%
Other (coded as "3")	21	1.6%
Missing*	0	0.0%
<b>Total</b>	<b>1,276</b>	<b>100.0%</b>

\* No missing because ethnicity was imputed.

<b>Lives alone</b>	<b>Frequency</b>	<b>Percent</b>
Yes (coded as "1")	764	59.9%
No (coded as "0")	512	40.1%
Missing*	0	0.0%
<b>Total</b>	<b>1,276</b>	<b>100.0%</b>

\* No missing because living arrangement was imputed.

**Table 21. Descriptive Data, Broome County, NY, Clients Aged 60+ (January 2008 – June 2009) (Continued)**

<b>ADL</b>	<b>Frequency</b>	<b>Percent</b>
0	252	19.7%
1	338	26.5%
2 or more	685	53.7%
Missing	1	0.1%
<b>Total</b>	<b>1,276</b>	<b>100.0%</b>

<b>IADL</b>	<b>Frequency</b>	<b>Percent</b>
0	9	0.7%
1	30	2.3%
2 or more	1,235	96.8%
Missing	2	0.2%
<b>Total</b>	<b>1,276</b>	<b>100.0%</b>

<b>Total Services</b>	<b>Frequency</b>	<b>Percent</b>
1	170	13.3%
2	325	25.5%
3	327	25.6%
4	250	19.6%
5 or more	204	16.0%
<b>Total</b>	<b>1,276</b>	<b>100.0%</b>

<b>Permanent Nursing Home Placement</b>	<b>Frequency</b>	<b>Percent</b>
Yes (coded as "1")	66	5.2%
No (coded as "0")	1,210	94.8%
<b>Total</b>	<b>1,276</b>	<b>100.0%</b>

<b>Survival Time</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>
Months	1,276	13.1	5.9

**Table 22. Descriptive Data, Chautauqua County, NY, Clients Aged 60+ (January 2008 – June 2009)**

<b>Age Category</b>	<b>Frequency</b>	<b>Percent</b>
60-69	166	10.6%
70-79	394	25.1%
80-89	722	45.9%
90-99	277	17.6%
100+	12	0.8%
Missing	0	0.0%
<b>Total</b>	<b>1,571</b>	<b>100.0%</b>

**Table 22. Descriptive Data, Chautauqua County, NY, Clients Aged 60+ (January 2008 – June 2009) (Continued)**

<b>Gender</b>	<b>Frequency</b>	<b>Percent</b>
Male (coded as "1")	496	31.6%
Female (coded as "2")	1,075	68.4%
Missing	0	0.0%
<b>Total</b>	<b>1,571</b>	<b>100.0%</b>

<b>Ethnicity</b>	<b>Frequency</b>	<b>Percent</b>
White, non-Hispanic (coded as "1")	1,539	98.0%
African American (coded as "2")	18	1.1%
Other (coded as "3")	14	0.9%
Missing*	0	0.0%
<b>Total</b>	<b>1,571</b>	<b>100.0%</b>

\* No missing because ethnicity was imputed.

<b>Lives alone</b>	<b>Frequency</b>	<b>Percent</b>
Yes (coded as "1")	1,005	64.0%
No (coded as "0")	566	36.0%
Missing*	0	0.0%
<b>Total</b>	<b>1,571</b>	<b>100.0%</b>

\* No missing because living arrangement was imputed.

<b>ADL</b>	<b>Frequency</b>	<b>Percent</b>
0	670	42.6%
1	313	19.9%
2 or more	568	36.2%
Missing	20	1.3%
<b>Total</b>	<b>1,571</b>	<b>100.0%</b>

<b>IADL</b>	<b>Frequency</b>	<b>Percent</b>
0	86	5.5%
1	111	7.1%
2 or more	1,358	86.4%
Missing	16	1.0%
<b>Total</b>	<b>1,571</b>	<b>100.0%</b>

<b>Total Services</b>	<b>Frequency</b>	<b>Percent</b>
1	361	23.0%
2	248	15.8%
3	286	18.2%
4	245	15.6%
5 or more	431	27.4%
<b>Total</b>	<b>1,571</b>	<b>100.0%</b>

Table 22. Descriptive Data, Chautauqua County, NY, Clients Aged 60+ (January 2008 – June 2009) (Continued)

Permanent Nursing Home Placement	Frequency	Percent
Yes (coded as "1")	143	9.1%
No (coded as "0")	1,428	90.9%
Total	1,571	100.0%

Survival Time	N	Mean	Standard Deviation
Months	1,571	15.3	4.8

Table 23. Descriptive Data, Erie County, NY, Clients Aged 60+ (January 2008 – June 2009)

Age Category	Frequency	Percent
60-69	653	12.5%
70-79	1,344	25.8%
80-89	2,371	45.4%
90-99	819	15.7%
100+	31	0.6%
Missing	0	0.0%
Total	5,218	100.0%

Gender	Frequency	Percent
Male (coded as "1")	1,580	30.3%
Female (coded as "2")	3,638	69.7%
Missing	0	0.0%
Total	5,218	100.0%

Ethnicity	Frequency	Percent
White, non-Hispanic (coded as "1")	4,051	77.6%
African American (coded as "2")	1,129	21.6%
Other (coded as "3")	38	0.7%
Missing*	0	0.0%
Total	5,218	100.0%

\* No missing because ethnicity was imputed.

Lives alone	Frequency	Percent
Yes (coded as "1")	3,446	66.0%
No (coded as "0")	1,772	34.0%
Missing*	0	0.0%
Total	5,218	100.0%

\* No missing because living arrangement was imputed.

ADL	Frequency	Percent
0	1,512	29.0%
1	1,196	22.9%
2 or more	2,162	41.3%
Missing	348	6.7%
Total	5,218	100.0%

**Table 23. Descriptive Data, Erie County, NY, Clients Aged 60+ (January 2008 – June 2009)  
(Continued)**

<b>IADL</b>	<b>Frequency</b>	<b>Percent</b>
0	58	1.1%
1	205	3.9%
2 or more	4,611	88.4%
Missing	344	6.6%
<b>Total</b>	<b>5,218</b>	<b>100.0%</b>

<b>Total Services</b>	<b>Frequency</b>	<b>Percent</b>
1	963	18.5%
2	3,101	59.4%
3	917	17.6%
4	206	4.0%
5 or more	31	0.6%
<b>Total</b>	<b>5,218</b>	<b>100.0%</b>

<b>Permanent Nursing Home Placement</b>	<b>Frequency</b>	<b>Percent</b>
Yes (coded as "1")	374	7.2%
No (coded as "0")	4,844	92.8%
<b>Total</b>	<b>5,218</b>	<b>100.0%</b>

<b>Survival Time</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>
Months	5,218	12.7	6.1

**Table 24. Descriptive Data, Tompkins County, NY, Clients Aged 60+ (January 2008 – June 2009)**

<b>Age Category</b>	<b>Frequency</b>	<b>Percent</b>
60-69	153	18.9%
70-79	208	25.7%
80-89	300	37.0%
90-99	145	17.9%
100+	5	0.6%
Missing	0	0.0%
<b>Total</b>	<b>811</b>	<b>100.0%</b>

<b>Gender</b>	<b>Frequency</b>	<b>Percent</b>
Male (coded as "1")	260	32.1%
Female (coded as "2")	551	67.9%
Missing	0	0.0%
<b>Total</b>	<b>811</b>	<b>100.0%</b>

**Table 24. Descriptive Data, Tompkins County, NY, Clients Aged 60+ (January 2008 – June 2009) (Continued)**

<b>Ethnicity</b>	<b>Frequency</b>	<b>Percent</b>
White, non-Hispanic (coded as "1")	762	94.0%
African American (coded as "2")	31	3.8%
Other (coded as "3")	18	2.2%
Missing*	0	0.0%
<b>Total</b>	<b>811</b>	<b>100.0%</b>

\* No missing because ethnicity was imputed.

<b>Lives alone</b>	<b>Frequency</b>	<b>Percent</b>
Yes (coded as "1")	511	63.0%
No (coded as "0")	300	37.0%
Missing*	0	0.0%
<b>Total</b>	<b>811</b>	<b>100.0%</b>

\* No missing because living arrangement was imputed.

<b>ADL</b>	<b>Frequency</b>	<b>Percent</b>
0	458	56.5%
1	119	14.7%
2 or more	167	20.6%
Missing	67	8.3%
<b>Total</b>	<b>811</b>	<b>100.0%</b>

<b>IADL</b>	<b>Frequency</b>	<b>Percent</b>
0	40	4.9%
1	56	6.9%
2 or more	650	80.2%
Missing	65	8.0%
<b>Total</b>	<b>811</b>	<b>100.0%</b>

<b>Total Services</b>	<b>Frequency</b>	<b>Percent</b>
1	197	24.3%
2	291	35.9%
3	173	21.3%
4	81	10.0%
5 or more	69	8.5%
<b>Total</b>	<b>811</b>	<b>100.0%</b>

<b>Permanent Nursing Home Placement</b>	<b>Frequency</b>	<b>Percent</b>
Yes (coded as "1")	16	2.0%
No (coded as "0")	795	98.0%
<b>Total</b>	<b>811</b>	<b>100.0%</b>

<b>Survival Time</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>
Months	811	16.2	3.6

Table 25. New York Modeling Results, Broome County – All Clients Age 60+

Total Clients	Nursing home placement	Percent nursing home placement
1,272	66	5.2

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	Pr>ChiSq (p-value)**
Age	1.082	1.043	1.122	<0.0001
Sex (Female)	1.138	0.661	1.959	0.6401
ADL	1.087	0.945	1.250	0.2409
IADL	1.303	1.035	1.641	0.0245
Lives Alone (Yes)	0.918	0.527	1.600	0.7625
Case Management units (hours/month)	1.257	1.176	1.345	<0.0001
Dementia(Yes)	1.778	1.005	3.145	0.0480
Total Services	0.864	0.713	1.047	0.1366

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement, and > 1 indicates increased risk, compared to the reference group for each variable.

\*\* Statistically significant results are indicated by *bold italics*. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

Table 26. New York Modeling Results, Chautauqua County – All Clients Age 60+

Total Clients	Nursing home placement	Percent nursing home placement
1,546	141	9.1

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	Pr>ChiSq (p-value)**
<i>Age</i>	<i>1.035</i>	<i>1.011</i>	<i>1.058</i>	<i>0.0035</i>
Sex (Female)	0.983	0.662	1.460	0.9321
ADL	1.009	0.919	1.109	0.8460
<i>IADL</i>	<i>1.208</i>	<i>1.082</i>	<i>1.349</i>	<i>0.0008</i>
Lives Alone (Yes)	0.754	0.517	1.101	0.1437
<i>Case Management units (hours/month)</i>	<i>10.128</i>	<i>5.957</i>	<i>17.219</i>	<i>&lt;0.0001</i>
<i>Personal Care units (hours/month)</i>	<i>0.958</i>	<i>0.930</i>	<i>0.987</i>	<i>0.0047</i>
<i>Total Services</i>	<i>0.878</i>	<i>0.783</i>	<i>0.985</i>	<i>0.0261</i>

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement, and > 1 indicates increased risk, compared to the reference group for each variable.

\*\* Statistically significant results are indicated by *bold italics*. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

Table 27. New York Modeling Results, Erie County – All Clients Age 60+

Total Clients	Nursing home placement	Percent nursing home placement
4,870	355	7.3

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	Pr>ChiSq (p-value)**
<i>Age</i>	<b><i>1.050</i></b>	<b><i>1.035</i></b>	<b><i>1.065</i></b>	<b><i>&lt;0.0001</i></b>
Sex (Female)	0.954	0.750	1.214	0.7016
ADL	1.023	0.956	1.094	0.5180
<i>IADL</i>	<b><i>1.235</i></b>	<b><i>1.150</i></b>	<b><i>1.326</i></b>	<b><i>&lt;0.0001</i></b>
<i>Lives Alone</i>	<b><i>1.314</i></b>	<b><i>1.031</i></b>	<b><i>1.674</i></b>	<b><i>0.0274</i></b>
<i>Race (coded as White, African American, Other)</i>	<b><i>0.489</i></b>	<b><i>0.351</i></b>	<b><i>0.682</i></b>	<b><i>&lt;0.0001</i></b>
Home Delivered Meals Units (meals/month)	0.993	0.986	1.001	0.0727
<i>Case Management units (hours/month)</i>	<b><i>1.403</i></b>	<b><i>1.264</i></b>	<b><i>1.557</i></b>	<b><i>&lt;0.0001</i></b>
<i>Personal Care units (hours/month)</i>	<b><i>0.975</i></b>	<b><i>0.958</i></b>	<b><i>0.992</i></b>	<b><i>0.0046</i></b>
<i>Total Services</i>	<b><i>0.690</i></b>	<b><i>0.588</i></b>	<b><i>0.811</i></b>	<b><i>&lt;0.0001</i></b>

\* Hazard Ratios < 1 indicate a lowering of the relative risk of nursing home placement, and > 1 indicates increased risk, compared to the reference group for each variable.

\*\* Statistically significant results are indicated by ***bold italics***. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

Table 28. New York Mean Survival Times by Number of Services, Erie County – Clients Age 60+

Number of Services	N	Mean Survival Time	Standard Deviation
1	963	9.8	6.6
2	3,101	12.5	6.0
3	917	15.6	4.4
4	206	16.5	3.4
5+	31	17.8	0.8

The Health and Retirement Study, a nationally representative longitudinal survey of older persons, conducted by the University of Michigan Institute for Social Research, was used as a type of comparison study for the state analyses presented previously. The survey asks about variables of interest such as physical functioning, receipt of services, nursing home placement, and demographics. Respondents 60 years of age and older at the 2000 data collection point were included in modeling similar to that done for the states' administrative data sets. In addition, for inclusion in the modeling, respondents had to have reported 90 or fewer nights in a nursing home during the previous two years at baseline. Three data collection points were used for this HRS group: 2000, 2002, and 2004. There were two categories of services received by the respondents: home care by a medical professional and additional service (e.g., adult day care, social worker, outpatient rehabilitation, transportation, or meals) treated as a single indicator variable. While these services are not directly comparable to the OAA home- and community-based services reported in the state analyses, they do provide an indication of the overall effect of the increased amount of services provided in the home on the likelihood of nursing home placement over a well-defined follow-up period.

## Summary of Results

### Descriptive Statistics

Descriptive statistics from the HRS are provided in **Table 29**. This population is much younger than the OAA service client populations. The most frequent age range is between 60 and 69 (46%), with 70 to 79 year olds making up 36% of the population. Only nineteen percent of the population is 80 or older. A slight majority of the clients are female (57%). The overwhelming majority of the population is white (88%), with about 9% being African American. Slightly more than one-quarter of the population lives alone (28%). A very high 77% have no ADL limitation, with only 10% having one ADL limitation and 13% having two or more limitations. The nursing home placement rate over the entire population was a low 2.4%, which is indicative of the younger population with few ADL limitations.

## Proportional Hazards Modeling

Results of the proportional hazards modeling are summarized in **Table 30**. We reduced the HRS sample to the set of respondents age 60 or older with at least one ADL limitation to more closely mirror the service clients in the states. In the HRS we did not have individual service indicators, because HRS is based on a general community-dwelling population. Thus, a service count comparable to those in the states' data sets was not possible to construct. However, the statistically significant hazard ratio less than 1 for home care is an indication of the lowering of the relative risk of nursing home placement for individuals receiving home care, compared to those who received no service in the home. The analysis is simultaneously controlled for all the other risk factors included in the table. This result provides a national benchmark against which to compare the results in the client population data analyses.

**Table 31** provides the mean survival time by number of services for the segment of the population that is age 60 or older with at least one ADL limitation. While there was a slight increase in mean 'survival times' (in months) in the community with increases in the total number of services, this increase is slight.

**Table 29. Descriptive Data, Health and Retirement Study (HRS)\***

Age Category	Frequency	Percent
60-69	18,700,800	45.6%
70-79	14,907,007	36.4%
80-89	6,544,840	16.0%
90-99	809,023	2.0%
100+	21,905	1.0%
Total	40,983,575	100.0%

Gender	Frequency	Percent
Male	17,741,168	43.3%
Female	23,242,407	56.7%
Total	40,983,575	100.0%

Ethnicity	Frequency	Percent
White/Caucasian	36,042,492	88.0%
African American	3,656,439	8.9%
Other	1,245,363	3.1%
Total	40,944,294	100.0%

Table 29. Descriptive Data, Health and Retirement Study (HRS)\* (Continued)

Lives alone	Frequency	Percent
Yes	11,377,741	27.8%
No	29,605,834	72.2%
Total	40,983,575	100.0%

ADL	Frequency	Percent
0	31,575,930	77.1%
1	4,119,702	10.1%
2 or more	5,276,752	12.9%
Total	40,972,384	100.0%

Permanent Nursing Home Placement	Frequency	Percent
Yes	976,443	2.4%
No	40,007,132	97.6%
Total	40,983,575	100.0%

\*Note that the frequencies and percents in the table are weighted to represent the total population sampled for the HRS. They are not raw counts of the sample sizes in each cell or unweighted percentages.

Table 30. Health and Retirement Study Modeling Results – Participants Age 60+ and ADL>0

Total Respondents	Number Placed in Nursing home	Percent nursing home placement
3,075	239	7.77

Variable	Hazard Ratio*	Hazard ratio, 95% lower conf. limit	Hazard ratio, 95% upper conf. limit	(p-value)**
Age	1.046	1.030	1.061	<.0001
Sex (Female)	1.389	1.037	1.860	0.0274
ADL	1.719	1.573	1.879	<.0001
Lives Alone (Yes)	1.512	1.159	1.973	0.0023
Ethnicity (coded as White, African American, Other)	0.881	0.671	1.156	0.3613
Home Care***	0.528	0.402	0.693	<.0001

\* Hazard Ratios < 1 indicate a lowering of the risk of nursing home placement.

\*\* Statistically significant results are indicated by ***bold italics***. In cases where the confidence intervals include the value 1.000, there is no statistical evidence concerning either an increased or decreased risk.

\*\*\* The reported use of home care in the HRS indicates when a medically trained professional provided services in the respondent's home. Data from the HRS did not provide indications of specific services received as in the state OAA service client data files.

Data Source: National Health and Retirement Study – national panel household survey conducted by the University of Michigan under contract to the National Institute on Aging, NIH.

Table 31. Health and Retirement Study Mean Survival Times by Number of Services – Age 60+ and ADL > 0

Number of Services	N	Mean Survival Time	Standard Deviation
0	1,383	40.9	14.1
1	1,104	41.4	14.2
2	590	43.0	12.9

The state-level analyses presented here are limited to Older Americans Act (OAA) service recipients in the geographic area defined by the administrative data for each state. These analyses are not necessarily representative of other states, other service client populations, or other populations of older persons. In addition, there is no formal comparison group that received no services represented in these analyses. A third limitation to these analyses is that the proportional hazards model as applied to these data automatically deletes from the analysis any observation with missing values for either the outcome variable, or any of the predictors. Whereas considerable effort went into minimizing missing data for these analyses, the amount of bias, if any, introduced by deletion of cases with incomplete data is unknown.

Westat believes that the results of these analyses for Rhode Island, Georgia, North Carolina and Erie County, NY are important in demonstrating the effectiveness of the total program of home- and community-based services in allowing at-risk older persons to remain in the community for a longer period of time. In North Carolina, this finding extends to non-nursing home Medicaid services for their clients as well. Please note that for the first Rhode Island dataset and the HRS, the analysis samples of individuals were limited to those with at least one ADL limitation. The reason for this is that the first Rhode Island client sample and the HRS population were much less frail in general than the client populations in New York, Georgia, North Carolina, and the second Rhode Island sample. By limiting the first Rhode Island sample and the HRS in this way, we obtained more comparable groups across studies. We did not subset the clients in the second Rhode Island data set, as these clients exhibited a higher level of frailty, as shown by the ADL and IADL score distributions.

The results for the total services counts for all data sets except Broome and Chautauqua Counties in NY are consistent with results of analyses from the national Health and Retirement Study (Health and Retirement Study, 2004; Brock et al., 2007), in which there was a consistent lowering of the risk of nursing home placement with the increased use of services. In the second Rhode Island data set, the total services count was not significant in the presence of case management and congregate meals; however, the total services count was still individually significant and protective against nursing home placement. The results suggest that identifying at-risk persons and moving them into the service system would have positive effects on the quality of life for most of these older persons.

It is important to note that since the state administrative data sets included only service recipients, the comparison group for the ‘total services’ variable in the state analyses was the group receiving only one service.

For Broome and Chautauqua Counties in New York the results were not consistent with what has been found elsewhere. Explanations for these differences may be related to differences in the client populations, differences among the counties in policies and procedures for placing at-risk older persons in nursing homes, or other differences that go beyond the scope of the data sets available for these analyses.

For New York, Rhode Island, Georgia, and the HRS, individual services (either indicators of service use or units of service consumed, depending on the state) were examined in separate models, but there was no consistent pattern in the relationship between receipt of an individual service and lowering of the risk of nursing home placement. Rather, in these data sets it appears that the whole program of services, as measured by the total count, is most important in delaying the time to nursing home placement in these service client populations and in the HRS respondents. In North Carolina, however, an additional significant lowering of relative risk of placement was found for unit increases in the average number of home-delivered and congregate meals received per person per month. The reference group for this risk factor was that group of clients who did not receive any meals.

Finally, in the tables showing the survival times by number of services, provided for each state, there was a persistent increase in mean survival times (in months) in the community with increases in the total number of services used. **Please note that comparison of mean survival times across states is not appropriate because the survival times are functions of the length of the study period, which is not comparable across states.** For example, Georgia’s study period exceeded five years, whereas the study period in North Carolina was limited to 27 months. The purpose is to show the relationship of survival time **in a particular state** to the number of services received by clients **in that state**.

Westat believes that overall the results of the analyses of the four states’ data and the HRS make a compelling case for the effectiveness of home- and community-based long term care services for the elderly as a means of postponing or perhaps even preventing nursing home placement for at-risk clients of Older Americans Act services. In spite of the limitations of each data set, cited above, the consistency of findings from location to location provides assurance that the findings are not simply artifactual or unique to a particular location. In addition, we believe that the finding that these

services appear to work most effectively in combination as opposed to singly is a new result, in the sense that it has not previously been described in the gerontology literature. Publication of this Advanced POMP finding to a broader audience in the field would seem to be a logical next step.

Further work in this area, as outlined in the draft report of the Cross Validation Workgroup of Next Generation POMP (2010), could prove useful in advancing the field, including the following:

- Expansion of the current work to additional state units on aging and/or AAAs to work toward the development of a “generic” model of nursing home placement avoidance
- Working with states to provide consistent data across the states for modeling
- Expansion of control variables for the models to include personal and institutional health resources and characteristics, area characteristics, and service agencies’ policies and structure
- Further comparisons with general populations of older persons to explore over a broader population the effectiveness of OAA services
- Expansion of the limited cost data available for comparison of institutional versus non-institutional long term care.

Research in these areas could provide additional knowledge useful for performance improvement and advancement of long term care for the elderly.

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