Resource Utilization and Predictive Modeling at End of Life

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Agenda

1. Why End-of-Life?
2. Analysis of the Medicare 5% File
3. Hospice
4. Predictive Analytics at End-of-Life
5. Discussion.

Introductions

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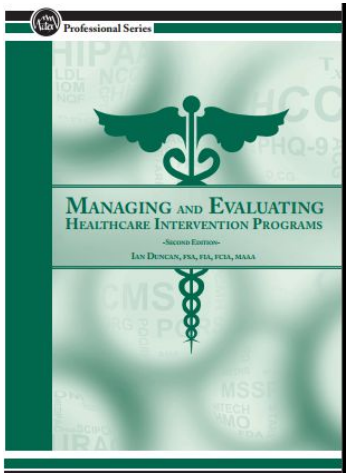
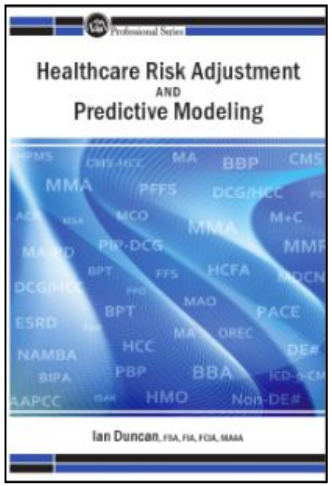
- Professor, Actuarial Statistics, University of California at Santa Barbara.
- Founder and former president, Solucia Consulting (now SCIO Health Analytics). President, Santa Barbara Actuaries Inc.
- Author of several books and a number of peer-reviewed studies on healthcare management and predictive modeling
- Former board member (2012-5), Society of Actuaries and Massachusetts Health Connector Authority (2007-14).



2nd Edition 2014



Why End-of-Life?

- Care at end-of-life is not congruent with patients' wishes.
- Care is often aggressive even when the prognosis is poor – Over-medicalized Death.
- Costs at the end of life are burdensome to patients, families and society.
- Payment and care models are changing away from FFS to value-based care.

Some Basic Statistics

Total no. deaths (US) 2013 2.6 million

- Over 65: 1.9 million

Deaths per 100,000 population:

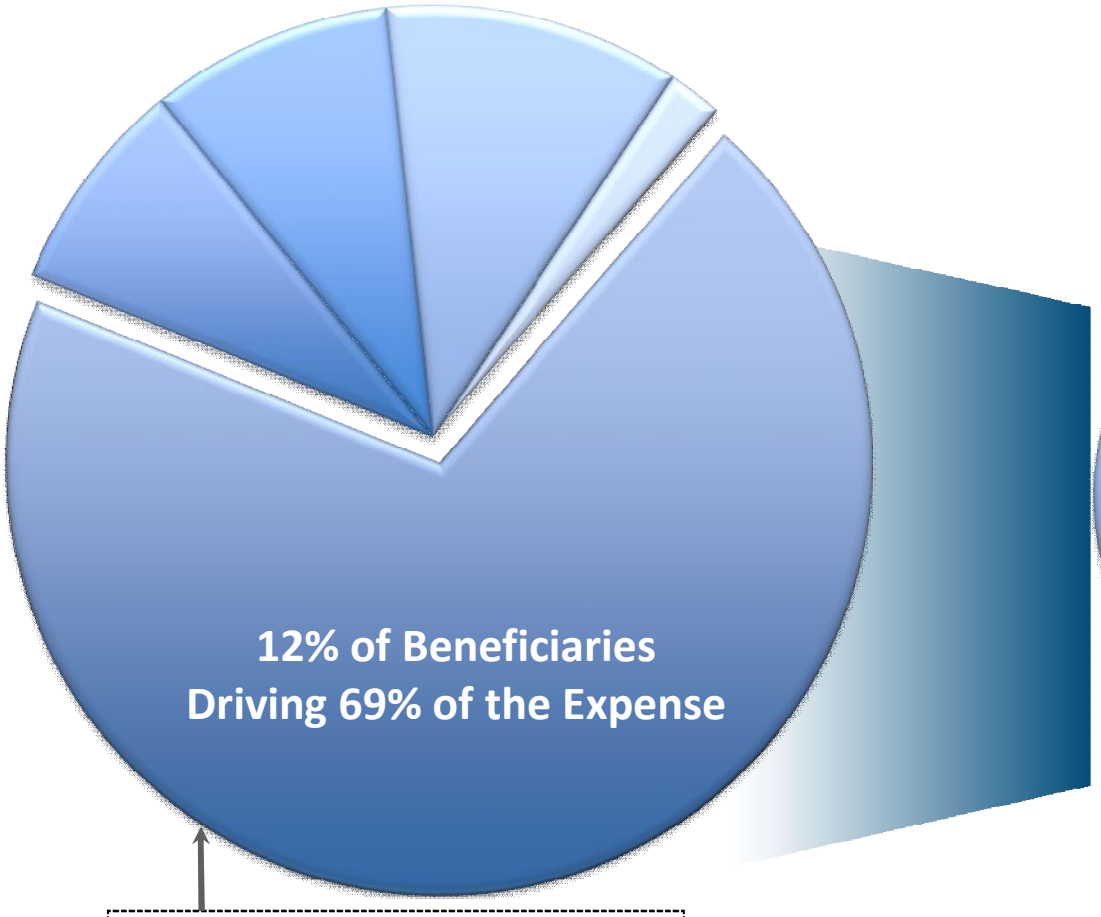
- 65-74: 1,802.1
- 75-84: 4,648.1
- 85 and over: 13,660.4

Cause of death (based on ICD–10)		Rank[1]	2013 Deaths	2013 Percent of total deaths
All causes		...	2,596,993	100.0
Diseases of heart	(I00–I09,I11,I13,I20–I51)	1	611,105	23.5
Malignant neoplasms	(C00–C97)	2	584,881	22.5
Chronic lower respiratory diseases	(J40–J47)	3	149,205	5.7
Accidents (unintentional injuries)	(V01–X59,Y85–Y86)	4	130,557	5.0
Cerebrovascular diseases	(I60–I69)	5	128,978	5.0
Alzheimer's disease	(G30)	6	84,767	3.3
Diabetes mellitus	(E10–E14)	7	75,578	2.9
Influenza and pneumonia	(J09–J18)	8	56,979	2.2
Nephritis, nephrotic syndrome and nephrosis	(N00–N07,N17–N19,N25–N27)	9	47,112	1.8
Intentional self-harm (suicide)	(*U03,X60–X84,Y87.0)	10	41,149	1.6

... Category not applicable.
[1]Based on number of deaths.

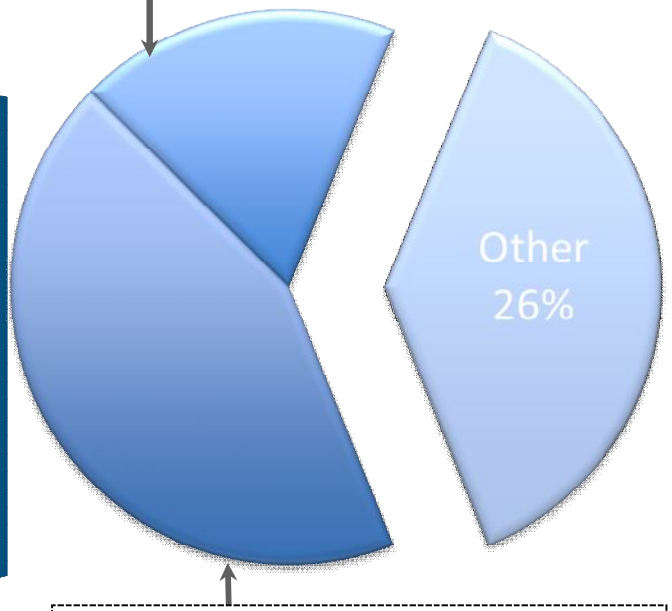
Highly-Medicalized Deaths

Spending at End-of-Life



5% of Medicare Beneficiaries die annually.

Second to last year of life represents 13% of the total Medicare FFS spend.



Last year of life represents ~30% of the total Medicare FFS spend.

Analysis of the Medicare 5% File

Analysis of Medicare 5% file 2012-3

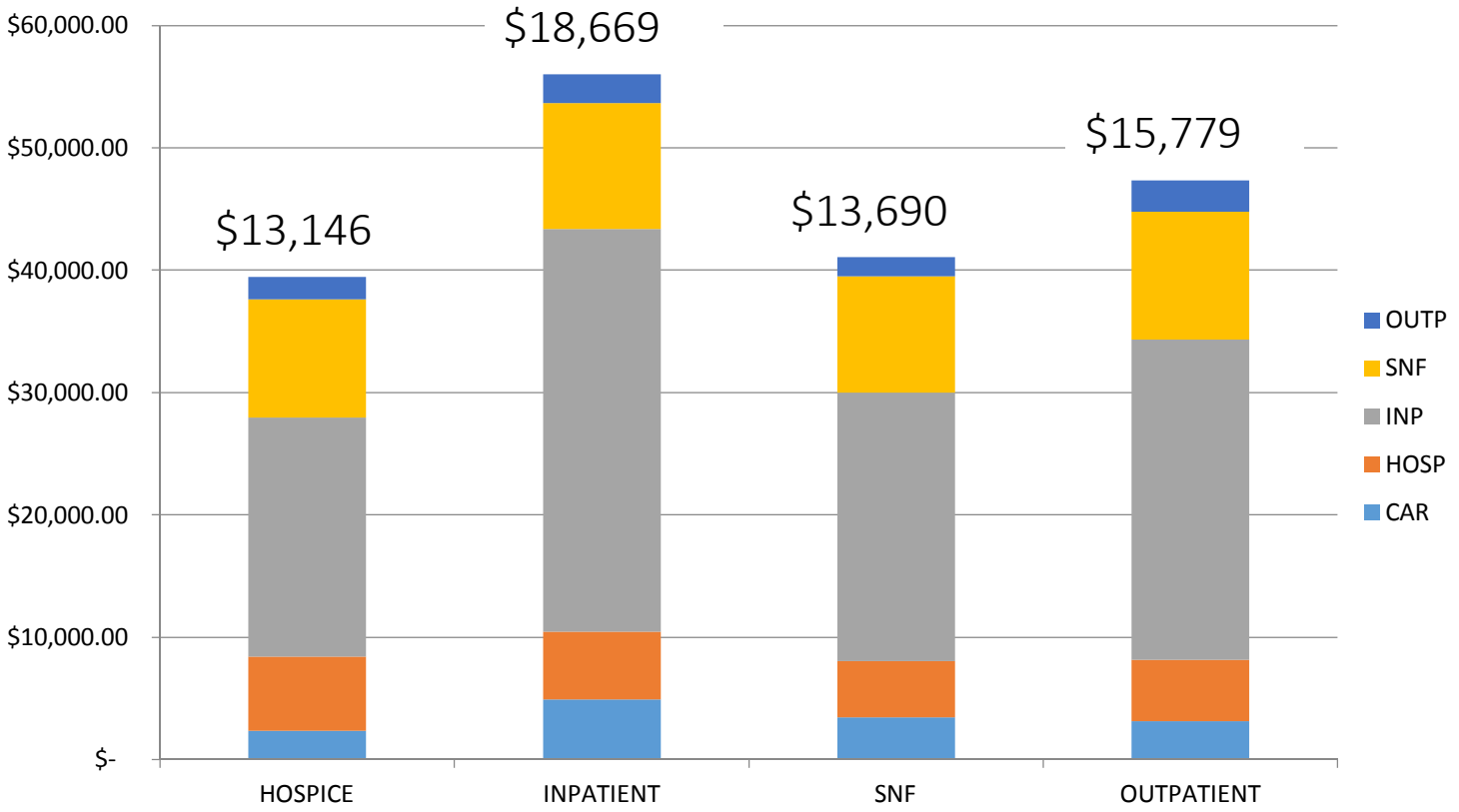
Year	Population	# Dying	%
2012	3,319,870	163,692	4.9
2013	3,321,384	164,929	5.0

Analysis of Medicare 5% file 2012-3

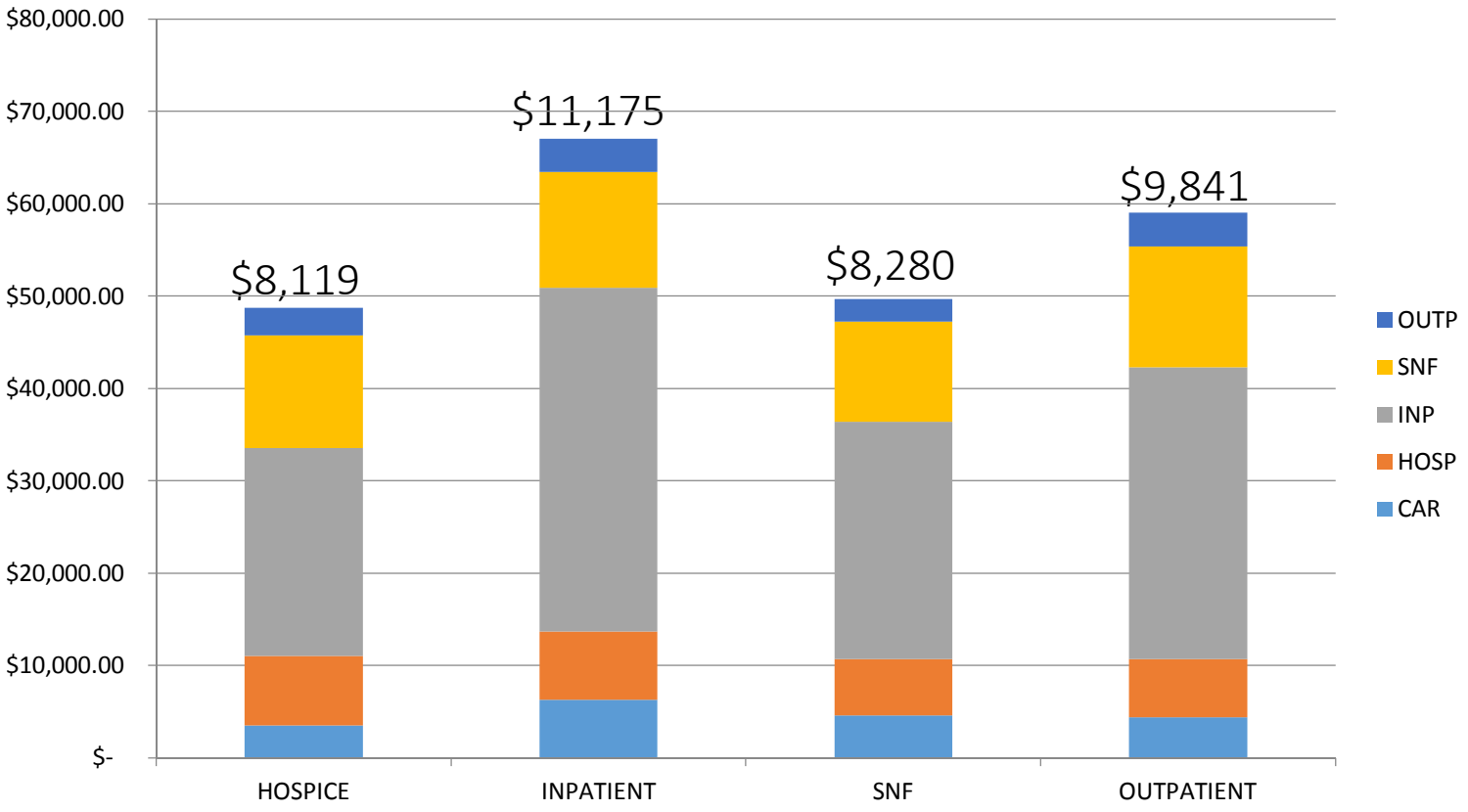
Average Cost by type of Service and Duration prior to Death

Dura-tion	PART B	HOS-PICE	INPATIENT	SNF	OUTPT	TOTAL	TOTAL PMPM
3 Month	$ 2,379	$ 6,045	$ 19,518	$ 9,658	$ 1,837	$ 39,437	$ 13,146
6 Month	$ 3,480	$ 7,530	$ 22,560	$ 12,209	$ 2,934	$ 48,714	$ 8,119

Spending in Last 3 Months of Life by Place of Death



…and Last 6 Months of Life by Place of Death



Hospice

What is Hospice?

Quality compassionate care at the end of life

- Pain and symptom management
- Maintenance of QOL
- Emotional, psychosocial, spiritual support
- Provides drugs, medical supplies, equipment
- Speech or physical therapy if needed
- Short-term inpatient care available if needed
- Instructs family on how to care for the patient
- A good death
- Bereavement care and counseling

Levels of Care

There are four general levels of hospice care:

- Home-based care
  - **Routine home care:** patient receives care at their home
  - **Continuous home care:** care consisting predominantly of licensed nursing care on a continuous basis at home. This is only for brief periods of crisis and only as necessary
- Inpatient care
  - **General inpatient care:** patient receives care in an inpatient facility for pain or acute/complex symptom control
  - **Inpatient Respite Care:** patient receives care in an approved facility on a short-term basis in order to give respite to the caregiver

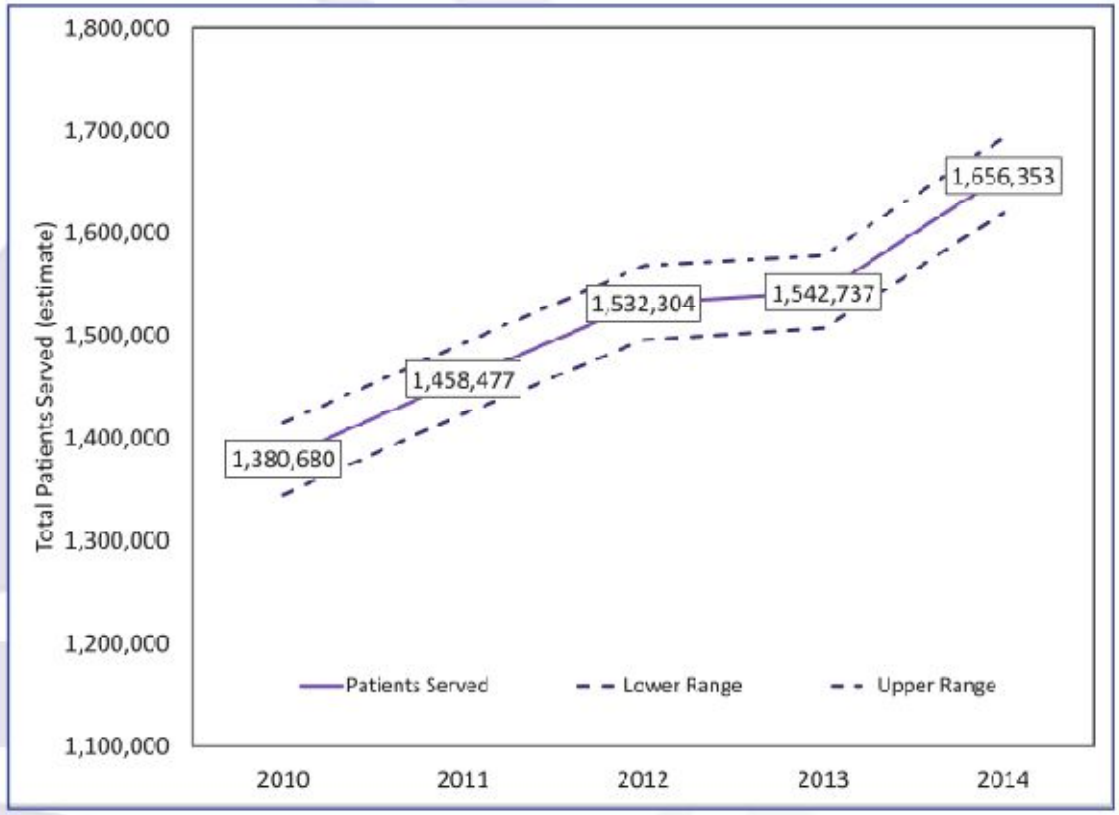
Medicare Hospice Benefit

The Medicare hospice benefit covers palliative and support services for beneficiaries who are terminally ill and have a life expectancy of six months or less. Beneficiaries may choose to elect the Medicare hospice benefit; in so doing, they agree to forgo Medicare coverage for conventional treatment of their terminal condition. In 2013, more than 1.3 million Medicare beneficiaries (including 47 percent of decedents) received hospice services from over 3,900 providers, and Medicare hospice expenditures totaled about $15.1 billion.

Medicare hospice payment categories and rates

Category	Description	Base payment rate, 2015	Percent of hospice days, 2013
Routine home care	Home care provided on a typical day	$159.34 per day	97.6%
Continuous home care	Home care provided during periods of patient crisis	$38.75 per hour	0.4
Inpatient respite care	Inpatient care for a short period to provide respite for primary caregiver	$164.81 per day	0.3
General inpatient care	Inpatient care to treat symptoms that cannot be managed in another setting	$708.77 per day	1.7

Hospice Utilization is Growing



Total Hospice Patients Served by Year[1]

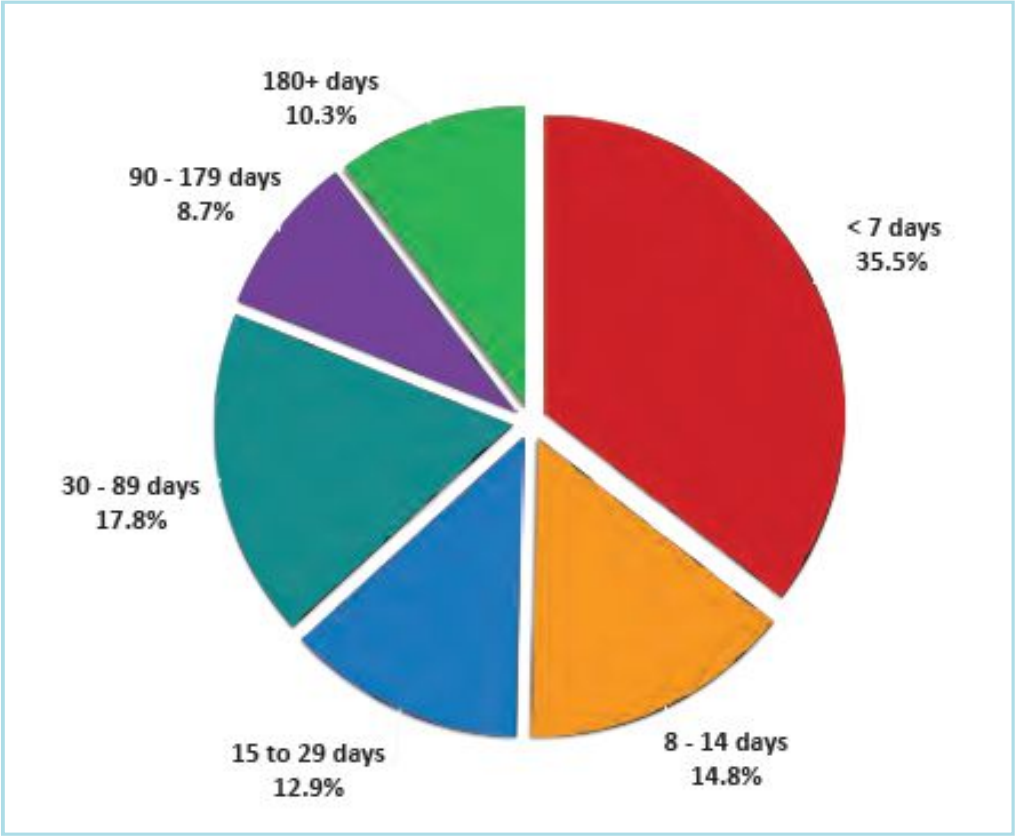
Annual growth rate ≈ 5%

Hospice Utilization is Growing

TABLE 12–5 **Hospice expenditures and average length of stay were virtually unchanged in 2013**

Category	2000	2011	2012	2013	Average annual change, 2000–2011	Percent change, 2011–2012	Percent change, 2012–2013
Number of hospice users (in millions)	0.534	1.219	1.274	1.315	7.8%	4.5%	3.2%
Total spending (in billions)	$2.9	$13.8	$15.1	$15.1	15.2%	9.3%	–0.1%
Average length of stay among decedents (in days)	53.5	86.3	88.0	87.8	4.4%	2.0%	–0.2%
Median length of stay among decedents (in days)	17	17	18	17	0 days	1 day	–1 day

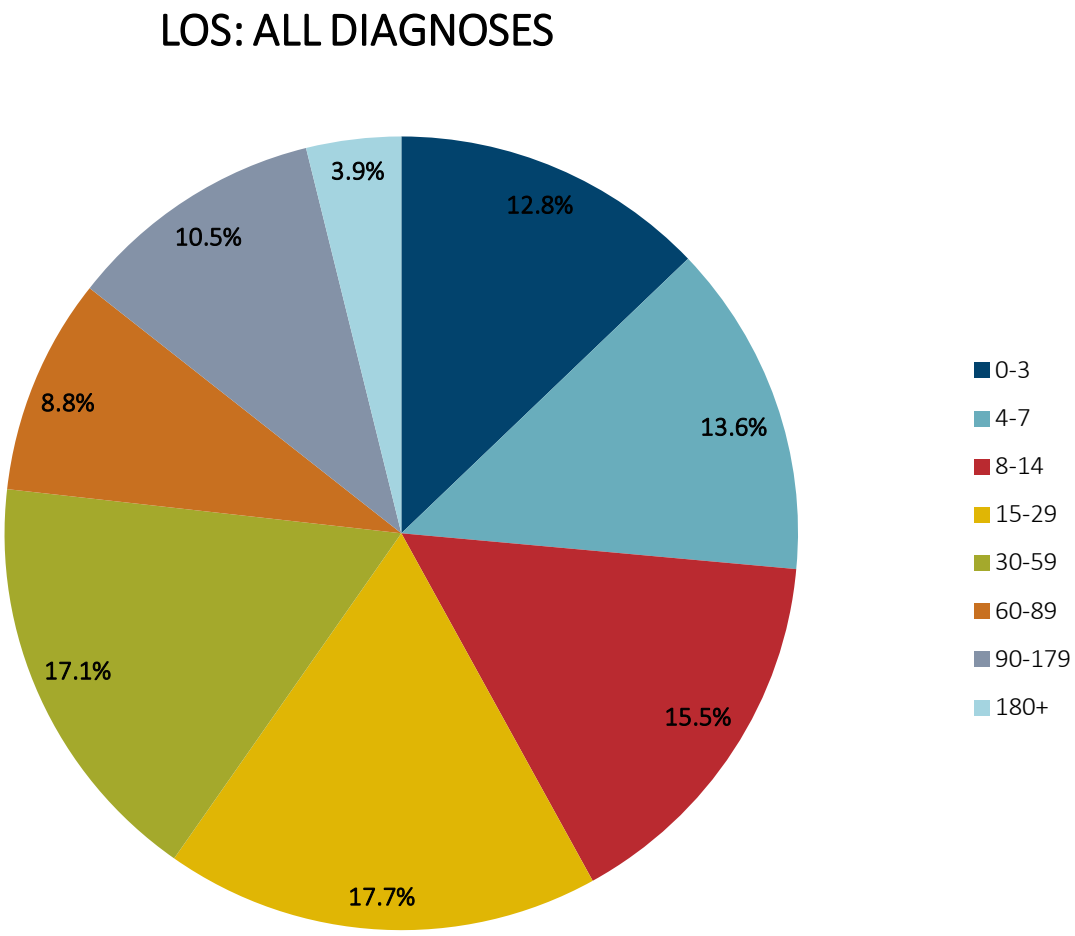
Hospice Stays



Hospice stays are highly skewed with most stays just a few days.

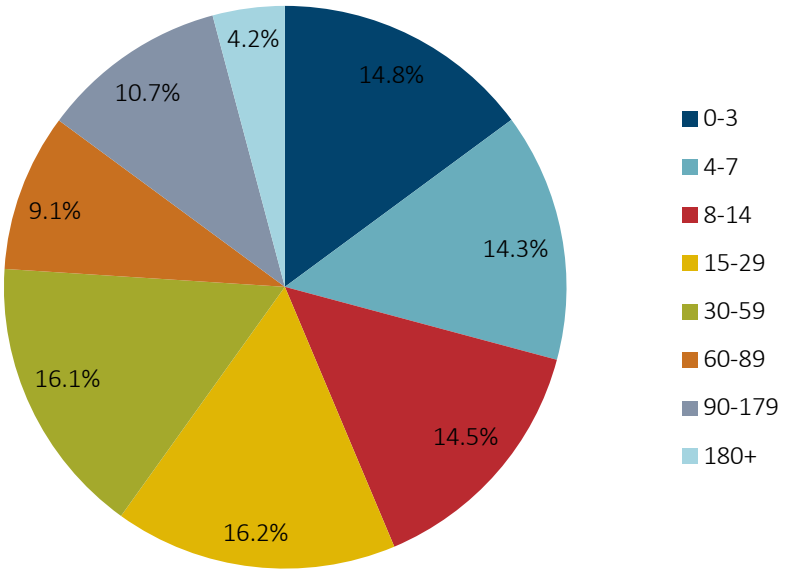
- 50% of patients stay for 14 days or fewer.
- Some outliers: 10% have stays > 180 days.
- Median LOS 2014: 17.4 days
- Avg. 71.3 days

LOS by Admitting Diagnosis

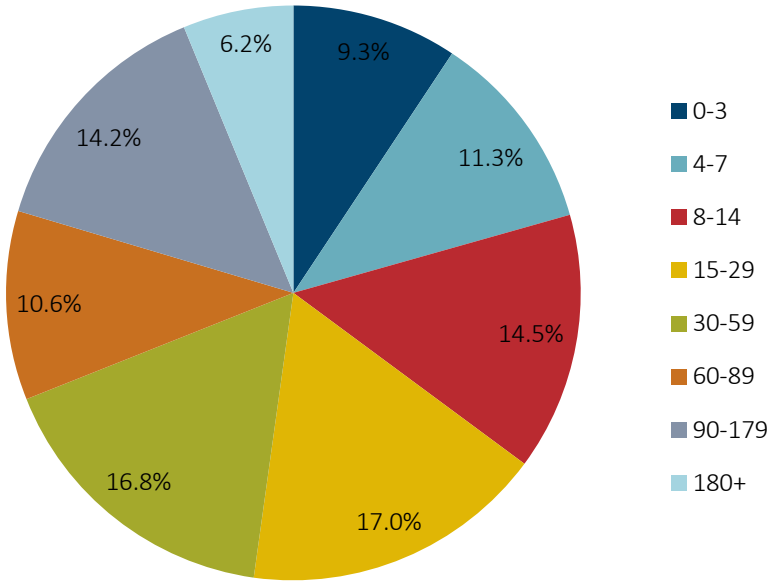


Highly variable by Admitting Diagnosis

LOS: CHF



LOS: PARKINSON'S DISEASE



Hospice is Primarily Provided at Home

Location of Hospice Patients at Death [1]

Location of Death	2014	2013
Patient's Place of Residence	58.9%	66.6%
Private Residence	35.7%	41.7%
Nursing Home	14.5%	17.9%
Residential Facility	8.7%	7.0%
Hospice Inpatient Facility	31.8%	26.4%
Acute Care Hospital	9.3%	7.0%

From NHCPO "Facts and Figures on Hospice Care (2015)"
http://www.nhpco.org/sites/default/files/public/Statistics_Research/2015_Facts_Figures.pdf

Cancer is not the only Admitting Diagnosis

Table 6. Percentage of Hospice Admissions by Primary Diagnosis [1]

Primary Diagnosis	2014	2013
Cancer	36.6%	36.5%
Non-Cancer Diagnoses	63.4%	63.5%
Dementia	14.8%	15.2%
Heart Disease	14.7%	13.4%
Lung Disease	9.3%	9.9%
Other	8.3%	6.9%
Stroke or Coma	6.4%	5.2%
Kidney Disease (ESRD)	3.0%	3.0%
Liver Disease	2.3%	2.1%
Non-ALS Motor Neuron	2.1%	1.8%
Debility Unspecified	1.9%	5.4%
Amyotrophic Lateral Sclerosis (ALS)	0.4%	0.4%
HIV / AIDS	0.2%	0.2%

Avg payment per Hospice Patient (2013): $11,615.38

Additionally, hospice patients incurred $1.3 bn in non-hospice payments (Part A, B and D)

From NHCPO "Facts and Figures on Hospice Care (2015)" http://www.nhpco.org/sites/default/files/public/Statistics_Research/2015_Facts_Figures.pdf

Predictive Analytics for End-of-Life

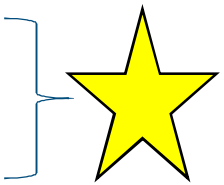
Over-Medicalized Death

Over-medicalized death defined as:

- Chemotherapy for cancer patients within 14 days of death
- Unplanned hospitalization within 30 days of death
- More than one emergency department (ED) visit within 30 days of death
- ICU admission within 30 days of death; or
- Life-sustaining treatment within 30 days of death

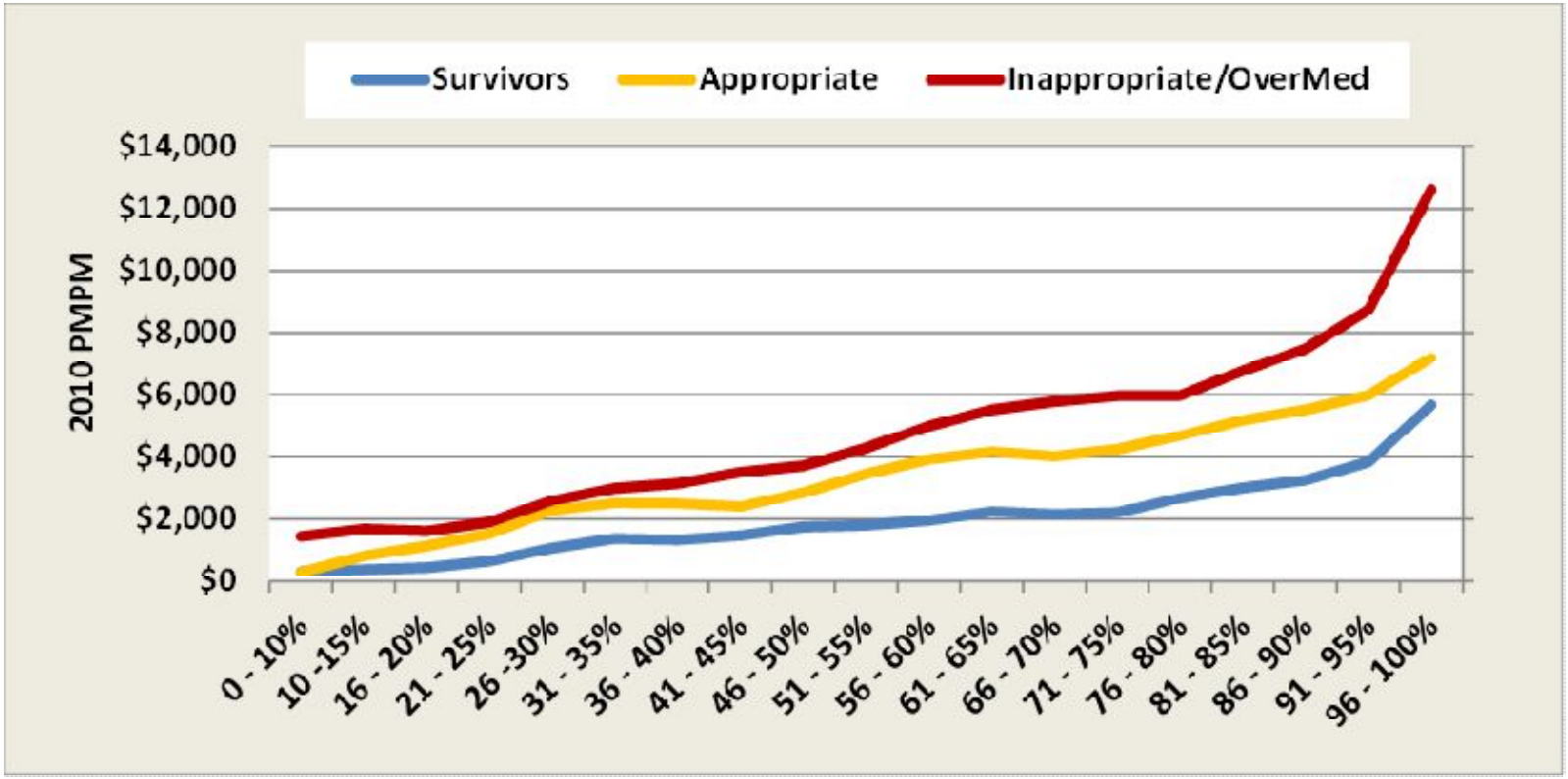
End-of-Life Opportunity

Medicare Patients and Deaths (based on 50% of the 5% file)			
Categories	Members	% of Total Population	PMPM
Survivors	819,189	92.0%	$684.80
Deceased	71,059	8.0%	$4,323.73
Appropriate	22,989	2.6%	$2,249.62
Inappropriate	9,832	1.1%	$3,433.30
OverMedicalized	38,238	4.3%	$5,797.08
Total	890,248	100.0%	$975.26



The difference between over-medicalized and appropriate death represents a financial and clinical opportunity. (Inappropriate death also represents an opportunity, although a smaller one).

Cost by Risk Level and Type of Death



The PMPMs for members in each category vary across the bands of risk scores. The difference in the costs between those that experience overmedicalized deaths versus those that experience appropriate deaths is greatest in members with risk scores >.95.

Financial Opportunity

Based on Members with Risk Scores >.95	
# of Members (out of 10,000)	341
% of Members (out of 10,000)	3%
Over Medicalized Sensitivity	46.0%
PPV (OM Deaths)	57.9%
# of True Positives (out of 10,000)	197
# of False Positives (out of 10,000)	143
Estimated Gross Savings	
# of True Positives (a)	197
Engagement Rate (b)	40%
Effectiveness Rate (c)	50%
Potential Savings per True Positive (d), (1)	$ 15,981
Estimated Gross Savings (a x b x c x d)	**$ 630,853**
Estimated Net Savings	
# of Members with p>.95 (e)	341
Engagement Rate (b)	40%
Cost of Case Management (f)	$ 940.67
Total Cost (e x b x f)	$ 128,234
Net Savings/(Costs)	**$ 502,619**

(1) Difference in costs between OM death and appropriate death, over 6.5 months (PMPM*6.5).

Six-Month Demonstration Pilot Outcomes

As of 4/15/16:

- 173 Total pts enrolled w/118 actively enrolled
  - Met project goal of enrolling 150 patients in 5 mos
- > 50% have PPS* 50 or less & 88% have PPS 60 or less

*: Palliative Performance Scale – indicates need for considerable assistance.

- 89% > age 80
- 38% lived alone
- 77% on 8 + meds
- 97% had goals of care addressed
  - 42% changed code status
- 32 referred and 26 admitted to hospice

Predicting Length of Stay

Hospice Length of Stay

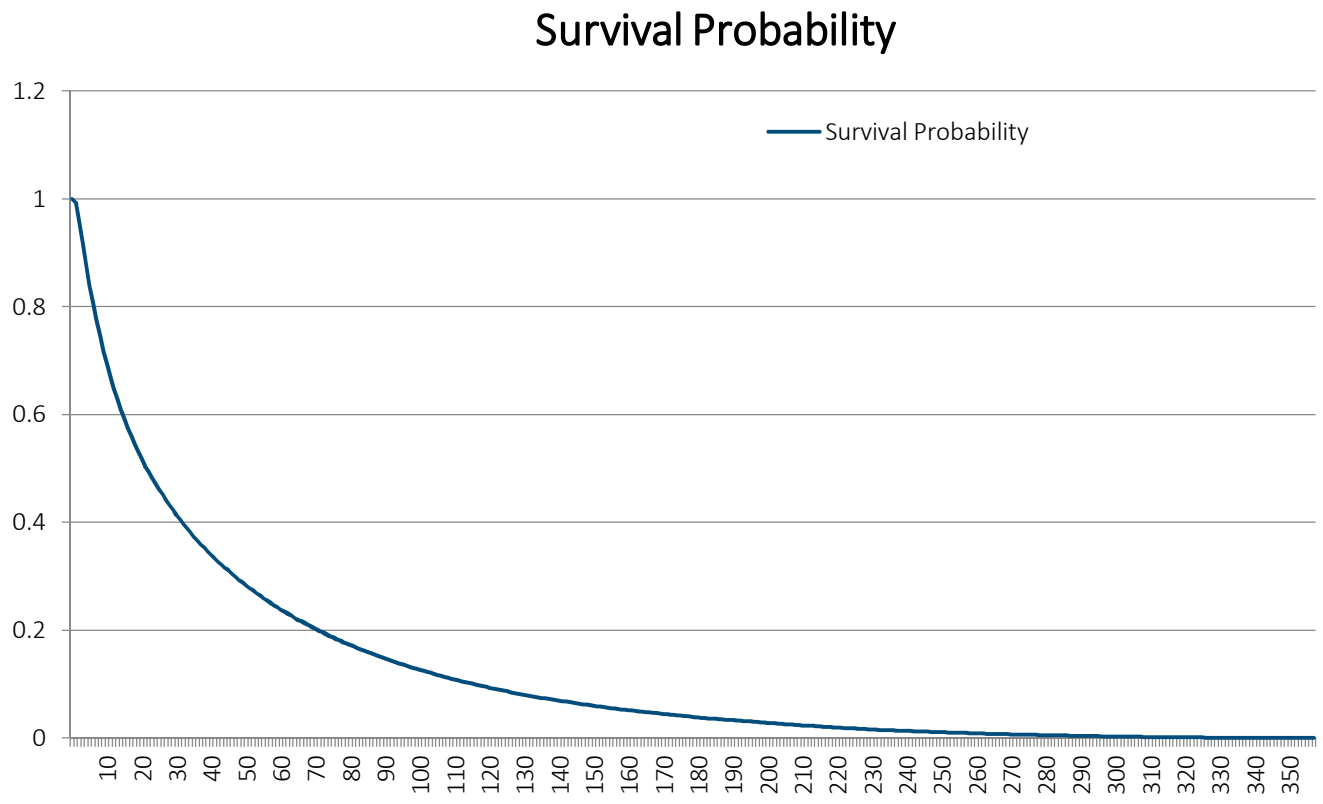
Predicting length of stay at admission to hospice.

Co-variates:

- Diagnosis(es)
- Age/sex
- Place of service (inpatient; long-term care; home).

Application of Actuarial Survival Modeling (Cox-type model)

Hospice Length of Stay



10-day Survival Probability: 0.7
20-day Survival Probability: 0.52
"Life Expectancy" = 44.3 days

Male, age 83, Long-term Care
Dx: Leukemia and Metastatic Cancer

Discussion

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