# Description of Emergency Department Use and Cost Over Time Among South Carolinians Living with Alzheimer's Disease or a Related Dementia

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Overview and Objectives

- By 2050 it is projected that there will be 16 million confirmed cases of Alzheimer's disease (AD).
- AD-related healthcare costs are expected to increase from $203 billion in 2010 to 1.2 trillion in 2050.
- AD is one of the most expensive diseases to the healthcare system as patients rely heavily on the emergency department (ED), skilled nursing, and home health.
- Studies show a spike in healthcare usage and cost around the time of diagnosis.
- Medicare claims data is commonly used to explore healthcare utilization.
- Healthcare utilization is typically limited to 2 to 4 years before and/or after diagnosis.

- *The primary objective is to extend the current description of ED utilization among patients with AD or related dementia (ADRD) to seven years prior and five years post-diagnosis.*
- *Two datasets were merged to create a unique dataset for this analysis.*
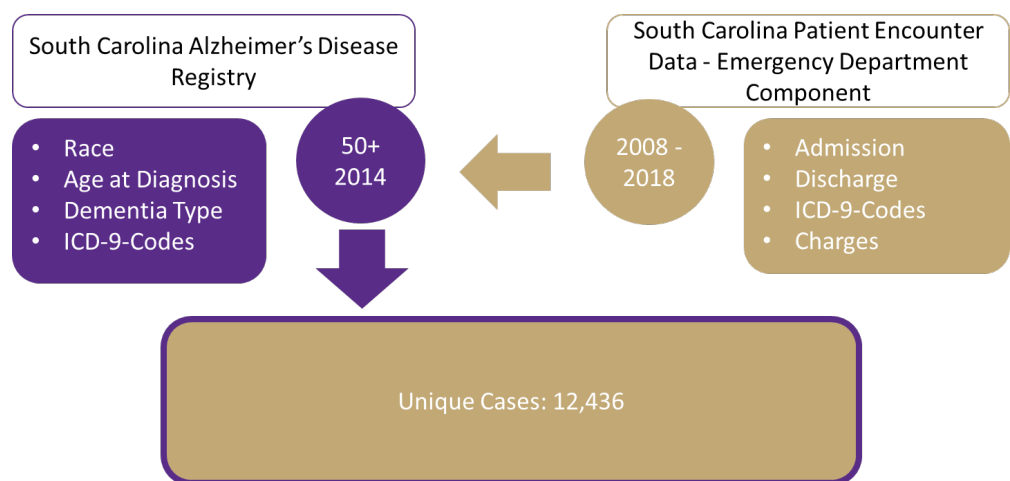

Study Design

Sample Selection
- The 2 datasets resulted in 12,436 unique cases.
- For inclusion, patients had to:
  - Have an ADRD diagnosis
  - Be 65 or older upon diagnosis
  - Have at least 1 ED encounter at any point from 2008 – 2018
- Cases were excluded if they had a comorbid or primary ADRD diagnosis of a specific type.
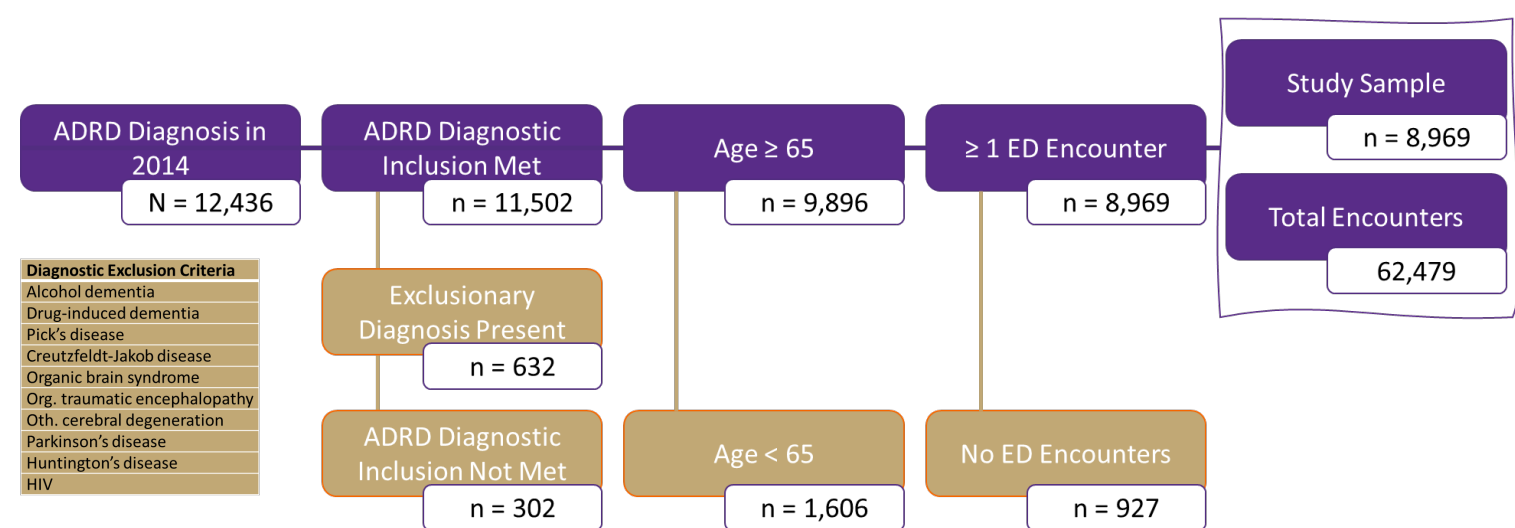
Sample Selection
- Month of diagnosis (dx) was excluded from time segments and analysis.
- Encounters were grouped and totaled based on 12-month increments.
- 7 encounter periods pre-diagnosis and 5 encounter periods post-diagnosis.
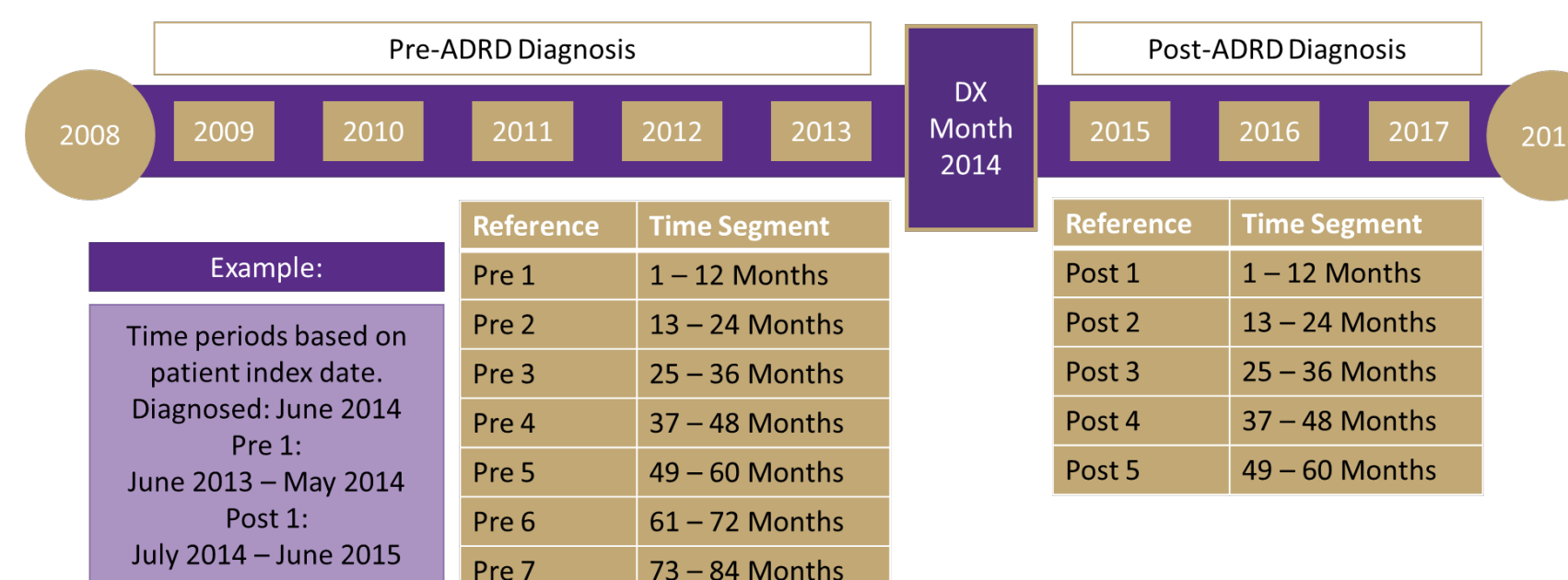
Data Analysis
- 2 equations to calculate the average encounter.
- Encounter ranged from 0 – 60 per time segment.

Equation 1:
$$\frac{\text{Total \# of ED encounters per time segment}}{\text{Total number of patients}}$$

Equation 2:
$$\frac{\text{Total \# of ED encounters per time segment}}{\text{Total number of patients with} \geq 1 \text{ encounter during time segment}}$$

Principle Findings

Case Characteristics

Patient Characteristics and ED Encounter Totals[1]	Unduplicated sample N=8,968 n (%)	ED encounters N=62,479 n (%)
Race		
White	6,468 (72%)	39,489 (63%)
Black	2,057 (23%)	18,654 (30%)
Asian	98 (1%)	449 (1%)
Multiple	345 (4%)	3,887 (6%)
Gender		
Female	5,601 (62%)	40,423 (65%)
Male	3,367 (38%)	22,056 (35%)
Age at time of ADRD diagnosis[2]		
65 – 69	1,092 (12%)	10,976 (18%)
70 – 74	1,432 (16%)	11,833 (18%)
75 – 79	1,675 (19%)	11,570 (19%)
80 – 84	1,835 (20%)	11,658 (19%)
85 +	2,934 (33%)	16,442 (26%)
Dementia type		
Alzheimer's disease	3,223 (36%)	22,801 (36%)
Vascular dementia	822 (9%)	6,076 (10%)
Multiple ADRDs[3]	3,115 (35%)	19,125 (31%)
Other dementia[4]	1,808 (20%)	14,477 (23%)

Case Encounters

Patient Characteristics and ED Encounter Totals[1]	Unduplicated sample N=8,968 n (%)	ED encounters N=62,479 n (%)
12-Month Time Segments Pre- & Post-Diagnosis[5]		
Pre 7	991 (11%)	1,428 (2%)
Pre 6	2,062 (23%)	3,321 (5%)
Pre 5	2,119 (24%)	3,578 (6%)
Pre 4	2,409 (27%)	4,198 (7%)
Pre 3	2,733 (30%)	4,896 (8%)
Pre 2	3,124 (35%)	5,939 (10%)
Pre 1	4,112 (46%)	8,476 (14%)
Post 1	4,143 (46%)	9,027 (14%)
Post 2	2,886 (32%)	6,269 (10%)
Post 3	2,343 (26%)	5,100 (8%)
Post 4	1,746 (19%)	3,760 (6%)
Post 5	804 (9%)	1,406 (2%)
Year of First ED Encounter		
2008	1,976 (22%)	24,236 (39%)
2009	1,254 (14%)	10,699 (17%)
2010	971 (11%)	6,922 (11%)
2011	880 (10%)	5,429 (9%)
2012	764 (9%)	4,009 (6%)
2013	814 (9%)	3,715 (6%)
2014	1,794 (20%)	5,637 (9%)
2015	263 (3%)	671 (1%)
2016	134 (1%)	323 (.52%)
2017	73 (.81)	144 (.23%)
2018	41 (.46)	49 (.08%)

[1] Totals may not sum to 100 due to rounding.
[2] All ADRD diagnoses were made between January 1, 2014, and December 31, 2014.
[3] Patient has more than one type of dementia diagnosis.
[4] Patient only has one dementia diagnosis, but it is not Alzheimer's disease or Vascular dementia.
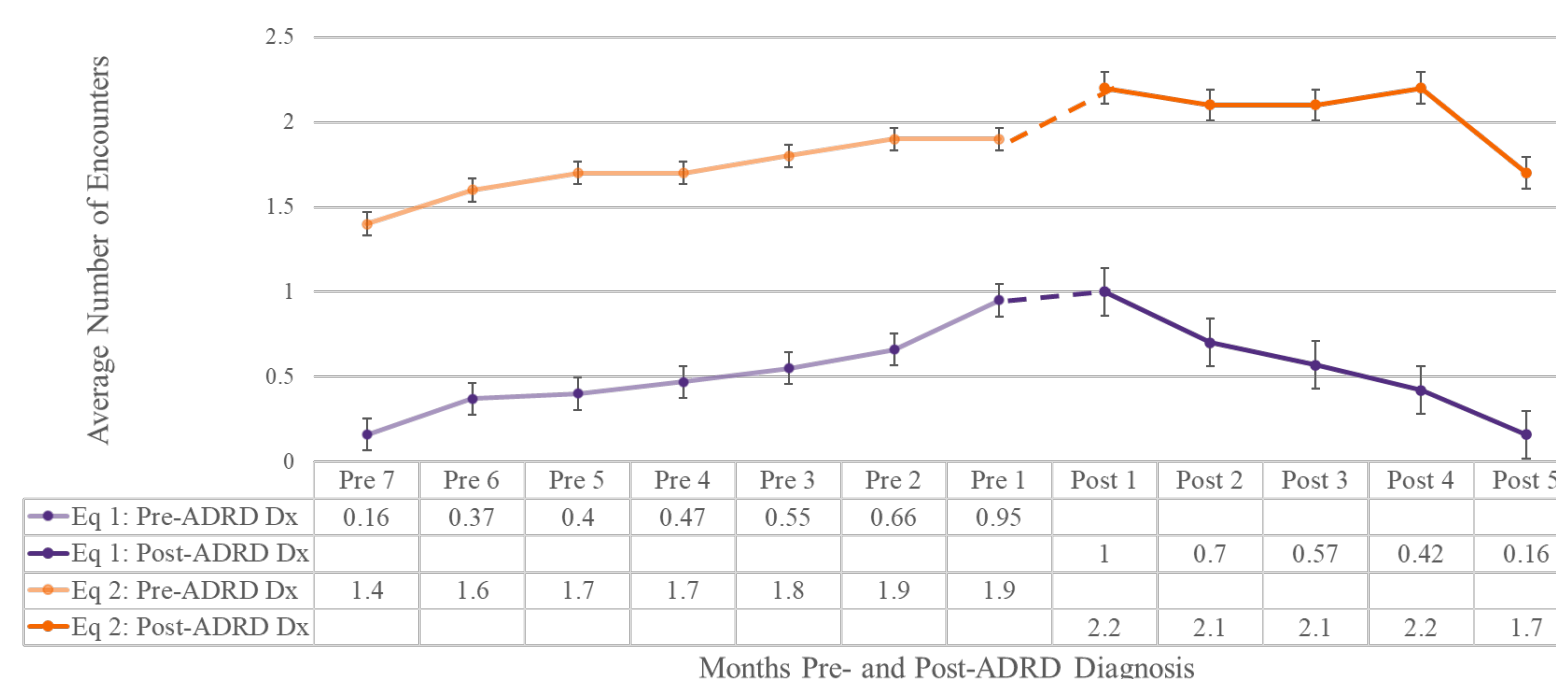[5] ED encounters that occurred during the month of diagnosis are not included in the totals.

Equation 1

Months[2]	Mean (sd) Encounters	25%[2]	50%[2]	75%[2]	90%[2]	95%[2]	99%[2]	Range of encounters
Pre 7	.16 (.65)	0	0	0	1	1	2	0 – 27
Pre 6	.37 (.97)	0	0	0	1	2	4	0 – 28
Pre 5	.40 (1.11)	0	0	0	1	2	4	0 – 39
Pre 4	.47 (1.15)	0	0	0	1	2	5	0 – 38
Pre 3	.55 (1.28)	0	0	1	2	3	5	0 – 32
Pre 2	.66 (1.89)	0	0	1	2	3	6	0 – 29
Pre 1	.95 (1.83)	0	0	1	3	4	7	0 – 60
Post 1	1.01 (1.79)	0	0	1	2	3	7	0 – 45
Post 2	.70 (1.99)	0	0	1	2	3	7	0 – 45
Post 3	.57 (2.30)	0	0	1	2	3	6	0 – 26
Post 4	.42 (1.25)	0	0	0	1	2	6	0 – 24
Post 6	.16 (.66)	0	0	0	1	3	0 – 18

Equation 2

Months[2]	Mean (sd) Encounters	25%[2]	50%[2]	75%[2]	90%[2]	95%[2]	99%[2]	Range of encounters
Pre 7	1.44 (1.42)	991	1	1	1	2	3	1 – 27
Pre 6	1.61 (1.45)	2,062	1	1	2	3	4	1 – 28
Pre 5	1.69 (1.73)	2,119	1	1	2	3	4	1 – 39
Pre 4	1.74 (1.63)	2,409	1	1	2	3	4	1 – 38
Pre 3	1.79 (1.76)	2,733	1	1	2	3	5	1 – 32
Pre 2	1.90 (2.82)	3,123	1	1	2	3	5	1 – 29
Pre 1	2.06 (2.23)	4,112	1	1	2	4	5	1 – 60
Post 1	2.18 (2.09)	4,143	1	1	3	4	6	1 – 45
Post 2	2.13 (2.14)	2,885	1	1	2	4	5	1 – 45
Post 3	2.10 (1.99)	2,342	1	1	2	4	5	1 – 26
Post 4	2.15 (2.08)	1,746	1	1	3	4	6	1 – 24
Post 6	1.75 (1.45)	804	1	1	2	3	4	1 – 18

Conclusion & Relevance to Policy

Principle Findings
- Average encounters for both equations increase up to diagnosis.
- There is a spike for the first two months following diagnosis.
- Equation 1 shows a steady decline 12 months post diagnosis.
- Equation 2 encounters remain steady 12 months after diagnosis.
- A very few cases accounted for the majority of encounters across the timespan.
- It is probable that the increase in ED utilization may align with disease onset.

Relevance to Policy
- On average people live 4 - 6 years after ADRD diagnosis.
- Changes in the brain can occur 20 years before diagnosis.
- People can live up to 20 years post-diagnosis.
- Understanding the long periods before and after diagnosis may provide insights into preventing, treating, and managing the disease
- High costs associated with ADRD may be attributable to a relatively small number of patients.

Encounters Averages & Ranges by Equations

	Pre 7	Pre 6	Pre 5	Pre 4	Pre 3	Pre 2	Pre 1	Post 1	Post 2	Post 3	Post 4	Post 5
Eq 1: Pre-ADRD Dx	0.16	0.37	0.4	0.47	0.55	0.66	0.95					
Eq 1: Post-ADRD Dx								1	0.7	0.57	0.42	0.16
Eq 2: Pre-ADRD Dx	1.4	1.6	1.7	1.7	1.8	1.9	1.9					
Eq 2: Post-ADRD Dx								2.2	2.1	2.1	2.2	1.7

Averages Encounter and Total Charges Pre and Post Diagnosis

	Pre 7	Pre 6	Pre 5	Pre 4	Pre 3	Pre 2	Pre 1	Post 1	Post 2	Post 3	Post 4	Post 5
Avg. Charges	$3,578	$3,782	$4,097	$4,402	$4,786	$4,914	$5,430	$5,709	$5,721	$6,042	$6,403	$6,519
Avg. Encounters	1.4	1.6	1.7	1.7	1.8	1.9	1.9	2.2	2.1	2.1	2.2	1.7