A Machine Learning Approach to Preventing Avoidable ED Utilization

FamilyCare, Inc

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EMERGENCY DEPARTMENT VISITS ARE COSTLY AND MANY ARE POTENTIALLY AVOIDABLE

Up to 27% of emergency department (ED) visits in the U.S. could be managed in physician offices, clinics, and urgent care centers. Moving these non-emergent visits to alternate medical centers could lead to at a savings of $4.4 billion annually.[1]

According to a 2013 National Hospital Ambulatory Medical Care Survey on Emergency Department Visits:

- 130.4 million ED visits were made in 2013
- 12.2 million of these resulted in hospital admission (9.3%)
- 29.8% of patients were seen in fewer than 15 minutes

ED use for non-emergent conditions:

- contributes to the rising cost of health care (can cost up to 10 times more than the same treatment by a primary care provider)
- may be an indication of lack of engagement with the member's primary care provider (PCP) and/or accessibility to a PCP or urgent care and after-hours facilities

[1]Weinick RM, Burns RM, Mehrotra A. Many emergency department visits could be managed at urgent care centers and retail clinics. Health Affairs. 2010;29(9):1630–1636.

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THE DATA CAN GUIDE INTERVENTION

Develop comprehensive – yet targeted – prevention programs to address both the individual and structural components that motivate avoidable emergency department visits; thus reducing cost and improving member care.

- Use data analysis to characterize the membership that is driving avoidable utilization
- Find patterns in utilization, e.g. time and place
- Find avoidable diagnoses that “travel together”

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MEDI-CAL PROVIDES A WORKING DEFINITION

Identify avoidable ED events according the Medi-Cal criteria, primary diagnosis of:

- Dermatophytosis of the body
- Candidiasis
- Acariasis
- Disorders of conjunctiva
- Suppurative
- Common cold
- Upper respiratory infection
- Migraine, tension headache
- Backache, lumbago
- Prickly heat
- Yeast infection
- Urinary tract infection
- Unspecified pruritic disorder
- Encounter for administrative purposes, general medical, follow up, special investigations exams

The Medi-Cal definition is considered very conservative, meaning errs on the side of "not avoidable." For example, it does not include diagnoses related to mental health or dental care.

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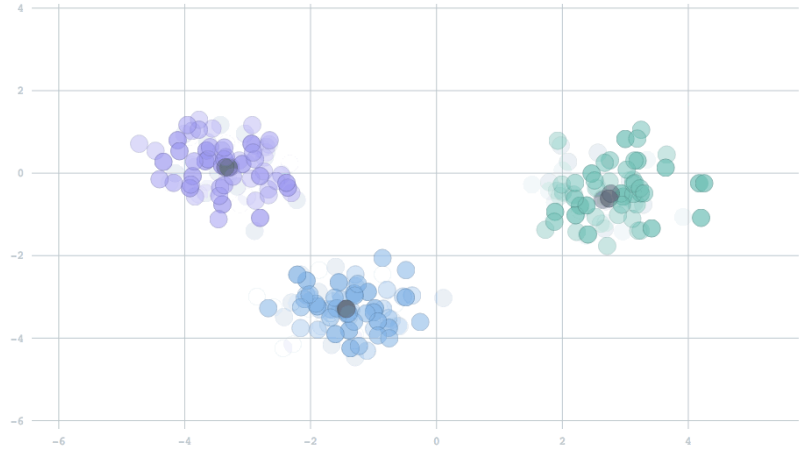
K-MEANS CLUSTERING GROUPS THE EVENTS

1. Segment avoidable ED events into groups using K-means clustering with the event primary diagnosis code as the input variable, creating clinically similar groupings of the events.



2. Perform between and within cluster exploratory analysis to characterize member demographics, explore cost profiles, and examine patterns of utilization.

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K-MEANS YIELDS A MATRIX OF CLUSTERS AND PREVALENCE

Cluster	1	2	3	4	5	6
Cluster Name	**"Respiratory and eye infections"**	**"Yeast and Bladder"**	**"Headache"**	**"Skin conditions and ED as GP"**	**"Back Pain"**	**"UTI"**
Diagnosis Group						
Acariasis	0.00	0.00	0.00	0.34	0.01	0.00
Acute_bronchitis	0.08	0.00	0.00	0.00	0.02	0.00
Acute_Pharyngitis	0.20	0.03	0.06	0.00	0.02	0.01
Acute_Upper_Resp_Inf	0.48	0.00	0.05	0.00	0.02	0.02
Migraine, tension headache	0.00	0.00	1.00	0.00	0.02	0.00
Backache	0.00	0.00	0.03	0.04	0.33	0.04
Yeast infections	0.00	0.34	0.00	0.00	0.01	0.01
Chronic_disease_of_tonsils_adenoids	0.00	0.00	0.00	0.00	0.01	0.00
Chronic_pharyngitis_nasopharyngitis	0.00	0.00	0.00	0.00	0.01	0.00
Chronic_sinusitis	0.02	0.00	0.03	0.01	0.01	0.00
Common_Cold	0.00	0.00	0.00	0.00	0.01	0.00
Cystitis	0.00	0.67	0.00	0.00	0.01	0.02
Dermatophytosis_of_body	0.00	0.00	0.00	0.00	0.01	0.00
Disorders_of_Conjunctiva	0.09	0.00	0.00	0.00	0.01	0.00
Encounter_for_administr_purpose	0.00	0.00	0.00	0.67	0.02	0.00
Follow_up_exam	0.01	0.00	0.00	0.01	0.01	0.00
General_medical_exam	0.01	0.00	0.00	0.02	0.01	0.00
Inflam_disease_of_cervix_vagina_vulva	0.00	0.00	0.00	0.00	0.01	0.01
Lumbago	0.00	0.00	0.03	0.00	0.81	0.03
Other_specified_pruritic_condition	0.00	0.00	0.00	0.00	0.01	0.00
Other_symptoms_referable_to_back	0.00	0.00	0.00	0.00	0.04	0.00
Prickly_heat	0.00	0.00	0.00	0.00	0.01	0.00
Special_investigations_exams	0.01	0.00	0.00	0.00	0.02	0.01
Suppurative	0.23	0.02	0.01	0.00	0.01	0.00
Unspecified_pruritic_disorder	0.01	0.01	0.00	0.09	0.01	0.00
UTI	0.00	0.00	0.02	0.00	0.02	1.00

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OUR CLUSTERS ARE SIMILAR TO OTHER ANALYSES

Avoidable ED clinical groups (clusters):

Group	% of Visits	Visits/Mbr	Problems and prevalence
Common Infections	51.8	1.11	48% upper respiratory infections; 20% acute pharyngitis; 8% acute bronchitis; 23% suppurative; 9% disorders of conjunctiva
Headache	19.5	1.12	100% Migraine, tension headache, abnormal face pain
Backpain	14.9	1.16	81% Lumbago; 33% backache
Urinary Tract Infection	7.7	1.09	100% UTI
Skin Conditions	3.5	1.19	67% encounter for admin purpose; 34% ascariasis; 9% unspecified pruritic disorder
Yeast and Bladder	2.7	1.03	66% cystitis; 34% yeast infections

How does our population compare?

Appendix 2: Top six reasons for potentially avoidable ER visits in the Puget Sound for Medicaid patients

	REASON	% OF AVOIDABLE ER VISITS
1.	Respiratory infection	29.9%
2.	Headache	20.3%
3.	Back pain	16.4%
4.	Urinary tract infection	11.7%
5.	Earache	9.6%
6.	Eye infection	3.3%

Right Care, Right Setting: A Report on Potentially Avoidable Emergency Room Visits in Washington State

WASHINGTON HEALTH ALLIANCE
Leading health system improvement

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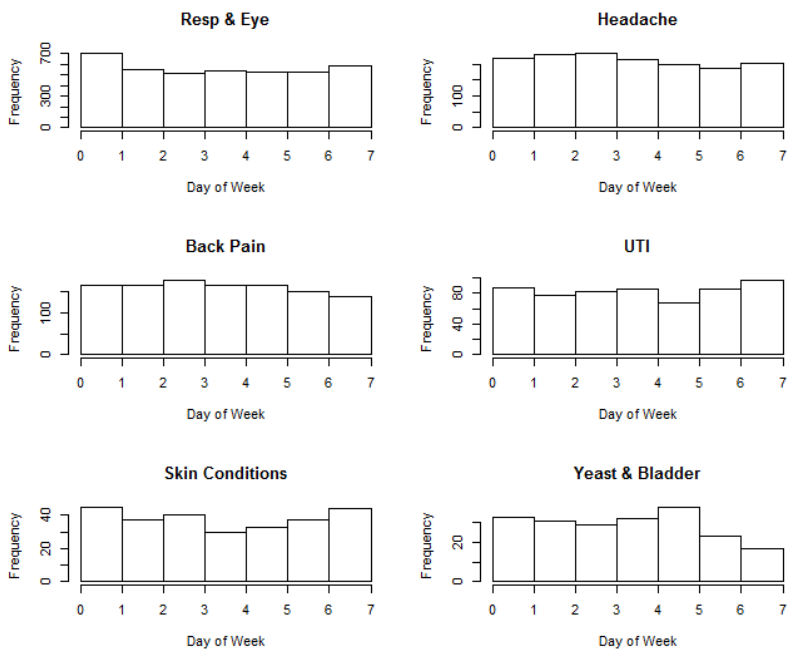
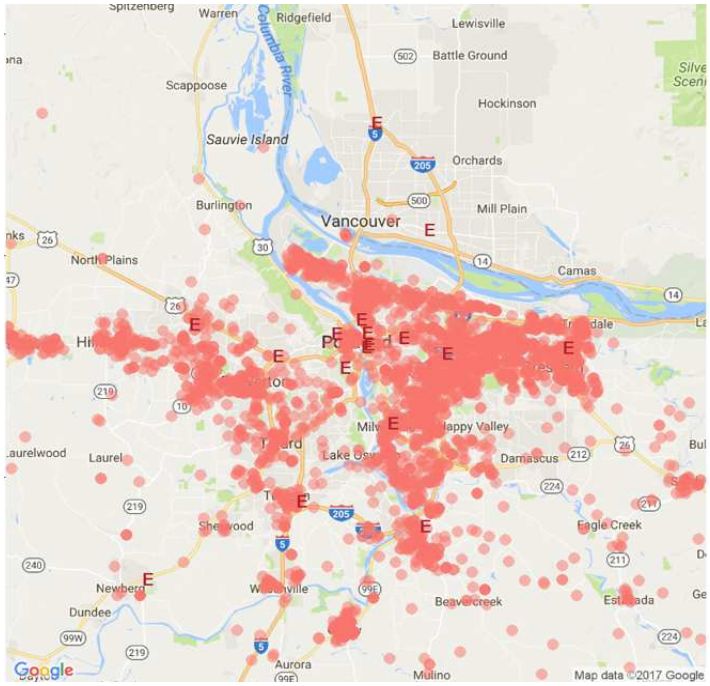
NO PATTERNS IN TIME AND PLACE OF EVENTS





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UTILIZATION VARIES BY RACE

Group 1: Common Infections

Rate Group	African-American	Caucasian	Hispanic	Unknown
1 - ACA Adults Aged 19-44	17.9	26.7	12.1	18.1
2 - ACA Adults Aged 45-54	2.9	4.6	4.0	3.2
3 - ACA Adults Aged 55-64	0.6	3.1	1.1	2.0
A - AB/AD With Medicare	2.3	1.4	1.1	0.1
B - AB/AD Without Medicare	8.1	4.8	2.2	0.3
C - Foster Children	2.9	2.1	1.8	0.1
E - PLM Adults over 100% FPL	4.0	3.0	0.7	1.9
I - TANF - Adults	7.5	10.6	8.1	9.4
J - PLM Adults under 100% FPL	2.3	1.7	1.5	0.6
M - Old Age Assist with Medicare Part A or AB	1.7	0.5	0.7	0.1
Medicare	1.2	0.9	0.4	1.0
O - Old Age Assistance without Medicare	0.6	0.1	0.0	0.1
Q - Children 0-1 Years	1.2	0.7	1.1	1.2
S - Children 1-5 Years	28.9	22.0	35.7	37.1
T - Children 6-18 Years	17.9	17.7	29.4	24.4
X - Special Needs Rate Group	0.0	0.1	0.0	0.1

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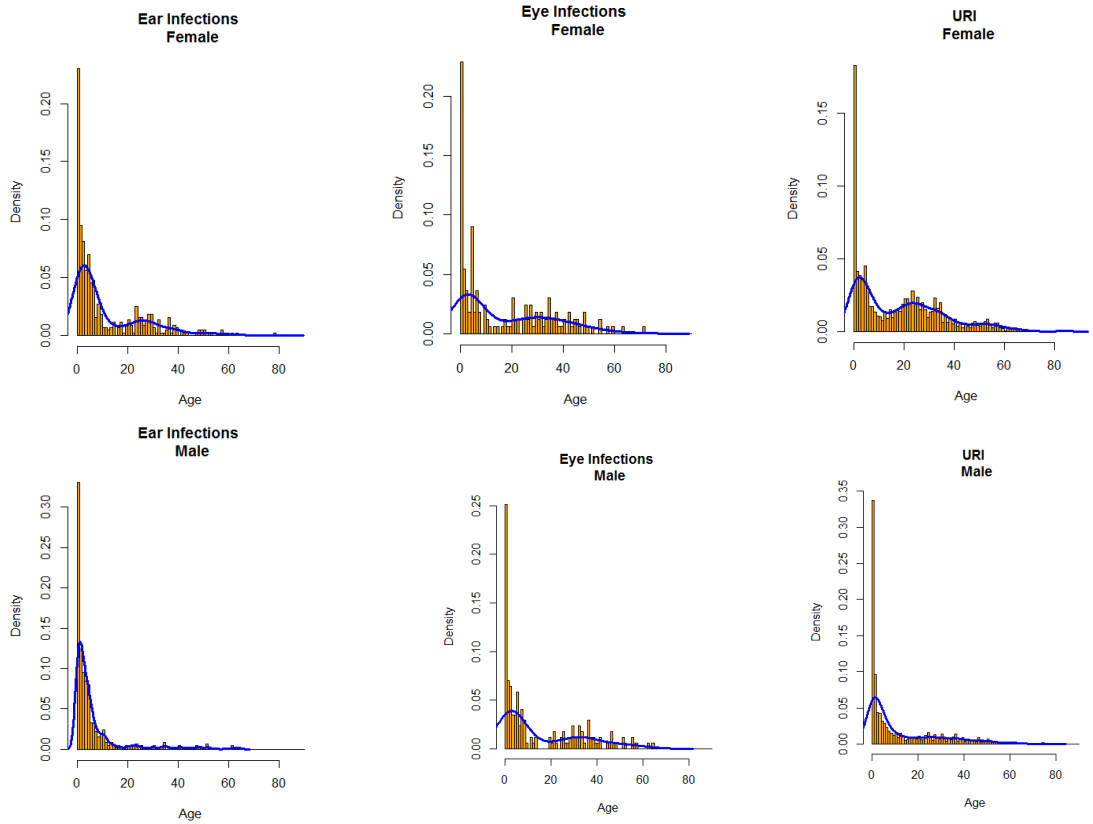
ADULT UTILIZATION DRIVEN BY FEMALES



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COMMON INFECTIONS DRIVEN BY FEMALES 18-30 AND CHILDREN

What is going on in the Common Infections cluster?

- ✓ Mothers taking children to the ED
  - 22% of female visits and 40% of male visits by children 0-2 years old
  - 23% of female visits and 25% of male visits by children 3-10 years old
  - 6% of female visits and 5% of male visits by youth 11-17 years old

- ✓ Young women taking themselves to the ED
  - 24% of female visits 18-30 years old vs. only 11% of male visits 18-30 years old
  - Young women are in the ACA rate group – not the mothers of the children!

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DEEPER ANALYSIS IS POSSIBLE

- Explore the other five clusters in similar manner
- Develop member- and provider-specific interventions
- Expand methodology to other types of avoidable utilization (ACSC hospital admissions, hospital re-admissions)
- Expand input variables to include pharmacy or chronic condition data

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SUMMARY

- ED visits are costly and many are avoidable
- A data driven approach can simplify analysis
- K-means clustering creates diagnostically similar groups of events
- Targeted interventions can be guided by examining member characteristics and utilization patterns within clusters
- Clustering approach can be used for various types of utilization

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