# NYU Emergency Department Visit Classification Algorithm for Type 2 Diabetes Patients Before and After Diagnosis

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Background

- Adults over 45 years of age with diabetes account for an estimated 12 million emergency department (ED) visits per year[1]
- The percentage of all ED visits for patients aged 45 and over made by those with diabetes increased from 2012 to 2015
- Two-thirds of hospital ED visits annually by privately insured individuals in the U.S. are avoidable[2]
- The New York University (NYU) Emergency Department Algorithm (EDA) is a tool that can be used to classify ED visits
- Retrospectively classifies ED visits into one of the following categories based on a probability model:[3]
  - Nonemergent
  - Emergent/primary care treatable
  - Emergent/ED care needed, but preventable/avoidable
  - Emergent/ED care needed, not preventable/avoidable
- EDA can help evaluate the potential need for more effective management of ED use in patients suffering from diabetes

Figure 1. NYU Algorithm for classifying diagnoses[4]

$$P_{NE} + P_{PCT} + P_{EPA} + P_{ENPA} = 100\%$$
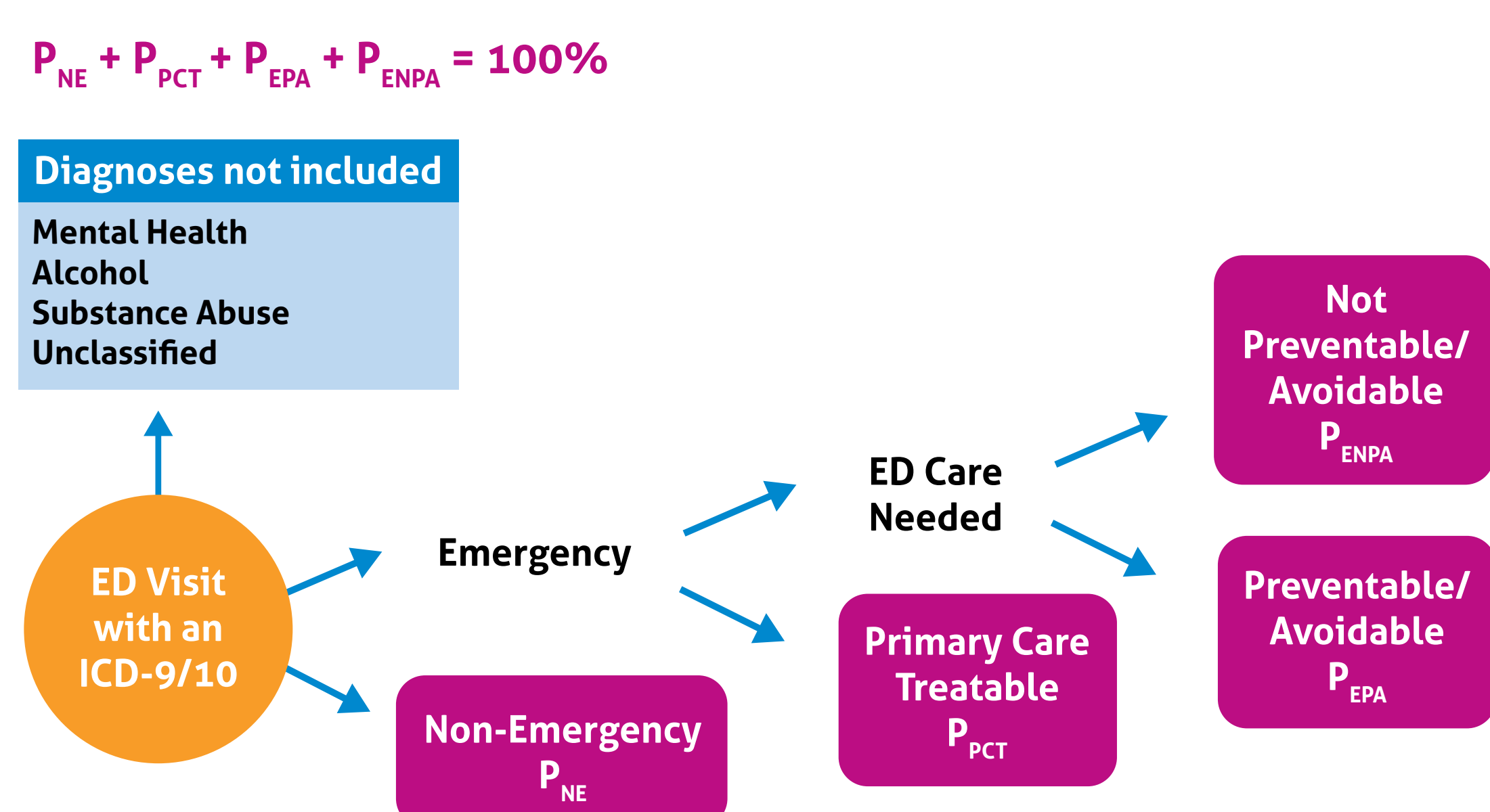
Objective

- This study sought to assess the association of emergent classification of an ED visit based on the modified EDA with hospital admissions in patients with type 2 diabetes

Methods

- This was a retrospective analysis of adult patients enrolled in commercial health plans
- Study time frame January 1, 2015 to September 30, 2018
- Inclusion criteria
  - A diagnosis of type 2 diabetes on at least two separate claims (index)
  - Age ≥ 18 years on the index date
  - Continuously enrolled in both medical and pharmacy benefits
    » for at least 24 months prior to the index date (defined as the baseline period)
    » through 24 or more months after the index date (defined as the follow-up period), inclusive
- Patients were assessed for 24 months pre-index and followed 24 months post-index
- The modified EDA categorized ED visits into three levels[5]:
  - Emergent
  - Intermediate
  - Nonemergent
- Healthcare resource utilization assessments included:
  - Proportion of patients with ED visits
  - Proportion of patients with hospitalizations
- Logistic regression analyses, adjusting for patient demographics and comorbidities, estimated the association of emergent ED visits with the probability of hospital admissions

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The New York University (NYU) Emergency Department Algorithm (EDA) can be used to assess trends and interventions for patients with diabetes with a goal of **reducing the use of the Emergency Department for non-emergent conditions while improving outcomes.**

Table 1. Patient Attrition

Measure	n	Proportion of Total Members
A diagnosis of Type 2 Diabetes: January 1, 2017 to June 30, 2019 (index)	963,323	100%
With at least 2 diabetes diagnosis claims	812,025	84.3%
Age ≥ 18 years on the index date	811,743	84.3%
Commercial members only	770,164	79.9%
Continuously enrolled in both medical and pharmacy benefits ≥24-months pre- and ≥24-months post index	812,025	9.2%
No other diabetes claims ≥24-months pre-index date	6,248	0.23%
Final Study Population	**6,248**	**0.6%**

Table 2. Patient Demographics and Clinical Characteristics

Variable		Study Population
N patients		6,248
Age at index in years, Mean (SD) [median]		53.0 (9.68) [54.00]
Gender (n,%)	Female	2,784 (44.6)
	Male	3,464 (55.4)
Pre-Index Deyo-Charlson Comorbidity Index score (n,%)	0	4,240 (67.9)
	1	1,042 (16.7)
	2	498 (8.0)
	≥3	468 (7.4)
Post-Index Deyo-Charlson Comorbidity Index score, Mean (SD)[median]		0.67 (1.42) [0]
Post-Index Deyo-Charlson Comorbidity Index score (n,%)	0	0
	1	2,738 (43.82)
	2	1,205 (19.29)
	≥3	2,305 (36.89)
Post-Index Deyo-Charlson Comorbidity Index score, Mean (SD)[median]		2.55 (2.23) [2]

Table 3. Emergency Department Use and Hospitalizations

Variable			n	Proportion of Study Population
Pre-Index	Emergency Department	Overall Use	1,116	17.9%
		Emergent	213	3.4%
		Intermediate	32	0.5%
		Nonemergent	477	7.6%
	Hospitilizations		682	11%
Post-Index	Emergency Department	Overall Use	1,816	29.1%
		Emergent	363	5.8%
		Intermediate	51	0.8%
		Nonemergent	707	11.3%
	Hospitilizations		1,438	23%

Table 4. Regression - Predictors of Hospitalization

Variable		Pre-Index			Post-Index		
		Estimate	P-value	OR (95% CI)	Estimate	P-value	OR (95% CI)
Age		-0.0141	0.0025	0.99 (0.98-1.00)	-0.0094	0.0058	0.99 (0.98-1.00)
Gender	Male (ref)	-	-	-	-	-	-
	Female	0.0302	0.7388	1.03 (0.86-1.23)	0.0559	0.3878	1.06 (0.93-1.20)
Deyo-Charlson Comorbidity Index score	0	-2.8591	<0.0001	0.06 (0.05-0.07)	-	-	-
	1	-1.4897	<0.0001	0.23 (0.17-0.29)	-1.6341	<0.0001	0.20 (0.17-0.23)
	2	-1.0304	<0.0001	0.36 (0.27-0.48)	-0.7383	<0.0001	0.48 (0.41-0.56)
	3+ (ref)	-	-	-	-	-	-
Emergency Department status	Nonemergent (ref)	-	-	-	-	-	-
	Emergent	0.6215	0.0015	1.86 (1.27-2.73)	0.3894	0.0047	1.48 (1.13-1.93)
	Intermediate	0.6365	0.1254	1.89 (0.84-4.27)	0.4048	0.1911	1.50 (0.82-2.75)

This table estimates the association between EDA visit classification and hospitalization
OR – Odds Ratio
ref – reference variable

Results

- A total of 6,428 patients met the inclusion criteria (45% female) with a mean age of 53 years
- In the pre-index period, 3.4%, 0.5% and 7.6% of the patients had emergent, intermediate and nonemergent ED visits, respectively, compared to 5.8%, 0.82% and 11%, respectively, in the post-index period
- In the pre-index period, 682 (11%) patients had at least one hospital admission and 1,438 (23%) in the post-index period
- The EDA measure of emergent ED visits was significantly associated with hospitalizations in the pre-index period (odds ratio [OR]: 1.86, 95% confidence interval [CI], 1.27-2.73) and post-index period (OR: 1.48, 95% CI, 1.13-1.93) compared to those with nonemergent visits
- In both periods, intermediate ED visits were not significantly associated with hospitalizations compared to those with nonemergent visits

Limitations

- Analysis is based on real world claims data. Services performed but not billed are not captured in the data
- Claims data analyzed represents data submitted by the provider and validated within tolerance limits. Undetectable data quality issues may exist that are common to all claims data sources such as submitting a valid code but not the code that was intended
- The health plan data largely represents commercial populations in regional health plans so that should be taken into account before generalizing the results to plans with potentially different populations and policies such as Medicaid plans or health plans outside the United States

Conclusion

- In both periods, emergent ED visits based on the algorithm are positively associated with hospitalizations
- As a tool, the EDA can be used to assess trends in ED utilization and applied by health plans toward intervention assessment for patients with diabetes

References

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