Factors and Trends in the Antibiotic Management of Skin and Soft Tissue Infections

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Introduction

Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) has emerged as a common inciting pathogen of skin and soft tissue infection (SSTI) [1]. This emergence has posed a problem regarding appropriate prescription practices and an uncertainty as to what physicians should be utilizing to empirically treat SSTIs [2]. One study demonstrated that between1997-2002 and 2003-2008, rates of antibiotic prescriptions targeting methicillin-sensitive *Staphylococcus aureus* (MSSA) for SSTIs decreased, while rates of antibiotics targeting MRSA increased [3]. An additional study correlated antibiotic prescription patterns in the treatment of abscesses and cellulitis to patient age, region of residence, and hospital department prescribing the antibiotic [4

In recent years, there is a push within the medical community to have better stewardship of these antibiotics to limit resistant microbials [5,6]. Limiting use of these antibiotics has shown to decrease inappropriate antibiotic use without increasing harm to patients, but what remains unclear is whether the prescribing relationships previously studied have continued in recent years; or with the advent of stewardship programs across the nation, this paradigm has shifted [7].

Methods

We conducted a retrospective analysis of visits for the diagnosis of SSTI utilizing the 2011-2016 National Ambulatory Medical Care Survey (NAMCS). Data analyzed included sex, age, race, insurance type, metropolitan statistical area status, type of infection, geographic region, provider training level, insurance type, and antibiotic used for treatment.

Results

Characteristics	Percent. of Total Visits	Prescribed at Least 1 Antibiotic (63.0% of patient encounters)	Not Prescribed an Antibiotic (37.0% of patient encounters)	P-value
Sex				0.266
Male	45.9%	44.4%	45.9%	
Female	54.1%	55.6%	51.6%	
Age, mean±SE				0.055
	53.9±0.7	52.7±0.8	55.1±1.0	
Race				0.121
White	83.2%	81.4%	86.3%	
Non-White	16.8%	18.6%	13.7%	
Insurance				0.992
Private	60.1%	60.1%	60.1%	
Other	39.9%	39.9%	39.9%	-
Region Where Visit Occurred				0.95
Northeast	17.1%	16.6%	18.0%	
Midwest	19.1%	19.5%	18.5%	
South	38.6%	38.8%	38.2%	
West	25.2%	25.1%	25.3%	
Metropolitan Statistical Area Status				0.507
MSA	88.2%	88.7%	87.2%	
Non-MSA	11.8%	11.3%	12.8%	

Table 1: Characteristics of visits receiving antibiotic prescription by selected patient and visit characteristics from 2011-2016

Characteristics	Total Visits	Prescribed Only an MSSA Antibiotic	Prescribed at Least 1 MRSA Antibiotic	P-value
Total	-	40.4%	59.6%	0.045
Sex				0.803
Male	44.5%	45.2%	44.0%	
Female	55.5%	54.8%	56.0%	
Age, mean±SE				0.045
	52.4±0.8	53.8±1.2	50.9±0.9	
Race				0.548
White	80.9%	83.3%	79.3%	
Non-White	19.1%	16.7%	20.7%	
Insurance				0.684
Private	60.5%	59.0%	61.5%	
Other	39.5%	41.0%	38.5%	
Region Where Visit Occurred				0.013
Northeast	16.3%	15.7%	16.7%	
Midwest	18.7%	21.4%	16.9%	
South	40.2%	30.8%	46.5%	
West	24.8%	32.1%	19.9%	
Metropolitan Statistical Area Status				0.791
MSA	88.6%	89.1%	88.3%	
Non-MSA	11.4%	10.9%	11.7%	
# of Antibiotics Received, mean±SE				<0.000
	1.4±0.02	1.1±0.2	1.7±0.0	

Table 3: Characteristics of visits receiving MSSA vs MRSA antibiotic for SSTI by patient and their visit characteristics from 2011-2016

	Total Prescriptions	Estimated Prescriptions	Percentage	95% Confidence Interval
MSSA Antibiotics				
Penicillins	117	2819886.8	6.5%	5.1-8.3
Cephalosporins	341	9310842.0	21.6%	18.2-25.4
MRSA Antibiotics				
Sulfonamides (Trimethoprim-Sulfamethoxazole)	264	7501547.1	17.4%	14.9-20.3
Tetracyclines	169	4581358.6	10.6%	8.6-13.0
Lincomycin derivatives (Clindamycin)	140	3256229.6	7.6%	5.8-9.8
Glycopeptides (Vancomycin)	18	614372.2	1.4%	0.8-2.7
Linezolid	6	120414.9	0.3%	0.1-1.0
Daptomycin	5	134651.2	0.3%	0.1-1.0
Glycylcyclines (Tigecycline)	1	6322.4	0.0%	0.0-0.1
Others				
Miscellaneous Abx	293	7236347.7	16.8%	14.5-19.3
Quinolone derivatives (Fluoroquinolones)	93	1842622.2	4.3%	3.0-6.1
Macrolides	25	381762.4	0.9%	0.5-1.6
Carbapenems	3	108729.8	0.3%	0.1-1.0
Urinary Anti-infectives	3	69432.4	0.2%	0.0-0.6
Aminoglycosides	1	20507.1	0.0%	0.0-0.3

Table 2: : Frequency and percentage of antibiotic drugs at ambulatory care visits for SSTIs from 2011-2016

Discussion

- Providers in the West prescribe antibiotics with MSSA coverage over MRSA coverage, similar to previous work from visits between 1993-2005 [8]. Providers in the Midwest also utilize MSSA coverage more frequently.
- Providers in the South had higher utilization of MRSA class drugs, consistent with a study of visits between 1997 and 2005 [4].
- Providers in the Northeast utilized roughly equivalent prescriptions between the two classes
  - Prior data had suggested providers in the Northeast were more likely to prescribe MRSA class antibiotics [8]
- Patient visits treated with antibiotics with MRSA coverage on average received a greater number of antibiotics per visit
  - May indicate providers are treating empirically then shifting to appropriate antibiotic classes derived from cultures or are stepping up coverage due to lack of response to initial therapy.
- Patients treated for SSTI with MSSA class antibiotics had a higher mean age
  - It is unclear if age is a risk factor for MRSA SSTI [9]

Conclusions

- Providers more frequently utilize antibiotics with MRSA coverage for SSTIs.
- Antibiotic class chosen was correlated with region, with providers in the South more likely to utilize antibiotics with MRSA coverage.
- Visits receiving at least one antibiotic with MRSA coverage received more antibiotics on average
- Individuals receiving antibiotics with MSSA coverage alone were older than those receiving antibiotics with MRSA coverage.

Future Directives

- Investigate regional practice differences and correlate regional fauna with these differences
- Define the temporal relationship in patient visits receiving multiple prescriptions for SSTI
- Determine if age is a risk factor for MRSA infection

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American Indian Adherence Rates to Medical Therapy Following Revascularization Procedures for STEMI

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Abstract

- The American Indian (AI) population suffers from cardiovascular disease (CVD) mortality rates that are 20% higher than the general population.
- Guideline-directed medical therapy (GDMT) adherence is essential for secondary prevention of ischemic events following revascularization.
- Our study compared GDMT adherence rates between AIs and non-AIs and found that trends of lower adherence rates exist in the AI population within 2 years following percutaneous intervention (PCI).
- GDMT adherence rates (defined as antiplatelet + statin + beta blocker for GDMT-1, and GDMT-1 + ACEI/ARB for GDMT-2) were found to have no statistical difference between the two populations at any time point within two years.
- No statistically significant difference was observed in the GDMT adherence rates between AI and non-AI patients during follow-up after PCI for STEMI.
- Despite a lack of statistical significance, noticeable trends of lower GDMT adherence rates and higher opioid rates in the AI population are concerning.
- Further studies into AI adherence to secondary prevention medical therapy after MI is warranted in order to identify and attempt to decrease the CVD morbidity and mortality burden in this underrepresented population.

Introduction

- When compared to any other ethnic group, American Indians (AIs) have been found to have higher rates of disease (CVD) risk, leading to increased rates of morbidity and cardiovascular mortality in these groups
- It is recommended that patients who undergo PCI follow guideline directed medical therapy GDMT, which consists of of beta-blockers, statins, and antiplatelet medications
- GDMT has been proven to improve long term outcomes following PCI
- Recent data have demonstrated that Northern Plains Indians receive GDMT after CABG at statistically similar rates as non-AI populations
- This data however has also shown a significant decrease in the adherence rates to statins at 1-year post-op in the AI population when compared to non-AI populations
- The goal of this study was to determine the rates of adherence to GDMT in patients treated with PCI in AI and non-AI populations
- Additionally, this data was used to compare adherence rates of GDMT in post-PCI and post-CABG patients within the AI population

Methods

- Data was collected via a retrospective analysis chart review of patients diagnosed with STEMI (ICD-9 410, ICD-10 121.3) who underwent PCI within the timeframe of June 1, 2012 to June 1, 2017 at Sanford Medical Center Fargo.
- Using the Sanford Health electronic medical record (Epic Systems Corporation; www.EPIC.com), adherence to GDMT was assessed at discharge, 30 days, 1 year, and 2 years post PCI.
- A total of 47 AI's and 54 non-AI patients were followed through 2 years
- Propensity matching of the groups was accomplished by using the *Risk Score for 30-Day Readmission after PCI* as well as hypertension, diabetes, and current dialysis status
- GDMT-1 was defined as anti-platelet + beta-blocker + statin
- GDMT-2 was defined as anti-platelet + beta-blocker + statin + ACE-I or ARB
- GDMT-3 was defined as dual anti-platelet + beta-blocker + statin + ACE-I or ARB and was only assessed at discharge and 30 days post-PCI
- Insulin, oral hypoglycemics, and opioids were also assessed

Results

- The incidence of prescribed ACE inhibitor/ARB, aspirin, beta-blocker, statins, opioids, and insulin were not significantly different at any follow-up point between the two groups
- Oral hypoglycemics were prescribed significantly less in the non-AI group vs. the AI group at 30 days, 1 year, and 2 years ($p = 0.04$, $p = 0.04$, $p = 0.01$ respectively)
- There were no differences in GDMT1, GDMT2, and GDMT3 adherence rates between the two groups at any follow-up point in the study
- Opioid use was similar between the two groups up until the 2-year time point, when AI use was at 42.6% vs 27.8% in non-AIs

Conclusions

- There is no significant difference in the adherence rates of GDMT between AI patients and non-AI patients through 2 years of follow-up in North Dakota populations
- Both populations had high rates of adherence throughout the 2-year timeframe (91.5% AI vs. 92.6% non-AI at 2 years).
- There was a trend of lower GDMT adherence rates in the AI populations seen at both 1 and 2 year follow-up, which mirrors the trend of lower GDMT adherence rates found by *Kruger et al.* in CABG patients in Northern Plains AI populations as noted by figure 4
- Unlike the AI and non-AI patients following CABG, where significantly lower rates of statin use were observed in the AI population, our data demonstrated no significant difference in statin use between AIs and non-AIs following PCI
- Future studies should further examine the adherence rates between PCI and CABG patients in the AI populations, as follow-up for longer periods of time with larger sample sizes may reveal a significant difference between GDMT adherence in AIs and non-AIs
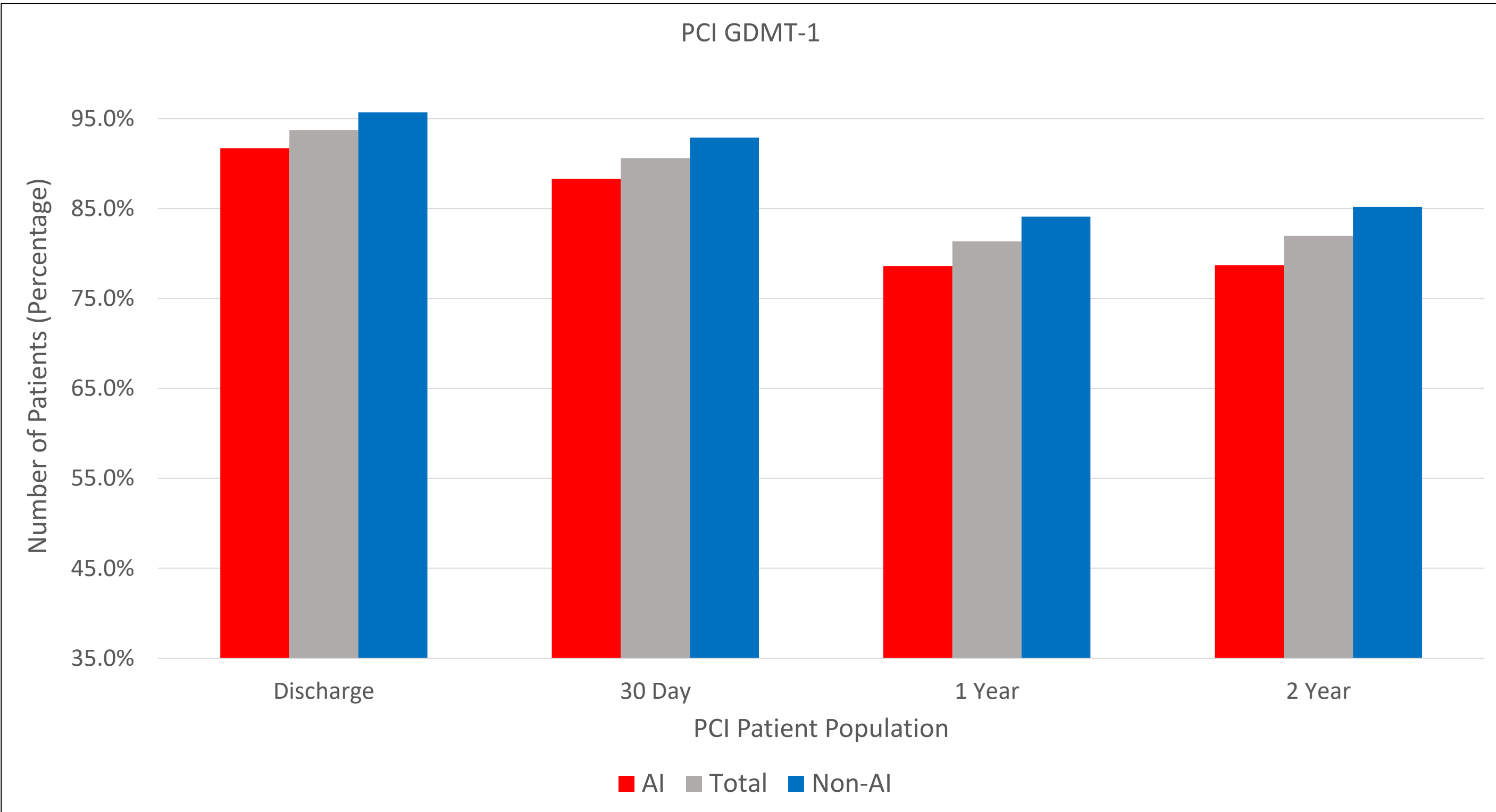

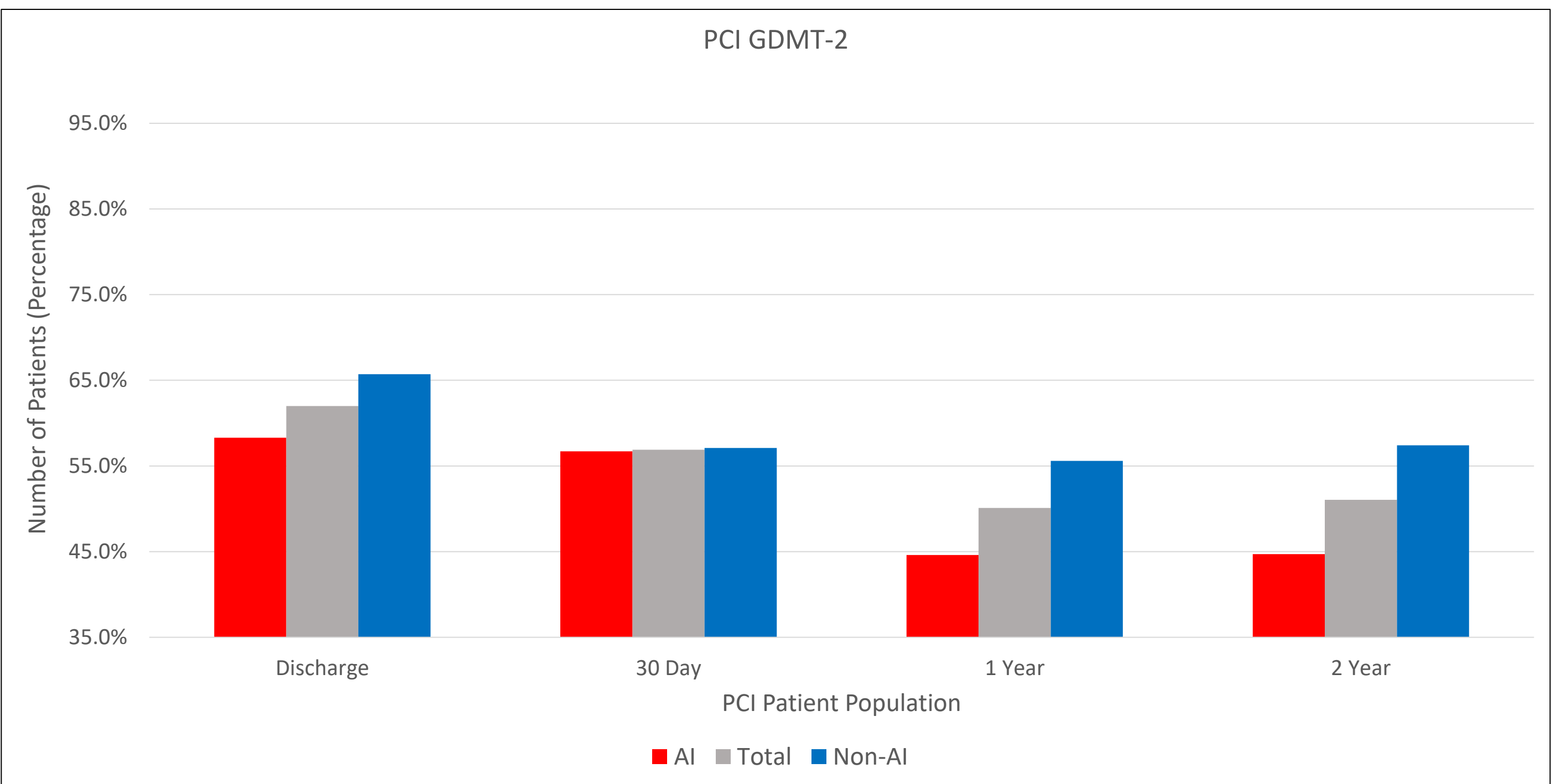Figure 1. Guideline-directed medical therapy-1: any antiplatelet and beta-blocker and statin.

Figure 2. Guideline-directed medical therapy-2: any antiplatelet and beta-blocker and statin and ACEI or ARB
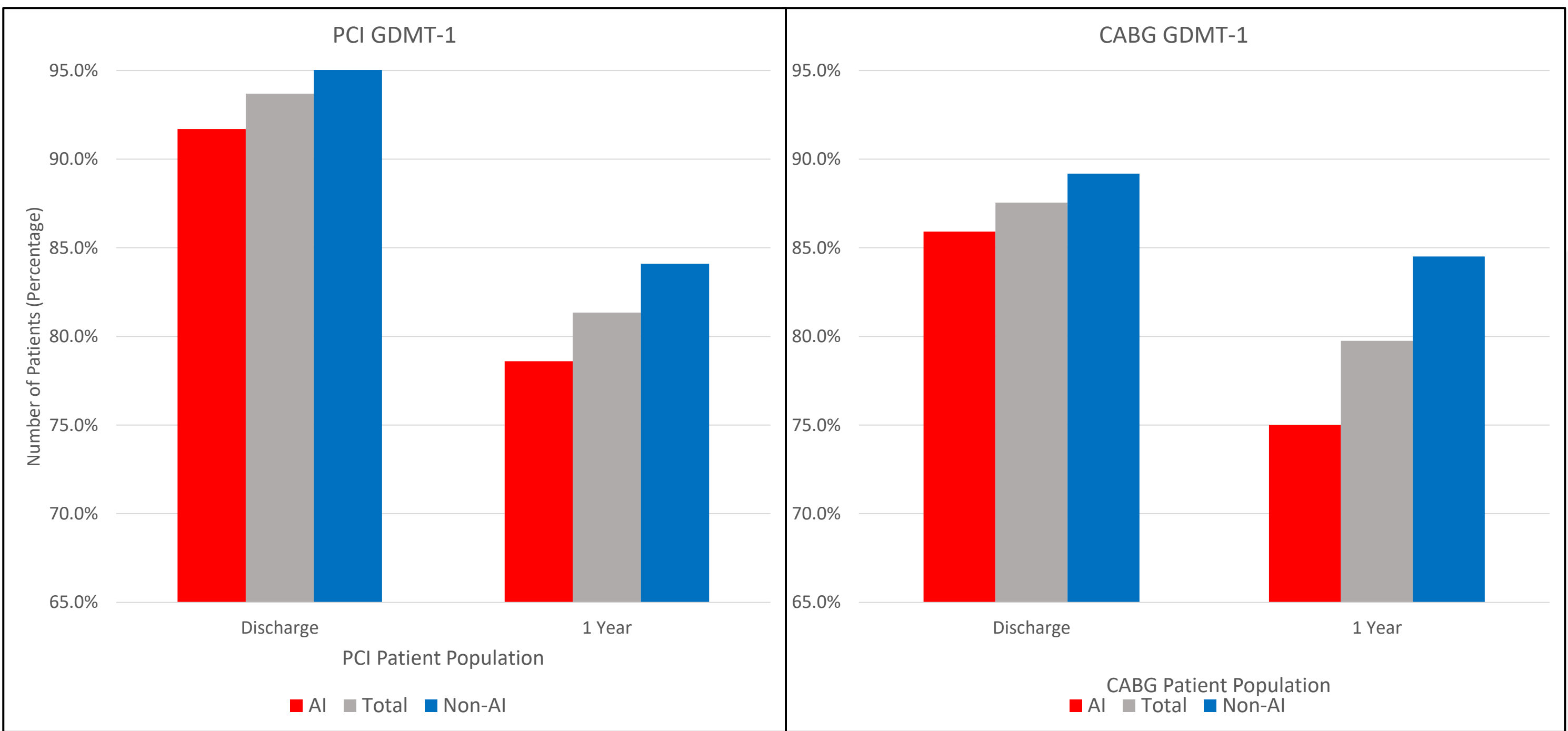

Figure 4. Comparison of GDMT-1 between CABG and PCI. Total at discharge 93.8% PCI vs. 87.6% CABG, p = 0.0984; at 1 year 81.5% PCI vs. 79.9% CABG, p = 0.7548. CABG adherence rates from (7): at discharge 85.9% AI vs. 89.2 % non-AI, p = 0.6195; at 1 year 75.0% AI vs. 84.5% non-AI, p = 0.2054.

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Prophylactic Pancreatic Duct Stent Retrieval: Retrospective Analysis of Outcomes and Spontaneous Dislodgement Rates

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Background

- Post-ERCP pancreatitis affects up to 10% of people undergoing endoscopic retrograde cholangiopancreatogram (ERCP)
- High risk patients for post ERCP pancreatitis (PEP) should receive prophylactic stenting of the pancreatic duct
- Advanced Endoscopists have varying practices on stent use, stent selection and protocol for removal
- Newer stent technology allows for spontaneous dislodgement of stents in short period of time (Figure 1 A-B)
- The ASGE recommends use of PD stent to prevent PEP, but does not have guidelines upon removal of the stents

Methods

- Sanford Analytics retrieved charts identified by CPT code for ERCP with stent modifier between Jan. 2009-Nov. 2019
- Charts were reviewed for type of pancreatic duct stents, follow-up imaging performed, time to follow-up endoscopy and complications of retained pancreatic stent (Figure 2)
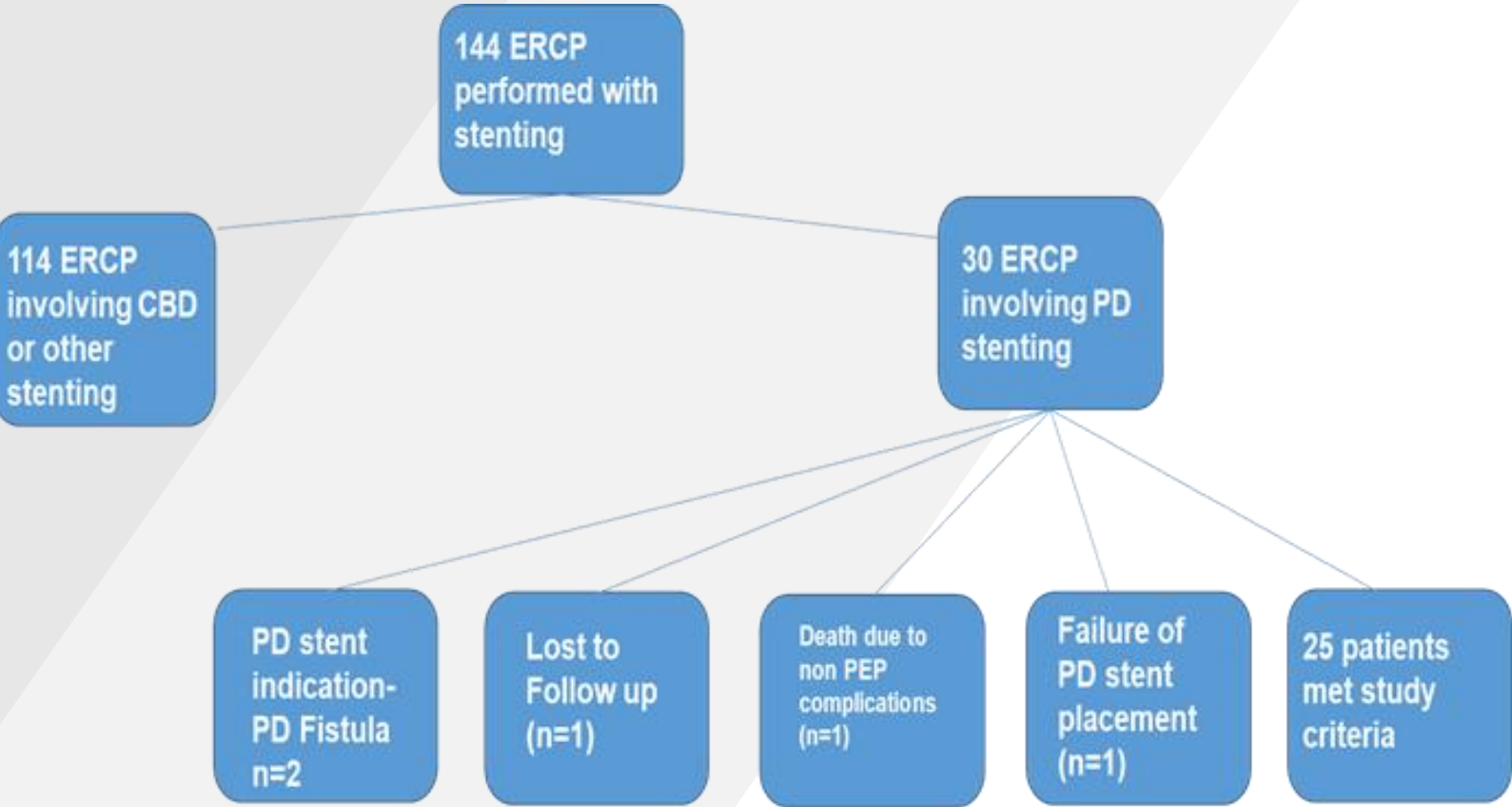

Figure 2: Case Selection

Results

- 25 patients met study criteria
  - 14 Female, 11 Male, Age (24-85, median 50)
  - All patients were high risk for PEP
- ERCP was performed by 11 different expert endoscopists
  - ALL had different retrieval practices
    - Repeat EGD in 1-2 days
    - Follow-up KUB in weeks (varied time frame)
    - No follow-up
    - Planned endoscopy for other indications than PD stent retrieval
- 64% of stents spontaneously dislodged *n*=16
- 60% dislodged within 16 weeks *n*=15/25
- 36% of stents removed by endoscopy within 8 weeks *n*=9

Figure 3: Time to Spontaneous Dislodgement
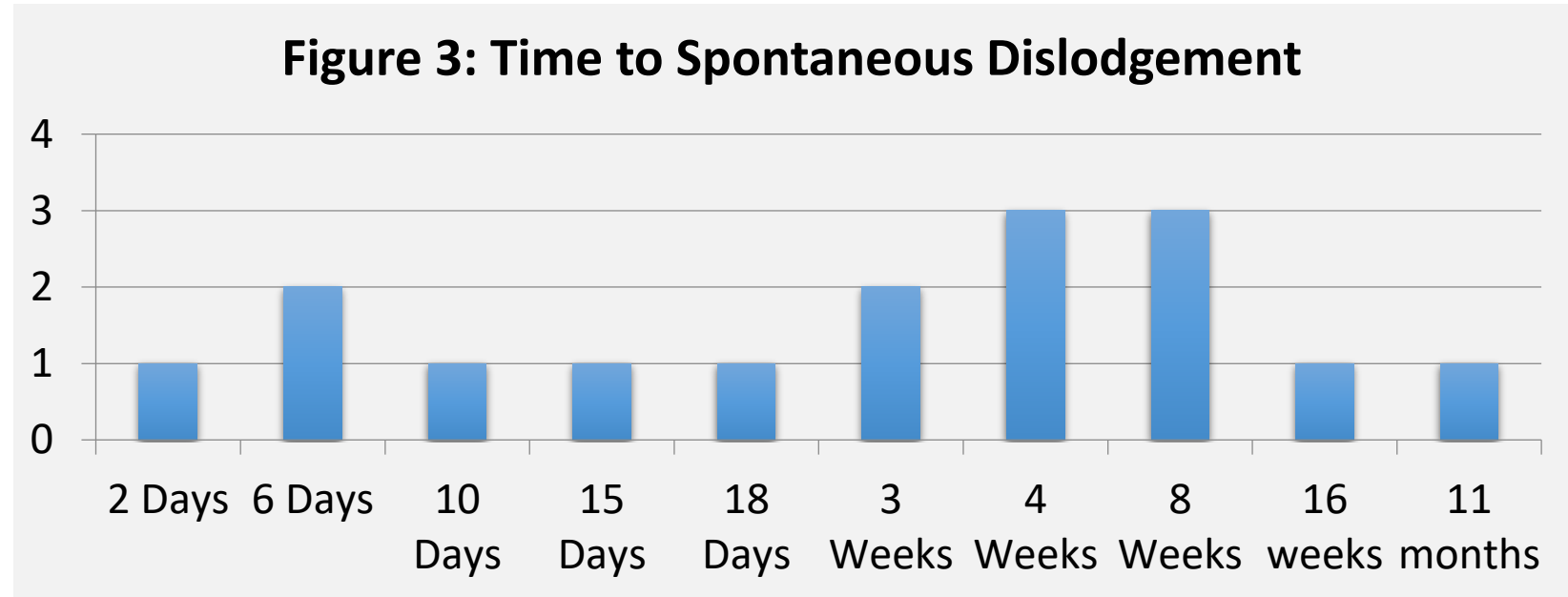
- Characteristics of temporary stents that self extricated
- OR of spontaneous dislodgement is improved with no internal flaps
  - OR 1.5 (95% CI 0.251-8.977) (*p*= 0.657)
- OR of retention with internal flaps
  - OR 0.66 (95% CI 0.111-3.989) (*p*= 0.657)
- OR of spontaneous dislodgment with external structure (flaps or pigtails)
  - OR 8.75 (95% CI 1.21-63.43) (*p*= 0.0319)

- NO COMPLICATIONS OF RETAINED STENTS
  - Infection, pancreatitis, pancreatic duct damage, perforation, stent obstruction, proximal stent dislocation

Figure 1: Temporary Pancreatic Duct Stents
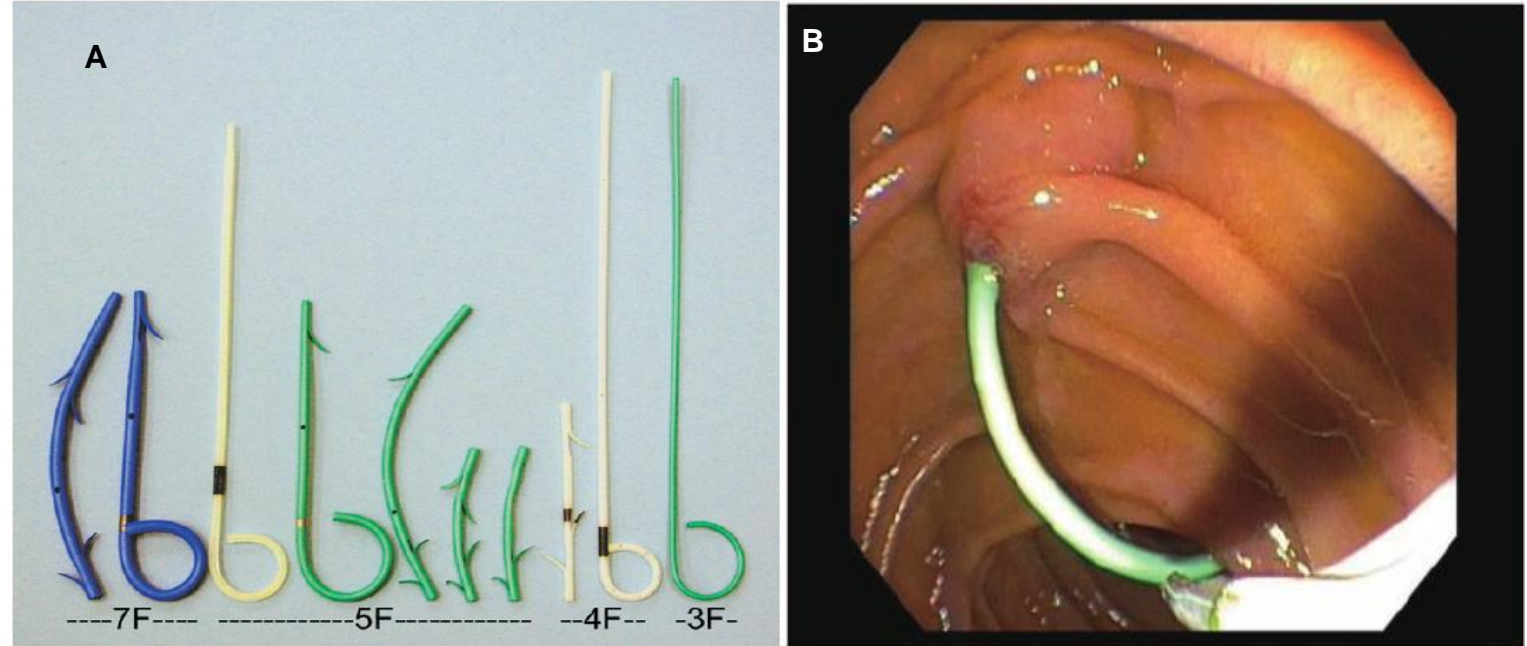
Discussion

- Rates of spontaneous dislodgement are significantly improved with the use of stents with external structures including flaps and pigtails
- Spontaneous dislodgement rates are lower than expected due to endoscopist practice and early repeat EGD
- If allowed 16 weeks, 96% of stents placed would have spontaneously dislodged, likely omitting the need for follow-up
- No complications were noted, and no incidence of PEP
- Identifying whether follow-up of these stents is necessary can save millions of dollars in repeat endoscopy, follow-up imaging, risks associated with anesthesia and endoscopic procedures
- This pilot project will provide baseline information to design a prospective clinical trial evaluating spontaneous dislodgement rates of prophylactic pancreatic duct stents, and appropriate timing of follow-up imaging

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Diet enriched in Palmitic Acid rescues motor function, Tyrosine Hydroxylase, and Dopaminergic neurons from MPTP in C57Bl/6 mice

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Abstract

Introduction: Synucleinopathies, a group of neurodegenerative disorders, are pathologically characterized by the abnormal accumulation of α-synuclein (α-syn) protein in intracellular neuronal and glial inclusions known as Lewy bodies. The role of α-syn in the pathogenesis of synucleinopathies is not well understood but extensive experimental data points to a neurotoxic role of high levels of the protein in its soluble and aggregated form. The cause(s) of synucleinopathies are likely multi-factorial with genetic predisposition and environmental factors contributing to the pathogenesis of the diseases. It is now becoming evident that the nature of our dietary intake influences disease-related genes and may thus potentially increase or reduce our risks of developing synucleinopathies. In the present study, we determined the contribution of the individual fatty acid palmitate to thoroughly elucidate the effects on PD-like pathology in cells and mice.

Methodology: In an effort to pinpoint the effects of palmitate on hallmarks of PD type synucleinopathy and a palmitate enriched diet on the progression of MPTP-induced parkinsonism in a mouse model we utilized many techniques including: differentiation of mouse PSC's into mature dopaminergic neurons, MPTP injections in animals on diet regimens containing altered levels of palmitic acid, bright-field microscopy, immunofluorescence, western blotting, Real Time-RT PCR, Immunohistochemistry, and motor behavior tests such as the pole test and the grip strength test.

Results: We demonstrate that a PA enriched diet is protective against MPTP induced motor strength deficits in C57BL/6 mice. The diet also decreases α-syn content and increases TH content in MPTP injected animals.

Conclusions: Our results show that a diet enriched in PA is protective against the MPTP-induced motor dysfunction, TH decrease, α-syn increase, and DA neuron loss in C57BL/6 mice.

Significance: This data is very significant for it suggests that dietary intervention may be protective against synucleinopathy risk. This finding could save individuals millions of dollars and the aversion of family hardship for individuals suffering with or those associated with individuals that have these debilitating diseases.

Methods

Mouse Dopaminergic Neuronal Differentiation from PSCs: Mouse pluripotent stem cells were differentiated into mature dopaminergic neurons following an optimized protocol provided by the R & D Systems Stem Cell Kit Human/Mouse Dopaminergic Neuron Differentiation Kit.

Mouse Experiments: Male C57Bl/6 mice were obtained from The Jackson Laboratory for this study. At four months of age animals were placed on either a control diet or a PA-enriched diet for 2 months prior to saline or MPTP injections.

Western Blotting: Cultured mouse dopaminergic neurons were treated for 24 hours with varying concentrations of palmitic acid and mouse substantia-nigra tissue was also harvested followed by protein extraction with RIPA buffer. Protein concentrations were determined with the BCA protein assay reagent by standard protocol. Proteins (10μg) were separated in a 5%/12% SDS-PAGE stacking gel for alpha-synuclein and Tyrosine Hydroxylase in 5%/10% SDS-PAGE stacking gel followed by transfer to a polyvinylidene difluoride membrane (Biorad, Hercules, CA) and incubated with antibodies overnight at 4ºC. The blots were developed with Clarity Western ECL Substrate (Biorad, Hercules, CA). The results were quantified by densitometry and represented as total integrated densitometric values.

Bright-field Microscopy: Images of the mouse PSC's differentiation procedure were obtained on an EVOS® cell imaging system with a 10x objective.

Immunofluorescence: Cultured mouse human dopaminergic neurons were treated for 24 hours with varying concentrations of palmitic acid followed by fixation to coverslips with acetone for 5 minutes. Cells were incubated at 4ºC overnight with primary antibodies and then washed 3 times with PBS before being subjected to secondary antibodies for 1 hour. Cells were washed 3 times with PBS and mounted to coverslips with mounting media containing Dapi (Vector Labs, Burlingame, CA).

Real Time-RT PCR: Cultured mouse dopaminergic neurons were treated for 24 hours with varying concentrations of palmitic acid followed by total RNA extraction with the QuickGene RNA cultured cell HC kit S (Autogen, Holliston, MA). 1μg of total RNA was reverse transcribed into cDNA with qScript cDNA SuperMix (Quanta Biosciences, Gaithersburg, MD). Real-time rtPCR was performed on the cDNA with taqman probes for the SNCA (Mm01188700_m1) and TH (Mm00447557_m1) genes (Applied Biosystems, Foster City, CA) and normalized to 18S rRNA.

Immunohistochemistry: The left cerebral hemispheres of C57Bl/6 mice in the four different conditions were sectioned using a freezing microtome. Multiple paraformaldehyde-fixed and sucrose-equilibrated tissues were embedded in a 15% gelatin (in 0.1 M phosphate buffer, pH 7.4) matrix to form sample blocks for simultaneous processing. The blocks were immersed in a 4% paraformaldehyde solution for 3-4 days to harden the gelatin matrix, followed by a 30% sucrose solution that was replaced every 2 days until the blocks were utilized. The blocks were then flash frozen using dry-ice/isomethylpentane, and 40 μm serial sections were cut using a freezing microtome. Serial sections (960 μm apart) were then immunolabeled for the selected proteins. The antigens were visualized using a Vector ABC kit and DAB as the chromogen (Vector Laboratories, Inc., Burlingame, CA) according to the manufacturer's protocols.

Design Based Stereological Cell Counting: The number of TH-positive neurons in the *substantia nigra* of saline- and MPTP-injected mice on the control or PA diet were determined using design-based stereology. The section number start point was random for each brain based on the key anatomical features of the *substantia nigra* positioned ventral and caudolateral to the hippocampus. Non-biased quantification of TH-positive cells was performed using the optical fractionator approach and the optical fractionator workflow in StereoInvestigator 10.0 (Microbrightfield Inc., Williston, VT). Low power tracings of the *substantia nigra* were generated at 2X magnification on an Olympus BX51WI with a motorized x, y and z stage and a minimum of four sections per brain were counted at 120 μm intervals encompassing the entirety of the structure. A range of randomly and systematically selected frames, 250 – 1500 depending on the substantia nigra representation, were counted at 40X magnification with each frame measuring 200 μm X 200 μm and the z-frame threshold distance measured at each counting site. The number and location of counting frames and the counting depth for that section were determined by entering parameters for the sample grid size (250 X 250 um), the thickness of the guard zones (2.5 μm each) and the optical dissector height (25 um). The TH-positive cells were counted if the immunolabeled cell body was fully within the counting frame. The values for total numbers of TH-positive neurons were determined using the optical fractionator formula (N=1/ssf.1/asf.1/hsf. ΣQ-) to quantify the estimated population number using mean section thickness with counts. For the calculations, ssf=section sampling fraction, which was 12 in our study as every 12th section was sampled; asf=area sampling fraction, which is calculated by dividing the area sampled with total area of the *substantia nigra*; hsf=height sampling fraction, which was calculated by dividing the height of the counting frame (25 um) with the section thickness at the time of analysis (40 um as the block advance value), and ΣQ- denotes the sum of the marks counted for the *substantia nigra*. The sampling was optimized for maximal efficiency, with a final mean coefficient of error (CE) of less than 0.01 for each set of sections counted per brain based on preliminary overcounting to determine optimal counting parameters.
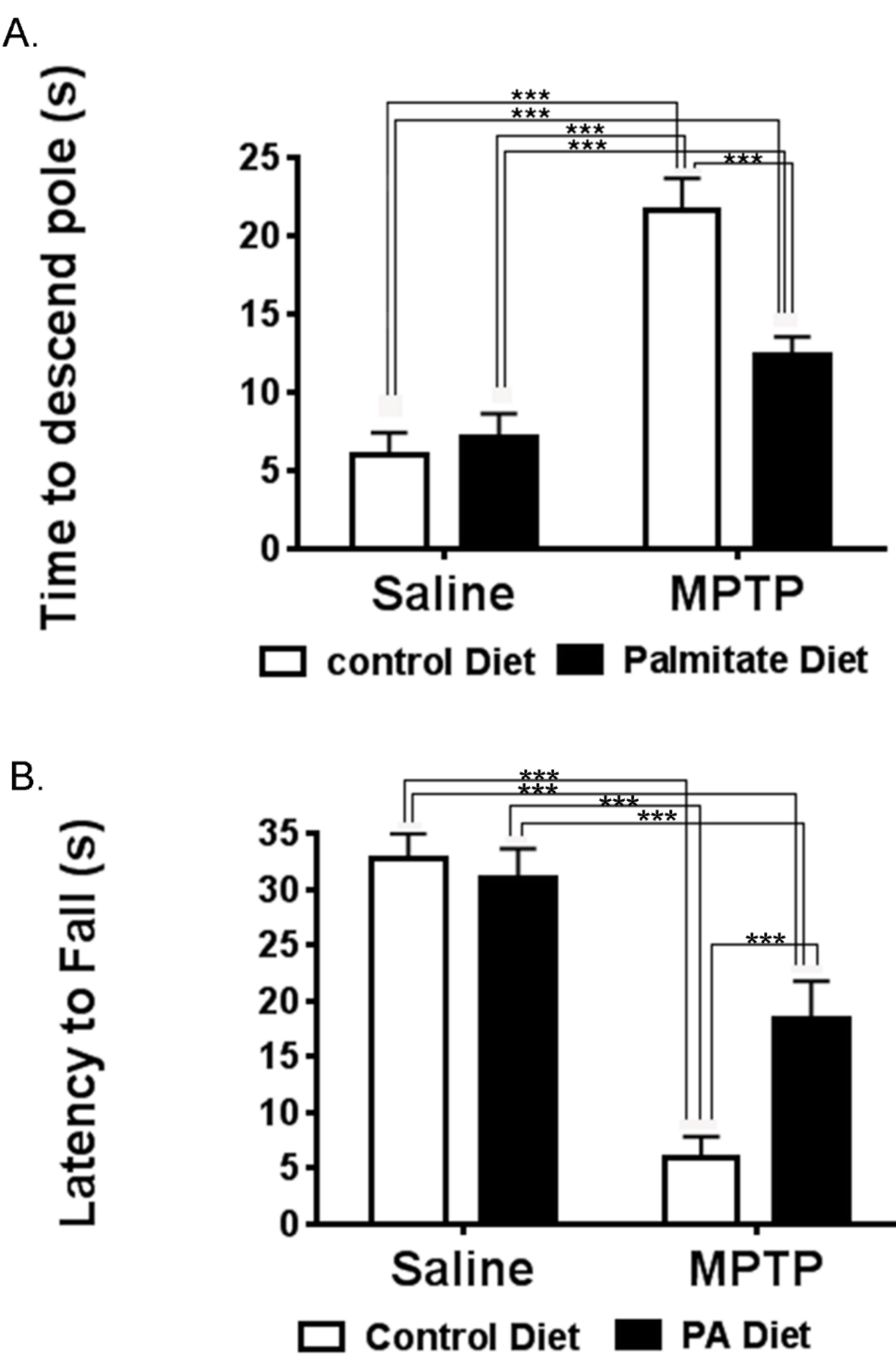
Results

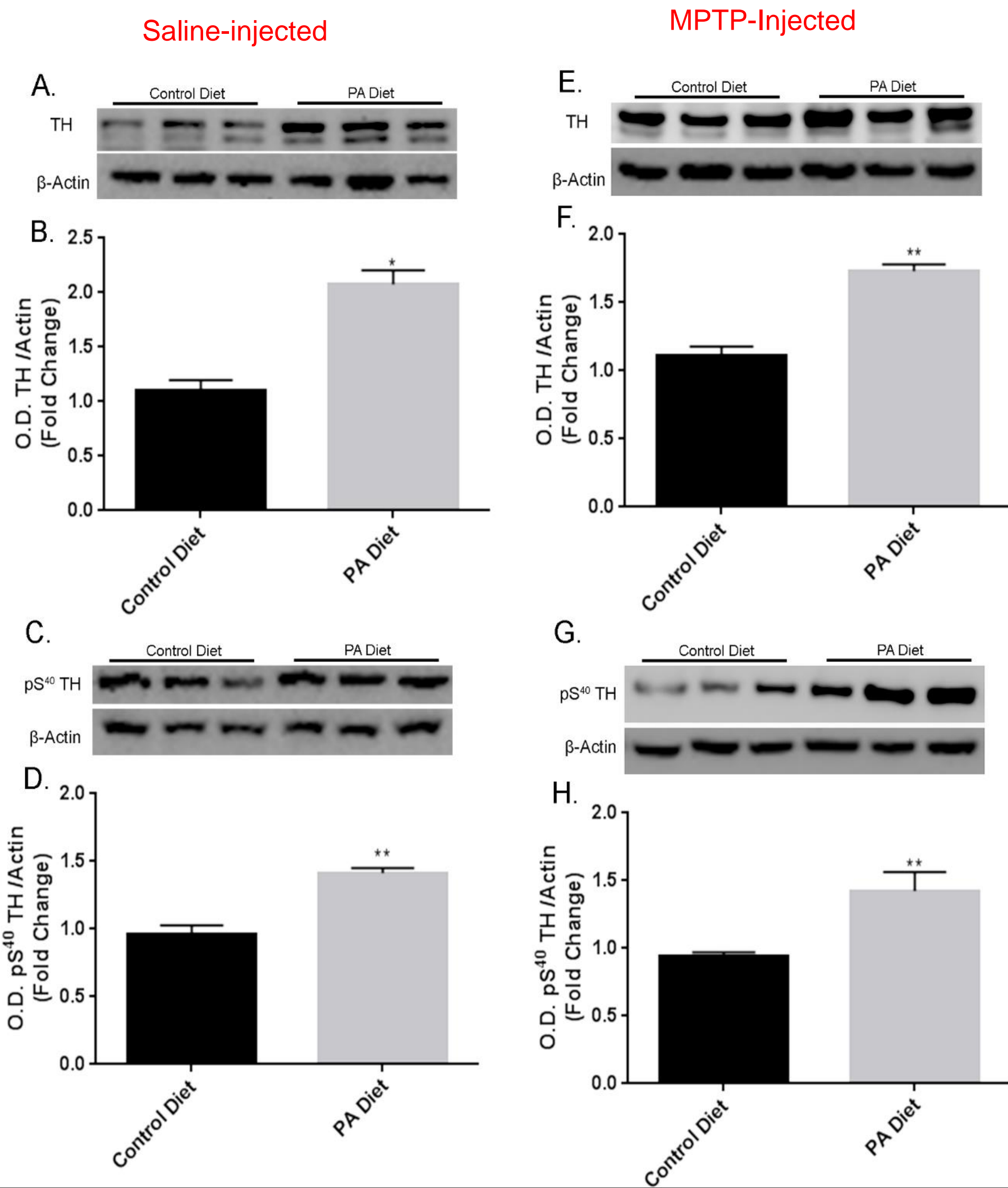### 1. Mouse Dopaminergic Neurons Express Tyrosine Hydroxylase
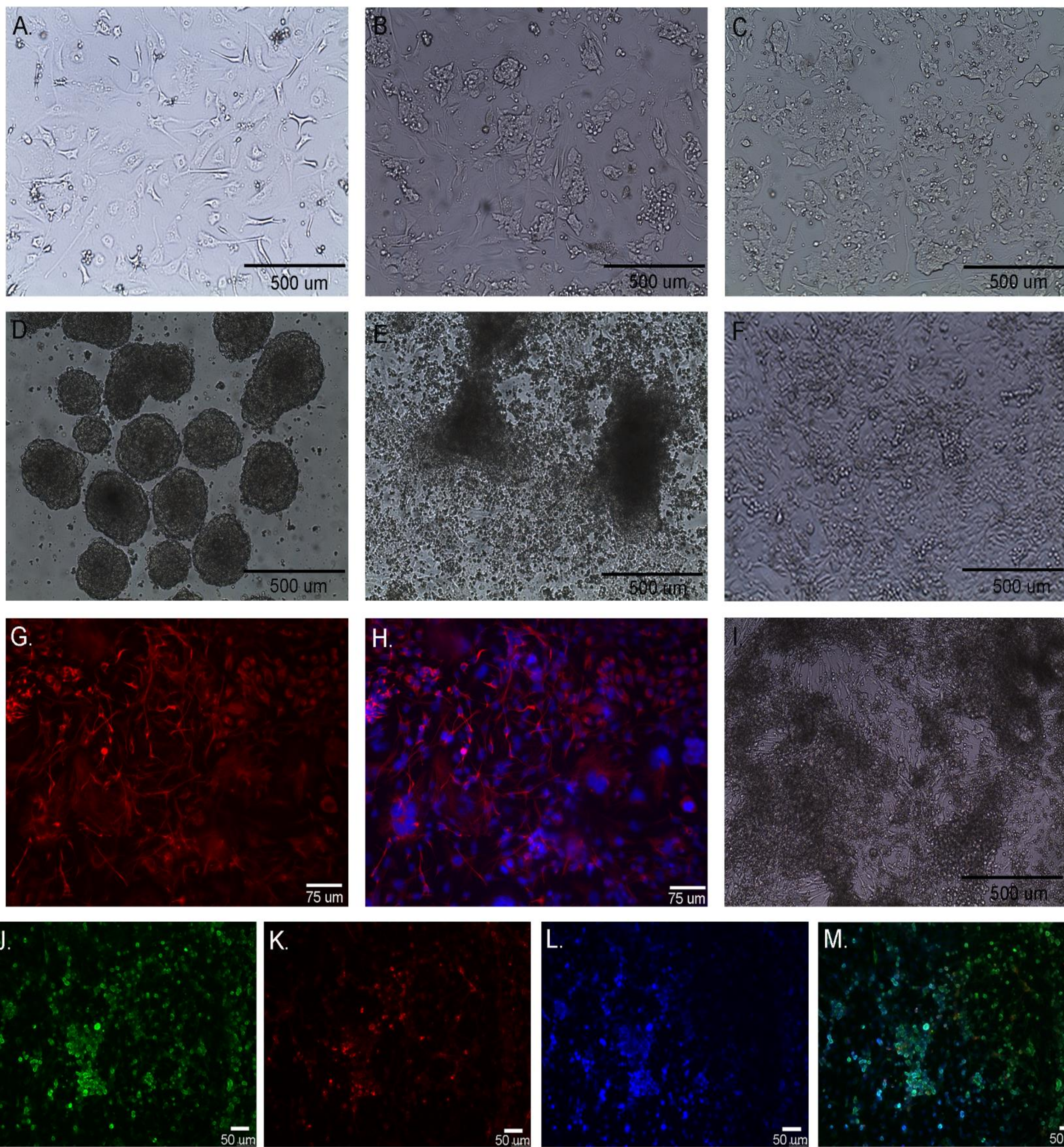
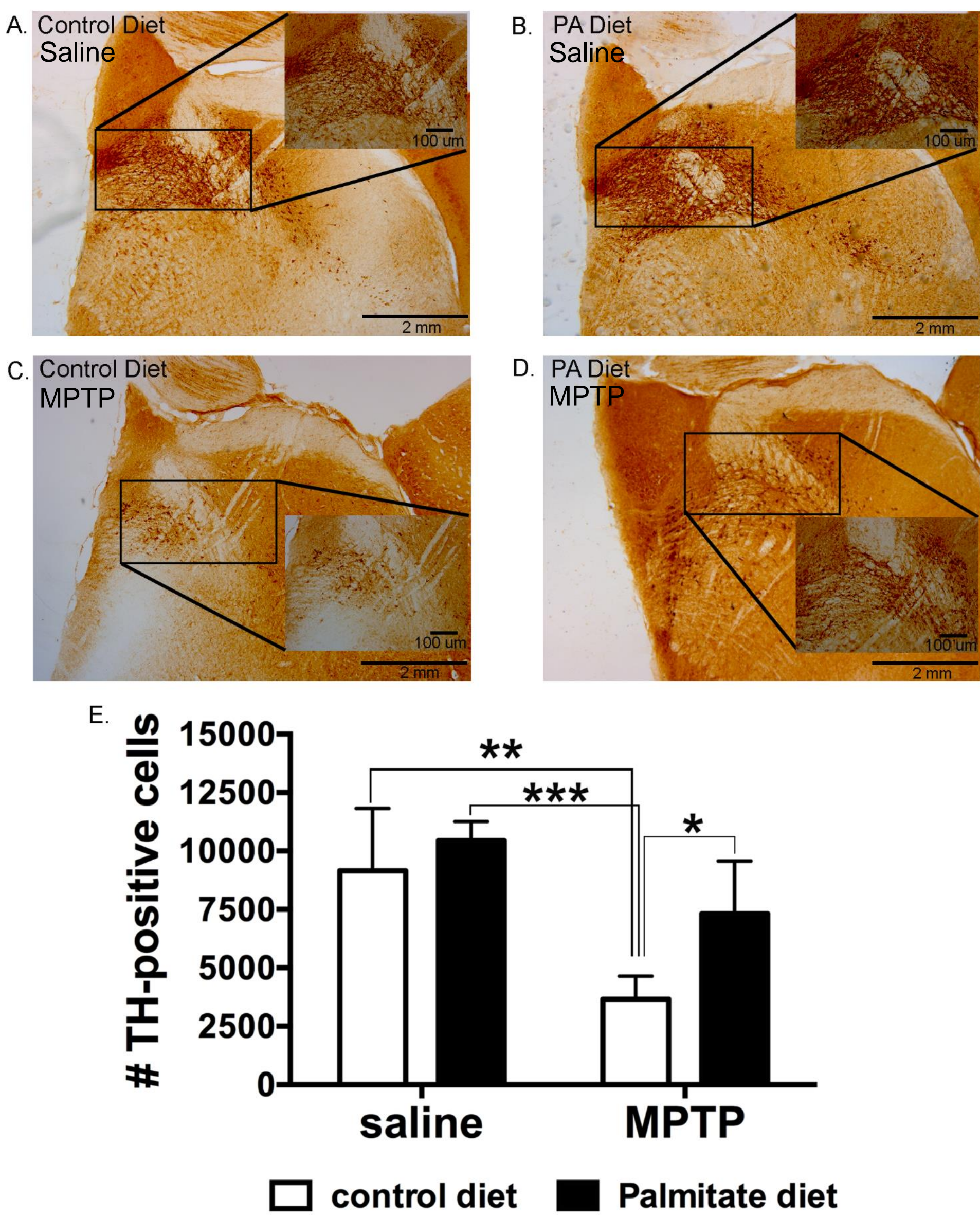### 2. Palmitic Acid decreases α-syn and TH in mouse dopaminergic neurons
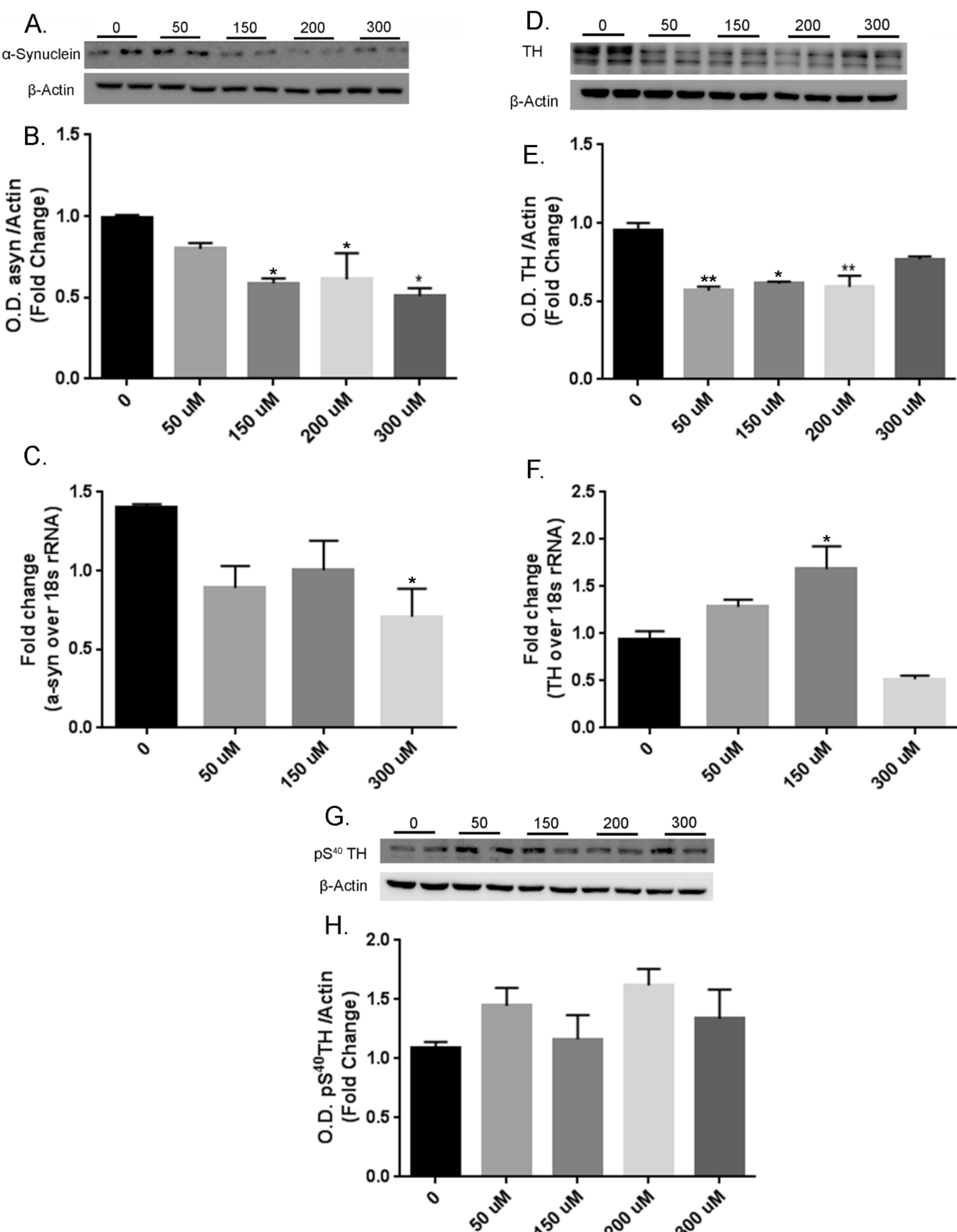
3. PA diet is protective against MPTP-induced motor strength deficits in C57BL/6 mice

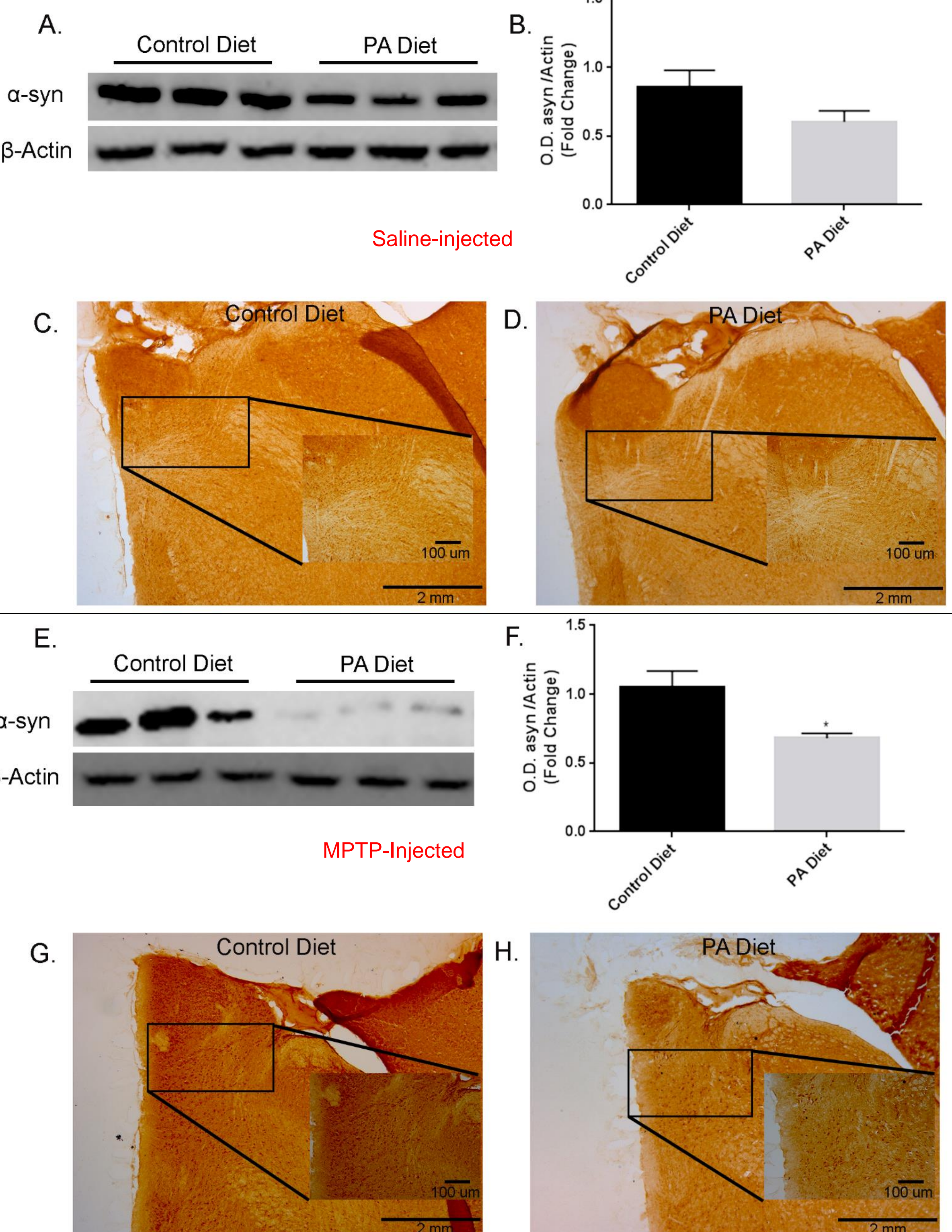### 4. PA diet decreases α-syn content in MPTP injected animals

5. PA diet increases TH content in saline- and MPTP-injected animals

6. PA diet increases survival of TH positive neurons in MPTP-injected animals

Conclusions

Our results demonstrate that PA:

- Decreases α-synuclein and TH levels in mouse dopaminergic neurons
- Is protective against MPTP-induced motor dysfunction
- Decreases α-synuclein levels in MPTP treated animals
- Increases TH and $PS^{40}TH$ levels in saline- and MPTP-injected animals
- Increases TH-positive neuronal survival in the *substantia nigra* of mice
- Such results suggest that a PA diet is protective against the MPTP-induced motor dysfunction, α-synuclein accumulation, TH depletion, and TH neuron loss

Together, our results suggest that a PA-enriched diet may be protective against toxin-induced synucleinopathies.

Acknowledgements

A comparison of nationwide 30-day readmission rates in patients with unruptured cerebral aneurysms that received either surgical clipping or endovascular coiling

Rakan E. Dodin, Michael A. Cerjance, James R. Beal, Ph.D, Abe E. Sahmoun, Ph.D

Abstract

- *Background:*
  - Both endovascular coiling (EVC) and surgical clipping (SC) used
  - Study aimed to assess patient variables that predict type of procedure
  - Does a difference in 30-day readmissions exist?
- *Methods:*
  - Retrospective analysis 1418 patients in 2016 NRD
  - Primary outcome: differences in age, gender, hospital LOS, primary payer, income, hospital teaching status, hospital size
  - Secondary outcome: differences in 30-day readmits
- *Results:*
  - Hospital LOS shorter in EVC (0.000)
  - More Medicare use in EVC (0.018)
  - Lower 30-day readmits in EVC (0.012)
- *Conclusion:*
  - On average older population undergoing EVC
  - EVC lower perioperative morbidity accounts for lower 30-day readmit rates
  - Lower perioperative morbidity leads to shorter stays

Methods

- Retrospective analysis 1418 patients in 2016 NRD
- Primary outcome: differences in age, gender, hospital LOS, primary payer, income, hospital teaching status, hospital size
- Secondary outcome: differences in 30-day readmits

Discussion

- Hunt-Hess grades IV-V in elderly → EVC recommended
  - Consideration of long-term durability not necessary
- EVC now is first-line for Medicare beneficiaries regardless eligibility for SC
  - Less morbidity due to minimally invasive nature
  - SC higher periprocedural morbidity and treatment may not reduce risk of subarachnoid hemorrhage
- 30-day readmit rates significantly higher in patients with longer ICU and hospital stays; infection often most common cause
  - Indirectly supported by our data

Experiments

Variables	Endovascular coiling (n=839)	Surgical clipping (n=579)	P-value
Total hospitalizations (n = 1418)	58.5% (53.5, 63.5) †	41.5% (36.5, 46.5)	
Age, mean ± SEM	59.3 ± 0.6	56.3 ± 0.7	0.000
Gender			0.631
Male	22.8% (19.8, 25.8)	24.1% (20.1, 28.1)	
Female	77.2% (74.2, 80.2)	75.9% (71.9, 79.9)	
Hospital length of stay (days)	1.8 ± 0.1	5.0 ± 0.4	0.000
Income‡			0.582
$1 - $42,999	28.6% (22.8, 34.4)	25.4% (20.0, 30.8)	
$43,000 - $53,999	28.5% (24.4, 32.6)	28.6% (22.5, 34.8)	
$54,000 - $79,999	24.5% (21.0, 27.9)	24.2% (19.5, 28.9)	
$71,000 or more	18.4% (13.8, 23.1)	21.7% (17.0, 26.5)	
Total charges ($)	109,842 ± 6044	117,098 ± 5449.2	0.205
Primary payer			0.018
Medicare	42.9% (39.0, 46.7)	36.3% (31.9, 40.8)	
Medicaid	10.7% (8.7, 12.8)	16.9% (12.7, 21.1)	
Private insurance	39.7% (35.8, 43.6)	41.4% (36.1, 46.6)	
Self-pay, no charge, other	6.7% (4.6, 8.8)	5.4% (3.0, 7.9)	
Hospital size based on # of beds			0.304
Medium	14.6% (8.6, 20.5)	18.7% (11.3, 26.2)	
Large	85.4% (79.5, 91.4)	81.3% (73.8, 88.7)	
Hospital teaching status			0.964
Metropolitan non-teaching	4.9% (2.7, 7.2)	4.8% (2.2, 7.5)	
Metropolitan teaching	95.1% (92.8, 97.3)	95.2% (92.5, 97.8)	
Readmission for any reason	6.5% (5.2, 7.7)	10.7% (6.7, 14.6)	0.012

Conclusions

- Patients who received EVC were older on average
- This same cohort was more likely to be on Medicare
- EVC is minimally invasive and thus lower perioperative morbidity
- This helps explain shorter hospital LOS
- This may also partially account for lower 30-day readmission rates in EVC group

Results

- 58.5% EVC; 41.5% surgical clipping
- 76.5% of patients females
- Average age EVC 59.3 ± 0.6; SC 56.3 ± 0.7 (0.000)
- Hospital LOS in EVC 1.8 ± 0.1; SC 5.0 ± 0.4 (0.000)
- Higher Medicare utilization rates in EVC (0.018)
- SC group more likely to be readmitted within 30 days (0.012)

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Risk Factors for Hospital Readmission Following Cholecystectomy

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Abstract

Background: Cholecystectomy is one of the most common surgical procedures in the United States yet there are relatively significant adverse outcomes with the procedure. Known risk factors for readmission include increased age, male sex, Medicare, Medicaid, surgery performed on weekends, and surgery performed at centers with lower surgical volumes. Current models assessing readmission risks have poor predictive values. We instead suggest assessing patients' risk factors on an individualized level. Our study is being conducted to add additional information regarding patient specific risk factors for hospital readmissions following cholecystectomy.

Methods: We conducted a retrospective review of 77,345 patients who underwent laparoscopic or open cholecystectomies by utilizing the HCUP National Readmissions Database from January 1, 2016 to November 30, 2016.

Results: We found that age ≥65, male gender, Medicare insurance, increasing mortality risk, elective surgery setting, discharge disposition, and length of stay were associated with hospital readmission post-cholecystectomy with a p value of 0.000. The hospital teaching status and location did not have an association with readmission status with a p-value of 0.172.

Conclusions: Our study identified male sex, increased age, Medicare, increased mortality risk, elective admission setting, non-routine discharge, and increased length of stay as risk factors for readmission following cholecystectomy. Teaching status of the hospital was found to not be a risk factor. Readmission increases health care costs and consumes resources. Future studies should focus on obtaining more data on these risks. This will assist in creating an individualized risk model to improve patient outcomes.

Introduction

- Cholecystectomy is one of the most common surgical procedures in the United States
- The most frequent indication for cholecystectomy is gallstone related disease[1]
- Annually, the health care cost of gallbladder disease is $6.2 billion in the United States[1]
- Surgical options include laparoscopic versus open cholecystectomy
- Previous studies have shown an overall decrease in morbidity and mortality with the laparoscopic procedure[2]

- Previous studies have compared:[3]
  - The outcomes of open and laparoscopic
  - Different outcomes depending on the amount of surgeries completed by the hospital
  - Patients with different insurance coverage

- Overall, the evidence has shown mixed results for complication rates between these two surgeries

- Readmission rates for laparoscopic cholecystectomy are overall low at 2.03% [4]
- Reasons for readmission included surgical complications
  - Bile duct obstruction
  - Post-operative pain

- The type of procedure performed and the indication for the procedure have been identified as important predictors of readmission [5]
  - Acute vs. Chronic cholecystitis
  - Intraoperative cholangiography
  - Age
  - Sex
  - Insurance type
  - Day of the week

- Our study was conducted to add additional information regarding patient specific risk factors for hospital readmissions following cholecystectomy
  - We assessed variables on an individual level to increase knowledge of risk factors associated with readmission
  - Our goal was to identify unique relationships that garner further research to improve patient outcomes

Results

Variables	Readmission %(n=5638)	No Readmission %(n=71707)	P value
Total (n=77345)	7.5 (7.2-7.7)	92.6 (92.3-92.8)	
Age group			0.000
< 18	1.6 (1.2-2.0)	2.4 (2.1-2.8)	
18-65	58.9 (57.3-60.4)	69.6 (68.9-70.4)	
>= 65	39.6 (38.0-41.1)	28.0 (27.3-28.7)	
Gender			0.000
Male	43.8 (42.3-45.4)	36.2 (35.7-36.7)	
Female	56.2 (54.6-57.7)	63.8 (63.3-64.3)	
Insurance status			0.000
Medicare	44.7 (43.0-46.5)	30.8 (30.0-31.5)	
Medicaid	18.4 (17.1-19.6)	21.0 (20.1-21.8)	
Private	29.1 (27.6-30.6)	38.3 (37.5-39.2)	
Other	7.8 (6.9-8.8)	9.9 (9.4-10.5)	
Mortality Risk			0.000
Minor	50.3 (48.4-52.1)	74.2 (73.5-74.9)	
Moderate	27.1 (25.7-28.4)	17.2 (16.7-17.7)	
Major	17.5 (16.2-18.8)	6.9 (6.6-7.2)	
Extreme	5.1 (4.4-5.8)	1.8 (1.6-1.9)	
Setting			0.000
Elecvtive admission	19.2 (17.4-21.0)	14.5 (13.4-15.6)	
Non elective admission	80.8 (79.0-82.6)	85.5 (84.4-86.6)	
Disposition			0.000
Routine	75.7 (74.2-77.2)	90.4 (90.0-90.8)	
Transfer to short-term hospital	0.5 (0.3-0.7)	0.2 (0.2-0.3)	
Transfer other*	10.5 (9.5-11.5)	3.7 (3.5-3.9)	
Home Health Care	12.8 (11.6-14.0)	5.5 (5.2-5.9)	
Against Medical Advice	0.5 (0.3-0.7)	0.2 (0.2-0.2)	
Teaching status			0.172
Metropolitan non-teaching	30.2 (27.9-32.5)	31.6 (29.8-33.5)	
Metropolitan teaching	61.2 (58.6-63.7)	59.8 (57.8-61.9)	
Non-metropolitan hospital	8.7 (7.5-9.9)	8.6 (7.8-9.4)	

Methods

- We conducted a retrospective review of 77,345 patients who underwent laparoscopic or open cholecystectomies by utilizing the HCUP National Readmissions Database from January 1, 2016 to November 30, 2019 within a 30 day period

- Data analyzed included: age, sex, insurance status, discharge disposition of patient, admission setting, hospital teaching status, mortality risk (Charlson comorbidity index), length of stay, and type of cholecystectomy (i.e. laparoscopic vs open)

- Analysis was performed using summary statistics and bivariate comparisons (Chi-square tests) with all significance tests were two-sided, P-value < .05 for significance

- Sampling errors were determined using the appropriate survey procedure following the guidance of the NRD documentation, which took into account the clustered nature of the sample

- The yearly Nationwide Readmissions Database (NRD) includes information on hospital readmissions for all types of payers, the uninsured, and inpatient discharges from community hospitals (excluding rehabilitation and long-term acute care, or LTAC, hospitals) in the United States

- We excluded: patients who died during index admission, hospital length of stay, or number of days until the event was missing. We assessed cholecystectomy readmissions with regards to all-cause readmissions within 30 days of the procedures index admission date for all readmissions

Conclusions

1. Our study identified male sex, increased age, Medicare, increased mortality risk, elective admission setting, non-routine discharge, and increased length of stay as risk factors for readmission following cholecystectomy. Teaching status of the hospital was found to not be a risk factor.

2. Readmission increases health care costs and consumes resources Current models centered on readmission risk have poor predictive values. It is suggested that assessing risk factors focused on a patient level have a better prediction outcome. Our study supports this individualized approach, focusing on patient specific variables to better predict readmission risks.

3. Future studies focusing on additional individual factors will continue to increase the insight on risk for postoperative complications. We suggest using a patient specific approach when considering their risk of readmission rather than the current models broadly assessing complication risks. This approach will better identify at-risk patients and efficiently utilize other available resources, such as transitional care units.

Acknowledgements

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Assessing the Relationship of Ambulatory Antibiotic Prescribing Patterns among Upper Respiratory Tract Infections, 2017-2018

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SANFORD HEALTH

BACKGROUND

- Upper respiratory tract infections represent a significant portion of outpatient antibiotic prescriptions, and their inappropriate use is a major driver of bacterial antibiotic resistance

- Antibiotic stewardship efforts have historically focused on hospitals and nursing homes – despite the majority of antibiotic use occurring in ambulatory settings

- Acute sinusitis is the most common outpatient upper respiratory infection for which antibiotics are prescribed; there is a paucity of data on antibiotic prescribing patterns in sinusitis, likely due to challenges in data collection
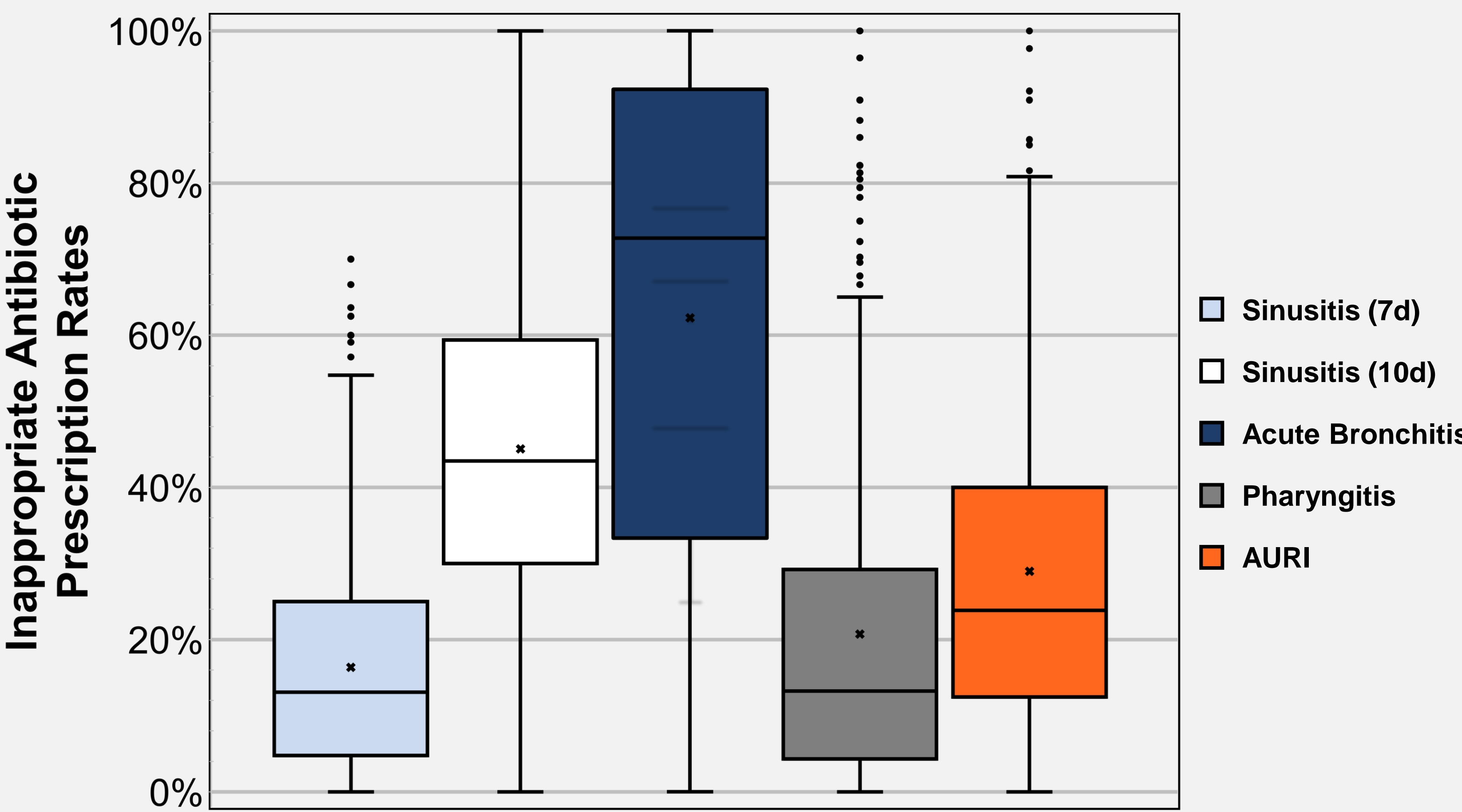
OBJECTIVES

- Investigate the relationship of ambulatory antibiotic prescribing habits among the following four types of upper respiratory tract infections:
  1. Acute bronchitis
  2. Pharyngitis
  3. Viral acute upper respiratory infection (AURI)
  4. Acute rhinosinusitis

- Determine whether automated data collection on prescribing patterns for bronchitis, pharyngitis, and AURIs can be used to make inferences about prescribing habits for sinusitis based on manually abstracted data

METHODS

- Coding data and manual chart review were used to assess prescribing in patient encounters (n=66,306) for Sanford Health providers from the period of June 1, 2017 – May 31, 2018

- According to established treatment guidelines, prescriptions were deemed unnecessary for patients diagnosed with one of the following URIs:
  1. Uncomplicated acute bronchitis
  2. Nonspecific acute upper respiratory tract infection (AURI)
  3. Pharyngitis without positive group A ß-hemolytic streptococcus (GABHS) test
  4. Acute sinusitis without documentation of a guideline-based indication (using both 7-day and 10-day wait criteria)

- Patient encounters were excluded from analysis for the following reasons:
  1. Current immunosuppressed condition
  2. Existing diagnosis of a chronic lung disease
  3. Provider visit for URI within 30 days prior to encounter
  4. Hospitalization within 1 week prior to encounter
  5. Secondary infection requiring antibiotic

- Interrater reliability was assessed on a random subsample of 5% of encounters that underwent manual chart review

RESULTS

- Inappropriate antibiotic prescribing was common among all five respiratory conditions studied with an overall rate of 35% (*Figure 1*)

- Inappropriate antibiotic use was highest for uncomplicated acute bronchitis and lowest for the 7-day sinusitis measure (*Figure 1*)

- Characteristics predicting inappropriate prescribing patterns were analyzed for a total of 366 providers (*Table 1*)

- Male sex was correlated with higher rates of inappropriate antibiotic prescribing across a composite of all four respiratory conditions – using both 7-day and 10-day sinusitis criteria (*Table 1*)

- There were no significant differences in mean prescribing rates between provider types, specialties, or regions (*Table 1*)

- Significant differences were identified between mean prescribing rates for all conditions except AURI and the 7-day sinusitis measure (*Table 2*)

Provider Characteristics (Total n=366)	Total (%)	Mean Composite Rates of Inappropriate Use (7d)	p-values	Mean Composite Rates of Inappropriate Use (10d)	p-values
Sex					
Female	243 (66%)	30.5% ± 15.7%	0.007	37.4% ± 16.6%	0.003
Male	123 (34%)	35.1% ± 15.2%		42.9% ± 15.9%	
Provider Type					
Medical Doctor	157 (43%)	32.8% ± 15.5%	0.592	40.1% ± 16.0%	0.621
Nurse Practitioner	105 (29%)	31.7% ± 16.3%		38.7% ± 17.6%	
Physician Assistant	84 (23%)	32.3% ± 15.7%		39.4% ± 16.6%	
Doctor of Osteopathy	20 (5%)	27.8% ± 13.8%		35.1% ± 15.6%	
Specialty					
Family Medicine	331 (90%)	32.0% ± 15.3%	0.857	39.3% ± 16.3%	0.839
Internal Medicine	35 (10%)	32.5% ± 18.9%		38.7% ± 19.1%	
Region					
Sioux Falls	202 (55%)	31.9% ± 15.6%	0.834	39.7% ± 16.4%	0.538
Fargo	164 (45%)	32.3% ± 15.7%		38.7% ± 16.8%	

Table 1. Provider demographics with comparison of inappropriate antibiotic use rates

Figure 1. Inappropriate antibiotic prescription rates for providers (n=366)

Respiratory Measures	Sinusitis (7d)	Sinusitis (10d)	Acute Bronchitis	AURI	Pharyngitis
Sinusitis (7d)		<0.001	<0.001	0.123	<0.001
Sinusitis (10d)	<0.001		<0.001	<0.001	<0.001
Acute Bronchitis	<0.001	<0.001		0.000†	<0.001
AURI	<0.001	<0.001	<0.001		<0.001
Pharyngitis	<0.001	<0.001	<0.001	<0.001	

Table 2. Pairwise comparisons of mean inappropriate antibiotic prescription rates (p-values)

CONCLUSIONS

- Inappropriate antibiotic prescribing for URIs is widespread among ambulatory care providers, most commonly for acute bronchitis

- Overall inappropriate use (35%) was lower than previous studies have shown (~50%), possibly due to successful ongoing stewardship efforts

- Male sex is more commonly tied to inappropriate antibiotic prescribing

- Using 10-day versus 7-day sinusitis wait criteria, 29% fewer patients met criteria for an antibiotic – this represented ~2,700 prescriptions

- Providers' antibiotic prescribing patterns for AURIs may serve as an indirect measure of their sinusitis prescribing habits with 7-day wait criteria

ACKNOWLEDGEMENTS

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Suicide-Related Over-the-Counter Analgesic Exposures Reported to US Poison Control Centers, 2000 - 2018

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Abstract

Objective: To investigate suicide-related over-the-counter (OTC) analgesic medication exposures among individuals ≥6 years old reported to United States (US) poison control centers.

Methods: Data from the National Poison Data System for the years 2000-2018 were retrospectively analyzed.

Results: From 2000-2018, United States poison control centers recorded 549,807 suicide-related cases involving over-the-counter analgesics, including 327,781 cases (59.6%) admitted to the hospital and 1,745 deaths (0.3%). Most cases involved a single substance (67.5%), and occurred among females (72.7%) and individuals 6-19 years old (49.7%). Overall, the rate of exposures increased significantly by 33.5% from 2000-2018, primarily driven by the increasing exposure rate among 6-19-year-old females. From 2000-2018, exposure rates for acetaminophen and ibuprofen increased, while that for acetylsalicylic acid decreased. Additionally, the proportion of cases resulting in a serious medical outcome or healthcare facility admission increased for all types of over-the-counter analgesics. Acetaminophen and acetylsalicylic acid accounted for 48.0% and 18.5% of cases, respectively, and 64.5% and 32.6% of deaths, respectively. Both acetaminophen and acetylsalicylic acid had greater odds of healthcare facility admission (ORs 2.56 and 2.63, respectively) and serious medical outcomes (ORs 2.54 and 4.90, respectively) compared with ibuprofen.

Conclusion: The rate of suicide-related over-the-counter analgesic cases is increasing. Acetaminophen and acetylsalicylic acid cases are associated with greater morbidity and mortality. Prevention efforts should include implementing unit-dose packaging requirements and restrictions on package sizes and purchase quantities for acetaminophen and acetylsalicylic acid products to reduce access to large quantities of these analgesics.

Background

- Intentional poisonings are the third leading mechanism for all suicide deaths behind firearms and suffocation.[1]
- Acetaminophen and other OTC analgesics are often readily available in large quantities in homes throughout the US.
- Previous research has shown that drug availability can be a factor when considering the medications used for suicide. [2,3]
- While OTC analgesics are used safely by millions of people each year, intentional self-poisonings can result in severe adverse outcomes, including death.[3]
- Some countries have reduced intentional overdoses by implementing strategies to limited the accessibility of acetaminophen and acetylsalicylic acid. No such restrictions exist in the US.[4]

Methods

- Data regarding OTC analgesic exposures with suicidal intent were obtained from the NPDS and retrospectively analyzed. The NPDS is a database of calls to US PCCs maintained by the American Association of Poison Control Centers (AAPCC).
- "Intentional –suspected suicidal" OTC analgesic exposures reported for ages ≥ 6 that occurred between January 1, 2000 and December 31, 2018 were included in the study.
- Age groups were divided into the following intervals: 6 to 19 years, 20 to 29 years, 30 to 39 years, and ≥ 40 years. OTC analgesics studied included acetaminophen alone, acetylsalicylic acid alone (ASA), ibuprofen alone, and other acetaminophen/ASA combinations. Level of healthcare facility (HCF) utilization and medical outcome were assessed.
- Annual exposure rates were calculated using data from the US Census Bureau utilizing July 1 population estimates.
- Trends were analyzed using simple linear regression and piecewise linear regression, as appropriate.
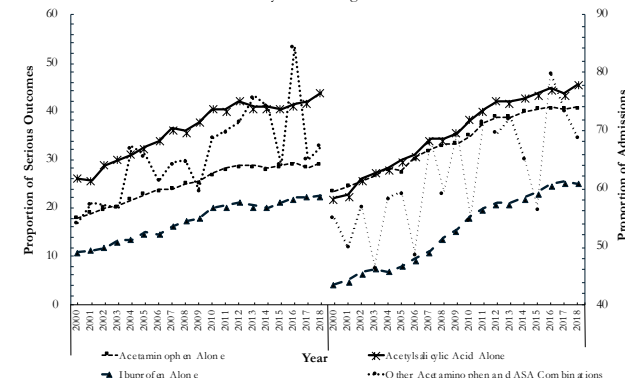
Results

Figure 1. Rate of OTC Analgesic Suicide Exposures by Age Group and Year
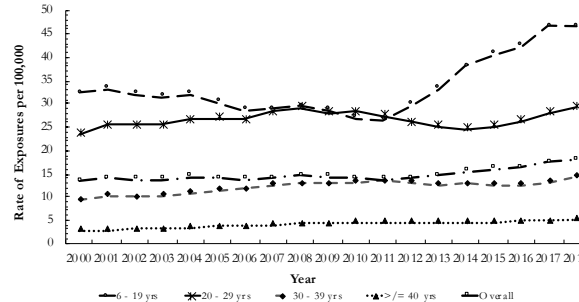
Figure 2. Rate of OTC Analgesic Suicide Exposures by OTC Analgesic
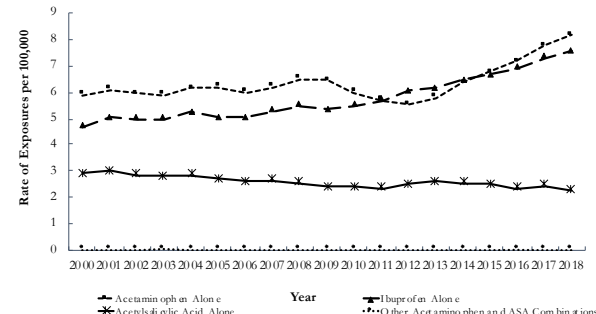
Figure 3. Proportion of Suicide Exposures that Result in a Serious Outcome or HCF Admission by OTC Analgesic

Table 1. Characteristics of suicide-related exposures to OTC analgesic medications by age group, NPDS 2000-2018

Characteristics	6 - 19 Years n (%)†	20 - 29 Years n (%)†	30 -39 Years n (%)†	≥ 40 Years n (%)†	Total n (%)†
Gender					
Female	221006 (80.9)	98415 (65.6)	38095 (62.4)	41844 (64.0)	399360 (72.6)
Male	51900 (19.0)	51420 (34.3)	22911 (37.5)	23508 (35.9)	149739 (27.2)
Unknown	334 (0.1)	226 (0.2)	91 (0.1)	57 (0.1)	708 (0.1)
Type of Exposure					
Single Substance	201254 (73.7)	96809 (64.5)	36233 (59.3)	36774 (56.2)	371070 (67.5)
Poly Substance	71986 (26.3)	53252 (35.5)	24864 (40.7)	28635 (43.8)	178737 (32.5)
Minor Substance Code					
Acetaminophen Alone	123378 (45.2)	73965 (49.3)	31844 (52.1)	34735 (53.1)	263922 (48.0)
Ibuprofen Alone	103561 (37.9)	48497 (32.3)	17594 (28.8)	13590 (20.8)	183242 (33.3)
Acetylsalicylic Acid Alone	45946 (16.8)	27363 (18.2)	11526 (18.9)	16901 (25.8)	101736 (18.5)
Other Acetaminophen and ASA Combinations	355 (0.1)	236 (0.2)	133 (0.2)	183 (0.3)	907 (0.2)
Level of Health Care Received					
No HCF care received	2945 (1.1)	1880 (1.3)	773 (1.3)	573 (0.9)	6171 (1.1)
Treated/evaluated and released	78063 (28.6)	34575 (23.0)	12768 (20.9)	10670 (16.3)	136076 (24.7)
Admitted	152435 (55.8)	88535 (59.0)	38882 (63.6)	47929 (73.3)	327781 (59.6)
Other§	39797 (14.6)	25071 (16.7)	8674 (14.2)	6237 (9.5)	79779 (14.5)
Medical Outcome					
No Effect	95401 (34.9)	45267 (30.2)	17544 (28.7)	16416 (25.1)	174628 (31.8)
Minor Effect	84863 (31.1)	43737 (29.1)	16777 (27.5)	15906 (24.3)	161283 (29.3)
Serious Outcome	41685 (15.3)	29845 (19.9)	15704 (25.7)	24389 (37.3)	111623 (20.3)
Not followed	17133 (6.3)	8353 (5.6)	3118 (5.1)	2728 (4.2)	31332 (5.7)
Unable to follow	34158 (12.5)	22859 (15.2)	7954 (13.0)	5970 (9.1)	70941 (12.9)
Total Exposures (row %)‡	273240 (49.7)	150061 (27.3)	61097 (11.1)	65409 (11.9)	549807 (100.0)

Conclusions

- The overall rate of suicide-related OTC exposures per 100,000 US population showed a significant 33.5% increase during the 19-year study period
- The increasing trend was primarily driving by the increasing exposure rate among 6-to 19-year-old females
- The most striking change in suicide-related OTC analgesic cases occurred after 2011, when the rate of exposures for 6-19 years old increased significantly by 75.5%
- Across all age groups, suicide related-OTC analgesic exposures were more commonly associated with acetaminophen
- The proportion of exposures resulting in a serious medical outcome or HCF admission increased significantly for all types of OTC analgesics
- Acetaminophen and acetylsalicylic acid accounted for 48.0% and 18.5% of cases, respectively, and 64.5% and 32.6% of deaths, respectively
- Prevention efforts should include implementing unit-dose packaging requirements and restrictions on package sizes and purchase quantities for acetaminophen and ASA products to reduce access to large quantities of these analgesics

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Importance of having a personal health care provider to diabetes management

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Introduction

- Diabetes affects approximately 10.5% of Americans.
- Primary care physicians play a crucial role in diabetes management and are responsible for implementing evidence-based guidelines to improve outcomes for diabetic patients.
- Compared to individuals without a primary care physician, Americans with a primary care doctor receive higher quality care, have lower mortality risk, and better self-reported health.
- To our knowledge, this study is the first to directly compare individuals with at least one health care provider to those without a personal health care provider among diabetics.
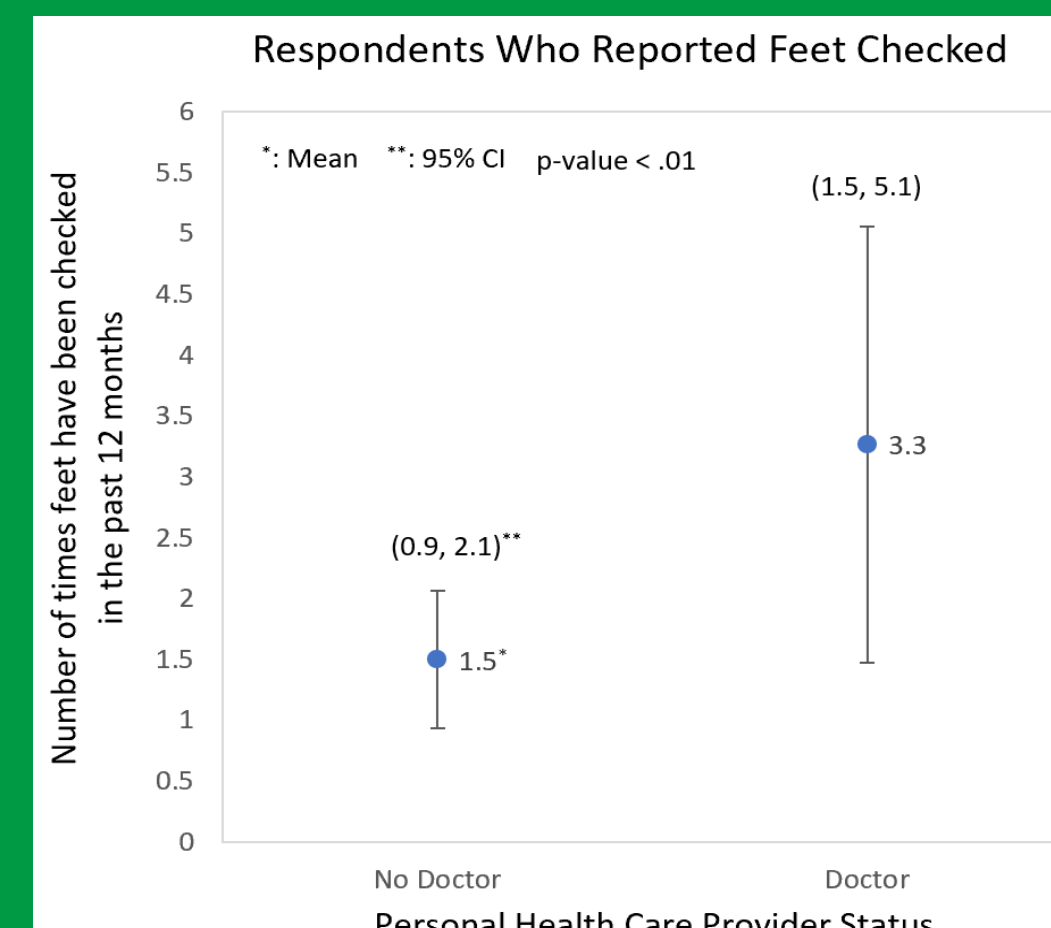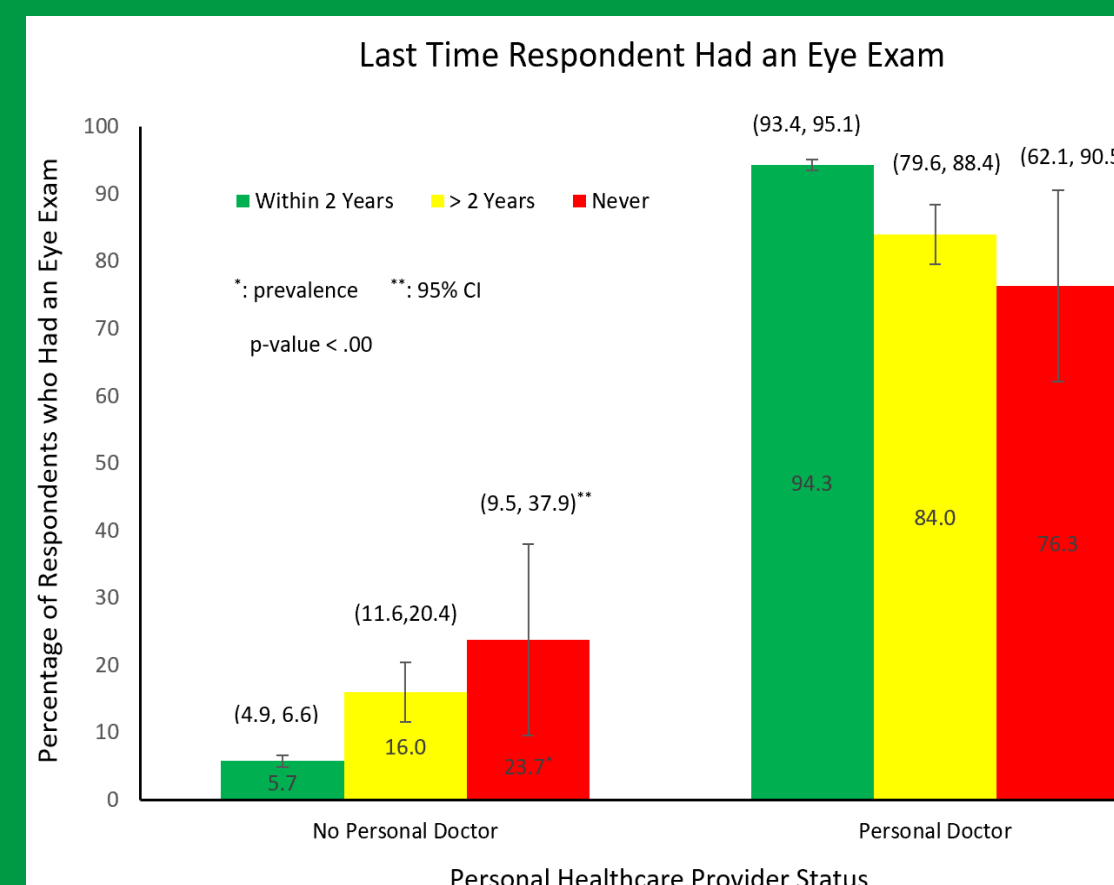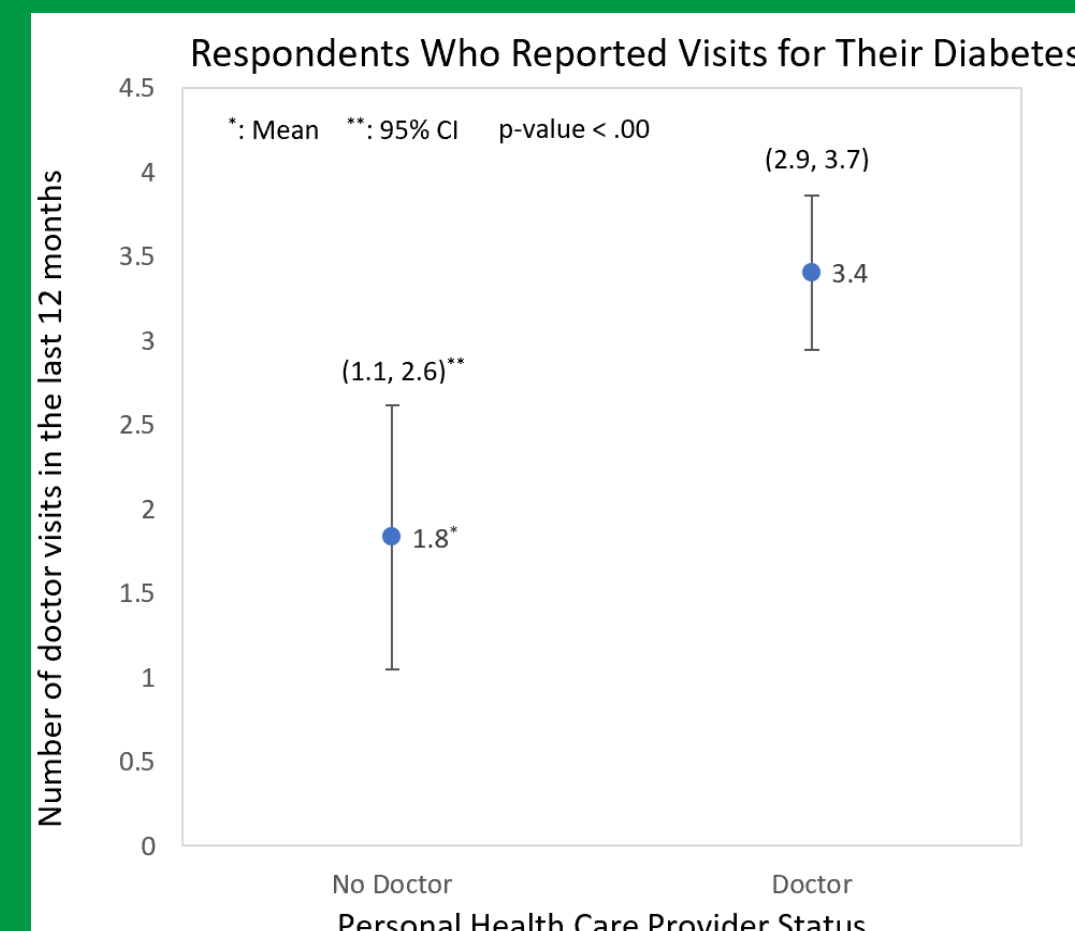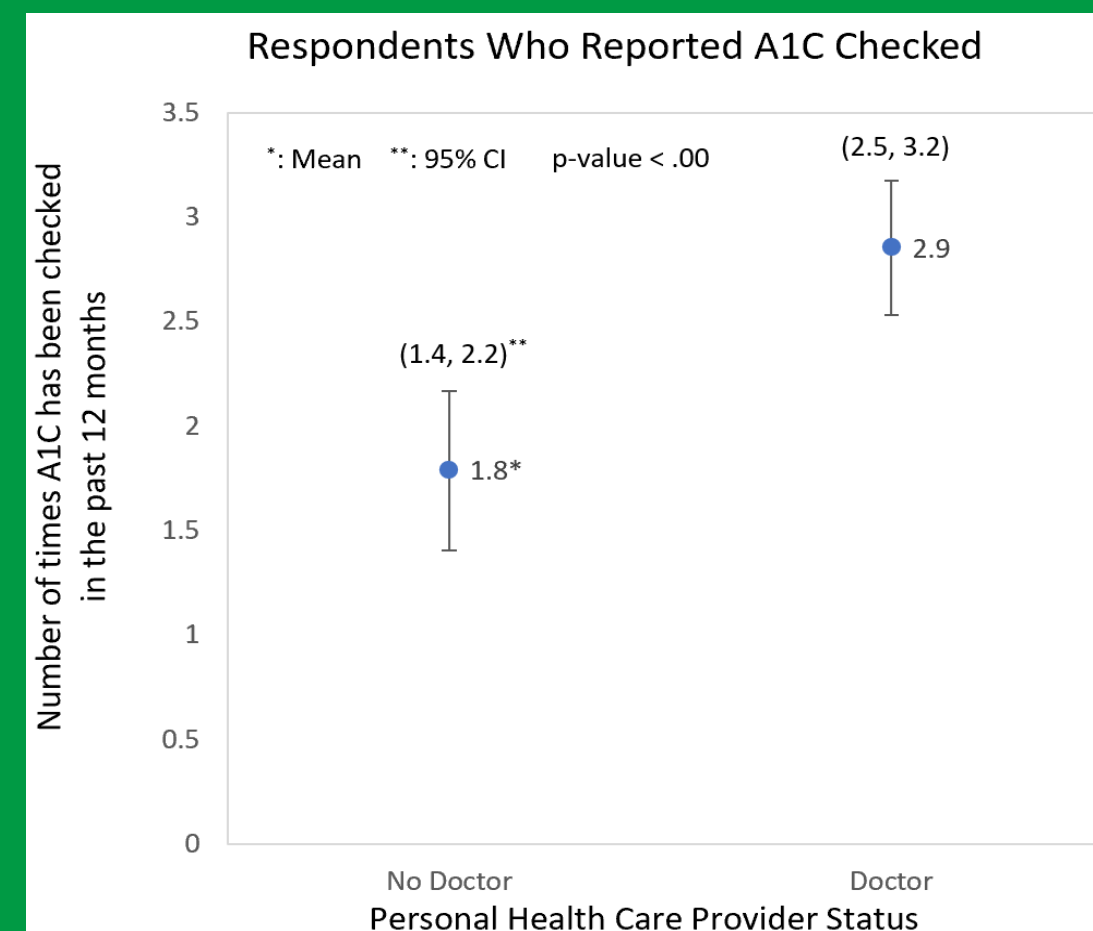
Objective

- To examine whether diabetic individuals without a personal health care provider have lower rates of recommended testing and monitoring of their diabetes.

Methods

- We used survey weighted logistic regression to create a propensity score of not having a personal health provider, adjusting for confounders. We generated national estimates by using survey estimation weights, primary sampling unit clusters, and sampling strata that accounted for the complex survey design of the BRFSS and for nonresponse.
- We compared having at least one personal health provider to not having one.

Results

Of the 51,456 national respondents, 3,035 (7.6%) reported not having a personal health provider.

Respondents Who Reported A1C Checked

Respondents Who Reported Visits for Their Diabetes

Last Time Respondent Had an Eye Exam

Respondents Who Reported Feet Checked

Limitations: Healthy individuals may have chosen to forego having a personal health provider. Including these individuals in the "no personal health provider" comparison group would bias our findings. To guard against this confounder, we used a propensity score weighting approach to eliminate this bias. Recall bias is likely in self-reporting surveys.

Strengths: Use of a large sample size allowed computing stable estimates. All the respondents were sampled randomly, which increases the generalizability of the conclusions. There are only small number of studies that have used individual-level empirical data to assess the association between having a personal health provider and diabetes management.

Conclusions

- Adults who reported not having a personal health provider are significantly less likely to receive recommended testing and monitoring of their diabetes.
- Despite reports recommending that each person have a primary care physician, a significant percentage of the population does not.
- There should be incentives that encourage people to have a personal health provider in order to prevent serious and costly complications from diabetes.

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Biomechanical Evaluation of the Accuracy in Radiographic Assessment of Femoral Component Migration Measurement after Total Hip Arthroplasty

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Introduction

The stability of the prosthetic components after total hip arthroplasty (THA) is critical for long-term implant performance. Implant subsidence is one criteria utilized to monitor for prosthesis loosening after THA with initial implant subsidence assessment often done utilizing plain radiographs. The specific aim of this study was to identify the most reliable references when using plain radiographs to establish an image magnification with the goals of being easy to use, inexpensive, reliable, and accurate. It is hypothesized that using femoral stem length to generate the radiographic image magnification factor will be a more reliable reference for determining femoral stem migration after THA.

Methods

- Two femoral stem implants (stem lengths: 127 mm, 207 mm) were utilized to simulate hemiarthroplasty of the hip with composite femurs. (Figure 1)
- Different combinations of femoral stem distances from the radiographic film (ODD), source-detector differences (SDD), hip rotation, and hip flexion were elected. (Figure 2)
- Standardized anterior-posterior pelvis for each parameter combination setup were taken
- Radiographic measurements were performed by each examiner with 1 day between measurements
- Radiographic image magnification factors were generated from two references (head diameter and stem length).
- Radiograph measurement reproducibility and stem seating length errors using these magnification factors were evaluated

Experiments

- The 2 stem lengths produced a total of 92 X-ray images with varying SDD, ODD, hip flexion, and hip rotation
- 3 examiners measured the femoral head diameter, femoral stem length, and femoral stem seating length of all images a 5 times separated by 1 day
- Stem Seated length error was then calculated using 8 separate formulas using magnification factors derived from the known femoral head (mag_FHD) and femoral stem length (Mag_FSL); Errors shown in Table 1
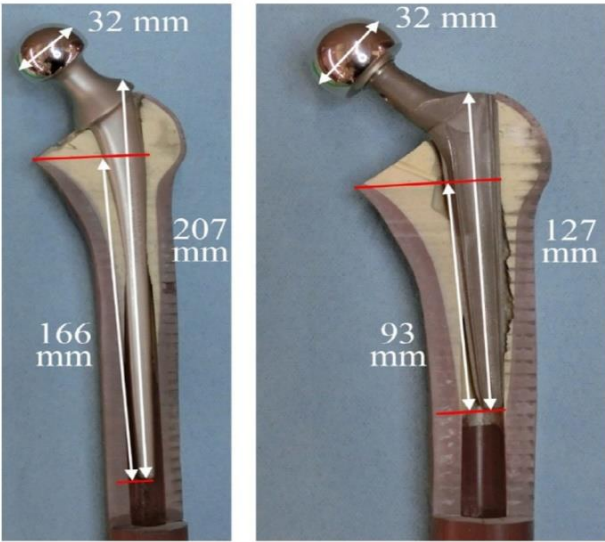

Figure 1: Simulated hemiarthroplasty of the hip using sawbone models with measured femoral stem seating length
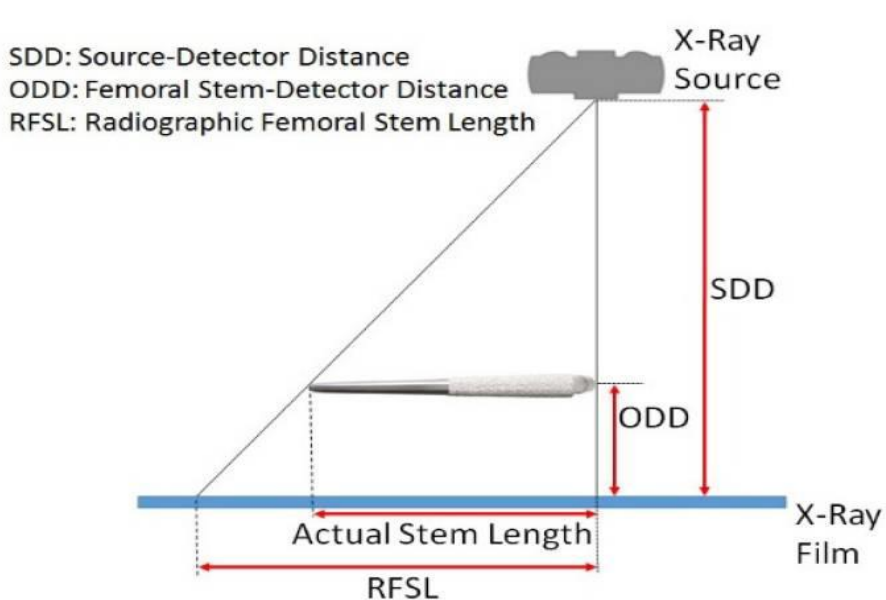

Figure 2: Radiographic image testing setup

Discussion

- Other studies utilizing reference points, lines, and/or markers show variation in measurement 4-12 mm if compared with radiostereometry (gold standard)
- Plain films are limited to 2-D image of a 3-D object
- Even with standardized patient positioning, small changes are inevitable. It was found that small changes in hip rotation, flexion, and ODD lead to significant changes in calibrated measurement error
- Can plain film radiographic parameters truly provide reliable information of THA subsidence?
- Limitations: Sawbones without soft tissue, only two models of implants used, measurement landmarks of stem seated length given limitation in some of the X-ray views
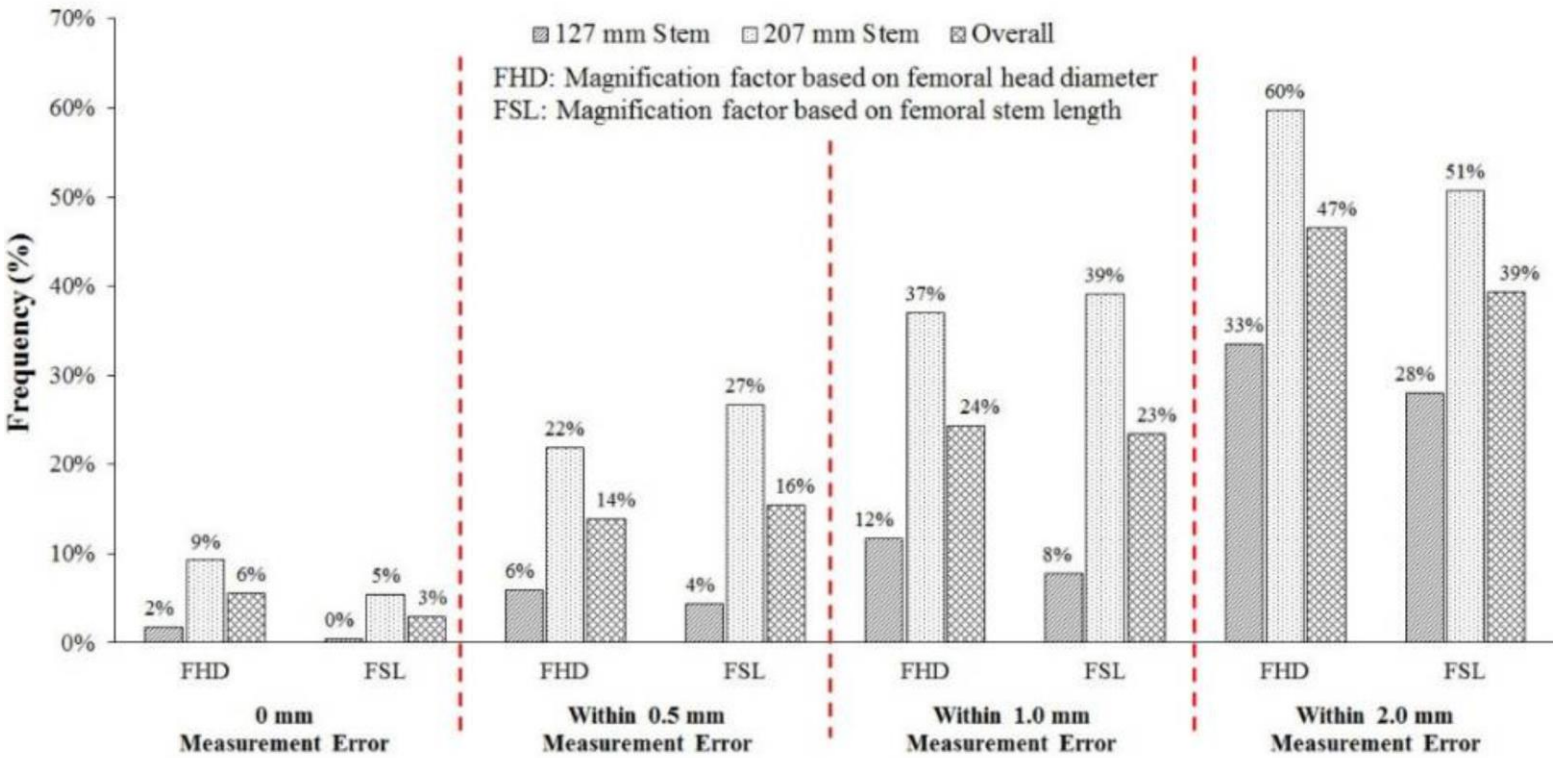
Table 1: Frequency distribution of calibrated stem seating length errors using reference magnification factors

Results

- High level of repeated measurements reliability was found for head diameter (99 ± 0%) and stem length (90 ± 7%) measurements, whereas seating length measurements were less reliable (76 ± 6%)
- Stem length error using the femoral head magnification factor yielded 11% accuracy
- Stem seating length error using both magnification factors were not reliable (< 7% accuracy)
- All parameters, except SDD, showed significant effect on calibrated measurement error

Conclusions

Current methods of assessing the implant subsidence after THA are inaccurate and unreliable. Clinicians should recognize these limitations and be cautious when diagnosing implant stability using plain radiographs alone.

Respiratory-related symptom prevalence among users and non-users of e-cigarettes: A retrospective analysis

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Abstract

- In late 2019, a cluster of temporally-related pulmonary illnesses called E-cigarette or Vaping-use Associated Lung Injuries (EVALI) were reported to the CDC
- Symptoms of EVALI include cough and shortness of breath
- This retrospective study compares the prevalence of respiratory-related symptoms among users and non-users of e-cigarettes

Methods

- Data was obtained from the 2018 Behavioral Risk Factor Surveillance System (BRFSS), exposure/outcome and SAS v9.4 software accounted for the complex sample survey design
- Summary statistics and bivariate comparisons were applied to our data analysis. All significance tests were two-sided, with a P-value < 0.05 for significance

Results

- 269,432 survey respondents were included, with 18% (n=48,598) reporting e-cigarette use
- Respondents reporting e-cigarette use were between 18-64 years (93.6%), male (55.5%), and white (66.1%), and reported a cough most days (24.1%), cough productive of phlegm or mucus (23.1%), and shortness of breath (30.9%) as compared to 15.0% (P= 0.000), 12.7% (P= 0.000), and 22.3% (P= 0.000) in non-users of e-cigarettes, respectively
- Respondents reported asthma in 19.0% of cases, as well as current smoker, former smoker, and never cigarette-smoker in 29.9%, 26.5%, and 31.6%, respectively

Experiments

Variables	E-Cigarette Use (n=48,598)	No E-cigarette Use (n=220,834)	P value
Total respondents (n=269,432)	22.7% (22.3, 23.0)	77.3% (77.0, 77.7)	
Age group			.000
18-64	93.6% (93.2, 93.9)	73.1% (72.7, 73.5)	
65-99	6.4% (6.1, 6.8)	26.9% (26.5, 27.3)	
Gender			.000
Male	55.5% (54.6, 56.4)	45.8% (45.3, 46.2)	
Female	44.5% (43.6, 45.4)	54.2% (53.8, 54.7)	
Race			.000
White	66.1% (65.2, 67.0)	61.4% (60.9, 61.9)	
Black	10.7% (10.1, 11.3)	12.6% (12.3, 12.9)	
Hispanics	15.5% (14.6, 16.3)	17.7% (17.2, 18.1)	
AI/AN	1.0% (0.9, 1.2)	0.6% (0.6, 0.7)	
Other	6.7% (6.2, 7.1)	7.7% (7.3, 8.0)	
Education attainment			.000
Did not graduate High School	12.8% (12.1, 13.5)	14.2% (13.8, 14.6)	
Graduated High School	32.7% (31.8, 33.5)	26.3% (25.9, 26.7)	
Attended College or Technical	37.5% (36.6, 38.4)	29.4% (28.9, 29.8)	
Graduated College or Technical	17.1% (16.5, 17.6)	30.1% (29.7, 30.5)	
Body Mass Index			.000
Underweight	2.4% (2.1, 2.6)	1.6% (1.5, 1.8)	
Normal	34.5% (33.6, 35.3)	30.7% (30.2, 31.1)	
Overweight	32.1% (31.3, 32.9)	35.7% (35.2, 36.1)	
Obese	31.1% (30.2, 31.9)	32.0% (31.6, 32.5)	
Health Insurance status			.000
Yes	83.6% (82.9, 84.3)	88.8% (88.5, 89.2)	
No	16.4% (15.7, 17.1)	11.2% (10.8, 11.5)	
Told Had Asthma			.000
Yes	19.0% (18.3, 19.7)	13.1% (12.8, 13.4)	
No	81.0% (80.3, 81.7)	87.0% (86.6, 87.2)	
Metropolitan Status			.000
Metropolitan	83.7% (83.2, 84.2)	84.7% (84.4, 84.9)	
Non-metropolitan	16.3% (15.8, 16.8)	15.3% (15.1, 15.6)	
Cigarette Smoking Status			.000
Now smokes every day	29.9% (29.1, 30.7)	4.8% (4.6, 5.0)	
Now smokes some days	12.1% (11.5, 12.6)	2.5% (2.4, 2.6)	
Former	26.5% (25.7, 27.3)	23.7% (23.3, 24.1)	
Never	31.6% (30.7, 32.4)	69.0% (68.5, 69.4)	
Had a cough in most days			.000
Yes	24.1% (22.7, 25.4)	15.0% (14.4, 15.6)	
No	75.9% (74.6, 77.3)	85.0% (84.4, 85.6)	
Did cough up Flegm or mucus			.000
Yes	23.1% (21.8, 24.4)	12.7% (12.1, 13.2)	
No	76.9% (75.6, 78.2)	87.3% (86.8, 87.9)	
Have shortness of breath			.000
Yes	30.9% (29.5, 32.3)	22.3% (21.7, 23.0)	
No	69.1% (67.7, 70.5)	77.7% (77.0, 78.3)	

Table 1. Variables examined amongst users and non-users of e-cigarettes per 2018 BRFSS questionnaire

Discussion

- Our data revealed a significant increase in reported prevalence of respiratory-related symptoms among users of e-cigarettes
- They reported a cough most days, a cough productive of phlegm or mucus, and/or shortness of breath significantly more than non-users
- The literature shows a significant increase in the prevalence of similar respiratory-related symptoms as well
- This may suggest a potential relationship between e-cigarette use and the development of respiratory symptoms
- Respondent demographics of individuals with a higher prevalence of e-cigarette use included individuals under the age of 65, male, white, attended college or technical school, had health insurance, and lived in a metropolitan area
- As our study is cross-sectional, future cohort studies are necessary to determine if this relationship is causal
- Secondary characteristics reported by respondents that could contribute to respiratory-related symptoms include a history of asthma and current or former cigarette use
- Future studies would benefit from exclusion criteria that include a history of respiratory disease or cigarette smoking
- As we do not fully understand the relationship between e-cigarette use and the development of respiratory symptoms and EVALI, it is apparent that this is an important area to expand on existing research due to the increasing prevalence of e-cigarette use and the potential health burden of e-cigarette morbidity and mortality

Conclusions

- Our results show a higher reported prevalence of respiratory-related symptoms in e-cigarette users vs. non-users
- Further studies are warranted to account for confounding factors

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Demographic and Behavioral Factors Associated with Malignant Melanoma

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Background

Malignant melanoma is considered the most dangerous form of skin cancer. Recent studies have shown rising incidence of melanoma that represents a real increase in disease burden and not over-diagnosis as a result of increased diagnostic intervention. The identification of subgroups at a high risk of malignant melanoma may result in primary prevention.

Objective: The aim of this study was to determine demographic and behavioral risk factors associated with malignant melanoma.

Methods

We utilized the 2018 Behavioral Risk Factor Surveillance System (BRFSS) to compare individuals who reported being diagnosed with malignant melanoma to individuals with non-melanoma skin cancer. BRFSS is a random representative sample of United States adult residents regarding health-related risk behaviors, chronic health conditions, and use of preventive services. The median survey response rate was 49.9% [range: 38.8%-67.2%]. We generated national estimates by using survey estimation weights, primary sampling unit clusters, and sampling strata that accounted for the complex survey design of the BRFSS and for nonresponse.

Results

Of the 2,180 individuals reporting skin cancer, 36.9 % (n=780) were diagnosed with malignant melanoma.

Males were significantly more likely to be diagnosed with melanoma than female, 45.9% vs. 28.4% (P< .0001).

Age, race, education attainment, health insurance, having a primary care doctor, and cost as a barrier to seeing a doctor were not risk factors for being diagnosed with malignant melanoma.

Figure 1. Effect of time of exposure to sun on Melanoma patients (%)

P<.0001
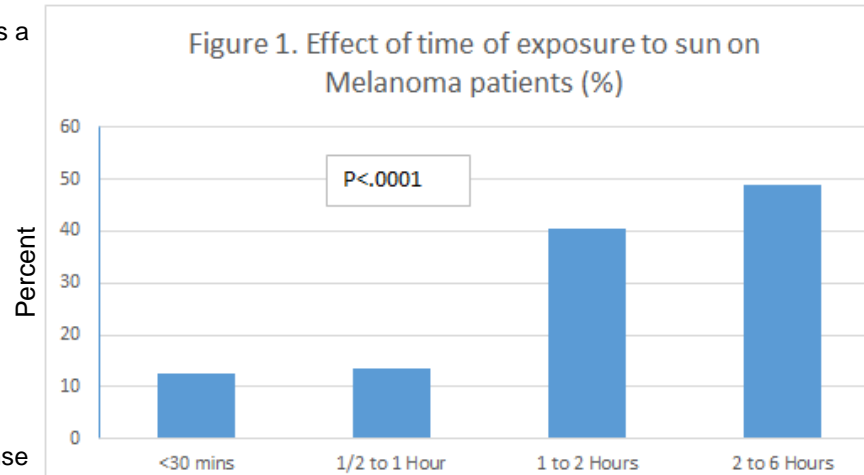
Strengths: Use of a large sample size allowed computing stable estimates. This national dataset included several confounders. All the respondents were sampled randomly, which increases the generalizability of the conclusions. There are only small number of studies that have used individual-level empirical data to determine demographic and behavioral risk factors associated with malignant melanoma.

Limitations: Recall bias is likely in self-reporting surveys. Only few states have asked the questions related to skin cancer.

Discussion

- Among the Melanoma respondents, males are more likely to be affected than women. Previous studies reported that such as Markovic *et al.,* where males were 1.5 times more likely to develop melanoma.[1]

- Exposure to sun more than 2 hours increase significantly the risk of Melanoma. This was studied previously Elwood *et al,* which interestingly concluded that intermittent sun exposure was a risk factor for melanoma vs chronic continuous pattern.[2,3]

Conclusions

- This study showed that male gender and long summer hours in the sun were significant predictors of malignant melanoma.
- Prevention efforts should emphasize the use of sun screen protection particularly for men.
- However, more studies are needed since we still don't truly know the basis in the increase in the lifetime risk of developing melanoma in United States

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A Low-Cost and Effective Tool to Calculate a Community's Substance Use Disorder-Related Hospitalization Risk

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Background

Substance used disorders (SUD) and the opioid crisis remain an ongoing public health problem in North Dakota. Solutions promoted nationwide have been difficult to implement in a predominantly rural state, complicated by the geographical, technological, and staffing challenges. In a paradigm shift, Green et al focused on the **existing resources** to combat this crisis and designed The Calculating for an Adequate Systems Tool (CAST) in 2017. This study, done in 2019, used the CAST tool on a reportedly successful community, Towner County, ND, to quantify the strengths and weaknesses of its SUD crisis response.

Methods

The CAST assesses county-level SUDs care systems for the four SAMHSA Continuum of Care categories with the addition of a fifth category, referral. The tool estimates needs in 32 components of the five categories based on region and community characteristics. The estimated needs are then compared to the existing resources, highlighting under- and overutilized areas. The result was a **global county risk of hospitalization due to SUD**, which was then compared to the national median

SAMHSA Continuum of Care Categories

The CAST and its workbook are practical and freely available.

Sources of information:

- National databases
- Key community leaders
- Construction of proxies with help of the tool's authors

Results

Region Risk of Hospitalization for Drug or Alcohol Related Cause Level	
Total Risk Score	13

The CAST calculated a global **risk score of 13** for Towner County, placing it in the medium range and correlates with a 0-25% increase in hospitalization rate compared to the national median.

Components of the categories of care that exceeded estimated need:

- Promotion category
  – Media based advocacy
  – Marketing advertisements
- Prevention category:
  – Community based programs
  – Housing vouchers
  – Needle exchange programs
  – Prescription drug disposal events/locations

Components	Definition and Units of Measurement	Maximum Community Need	Program Usage Rate	Adjusted community need	Observed Community Totals	Estimated Need
Promotion						
Marketing Advertisements	Individual advertisements placed on tv, radio, print, billboards, web, and social media within one year	14	85%	12	104	92
Media Advocacy Events	Individual, in-person gatherings meant to raise awareness of substance abuse	9	3%	0	4	4
Community Coalitions	Individual coalitions of political, non-profit, and/or business organizations that receive and allocate grant funding to limit substance abuse.	0	7%	0	1	1
Prevention						
School-based prevention programs	Substance abuse prevention programs being implemented within schools. Each program was counted as 1.	0	93%	0	2	2
Community-based prevention programs	Substance abuse prevention programs being implemented within community settings. Each program was counted as 1.	5	12%	1	2	1
Housing Vouchers for homeless residents	Dedicated beds for homeless, across all types of CoC project types	40	20%	8	10	2
Needle Exchange	Number of locations offering needle exchange	0	45%	0	1	1
Prescription Drug Disposal Events/Locations	Number of drug disposal events held per year, combined with all drug disposal locations	0	60%	0	4	4

Components of the categories of care that **did not meet estimated need:**

- Referral category
  – Mental health training for police
- Recovery category
  – Transportation vouchers
  – Parenting classes for those with SUD

Components	Definition and Units of Measurement	Maximum Community Need	Program Usage Rate	Adjusted community need	Observed Community Totals	Estimated Need
Recovery Support						
Religious or spiritual advisors for those who have been involved with treatment in the past 5 years	Individual, religious or spiritual professionals providing substance abuse therapy and counseling	7	11%	1	1	0
12-step groups for those who have been involved with treatment in the past 5 years	Number of substance abuse support groups offered weekly	2	30%	1	4	3
Transportation for those receiving treatment	Number of vouchers provided within a year to assist those seeking treatment	462	14%	65	5	-60
Employment support for those receiving treatment	Number of programs offered by each responding or reported group	2	5%	0	1	1
Educational support for those who have completed treatment in the past 3 years	Number of programs offered by each responding group	0	14%	0	0	0
Parenting education for individuals with a use disorder	Number of programs offered by each responding group	8	7%	1	0	-1
Housing Assistance	Number of programs offered by each responding group	2	7%	0	1	1
Insurance Assistance	Individual professionals who provide insurance enrollment support	1	43%	0	2	2

Conclusions

- The CAST, its handbook, and most of the required data are freely available online.
- Identifies needed or redundant resources and optimizes resource allocation.
- May **reduce hospitalization rate** and improve community SUD care outcomes

Limitations to this study include:

- Development of proxies due to lack of available in rural counties.
- Towner county's services may be used by patients from other counties and vice versa, potentially affecting data.

Further research opportunities include application of the CAST system to other rural counties.

Patterns of Emergency Department Antibiotic Utilization for ARTIs in Adult U.S. Populations

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Background

- Antimicrobial resistance causes >2.8 million antibiotic resistant infections yearly in the U.S., resulting in 35,000 deaths
- Significant costs associated with infections, ranging from impact on patient to a monetary standpoint
- 2001-2010: no significant change in antibiotic prescribing rates in Emergency Department (ED) whereas outpatient setting saw a decrease in the rate of antibiotic use
- Purpose was to evaluate antibiotic utilization for acute respiratory tract infections (ARTIs) in ED setting from 2011-17
- Expected a decrease in inappropriate antibiotic prescribing since 2011 due to pressure to practice antibiotic stewardship

Methods

- Retrospective analysis of adult ARTIs visits to EDs and prescription rates between 2011-2017 utilizing National Hospital Ambulatory Medical Center Survey-Emergency Department (NHAMCS-ED) datasets
  - 4,632 unweighted visits, representing >28 million visits
- Antibiotics based upon NHAMCS-ED's Multum Lexicon Drug Database coding system
- Diagnoses appropriately treated included:
  - Otitis media, Tonsillitis, Sinusitis, Pharyngitis, Non-viral Pneumonia
- Diagnoses inappropriately treated included:
  - Nasopharyngitis, Unspecified URI, Bronchitis, Bronchiolitis, Viral pneumonia, Influenza

Results

- Majority of patient demographics:
  - Females (65.2%)
  - 25-44 years of age (45.3%)
  - White (64.0%)
  - Government insurance (50.9%)
  - Metropolitan statistical area (MSA) (81.5%)
  - Not seen within the last 24 hours (97.3%)
- More likely to receive antibiotic if:
  - ≥45 years old (p=0.005)
  - Male (p=0.039)
  - Living in a non-MSA area (p=0.002)
- Not associated with receiving an antibiotic:
  - Race, insurance status, CBC, Xray, blood cultures
- 57.2% of visits resulted in antibiotic prescription
- Prescribing rates of antibiotics for ARTIs in the ED declined significantly since 2011 from 65.8 to 54.3% in 2017 (p=0.046)

Discussion

- Males more likely to receive an antibiotic, despite females more commonly visiting the ED, comparable to previous studies
- Non-MSA status more likely to receive antibiotics
- ARTIs are more commonly a clinical diagnosis explaining the insignificance of lab work-up
- Study limitations
  - Large estimated sample size
  - Small percentage of patients >65 years

Figure 1: U.S. Emergency Department Visit Antibiotic Rates, 2011-2017
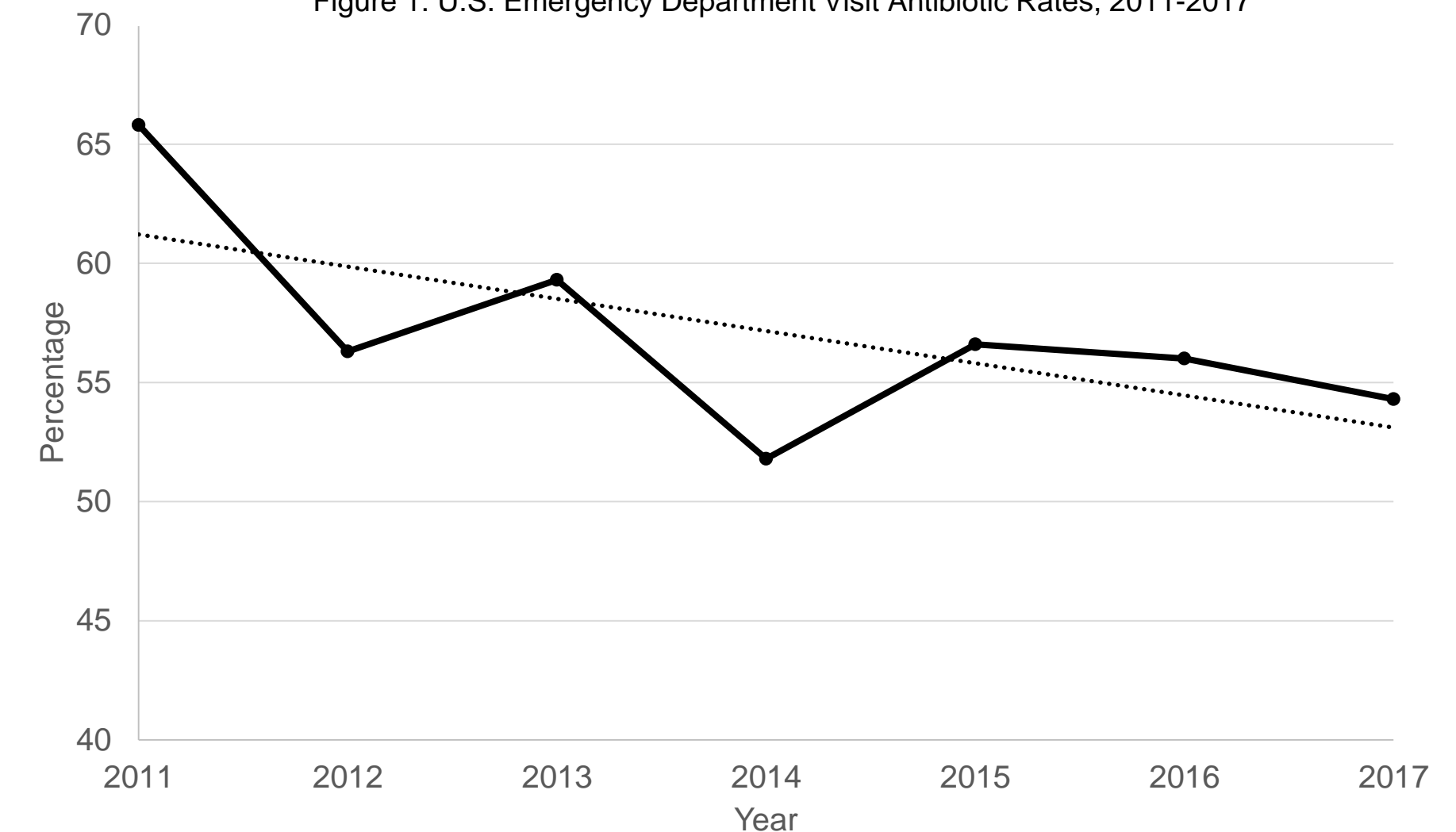
Conclusion

- Prescribing rates of antibiotics for adult ARTIs in the ED decreased significantly since 2011
- Future studies:
  - Observing prescribing rates of specific antibiotic agents and associated hospital antibiograms
  - More participants in each subgroup to elucidate trends or prescribing biases based on age
  - Assessment of therapy duration

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