SURG238: PRACTICAL INTRODUCTION TO CLINICAL RESEARCH

Welcome to Week 5!

Agenda

1. Writing: methods
2. Making great figures/tables
3. Writing: results
4. Making your presentation slide deck

Methods: succinct, but enough detail to replicate results

*craft a personal formula: write systematically ("manuscript factory")

Paragraph 1

Methods

IRB

This cohort study did not meet Stanford University Institutional Review Board review criteria. We followed the Strengthening the Reporting of Observational Studies in Epidemiology guidelines (Supplement). Analytic code is publicly available.[4]

EQUATOR guideline

Analytic code (more later)

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Methods: use subheadings

- “Study population” / “Data source”
- “Primary and secondary outcomes”
- “Variables”
- “Statistical analysis”
- “Missing variables”
- “Sensitivity analysis”

Study Population

The study population comprised National Inpatient Sample 2016 and 2017 encounters of adults aged ≥65 years admitted after traumatic injury. We excluded non-admission encounters and encounters with missing hospital discharge disposition (<0.01%). The study population was randomly split 10:90 into development:validation cohorts (we assigned proportionally more subjects to the validation cohort after considering study population size, computational efficacy, and the need to maximize generalizability [i.e. bias-variance tradeoff]).

Choi J, Marafino BJ, Vendrow EB, et al. Rib Fracture Frailty Index: A risk stratification tool for geriatric patients with multiple rib fractures. *J Trauma Acute Care Surg*. 2021;91(6):932-939. doi:10.1097/TA.0000000000003390

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Methods: follow STROBE etc. checklist

Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (*b*) For matched studies, give matching criteria and number of exposed and unexposed
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (*d*) If applicable, explain how loss to follow-up was addressed (*e*) Describe any sensitivity analyses

If conducting e.g. regression analysis: have to outline method of narrowing down relevant predictors *a priori* and stick with it. Do NOT p-hack (try out different combos of predictors to yield a "significant p-value)

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“But my methods are super complex.” Move details to supplement

main body should give *general* overview of methods

Every paper should have an EQUATOR checklist as supplemental table 1

The cluster with the highest proportion of patients with previously validated frailty markers (Supplemental Data 2) was defined as the frail cluster.[10] We compared demographic, injury, hospital, and hospitalization characteristics of clusters using standardized mean

Supplemental Data 2: A priori-defined frailty markers

Diagnosis	ICD-10 codes
Dementia	G30.x, G31.x, F01.x, F02.x, F03.x, F05.x
Fecal incontinence	R15.x
Urinary incontinence	R32.x, R39.0, R39.1, R39.81
Amnesia	R41.0, R41.1, R41.2, R41.3, R41.8
Poor hygiene	R46.0
Senile	R54.x
Falls	W00.x, W01.x, W03.x, W05.x, W06.x, W07.x, W08.x, W10.x, W18.x, W19.x
Need assistance with activities of daily living	Z73.89, Z73.9, Z74.1, Z74.2, Z74.3, Z74.8, Z74.9
Mobility problems	Z74.0, Z99.3, R26.x
Asthma	J45.x
Chronic obstructive pulmonary disease	J41.x, J42.x, J43.x, J44.x
Pressure ulcer	L89.x
Malnourished	E40.x, E41.x, E42.x, E43.x, E44.x, E45.x, E46.x
Dependent on dialysis	Z99.2
Heart failure	I10.981, I11.0, I13.x

Choi J, Marafino BJ, Vendrow EB, et al. Rib Fracture Frailty Index: A risk stratification tool for geriatric patients with multiple rib fractures. *J Trauma Acute Care Surg*. 2021;91(6):932-939. doi:10.1097/TA.0000000000003390

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Methods: make *all* analytic code publicly-available

Readable code: for your own sake (revisions) and for good science.

Anyone with the dataset should be able to replicate your results, every time.

```
####STUDY AIM #####
  #1) Understand prevalence of 3-month readmissions among geriatric patients with rib fx without polytrauma
  #2) Understand top causes of those readmissions
  #3) Understand associations between index admission charactersitics (injury pattern ,decisions) & readmission


#### PACKAGES ####
library(data.table)
library(devtools)
devtools::install_github("ablack3/icdpicr")
devtools::install_github("vcastro/CCS")
library(icdpicr)
library(tidyr)
library(dplyr)
library(tableone)
library(glmnet)
library(stringr)
library(survival)
library(survminer)
library(survey)
library(srvyr)
library(tableone)
library(questionr)

####DATA EXPLANATION####
#"data" contains cleaned NRD 2017 with the following inclusion criteria:
# adults aged ≥18 years (will subset to older adults later on)
# index hospitalizations of patients with principal diagnosis (ICD_DX1) of multiple rib fractures, and their 3-month readmission encounters


#### DATA CLEANING####
#import dataframe with index rib fx admit encounters + subsequent 3-month readmissions
data<-fread("Data/dHTX_NRD2017_trauma_only_formatted_meet_criteria.csv") #fread to rapidly import large files
  colnames(data)

data_iss<-icdpicr::cat_trauma(data,"I10_DX", TRUE, "roc_max_NIS") # this calculates ISS, AIS scores using ICDpic
  write.csv(data_iss,"/Data/dHTX_NRD2017_data_iss.csv")
```

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What are great tables/figures?

The reader should be able to grasp main purpose + results of study by skimming through tables/figures

What should be in a table?

- "Table 1": often, baseline comparison between 2 groups
  - Do NOT include ALL variables: only relevant ones

- Table/supplemental table can have details to keep your writing succinct
  - Do NOT write out differences between two groups for *every* baseline characteristic

Table 1

Table 1. Characteristics of adults aged ≥65 years with multiple rib fractures classified as frail and not frail by partitioning-around-medoids clustering.
SMD= standardized mean difference.
** Isolated major thoracic injury: abbreviate injury scale- chest ≥3 and non-chest regions <3*

	Frail (N=27,548)	Not frail (N=27,992)	SMD
Demographic Characteristics			
Age, Mean (SD), years	79.9 (7.9)	77.8 (8.3)	0.27
Female, No. (%)	13318 (48.3)	14263 (51.0)	0.05
Frailty diagnosis, No (%)	18195 (66.0)	9458 (33.8)	0.68
≥3 Frailty diagnoses, No (%)	1538 (5.6)	250 (0.9)	0.27
Injury Characteristics			
Sternal fracture, No. (%)	939 (3.4)	1388 (5.0)	0.08
Flail chest, No. (%)	72 (0.3)	67 (0.2)	0.004
Pulmonary contusion, No. (%)	1933 (7.0)	3527 (12.6)	0.19
Injury Severity Score, Mean (SD)	7.6 (7.1)	8.0 (6.9)	0.06
ISS≥15, No. (%)	3410 (12.4)	3416 (12.2)	0.005
Isolated major thoracic injury*, No. (%)	3943 (14.3)	4371 (15.6)	0.04
Hospital Characteristics			
Hospital type, No. (%)			0.11
Rural	2283 (8.3)	2399 (8.6)	
Urban, nonteaching	6232 (22.6)	5626 (20.1)	
Urban, teaching	19039 (69.1)	19967 (71.3)	
Hospitalization Characteristics			
Hospital length of stay, Mean (SD), days	7.7 (8.7)	5.1 (4.8)	0.38
Intubated ≥24 hours, No (%)	478 (1.7)	67 (0.2)	0.15
Disposition to home, No (%)	2610 (9.5)	11280 (40.3)	0.76
Mortality, No (%)	3543 (12.9)	355 (1.3)	0.47

Detailed description:
"stand alone"

Footnotes/abbreviation

Alignment

Decimal places
- P values: 2 decimals OR 3 decimals (if <0.01) OR "<0.001"

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Table 1

Useful package: R- “tableone”

Other tables

If reporting OR/RR/IRR, ALWAYS report 95% CI (more important than P value)

Table 2. Number of Cancers and IRRs

Outcome	Patient group, No. of cancers		IRR (95% CI)[a]	No. of excess cancers in CT-exposed group[a,b]	Absolute excess incidence rate per 100 000 person-years (95% CI)[a,c,d]
	CT-exposed (n = 306 727)	CT-unexposed (n = 519 093)			
Primary[e]					
Hematologic malignant neoplasms	323	500	1.26 (1.09 to 1.45)[f]	66[g]	4.44 (1.83 to 6.70)
Lymphoma (*ICD-10* codes C81-C88)[h]	116	199	1.13 (0.84 to 1.51)	13	0.90 (−1.46 to 2.65)
Multiple myeloma (*ICD-10* code C90)[h]	41	54	1.31 (0.78 to 2.21)	10	0.66 (−0.77 to 1.51)
Leukemia (*ICD-10* codes C91-C96)[h]	125	185	1.40 (1.04 to 1.87)[i]	35	2.38 (0.35 to 3.90)
Myelodysplastic syndromes and others (*ICD-10* codes D45-D46, D47.1, D47.3-D47.5)[h]	41	62	1.21 (0.73 to 2.01)	7	0.49 (−1.00 to 1.39)
Secondary[j]					
Abdominopelvic organ cancers	1152	2420	1.07 (1.00 to 1.15)	76	11.08 (−0.43 to 21.80)
All cancers					
Excluding hematologic malignant neoplasms	2173	5022	1.02 (0.97 to 1.07)	44	6.51 (−9.80 to 22.01)
Including hematologic malignant neoplasms	2338	5323	1.04 (0.99 to 1.09)	85	12.44 (−4.23 to 28.32)

Abbreviations: CT, computed tomography; *ICD-10*, *International Statistical Classification of Diseases, 10th Revision*; IRR, incidence rate ratio.

[a] Adjusted for age and sex.

[b] The excess number of cancers attributed to abdominopelvic CT radiation exposure in the exposed group was calculated as [1 − (1/IRR)] times the observed number of cancers in the exposed group.

[c] The excess number of cancers was divided by the total number of person-years of the exposed group to estimate the absolute excess incidence rate in the exposed group compared with the unexposed group.

[d] Because the absolute excess incidence rate was derived using the IRR estimate, its 95% CI was obtained similarly using the uppermost and lowermost values of the 95% CI of the IRR.

[e] Analyzed based on a 2-year lag period.

[f] Statistically significant at 2-sided $P < .05$.

[g] Because of rounding, the total number of excess cancers is not equal to the sum of the subcategories.

[h] 98.75% CIs were calculated to adjust for multiple testing using Bonferroni correction.

[i] Statistically significant at 2-sided $P < .0125$.

[j] Analyzed based on a 5-year lag period.

Lee KH, Lee S, Park JH, et al. Risk of Hematologic Malignant Neoplasms From Abdominopelvic Computed Tomographic Radiation in Patients Who Underwent Appendectomy. *JAMA Surg*. Published online January 20, 2021. doi:10.1001/jamasurg.2020.6357

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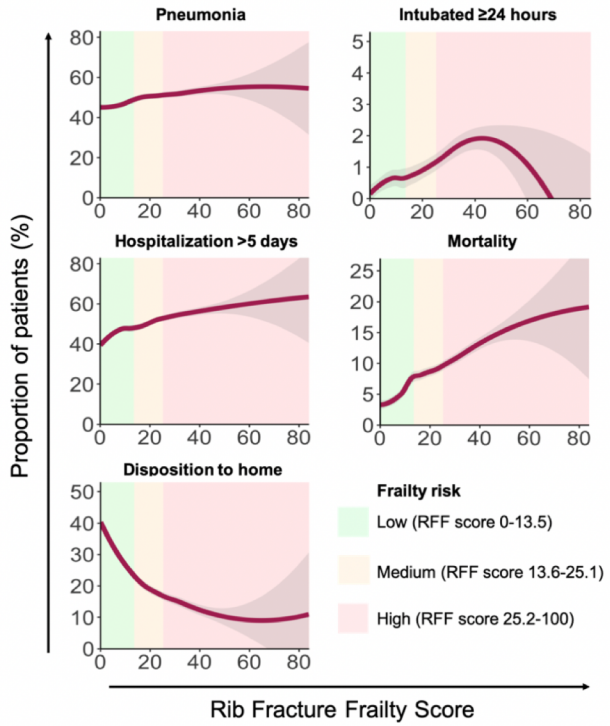
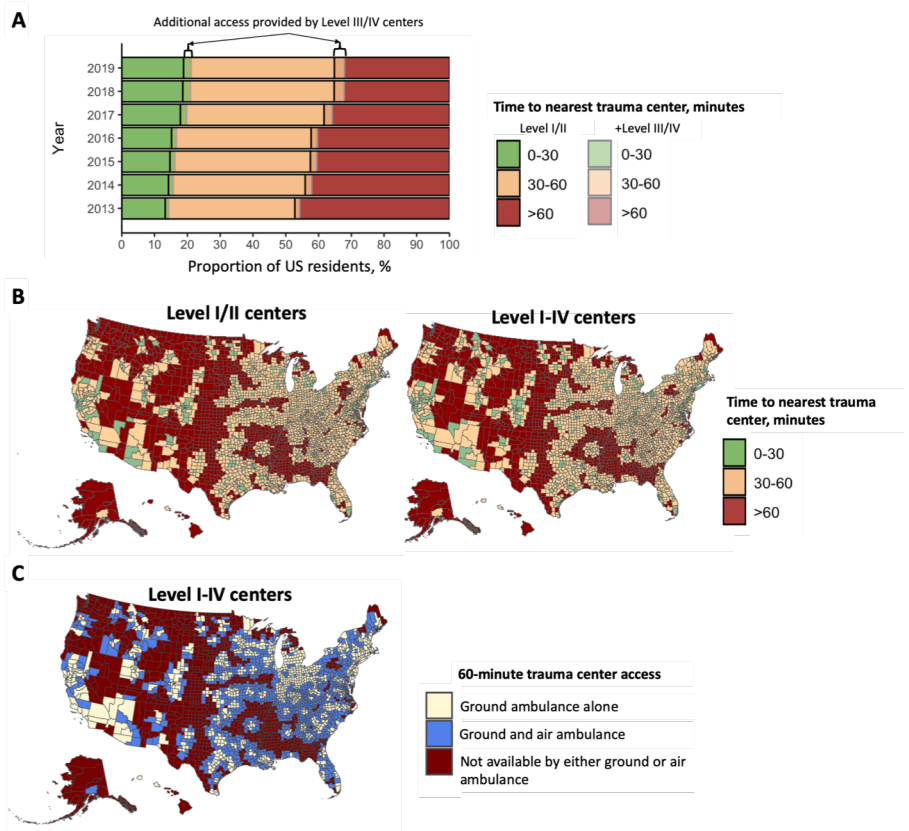
Figures should stand on their own

Figure 1. Association between Rib Fracture Frailty scores and outcomes of geriatric patients with multiple rib fractures (external validation cohort).
Locally Weighted Scatterplot Smoothing (LOWESS) lines with 95% confidence intervals (shade).



Choi J, Marafino BJ, Vendrow EB, et al. Rib Fracture Frailty Index: A risk stratification tool for geriatric patients with multiple rib fractures. *J Trauma Acute Care Surg*. 2021;91(6):932-939. doi:10.1097/TA.0000000000003390

Figure 1. A. Nationwide trend in access to American College of Surgeons Committee-on-Trauma-verified trauma centers (by ground or air ambulance transport), 2013-2019. B. Time to nearest American College of Surgeons Committee-verified trauma center (by ground or air ambulance transport), 2019. C. Regions with 60-minute trauma center access by ambulance transport modality.
Maps display county-level data.

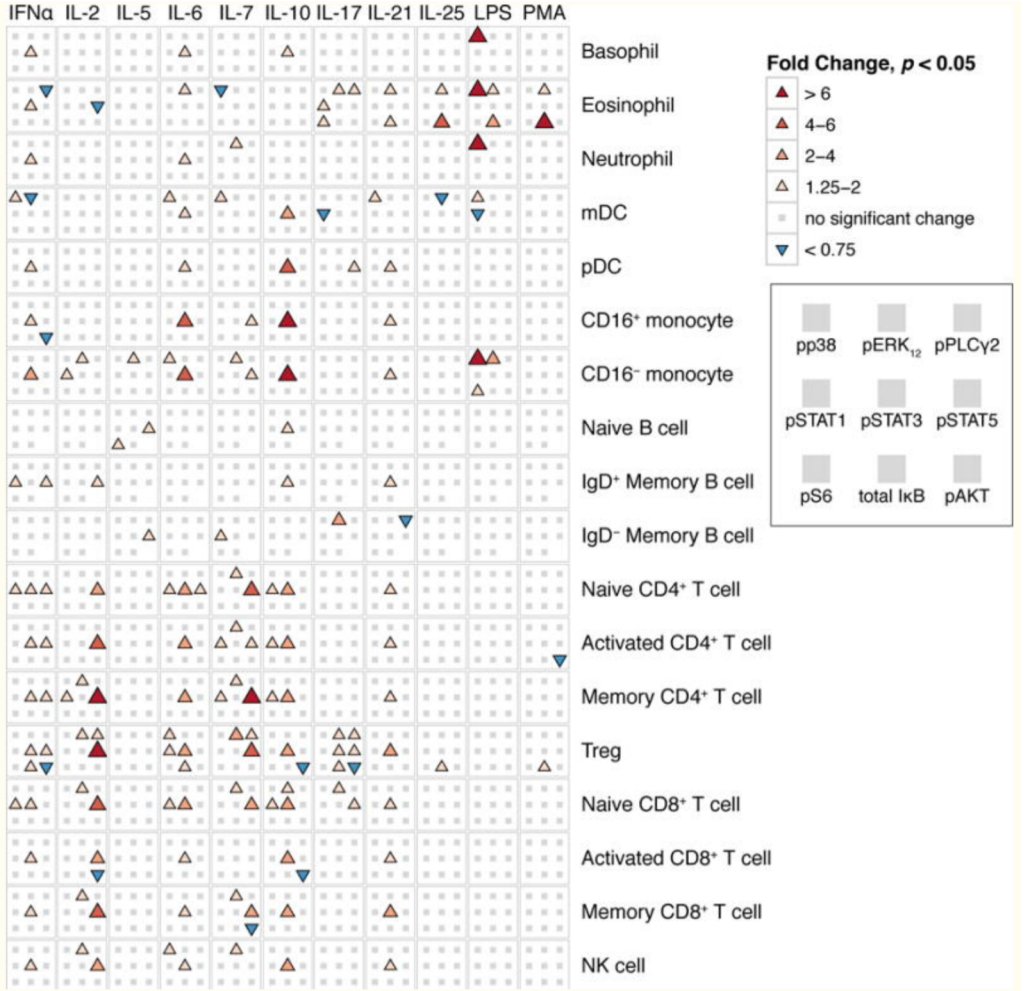


Choi J, Karr S, Jain A, Harris TC, Chavez JC, Spain DA. Access to Trauma Centers in the United States, 2013-2019. *Under Review*

Slides by J.Choi 2022

Making figures: you can do better than excel!

If using R: master the “ggplot2” package



Choi J, Fernandez R, Maecker HT, Butte MJ. Systems approach to uncover signaling networks in primary immunodeficiency diseases. *J Allergy Clin Immunol*. 2017;140(3):881-884.e8. doi:10.1016/j.jaci.2017.03.025

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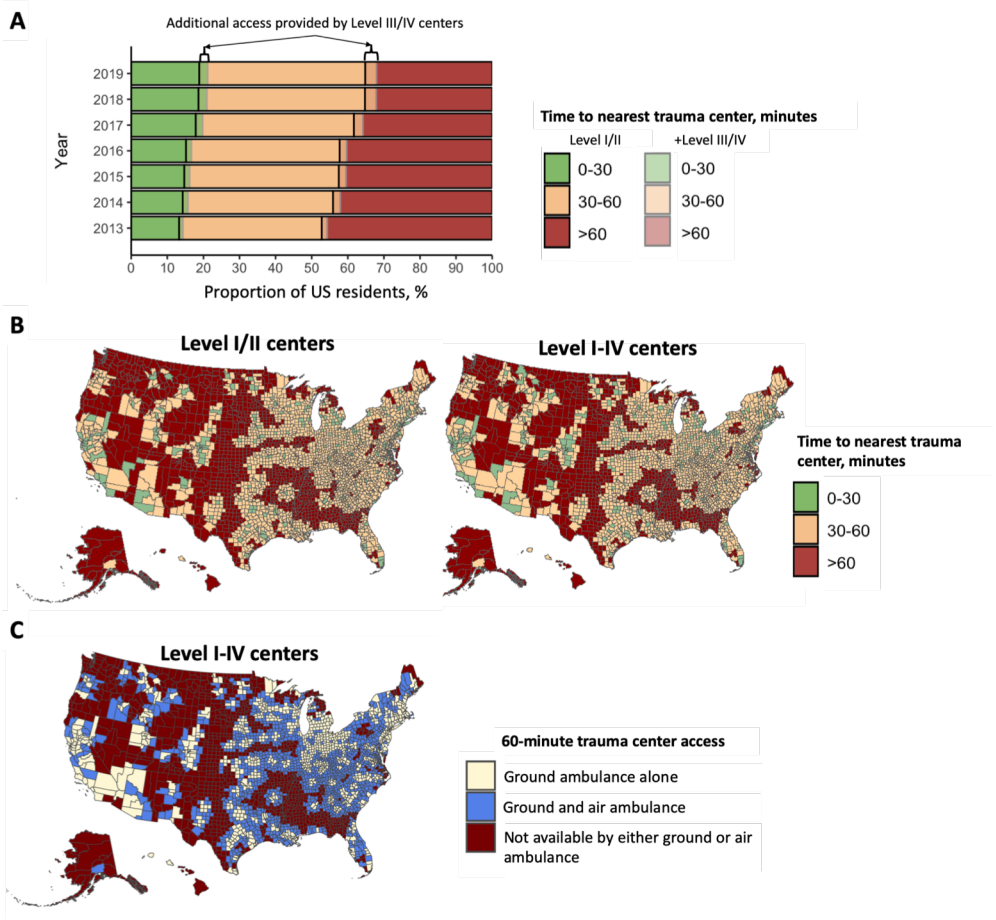
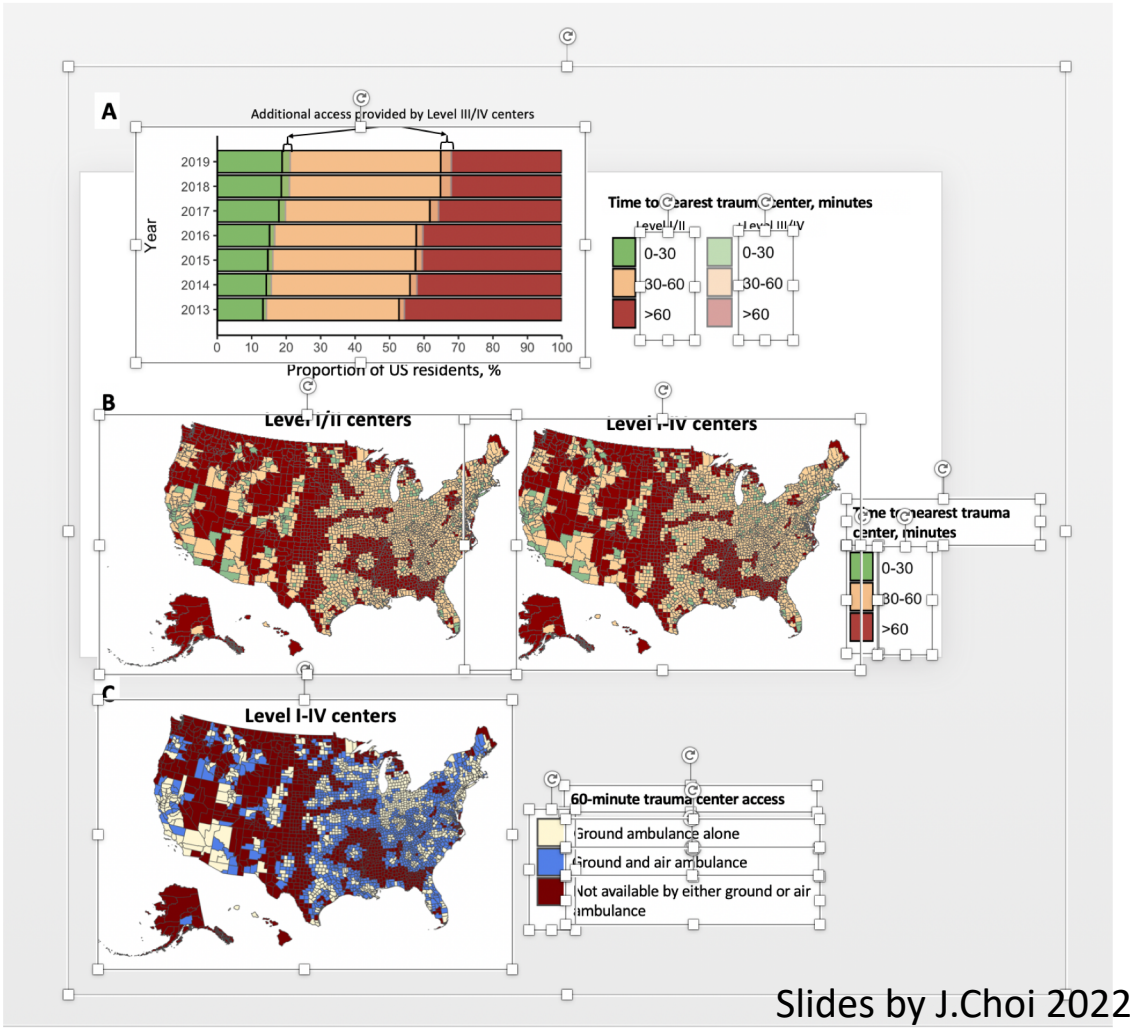
Making figures: you can do better than excel!

Don’t have to code EVERYTHING. MS ppt is your friend



=



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Don’t forget: supplementary tables/figures

List of ICD9/10 codes

Subgroup demographics tables

Get around journal limitations

- Can also use Figure 1A,B,C…etc.

Don’t forget: supplementary tables/figures

Supplementary Online Content

Lee KH, Lee S, Park JH, et al. Risk of Hematologic Malignant Neoplasms From Abdominopelvic Computed Tomographic Radiation in Patients Who Underwent Appendectomy. *JAMA Surg.* Published online January 20, 2021. doi:10.1001/jamasurg.2020.6357

This supplementary material has been provided by the authors to give readers additional information about their work.

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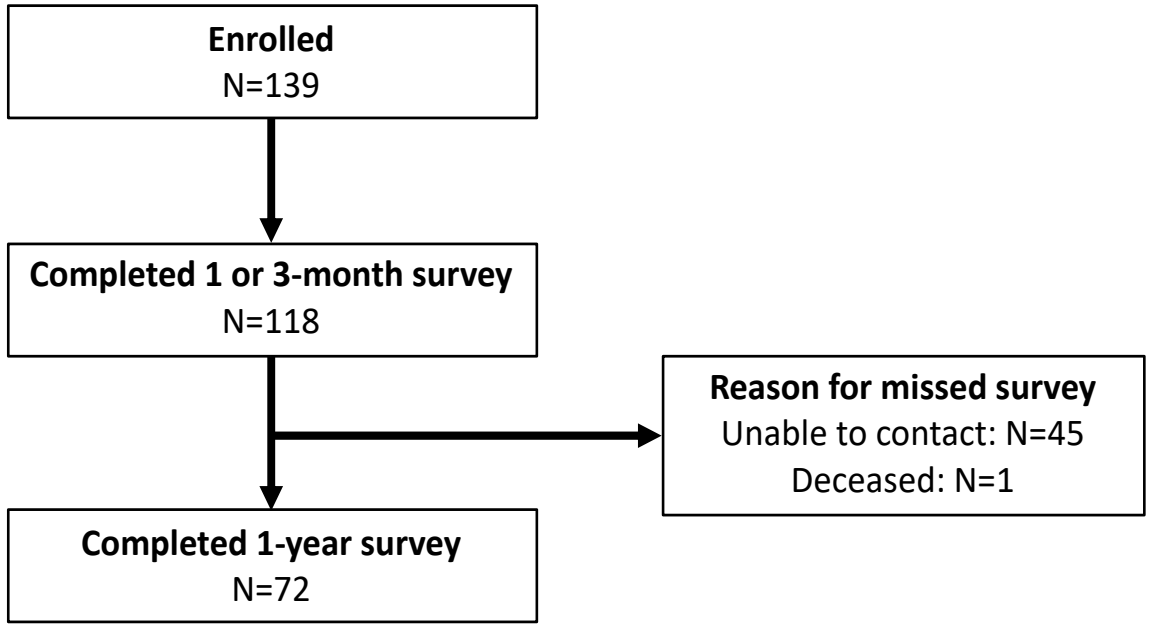
Results: follow EQUATOR guideline

Consider including flow diagram



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Results: be systematic

Remember subheadings for methods? Use same subheadings

Use tables + figures. The goal: “deliver your findings in as few words as possible”

- Should not exceed 1 page single space

State objective findings. Do NOT make any interpretations

Making your presentation slide deck

Things to consider: these are my opinions*

The audience probably won’t remember most talks at all. They will remember “the one thing” from the best talks

The audience cares about: sound method? what was the result?

Your presentation should accomplish 2 objectives

Implant “the one message” into the mind of the audience

Don’t bore the audience

Tell them what you’re going to tell them

Tell them

Tell them what you’ve told them

Don’t do this

Background

Traumatic injury remains the leading cause of mortality among Americans aged 1 to 44 years (third leading cause of mortality across all ages).

Timely trauma center access is a critical component of US healthcare infrastructure.

In 2005[2] and 2010,[3] approximately 16% and 10% of Americans lived over an hour from an American College of Surgeons Committee on Trauma (ACS-COT)-verified level I or II trauma center—hospitals with highest capacities to care for the injured.

The ACS-COT verifies new trauma centers and contemporary geocoding tools now facilitate estimating realistic travel times based on road-specific driving conditions.

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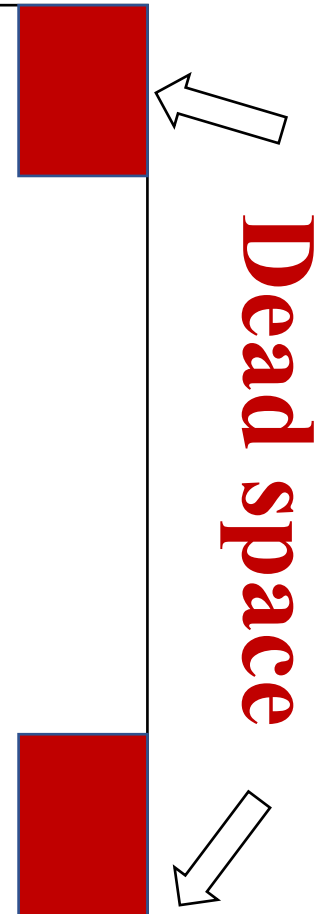
REFERENCE 1
REFERENCE 2
REFERENCE 3



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Consider..

How many Americans can access a trauma center in 60 minutes?

Trauma center access = critical

Unknown: 60-minute trauma center access in the recent decade

Great images: thenounproject.com

Animations *can* be effective: what they hear should = what they see

Logistics: the general slide deck format

“Title slide”
- Include ALL authors (bold your name)

Disclosures

Agenda

Background, Methods, Results, ”So what”

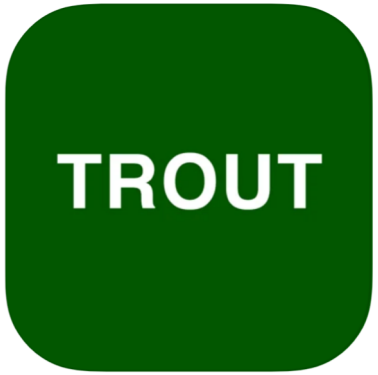
Acknowledgements
- consider: headshots, photos of team members

Agenda

1. What is TROUT Index?
2. Background: Prediction tools & machine learning
3. TROUT Index development & validation
4. Results
5. How to use TROUT Index

What is **TROUT Index**?

A tool to prognosticate outcomes after traumatic injury based on ***baseline frailty***



Trauma f**R**ailty **OUT**comes

@JeffChoi01

Frailty is important to characterize

Frailty ~ poor outcomes post-injury: well-known

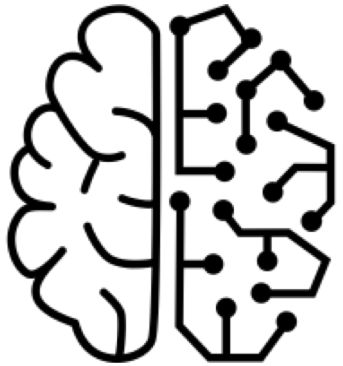
Ideal: integrate frailty ➡ clinical decision-making

Reality: Quantifying frailty and developing an accurate & practical prediction tool = challenging

@JeffChoi01

Background

PREDICTION TOOLS



MACHINE LEARNING

@JeffChoi01

Prediction tools