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# A Pragmatic Multi-system Opioid Use Disorder Computable Phenotype for the Emergency Department

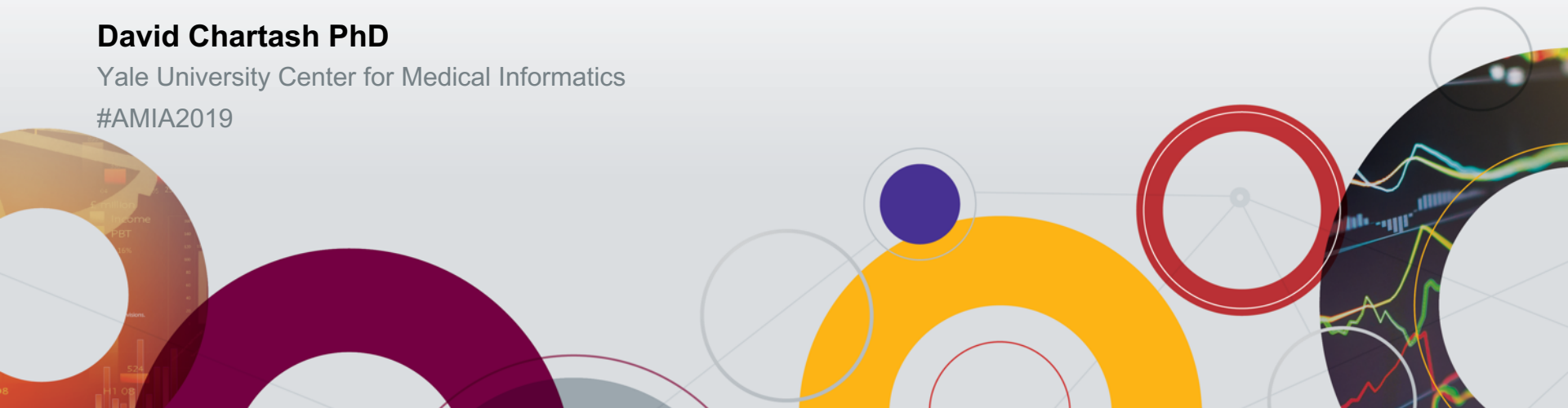
Oral Presentations – The Opioid Epidemic

S104

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# Disclosure

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I have no relevant relationships with commercial interests to disclose.

# Learning Objectives

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After participating in this session the learner should be better able to:

- Understand how computable phenotyping is influenced by gold standards of diagnosis when using structured data
  - Understand the concept of “computable phenotype” for Opioid Use Disorder
  - Recognize how computable phenotypes can be created from structured clinical data in the Electronic Medical Record
  - Describe how computable phenotypes can be used to identify patients eligible for interventions

# Full Paper in JMIR Medical Informatics

<https://medinform.jmir.org/2019/4/e15794/>



# Problem Definition

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1. For the purposes of a pragmatic trial:

*Define a computable phenotype to identify Opioid Use Disorder (OUD) in the clinical setting of the emergency department*

2. For the purposes of classifying disease:

*Define criteria which to perform triage classification of OUD for Medication-Assisted Treatment (MAT)*

# Computable Phenotyping

- What is a computable phenotype?

A defined set of data elements and logical expressions used to **identify individuals or populations (i.e. cohorts)** with particular diagnoses or medical conditions via **clinical characteristics, events, and service patterns** that are ascertained using a computerized query of an EMR system or data repository

- Primarily, this task is to identify patients for the pragmatic trial given an EMR query
- Secondly, this task is to identify patients who have particular diagnoses or medical conditions based on information within the EMR (characteristics, events, service patterns)

# Triage vs. Diagnostic Classification

- Triage is upstream of diagnosis, yet serves to be prognostic of diagnosis
- In a diagnostic decision tree, this means it is not comparable against expected value of perfect information, rather solely expected value of sample information
- Evaluation of the implementation therefore requires an understanding of information gain post-triage for diagnosis
  - This can only be performed retrospectively
- Diagnostic classification is definitional
- Framed as a prediction task, solvable by heuristics and statistical machinery

Croskerry, Pat. "A universal model of diagnostic reasoning." *Academic medicine* 84, no. 8 (2009): 1022-1028
- Requires an understanding of definitional elements of disease (such as chronicity) which require diagnosis to differ from triage
  - E.g. psychiatric diagnoses which require a pattern of affect which results in dysfunction over a long period (such as 12-months for OUD)

# The Case of Opioid Use Disorder: Screening and Diagnosis – DSM 5

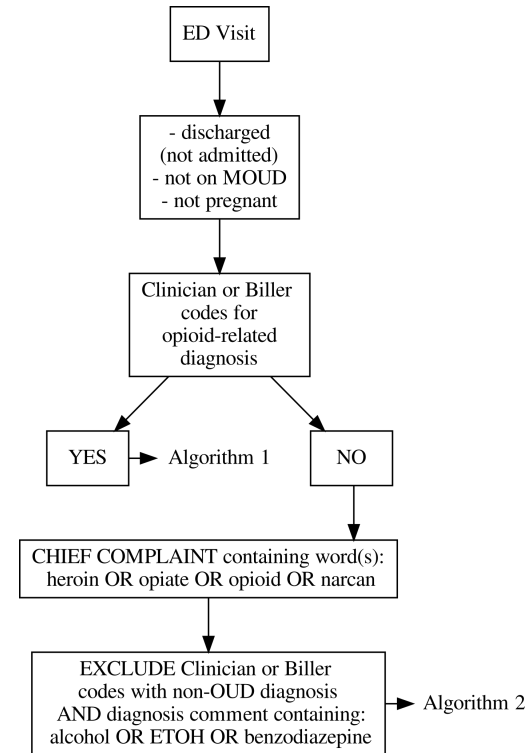
*A problematic pattern of opioid use leading to clinically significant impairment or distress, as manifested by at least two of the following 12 criteria, occurring within a 12-month period. (DSM 5)*

- OUD is defined by a pattern of use within a 12-month period
- Impairment or distress must be clinically significant and manifested through a set of psychiatric criteria
  - These criteria are not easily identifiable from (structured) data within the EMR
- How can the ED screen for such a disorder? Is this screening “diagnostic”?
  - Prescription Drug Monitoring Programs
  - Indication through medications (buprenorphine, methylphenidate, long acting/extended release opioids)
  - Explicit inquiry as to substance use
    - Through technology, per Gilbert, Amy Lewis, Allison L McCord, Fangqian Ouyang, Dillon J Etter, Rebekah L Williams, James A Hall, Wanzhu Tu, Stephen M Downs, and Matthew C Aalsma. “Characteristics associated with confidential consultation for adolescents in primary care.” *The journal of pediatrics* 199 (2018): 79-84)



# Phenotype Algorithm

1. Codes entered for OUD (post-encounter)
  2. Chief complaint or diagnosis containing phraseology
- Reference standard of chart review by EM physicians
    - Inferred DSM criteria within the reviewed chart
  - Epidemiologic 2x2 table was constructed: reference standard of adjudicated diagnosis vs. test of phenotype result
    - Algorithm 1: PPV of 0.96 (0.863-0.995 95% CI), NPV of 0.98 (0.893-0.999 95% CI)
    - Algorithm 2: PPV of 0.8 (0.593-0.932 95% CI), NPV of 1.0 (0.863-1 one-sided 97.5% CI)



# DSM Criteria Inferred On Chart Review

- Greatest discrepancy in chart inference between reviewers: “A great deal of time is spent in activities necessary to obtain the opioid, use the opioid, or recover from its effects”
  - Assessment of psychological characteristics of OUD: desire, craving, hazard
- Least discrepancy in chart inference between reviewers: “Recurrent opioid use resulting in a failure to fulfill major role obligations at work, school, or home”
  - Amount of use, withdrawal, misuse following prescription
- Suggests that the record is more of a source of information for objective rather than subjective diagnostic information used by reviewers
  - Is this a characteristic of emergency medicine compared to psychiatry?

# Clinical Context of Opioid Use Disorder and its DSM 5 Affect – Chart Review

- Gold standard of chart review did not find the sociologic context of OUD
- Performance of the phenotype as a diagnostic device?
  - Rather, there is a focus on clinical trials recruitment (i.e. pragmatic clinical trial purpose)
- DSM is not rule-based arbiter, rather is psychiatric evaluation (performed by physician) using the DSM as a guide
- Can this be performed retrospectively, given inferences from notes?
  - Inference from notes is demonstrably error-prone

Dresselhaus, T. R., J. Luck, and J. W. Peabody. "The ethical problem of false positives: a prospective evaluation of physician reporting in the medical record." *Journal of medical ethics* 28, no. 5 (2002): 291-294.

- We can identify a phenotype that performs well against known patients with OUD upon chart review for cohort identification
  - Algorithm 1: PPV of 0.96 (0.863-0.995 95% CI), NPV of 0.98 (0.893-0.999 95% CI)
  - Algorithm 2: PPV of 0.8 (0.593-0.932 95% CI), NPV of 1.0 (0.863-1 one-sided 97.5% CI)
- When adjudicated by chart reviewers (especially physicians) we must take into account an understanding of the clinical gold standard and inference made upon the task of reviewing
  - Applying diagnostic guidelines as a gold standard requires the clinical encounter, and therefore error is introduced upon retrospective evaluation
  - Information collected during the encounter that is not written into the medical record

# Thank you!

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