# Semantic Interoperability of National Poison Center Data

Presenter:

**Ryan Butcher, MS**

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Co-Authors:
Marc-Aurel Martial, RN, MPH[2],
Ramkiran Gouripeddi, MBBS, MS[1,3], Mollie Cummins, PhD, RN, FAAN[2,3]
[1]Biomedical Informatics Core, Center for Clinical and Translational Sciences,
[2]College of Nursing, [3] Department of Biomedical Informatics, University of Utah,
Salt Lake City, UT, USA

UNIVERSITY OF UTAH
COLLEGE OF NURSING

# Overview

- Background on the project
- National Poison Data System (NPDS)
- The NPDS Coder Users' Manual (v3.1) (NPDS-CM)
- Helping in-part to change the paradigm of communication using SNOMED CT
- Products of the work
- Validation Survey

# Background

- Poisonings are the leading cause of un-intentional injury death in the United States of America.
  - ➢ This is largely driven by prescription medications & especially pain medications.
- Poison Centers (PC) in the United States are 24 hour resource centers for poison information, clinical toxicology consultation, and poison prevention education.

# Background

- Poison Centers are staffed with pharmacists, nurses, physician assistants, & sometimes physicians.
  - Their role is to assess the situation over the phone, take a thorough poisoning history, and make a risk assessment to determine if the situation is safe to manage on site or if the patient needs to be referred to the hospital emergency department.

# Background

- Currently, US Poison Control Centers rely upon telephone communication to share information and collaborate in the context of poison exposures

# Background

- The purpose of the U.S. Agency for Healthcare Research & Quality (ARHQ) supported study, was to determine the information requirements for a health information exchange supported collaboration process between emergency departments and poison control centers.

  - Much essential information does not require telephone communication and could be transmitted electronically.

  - Institute closed loop communication where the poison control center can verify the emergency department has seen the information and vice-versa.

# Background

- Key Challenge in health information exchange is information overload.

- Must deliver select subsets of highly relevant health information at the point of decision making.

***"You have to make the information move & you have to make it matter!"***

*- Dr. Mollie Cummins, 2014*

# Background

- Clinicians in the emergency department may have to choose whether or not to stop taking care of a patient in order to take a phone call from the poison control center.

- Clinicians should not have to choose. They should be able to focus on care and get the needed information in an efficient and effective manner.

# Background

***"The busy workflow of an emergency department is one of the biggest challenges to effective communication with the poison control center,"***

– Dr. Todd L. Allen M.D. (Emergency Department Physician), 2014

# Background

- This study revealed clear inefficiencies and safety vulnerabilities in the current process.
  - Discussions of multiple cases during a single telephone call.
  - Difficulty discerning one patient from another.
  - Ambiguous exchange of clinical information as well as exchange of information with non-clinical care providers in the emergency department.

# Background

- Current process information is documented in disparate data sources

  - During a poisoning event, a Poison Center data specialist is creating a medical record at the poison control center.
  - Emergency department has medical record that is solely in that healthcare systems network.

# Solutions

- Create a process using Health Information Exchange (HIE) so that emergency care provider does not need to be interrupted from their work flow in order to access key information.

- Care can be improved by sending more accurate and complete information automatically so that poison control center can update their recommendations in a more timely way.

- Not intended to eliminate need to talk to clinician about difficult or unusual problems. Instead, streamline and improve overall communication between poison control centers and emergency departments.

# Solutions

- The goal is to create a replicable scalable process that could be adopted by any emergency department and poison control center in the United States.

- Potential to fundamentally change the paradigm for communication and collaboration between emergency departments and poison control centers.

# Part of the Poison Paradigm

- The National Poison Data System (NPDS), owned and operated by The American Association of Poison Control Centers' (AAPCC), is a centralized data repository that captures case information reported to all regional poison centers and is a vital infrastructure of the association.

# Part of the Poison Paradigm

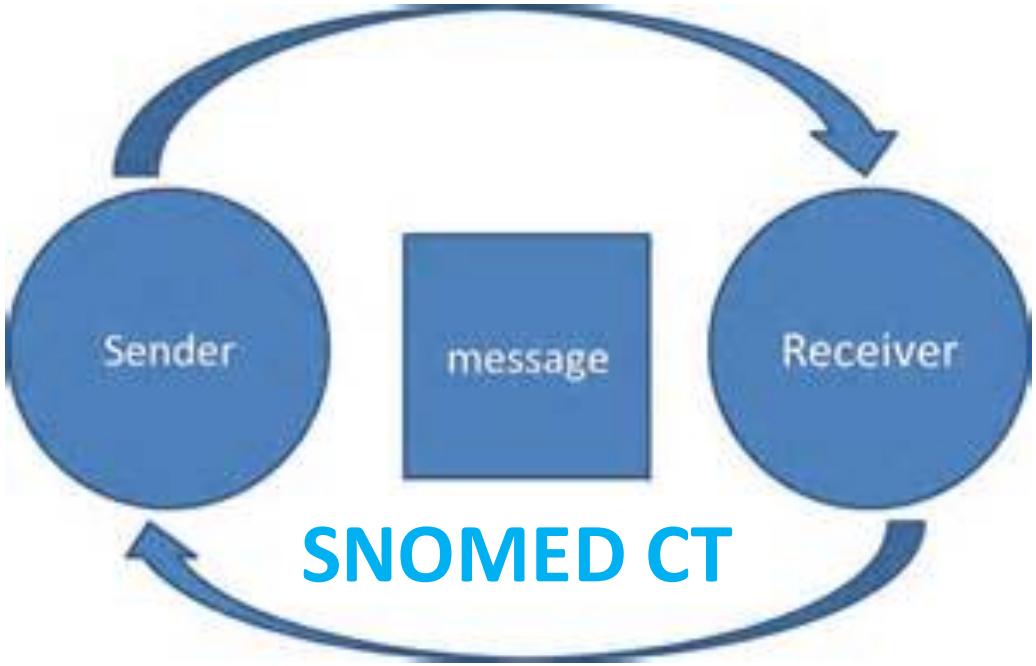
- The NPDS Coder Users' Manual (v3.1) (NPDS-CM) is intended to provide detailed information regarding the standardized structure, format, and content of NPDS.

- However, the manual does not utilize standard terminologies, consequently, its ability to be semantically interoperable is limited.

- Previous automated mapping of its contents yielded disappointing results

# Changing the Paradigm

- Part of changing the paradigm of communication is to implement standards when possible.



# Standardization

- In an effort to address this problem, we attempted to organize, extract, and formulate a mapping plan for all elements of the NPDS Coders' Manual that could fit into an ontological paradigm.

- Adverse events related to drugs have traditionally been reported to regulatory agencies using controlled terminologies such as the Medical Dictionary for Regulatory Activities (MedDRA).

- However, the terminologies most used in clinical settings and electronic medical records are clinical terminologies such as SNOMED CT.

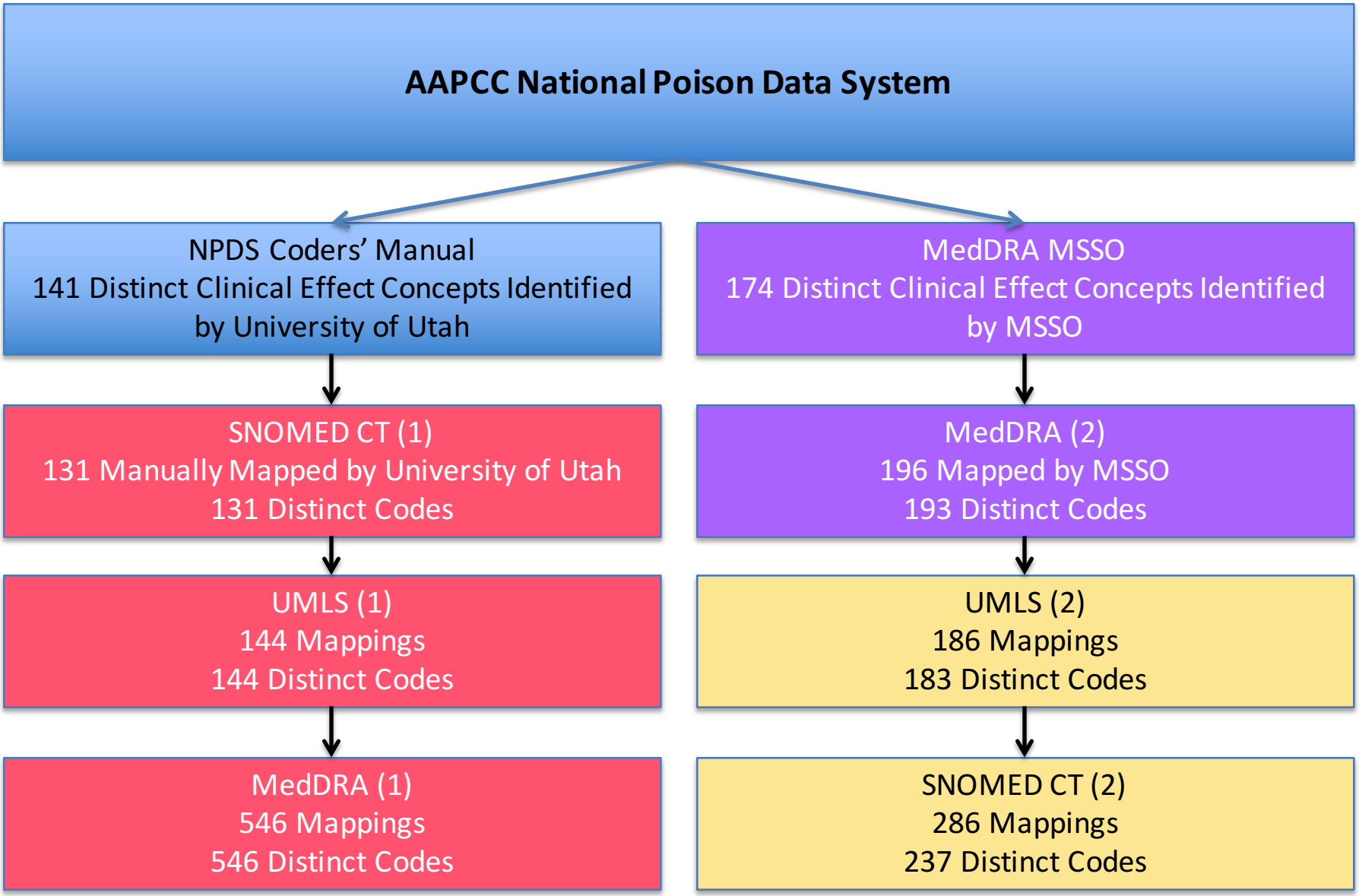
# Standardization

- We analyzed the structure and content of the NPDS Coders' Manual to establish guidelines for extracting concepts from the manual.

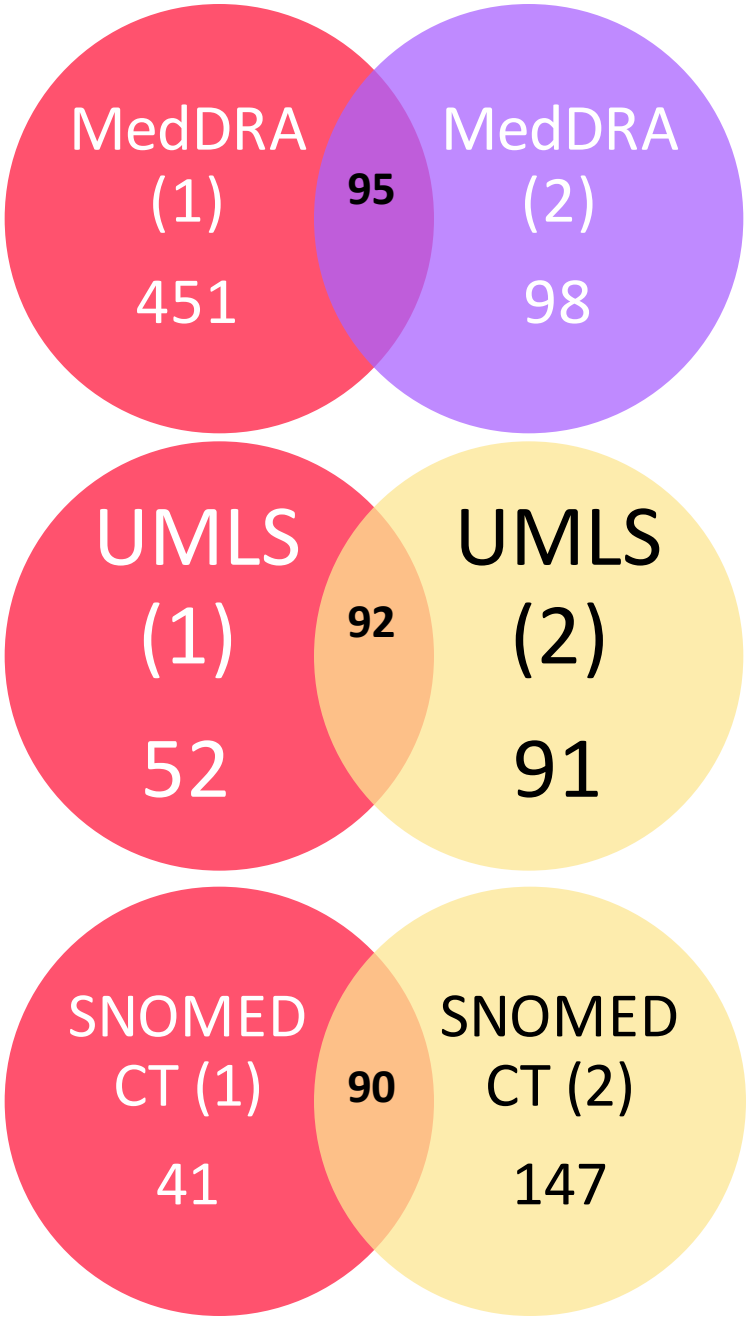
- For example, parent concepts were often derived from page headings or sub - headings and children concepts were often derived from table headers and/or various column headers.

# Standardization

- We decided the best initial approach was to map those concepts identified in the manual to SNOMED CT.
- The AAPCC also provided us a limited set of mappings they obtained from the MedDRA Maintenance and Support Services Organization (MSSO) that overlapped with the Clinical Effect section of the NPDS Coders' Manual.
- We analyzed the SNOMED CT and MedDRA mappings to help make decisions on standard terminologies representative of the poisoning domain, and assess interoperability.


AAPCC National Poison Data System
NPDS Coders' Manual
141 Distinct Clinical Effect Concepts Identified by University of Utah
MedDRA MSSO
174 Distinct Clinical Effect Concepts Identified by MSSO
SNOMED CT (1)
131 Manually Mapped by University of Utah
131 Distinct Codes
MedDRA (2)
196 Mapped by MSSO
193 Distinct Codes
UMLS (1)
144 Mappings
144 Distinct Codes
UMLS (2)
186 Mappings
183 Distinct Codes
MedDRA (1)
546 Mappings
546 Distinct Codes
SNOMED CT (2)
286 Mappings
237 Distinct Codes

**Distinct Code Overlap**



# Coverage Breakdown

- NPDS-CM - Clinical Effect Section
  - Approximately 93% of identified NPDS-CM concepts could be mapped to SNOMED CT
- Of those concepts mapped to SNOMED CT
  - ~ 61 % Finding
  - ~ 38 % Disorder
  - ~ 1 % Event & Substance

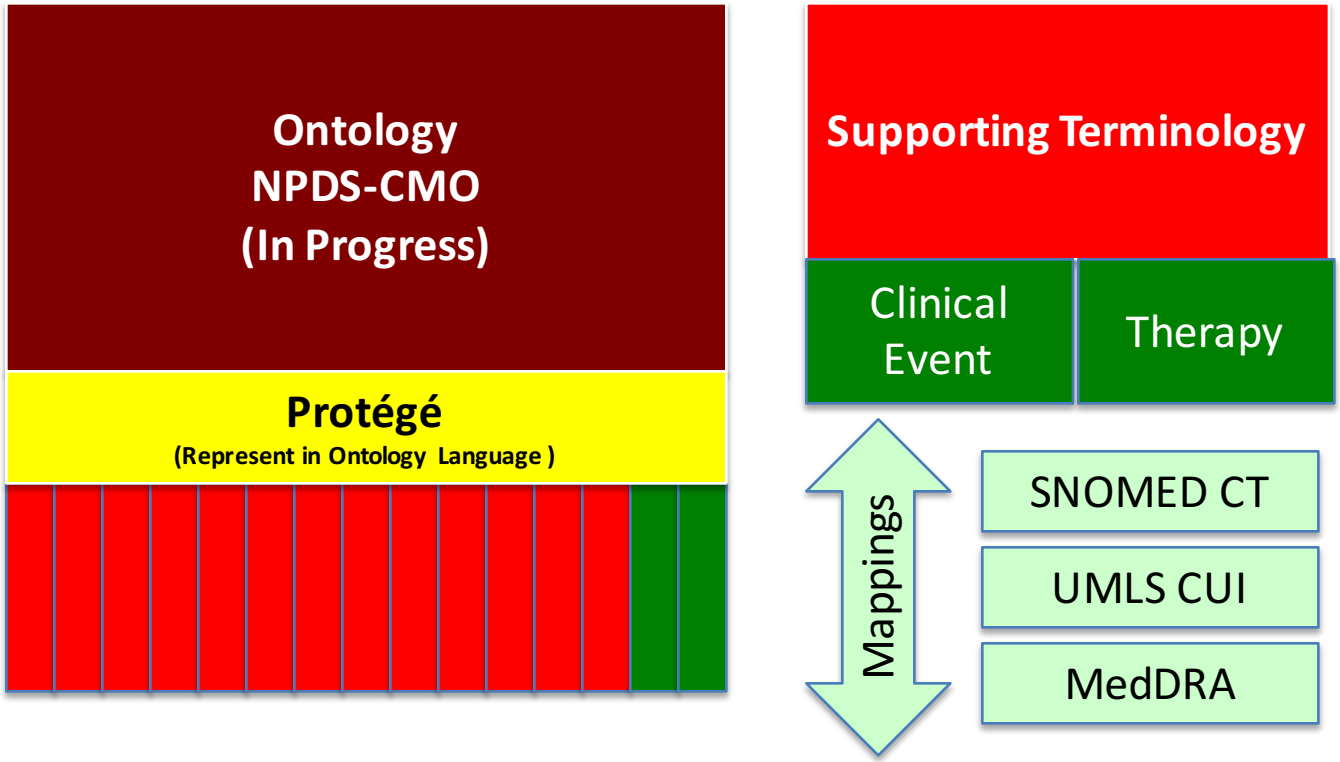
# Other Coverage

- NPDS-CM - Therapy Section
  - Approximately 92% (67/73) of identified NPDS-CM concepts could be mapped to SNOMED CT
- Of those concepts mapped to SNOMED CT
  - ~ 71 % Substance
  - ~ 29 % Procedure

# Other Coverage

- In both Clinical Effect & Therapy ambiguous at the source
  - "Unspecified INACTIVE"
  - "Extracorp. procedure (other)"
  - "Other"

# Future Progress & Products



# Validation

- Two validation surveys
  1. Poison Control Experts
  2. Terminologists

REDCap™
Research Electronic Data Capture

# Contact Information


1. Principal Investigator Dr. Mollie Cummins, PhD, RN, FAAN
   University of Utah
   Email: Mollie.Cummins@utah.edu
   Twitter: @MRCutah

2. Ryan Butcher, MS
   University of Utah
   Email: Ryan.Butcher@utah.edu
   Twitter: @RyanxButcher

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4. The American Association of Poison Control Centers' (AAPCC).

# Comments or Questions?

# References


1. Mowry JB, Spyker DA, Cantilena LR Jr, McMillan N, Ford M. 2013 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 31st Annual Report [Internet]. [cited 2015 Mar 12]. Available from: http://europepmc.org/abstract/med/25559822

2. NPDS Coding Users' Manual (v3.1). American Association of Poison Control Centers (AAPCC); 2014.

3. Cummins, M., Doing-Harris, K., Passman, J., & Mateos, B. (2013). Automated mapping of NPDS data elements to the UMLS Metathesaurus, American Medical Informatics Association (AMIA) Annual Symposium Proceedings. Washington, D.C.: American Medical Informatics Association.

4. Bodenreider O. Using SNOMED CT in combination with MedDRA for reporting signal detection and adverse drug reactions reporting. AMIA Annual Symposium Proceedings [Internet]. American Medical Informatics Association; 2009 [cited 2015 Mar 10]. p. 45. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2815504/

4. AHRQ Health IT (2014). Health IT Success: Building a Foundation for Health Information Exchange to Improve Poison Control. Available from: https://youtu.be/lH_i5qRflPM