Syndromic Surveillance Case Definition for Monitoring Opioid Related ED visits in the Colorado North Central Region (CO-NCR), State of Nebraska, and Marion County, Indiana

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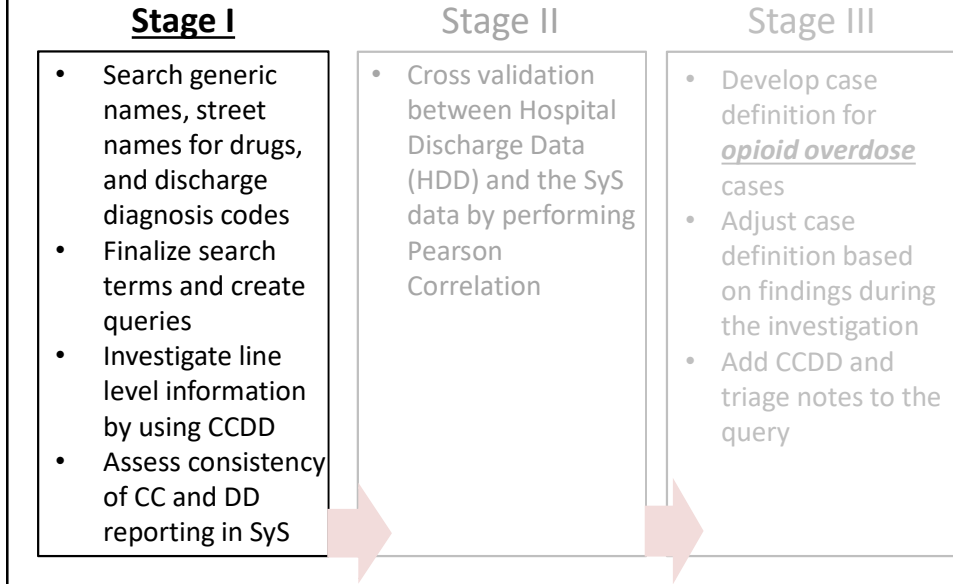Sandra Gonzalez (*Nebraska*)
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ISDS Opioid Webinar Series

Outline

- Background
- Study Design
- Chief complaint and Diagnosis codes search terms
- Evaluation of case definition:
  - Hospital discharge data (HDD)
  - Internal consistency
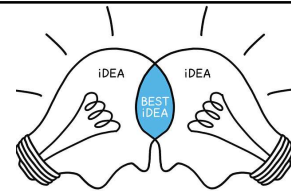- Lessons learned and next steps

Workflow of developing and validating opioid overdose case definition

Stage I

- Search generic names, street names for drugs, and discharge diagnosis codes
- Finalize search terms and create queries
- Investigate line level information by using CCDD
- Assess consistency of CC and DD reporting in SyS

Stage II

- Cross validation between Hospital Discharge Data (HDD) and the SyS data by performing Pearson Correlation

Stage III

- Develop case definition for *opioid overdose* cases
- Adjust case definition based on findings during the investigation
- Add CCDD and triage notes to the query

Background

- **_Why:_**
  - Collaboration across different states
  - Coordinate efforts and strength
  - Increased concern of opioid drug abuse across the country
- **_What:_**
  - Chief complaint and discharge diagnosis in syndromic surveillance data
- **_When:_**
  - Stage I : March 2016-April 2016
- **_Where:_**
  - Colorado North Central Region (CO-NCR), State of Nebraska, and Marion County, Indiana
- **_Who:_**
  - "All" opioid related emergency department (ED) visits
- **_How:_**
  - Investigate characteristics in ED data by establishing metadata
  - Collect and research on drug brand names and street names
  - Collect related discharge diagnosis code

Study Design

- Metadata for 3 different jurisdictions
- Worksheet has been created for our project
- Chief complaint only: Searched terms of single drug in chief complaint
- Chief complaint only: Searched terms of combined in chief complaint
- Diagnosis only: Searched diagnosis code(ICD-9/10)
- Final Query: Chief complaint text *OR* Discharge diagnosis

Chief Complaint Search Term - Single Substance

Heroin		Prescription Opioids		Opioid, uspecified		Naloxone (opioid antidote)	
Common Name	Street Name	Generic or Brand Name	Street Name	Common Name	Street Name	Generic or Brand Name	Street Name
Heroin	Dope	methadone	Fizzies	Opioid		Narcan	
Heroine	Hod	Amidone				naloxone	
Heroi	Speedball	Fentanyl	Apache			Evzio	
	Speed ball	Actiq	China Girl				
	Speed bal	Duragesic	Dance Fever				
	Smack	Fentora	Friend				
	Mud		Goodfella				
	Horse		Jackpot				
	Skag		Murder 8				
	Junk		Tango and cash				
	H		TNT				
	Black tar	oxycodone	OC				
	Black pearl	Tylox	OX				
	Brown sugar	OxyContin	Oxy				
	Witch hazel	OxyIR	Oxycotton				
	Birdie powder	OxyFast	Hillbilly heroin				
	Dragon		Kicker				
	Hero	hydrocodone					
	White stuff	Lorcet-HD					
	China white	Hycodan					
	Boy	Vicoprofen					

Search results:

-Inclusion: Common brand names and street names
- Confusion: Terms will bring up many false positive cases
- Exclusion: in remission, withdrawal, denies heroi
- Potential inclusion: under dosing, stop using, quit using

Information source of drug names: https://www.drugabuse.gov/drugs-abuse/commonly-abused-drugs-charts

Chief Complaint Search Term - Combined Substance

Heroin + Marijuana	A-bomb
	atom bomb
Heroin + Xanax	Chocolate bars
Heroin + Crack cocaine	Dragon rock
	Primo
Heroin + Cocaine	Dynamite
	El diablo
Heroin + Ecstasy	H-bomb
Heroin + LSD + PCP	LBJ
Heroin + LSD	Neon nod
Heroin + Methamphetamine	Screwball
Oxycodone + Aspirin	Percodan
Oxycodone + Acetaminophen	Percocet
Oxycodone + Benzodiazepine + Soma (carisoprodol))	Cocktail or Holy Trinity
Hydrocodone + Acetaminophen	Lortab

*LSD: *A hallucinogen- lysergic acid diethylamide*
*PCP: *A hallucinogen- phencyclidine*

Search results:

- Inclusion: Common drug names
- Confusion: Terms will bring up many false positive cases
- *Exclusion: in remission, withdrawal, denies*

- **What we found in this search:**

-Although patients reported use of >1 drug, no drug combination street names were found in the CC

-However, we did find combination brand names in the CC (Percocet and Lortab)

*Information source of drug names:
https://www.drugabuse.gov/drugs-abuse/commonly-abused-drugs-charts

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Discharge Diagnosis Codes

- **ICD-9**

ICD-9	Definition
965.00-09	Poisoning by opiates and related narcotics
E850.0	Accidental poisoning by heroin
E850.1	Accidental poisoning by methadone
E850.2	Accidental poisoning by other opiates and related narcotics

Comments:
- Some hospitals were still sending ICD-9 in this time period

- **ICD-10**

ICD-10	Definition
F11	Opioid related disorders
T40.1	Poisoning by and adverse effect of heroin
T40.2	Poisoning by, adverse effect of and underdosing of other opioids
T40.3	Poisoning by, adverse effect of and underdosing of methadone
T40.4	Poisoning by, adverse effect of and underdosing of other synthetic narcotics

Comments:
- Excluding F11.21 (Opioid dependence, in remission), F11.23 (Opioid dependence with withdrawal), F11.93 (Opioid use, unspecified with withdrawal)
- T40, we included initial encounter (A) and subsequent encounter (D). We did not include sequela cases (S).
- Poisoning cases were included

Information source of discharge diagnosis code:
1) Ising A, Proescholdbell S, Harmon KJ, *et al. Use of syndromic surveillance data to monitor poisonings and drug overdoses in state and local public health agencies.* Inj Prev. 2016 Apr;22 Suppl 1:i43-9. doi:10.1136/injuryprev-2015-041821.
2) CSTE Alcohol and Other Drugs Indicator Subcommittee August 2016 Call

Nebraska: Opioids

Summary of results:

- Of 6 possible cases detected by the CC definition, 33% (2/6) identified opioid-related diagnostic codes.

- Of 42 possible cases detected by the DD definition, only 5% (2/42) identified opioid-related CC search terms.

- Search terms associated to opioid abuse health consequences or underlying factors were observed in 65% (26/40) of the cases detected only by the DD definition. Associated diagnostic codes were observed in 93% (37/40) of these records.
  - This suggests underreporting of opioid abuse in the CC.

- 15% (6/40) of cases detected only by the DD definition indicated possible tolerance or abuse to a prescribed opioid in the CC (e.g. DD: F11.10 and CC: medication refill; DD: F11.10 and CC: chronic pain indicators).

Nebraska	Diagnosis-P	Diagnosis-F	Total
Chief Complaint-P	2	4	6
Chief Complaint-F	40	42386	42426
Total	42	42390	42432

Indiana, Marion County: Opioids

Marion County, IN	Diagnosis-Positive	Diagnosis-Negative	Total
Chief Complaint-Positive	39 (TP)	56 (FP)	95
Chief Complaint-Negative	152 (FN)	91,446 (TN)	91,598
Total	191	91,502	91,389

Summary of results:

- Of 95 possible cases detected by the CC definition, 70% (39/56) identified opioid-related diagnostic codes.
- Of 191 possible cases detected by the DD definition, only 20% (39/191) identified opioid-related CC search terms.
- Chief complaints for the possible cases that were detected by the DD definition made reference to:
  - Gastrointestinal issues
  - Depression
  - Suicidal ideation
  - General Pain
  - Allergic Reaction

CO-NCR: Opioids

CO-NCR	Diagnosis-Positive	Diagnosis-Negative	Total
Chief Complaint-Positive	957 (TP)	6 (FP)	963
Chief Complaint-Negative	488 (FN)	118,827 (TN)	119,315
Total	1445	118,833	120,278

*49 cases with missing diagnosis or chief complaint information

6 Detected only by CC **488 Detected only by DD**
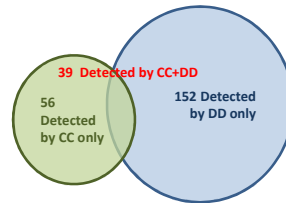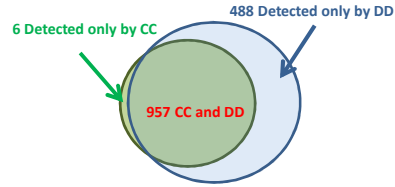
957 CC and DD

Summary of validation:

- Of 963 possible cases detected by the CC definition, 99.4% (957/963) identified opioid-related diagnostic codes
- Of 1,445 possible cases detected by the DD definition,66.2 % (957/1,445) identified associated opioid-related chief complaint
- F11.20 indicated patients who need a prescription of methadone or naloxone (71.2%)
- Other potential keywords found in chief complaint: Dosing appointment, anti-abuse, intake, pain evaluation, RX Refill, detoxification

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Stage I- Inclusion and Exclusion Search Terms for Opioid Related ED Visits

- *For Chief Complaint, Triage Notes, and Clinical Impression:*
  1) Inclusion: heroi, dope, speedball, China white, methadone, fentanyl, opioid, oxycodone, oxy, hydrocodone, narcan, naloxone, Percocet, Lortab,
  2) Exclusion: withdraw, W/D, WD, OXYGEN, denies heroi, possible heroi, underdosing, r/o, quit using, stopped using, denies any heroi

- *For Discharge Diagnosis (ICD-9):*
  1) Inclusion: 965.0, E850.0-E850.2, E935.0
  2) Exclusion: No exclusion for ICD-9

- *For Discharge Diagnosis (ICD-10):*
  1) Inclusion: T40.0X1-T40.0X4 (Extension: Only include A and D),
          T40.1X1-T40.1X4 (Extension: Only include A and D),
          T40.2X1-T40.2X4 (Extension: Only include A and D),
          T40.3X1-T40.3X4 (Extension: Only include A and D),
          T40.4X1-T40.4X4 (Extension: Only include A and D),
          F11
  2) Exclusion: F11.21, F11.23, F11.93

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Stage I- Lessons Learned

- We did not add the "overdose" keyword to the query because we wanted to develop a general query that could help monitor the burden of opioid related ED visits, underlying factors and consequences of opioid use.

- Although the keywords "overdose", "intake" and "dosing" are indicators of substance abuse, these terms are not specific enough to allow the identification of a specific substance.

- While reviewing cases, we found many chief complaint or diagnosis codes included indicators of opioid overdose signs and symptoms, opioid abuse underlying factors (e.g. mental health issues), and opioid abuse health consequences (e.g. motor vehicle crash, falls, overdose).

Workflow of developing and validating opioid overdose case definition

Stage I	Stage II	Stage III
• Search generic names, street names for drugs, and discharge diagnosis codes • Finalize search terms and create queries • Investigate line level information by using CCDD • Assess consistency of CC and DD reporting in SyS	• Cross validation between Hospital Discharge Data (HDD) and the SyS data by performing Pearson Correlation	• Develop case definition for *opioid overdose* cases • Adjust case definition based on findings during the investigation • Add CCDD and triage notes to the query

Nebraska: Pearson Correlation Analysis

- **In the State of Nebraska:**
  - o The consistency of DD codes corresponding to the opioid definition was assessed by comparing weekly counts between 2015 ED SyS data and 2015 ED HDD.
  - o The mean percent of completeness of DD codes for Nebraska's 2015 ED SyS data was 87%.
  - o Results of the Pearson correlation analysis indicate statistically significant correlations between 2015 Nebraska's SyS and HDD ED data for the DD codes based opioid definition ($r = 0.63$, $p < 0.0001$).

CO-NCR: Pearson Correlation Analysis

- **In the CO-NCR:**
  - o Comparing the Discharge Diagnosis (DD) in SyS and HDD
  - o 46 DD codes were included and used in SyS and HDD
  - o The consistency of DD codes corresponding to the opioid related definition was assessed between 2015 SyS and 2015 HDD
  - o The mean percent of completeness of DD codes for CO-NCR 2015 SyS data was 85%
  - o Results of the Pearson correlation analysis indicated statistically significant correlations between 2015 SyS and HDD data for the DD codes based on the opioid definition we created ($r = 0.92$, $p < 0.0001$)

Stage II- Diagnosis codes for cross validation

- *For Discharge Diagnosis (ICD-9):*
  1) Inclusion: 965.0, E850.0-E850.2, E935.0
  2) Exclusion: No exclusion for ICD-9

- *For Discharge Diagnosis (ICD-10):*
  1) Inclusion: T40.0X1-T40.0X4 (Extension: Only include A and D),
        T40.1X1-T40.1X4 (Extension: Only include A and D),
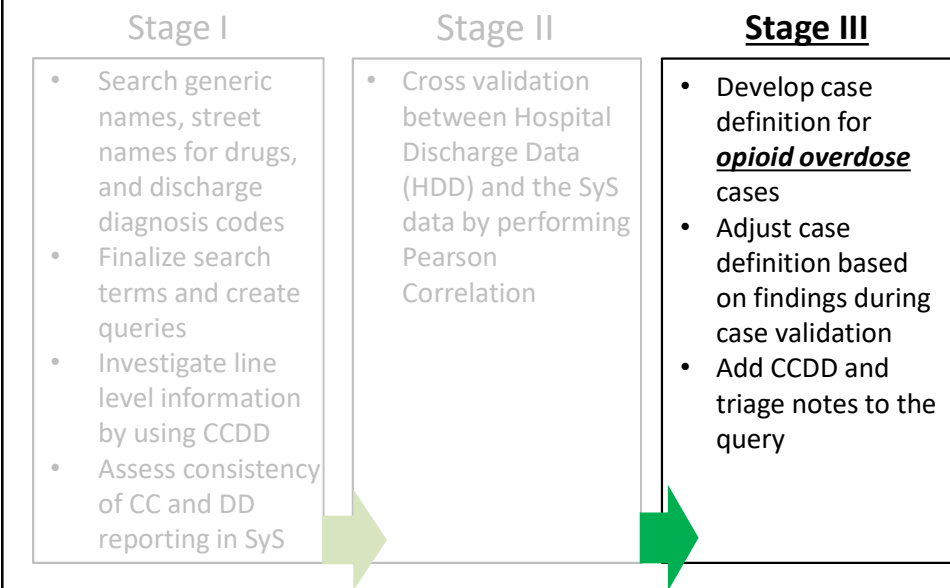   T40.2X1-T40.2X4 (Extension: Only include A and D),
        T40.3X1-T40.3X4 (Extension: Only include A and D),
        T40.4X1-T40.4X4 (Extension: Only include A and D),
        F11
  2) Exclusion: F11.21, F11.23, F11.93

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Workflow of developing and validating opioid overdose case definition

| Stage I	Stage II	**Stage III**
• Search generic names, street names for drugs, and discharge diagnosis codes • Finalize search terms and create queries • Investigate line level information by using CCDD • Assess consistency of CC and DD reporting in SyS	• Cross validation between Hospital Discharge Data (HDD) and the SyS data by performing Pearson Correlation	• Develop case definition for ***opioid overdose*** cases • Adjust case definition based on findings during case validation • Add CCDD and triage notes to the query

Stage III- Inclusion and Exclusion Search Terms for Opioid Overdose Visits

- *Chief Complaint:*
  1) Exclusion:
  denies her[io][oi]n, underdosing, quit using, stopped using, denies any her[io][oi]n

- *CCDD:*
  1) Inclusion:
  (methadone, fentanyl,fentanil,oxycodone,oxy,hydrocodone,narcan,naloxone,Percocet,Lortab, china white, opioid, opoid, opiate, dope, her[i|o][o|i]n, her[i|o]n, speed ball, speedball, morphine, codeine, opana, oxymorphone**) AND (**narcan, naloxo , poison, overdose, intox**)**

  2) Inclusion:
  T40.[0-4]X[1-4][AD],T40.[0-4]X[1-4][AD],T40.60[0-3][AD],T40[0-4]X[1-4][AD],T40[0-4]X[1-4][AD],T4060[0-3][AD],965.0,E850.[0-2],E935.0,9650,E850[0-2],E9350

- *Triage Notes:*
  1) Inclusion:
  (methadone, fentanyl,fentanil,oxycodone,oxy,hydrocodone,narcan,naloxone,Percocet,Lortab, china white, opioid, opoid, opiate, dope, her[i|o][o|i]n, her[i|o]n, speed ball, speedball, morphine, codeine, opana, oxymorphone**) AND (**narcan, naloxo ,poison, overdose, intox**)**

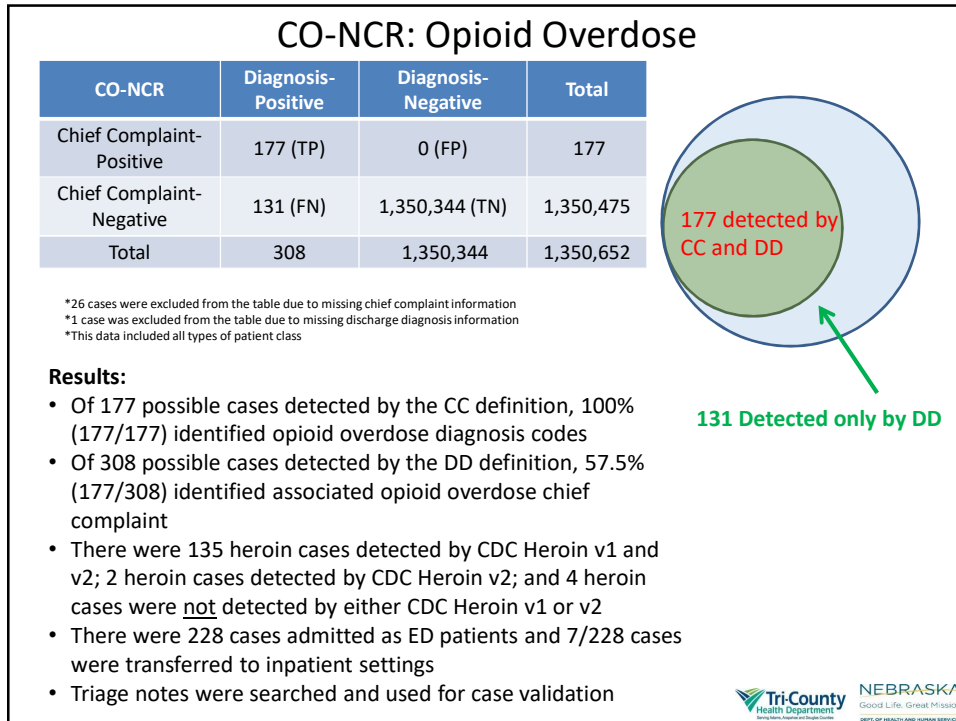Tri-County Health Department — NEBRASKA Good Life. Great Mission. DEPT. OF HEALTH AND HUMAN SERVICES

Nebraska: Opioid Overdose

CO-NCR	Diagnosis-Positive	Diagnosis-Negative	Total
Chief Complaint-Positive	1 (TP)	2 (FP)	3
Chief Complaint-Negative	110 (FN)	563,615 (TN)	563,725
Total	111	563,617	563,728
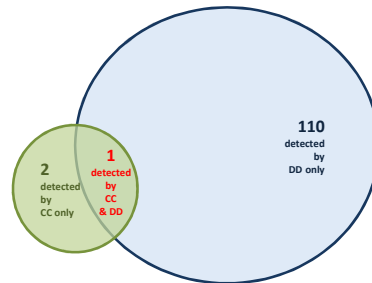
*1 case was excluded from the table due to missing DD information
*This data includes only ED data.

2 detected by CC only | 1 detected by CC & DD | 110 detected by DD only

Results:
- Of 3 possible cases detected by the CC definition, 33% (1/3) identified opioid overdose diagnostic codes.

- Of 111 possible cases detected by the DD definition, only 1% (1/111) identified opioid overdose search terms in the chief complaint.

- Triage notes were searched and used for case validation. Triage notes were consistent with opioid overdose in 49% (54/111) of the 111 cases possible cases detected by the DD definition.

- Of the 113 opioid overdose related ED visits, 47 were transferred to inpatient settings.

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CO-NCR: Opioid Overdose

CO-NCR	Diagnosis-Positive	Diagnosis-Negative	Total
Chief Complaint-Positive	177 (TP)	0 (FP)	177
Chief Complaint-Negative	131 (FN)	1,350,344 (TN)	1,350,475
Total	308	1,350,344	1,350,652

*26 cases were excluded from the table due to missing chief complaint information
*1 case was excluded from the table due to missing discharge diagnosis information
*This data included all types of patient class

177 detected by CC and DD
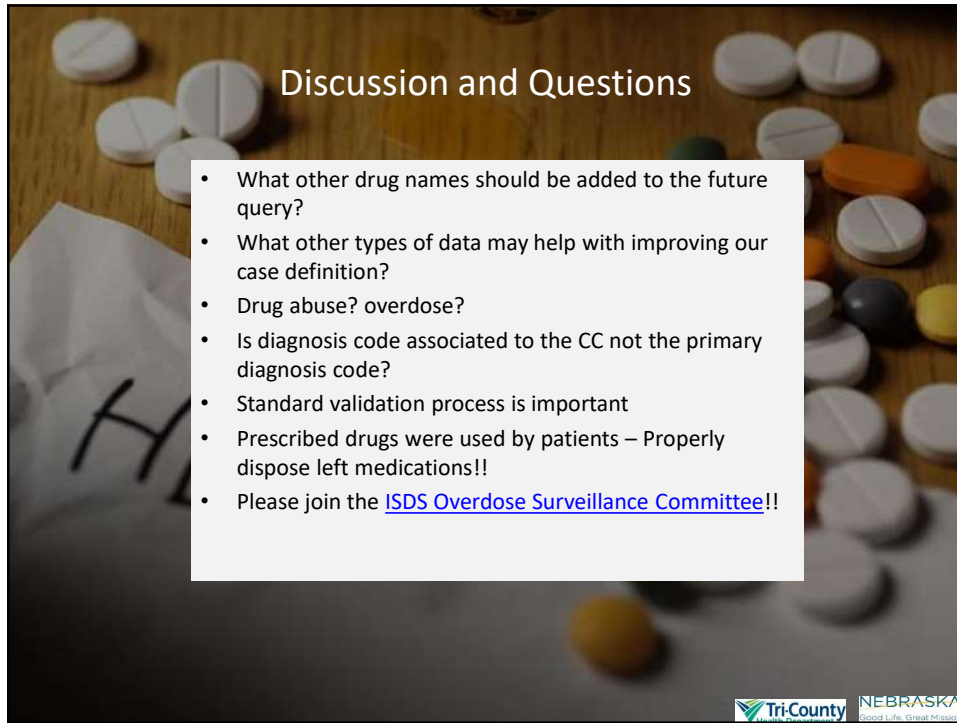
131 Detected only by DD

Results:
- Of 177 possible cases detected by the CC definition, 100% (177/177) identified opioid overdose diagnosis codes
- Of 308 possible cases detected by the DD definition, 57.5% (177/308) identified associated opioid overdose chief complaint
- There were 135 heroin cases detected by CDC Heroin v1 and v2; 2 heroin cases detected by CDC Heroin v2; and 4 heroin cases were not detected by either CDC Heroin v1 or v2
- There were 228 cases admitted as ED patients and 7/228 cases were transferred to inpatient settings
- Triage notes were searched and used for case validation

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Stage III- Lessons Learned

- CDC Heroin v1 and v2 definitions were accurate and helpful for Heroin case validation
- Chief complaint discharge diagnosis (CCDD) search helps create an effective query
- Withdrawal and detox patients often were coded with F11, however, patients who have F11 in their record may also have T40
- Narcan was mentioned in most of patients triage notes
- Our query in the earlier stage could capture many drug overdose but not necessarily including the drug name information
- 'Allergic reaction to drugs' was in the chief complaint
- In CO-NCR, chief complaint showed a lot of "Altered mental status" instead of other symptoms
- Requesting a data guide from hospitals/vendors will be helpful
- We used diagnosis information as our standard in this project
- Chief complaint, diagnosis information, and triage notes are equally important to the data!!! They all have good value!

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Discussion and Questions

- What other drug names should be added to the future query?
- What other types of data may help with improving our case definition?
- Drug abuse? overdose?
- Is diagnosis code associated to the CC not the primary diagnosis code?
- Standard validation process is important
- Prescribed drugs were used by patients – Properly dispose left medications!!
- Please join the ISDS Overdose Surveillance Committee!!

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Questions