Mortality Reporting and Cause of Death Statements: An Analyst’s Perspective

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How is a death certificate used?
37. MANNER OF DEATH
- Natural
- Homicide
- Accident
- Pending Investigation
- Suicide
- Could not be determined

CAUSE OF DEATH (See instructions and examples)

32. PART I. Enter the chain of events—diseases, injuries, or complications—that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.

IMMEDIATE CAUSE (Final disease or condition resulting in death)
- a. ____________________________ Due to (or as a consequence of):

Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST
- b. ____________________________ Due to (or as a consequence of):
- c. ____________________________ Due to (or as a consequence of):
- d. ____________________________ Due to (or as a consequence of):

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I

Approximate interval: Onset to death
<table>
<thead>
<tr>
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<th></th>
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<td>T424</td>
<td>T430</td>
<td>T432</td>
<td>T450</td>
<td>T509</td>
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<td>T432</td>
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<td>T509</td>
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<td></td>
<td></td>
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<td>T432</td>
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<td>T402</td>
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<td>T404</td>
<td>T424</td>
<td>T426</td>
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<td>T403</td>
<td>T424</td>
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</tr>
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<td>F199</td>
<td>T402</td>
<td>T424</td>
<td>T428</td>
<td>T432</td>
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</tr>
<tr>
<td>X44</td>
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<td>T428</td>
<td>T432</td>
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<td>T430</td>
<td>T432</td>
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</table>
How do we go from a text-based cause of death to the record coding used to generate counts and related health statistics, such as indicators?
Cause of Death Text → MICAR200 → ICD-10 Entity Codes → ACME TRANSAX → ICD-10 Record Codes
What are indicators?

• Calculated per year
• State residents only
• **Must have an underlying CoD:** X40-X44, X60-X64, X85, Y10-Y14
• Separate indicators are calculated for specific drugs

• Some use T-code guidelines:
  • Heroin: T40.1
  • Prescriptions: T40.2, T40.3

• Some use CoD text:
  • Fentanyl: ‘fentan’
  • Buprenorphine: ‘bupre’ OR ‘norph’
Bottom Line For Analytics:
1. Overdoses need to end up with an appropriate underlying code
2. Specific drugs need to be listed
What if drugs are not listed?
### Table 1

**Highest Frequency Record Codings for Overdose Indicator Deaths**

<table>
<thead>
<tr>
<th>DCauseCodeR1</th>
<th>DCauseCodeR2</th>
<th>DCauseCodeR3</th>
<th>DCauseCodeR4</th>
<th>Frequency</th>
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</thead>
<tbody>
<tr>
<td>X44</td>
<td>T509</td>
<td></td>
<td></td>
<td>284</td>
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<tr>
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<td>T402</td>
<td>T424</td>
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<td>240</td>
</tr>
<tr>
<td>X42</td>
<td>T402</td>
<td></td>
<td>T509</td>
<td>175</td>
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<tr>
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<td>T402</td>
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<td>F119</td>
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<td></td>
<td>66</td>
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<td></td>
<td>50</td>
</tr>
<tr>
<td>X42</td>
<td>T405</td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>X42</td>
<td>T404</td>
<td></td>
<td></td>
<td>49</td>
</tr>
</tbody>
</table>

Of the 6,605 overdoses in TN from 2012 to 2016, **5.1%** of them cannot be tracked by drug type due to lack of information.
### Table 2

**Percentage of Indicator Counts that Result from Polypharmacy Overdose**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2012 Total</th>
<th>Polydrug Percentage</th>
<th>2013 Total</th>
<th>Polydrug Percentage</th>
<th>2014 Total</th>
<th>Polydrug Percentage</th>
<th>2015 Total</th>
<th>Polydrug Percentage</th>
<th>2016 Total</th>
<th>Polydrug Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Overdoses</td>
<td>1094</td>
<td>47.90</td>
<td>1166</td>
<td>61.75</td>
<td>1263</td>
<td>60.97</td>
<td>1451</td>
<td>64.44</td>
<td>1631</td>
<td>68.67</td>
</tr>
<tr>
<td>All Opioids</td>
<td>698</td>
<td>62.75</td>
<td>754</td>
<td>72.81</td>
<td>861</td>
<td>70.27</td>
<td>1034</td>
<td>76.60</td>
<td>1186</td>
<td>80.27</td>
</tr>
<tr>
<td>Prescription Opioids</td>
<td>547</td>
<td>65.63</td>
<td>578</td>
<td>76.82</td>
<td>603</td>
<td>76.62</td>
<td>689</td>
<td>80.55</td>
<td>739</td>
<td>84.03</td>
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<tr>
<td>Heroin</td>
<td>45</td>
<td>66.67</td>
<td>63</td>
<td>73.02</td>
<td>147</td>
<td>70.07</td>
<td>205</td>
<td>80.49</td>
<td>260</td>
<td>83.08</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>4</td>
<td>50</td>
<td>53</td>
<td>75.47</td>
<td>69</td>
<td>68.12</td>
<td>169</td>
<td>81.66</td>
<td>294</td>
<td>83.33</td>
</tr>
</tbody>
</table>

From 2012 to 2016, 5.93% of general overdose deaths are identified as polypharmacy through text alone: ‘poly,’ ‘multi,’ ‘mixed,’ ‘combined,’ with no indication of the actual drug taken. Drug-specific indicators are therefore underreported!
How are underlying codes generated?
Step #1: Entity Coding Using MICAR200

• MICAR200 performs a line-by-line transliteration
• Extremely sensitive to wording choices
• First pass ignores Part II of the cause of death

• Instruction Manual Highlights:
  • Drug intoxication listed as *due to treatment* will cause death to be coded as complication of therapy
  • The word ‘acute’ is only associated with the immediate following condition
Transliteration Consequences

Record #1
I. (a) MULTIPLE DRUG OVERDOSE
    (b) (OXYCODONE, ALPRAZOLAM)
    (c)

Entity Coding:
X44      T509
T402     T424

Record #2
I. (a) OXYCODONE & ALPRAZOLAM OVERDOSE
    (b)
    (c)

Entity Coding:
X44      T402     T424

Record #3
I. (a) MULTIPLE DRUG OVERDOSE (OXYCODONE,
    (b) ALPRAZOLAM)
    (c)

Entity Coding:
X42      T402
X44      T424
Wording Choices

Table 3

Failure Ratios of Specific Word Choices in Overdose Identification

<table>
<thead>
<tr>
<th></th>
<th>“Overdose”</th>
<th>“Toxicity”</th>
<th>“Intoxication”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contains</td>
<td>Not Identified</td>
<td>Contains</td>
</tr>
<tr>
<td></td>
<td>Term</td>
<td></td>
<td>Term</td>
</tr>
<tr>
<td>2014</td>
<td>293</td>
<td>3.41%</td>
<td>617</td>
</tr>
<tr>
<td>2015</td>
<td>300</td>
<td>4.67%</td>
<td>703</td>
</tr>
<tr>
<td>2016</td>
<td>292</td>
<td>2.40%</td>
<td>828</td>
</tr>
</tbody>
</table>

According to the **algorithm**, the most unambiguous, consistent term in identifying drug overdoses is the word **OVERDOSE**!

Despite the medical community’s agreement that **overdose** is a non-specific term and counter to the recommendation against using it, the **algorithm** appears to favor this word.
Figure 1
Terminology Usage In All Overdose Deaths, 2012-2016

- "Toxicity" 35%
- "Intoxication" 26%
- "Overdose" 18%
- No Text 16%
- Other 5%

80% of the No Text category are from 2012.

N = 6,933*
- $n_{od} = 1,274$
- $n_{tox} = 2,453$
- $n_{intox} = 1,792$
- $n_{miss} = 1,073$
- $n_{other} = 341$
ABUSE

• An overdose is an external cause of death, an X-code or a Y-code
• Drug abuse is a ‘natural’ behavioral cause of death, an F-code
• Of the 2,066 deaths containing the text ‘ABUSE’ with no reference to overdose or toxicity, only 16 of them are coded as an overdose

• Conclusion: The word ‘ABUSE’ cannot be used to indicate overdose
Step #2: Record Coding Using ACME/TRANSAX

• General Principle: Select the condition on the lowest line of Part I only if it could cause all above conditions

• Rule #1: If GP does not apply, select the cause of the first-mentioned sequence

• Rule #2: If there is no sequence, select the first-mentioned condition

• Rule #3: If previous rules lead to a condition that is obviously caused by something else on the certificate, report that instead

• Other Useful Rules:
  • Time intervals will always be obeyed
  • A linkage in Part I will *always* be preferred over Part II
  • The most specific chain will always be chosen
Order Matters

Record #1

I. (a) HYPERTENSIVE CARDIOVASCULAR DISEASE AND ACUTE HYDROCODONE, ALPRAZOLAM AND (b) DIPHENHYDRAMINE INTOXICATION.

Underlying Code:

I119: Hypertensive heart disease without heart failure

Record #2

I. (a) ACUTE RESPIRATORY DEPRESSION (b) MULTIPLE DRUG INGESTION

Underlying Code:

E669: Obesity, unspecified

Issues here: Part II lists ‘MORBID OBESITY’, Manner of Death is coded as Natural

Record #3

I. (a) RESPIRATORY ARREST (b) SEVERE COPD (c) POLYPHARMACY OVER MEDICATION (d) DEMENTIA – ALTERED MENTATION

Underlying Code:

J449: Chronic obstructive pulmonary disease, unspecified

Maybe issue: Manner of Death is coded as Natural

Manual states that dementia cannot be underlying CoD
Manner of Death

• Causes of death are **natural** or **external**
  • If the selected manner of death is ‘natural,’ it is far less likely that an overdose will be detected by the algorithm

• Specific drug names generate **nature of death** T-codes
  • Nature of death codes must appear *beside* an appropriate cause of death code
  • Deaths caused by external factors can have multiple external cause of death codes
  • Deaths caused by natural factors are not *supposed* to have any external codes
What’s the takeaway?
1. List drugs if at all possible
2. Our data suggest that the most unambiguous way to indicate overdose is to use the actual word ‘overdose’ in the cause of death text
   • Even though other sources* recommend against using this word, the algorithm appears to behave differently
3. Order matters: if a death is an overdose, the causal chain needs to be appropriately specified for the algorithm to work
4. Manner of death needs to be appropriately indicated as other than natural in overdose cases
5. If multiple contributing factors, including potential overdose, be aware that algorithm will ‘pick’ the most specific chain

Want to learn more?

• The manuals describing how these algorithms work are found at: https://www.cdc.gov/nchs/nvss/instruction_manuals.htm
• NVSS recommendations for writing cause of death statements: https://www.cdc.gov/nchs/nvss/writing_cod_statements.htm