Evaluation of the Proposed Clinical Drug Term Model

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HL7 Vocabulary Technical Committee
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Toronto, Ontario
Drug Model Hierarchy

- **Ingredient**
  - **Ingredient Class**
  - **Manufactured Components**
  - **Trademark Drug**
  - **Clinical Drug**
    - **Not-Fully-Specified Drug**
      - **Drug Class**
        - **Medications**
          - **Chemicals**
            - Packages
              - **International Package Identifiers**
                - **Country-Specific Packaged Product**
                  - **Composite Clinical Drug**
                    - **Composite Trademark Drug**
Clinical Drugs

• Dosage form
• Active ingredients
  – Chemical
  – Form Strength
    • Strength amount
    • Strength units
    • Volume
    • Volume units
Experiment

• Can model allow for interoperability?
  – Single terminology vs.
  – Mapping between terminologies
• Select random sample of drug terms
• Obtain descriptions from terminology developers
• Compare description components
• Examine overall match rate
Sample Selection

- 71,000 NDC Codes
- 1000 selected at random (1.4%)
- Many are obsolete
<table>
<thead>
<tr>
<th>Name</th>
<th>Form</th>
<th>Ingredient 1</th>
<th>Ingredient 2</th>
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</thead>
<tbody>
<tr>
<td>Valium 5mg Tablet</td>
<td>Tablet</td>
<td>Diazepam</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>^5^mg</td>
<td></td>
</tr>
<tr>
<td>Tylenol #3</td>
<td>Tablet</td>
<td>Acetaminophen</td>
<td>Codeine</td>
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<tr>
<td></td>
<td></td>
<td>^325^mg</td>
<td>^30^mg</td>
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<tr>
<td>Chlortal Hydrate Syrup</td>
<td>Syrup</td>
<td>Chlortal Hydrate</td>
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<td></td>
<td></td>
<td>100.000000^mg</td>
<td>1.000000^ml</td>
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## Descriptions from Vendors

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<tr>
<th>Set</th>
<th>Mapped</th>
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<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<td>554</td>
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<td>-</td>
<td>434</td>
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</table>

Overall, 367 terms were not represented in any set, 71 appeared in only one set, 77 appeared in exactly two sets, 83 appeared in three sets, 91 appeared in four, and 311 terms appeared in all five terminologies.
# Pairwise Comparisons

<table>
<thead>
<tr>
<th>Set</th>
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<th>D</th>
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<tr>
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Comparisons

- Dosage Form: 3982
- Ingredient (number and match): 5507
- Dose Strength (dose, units, volume, volume units): 4337
- Overall: 3982
Dosage Form Matching

- TAB = TABLET
- LIQUID = ORAL LIQUID
- 111 Dosage form synonyms
Ingredient Matching

- HCl vs. Hydrochloride
- Salt vs. Base
- Inclusion of form or route
- Mention of animal source
Dose Strength Matching

- Standard format (000050000 vs. 500.00)
- Normalization of units (GM vs. MG)
Dose Units Matching

- Standard abbreviations
- Normalization of units (GM vs. MG)
- Missing values
- Inclusion of concentration information
- MG vs. %
Dose Volume Matching

• Not given
• Different numeric formats
• Defaults (0 and 1)
• Different volumes (per 1ml vs per 5ml)
Dose Volume Units Matching

• Not given
• “Each”
• Different abbreviations
Overall Matching

- Form matches
- Same number of ingredients
- Each ingredient matches on chemical and all four other parameters
## Overall Matching

<table>
<thead>
<tr>
<th>Components:</th>
<th>Total</th>
<th>Before Conversion</th>
<th>After Conversion</th>
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<tr>
<td>Ingredients</td>
<td>5507</td>
<td>3607 (65%)</td>
<td>4337 (79%)</td>
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<tr>
<td>Strength</td>
<td>4337</td>
<td>374 (9%)</td>
<td>3262 (75%)</td>
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<tr>
<td>Units</td>
<td>4337</td>
<td>1845 (43%)</td>
<td>2964 (68%)</td>
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<tr>
<td>Volume</td>
<td>4337</td>
<td>1054 (24%)</td>
<td>3754 (87%)</td>
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<tr>
<td>Volume Units</td>
<td>4337</td>
<td>2319 (53%)</td>
<td>3486 (80%)</td>
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</table>

**Overall:**

<table>
<thead>
<tr>
<th>Overall:</th>
<th>Total</th>
<th>Before Conversion</th>
<th>After Conversion</th>
</tr>
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<tr>
<td>Each Ingred</td>
<td>4337</td>
<td>0 (0%)</td>
<td>2773 (64%)</td>
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<tr>
<td>All Ingred</td>
<td>3982</td>
<td>0 (0%)</td>
<td>2519 (63%)</td>
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<tr>
<td>Dose Form</td>
<td>3982</td>
<td>645 (16%)</td>
<td>2859 (72%)</td>
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<tr>
<td>Complete Drug</td>
<td>3982</td>
<td>0 (0%)</td>
<td>2128 (53%)</td>
</tr>
</tbody>
</table>
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## Pairwise Complete Matches

<table>
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<td>-</td>
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<tr>
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<td>52%</td>
<td>62%</td>
<td>48%</td>
<td>58%</td>
<td>-</td>
</tr>
</tbody>
</table>
Example of Mismatch

GUAIFENESIN AC LIQUID|10;100|MG/5ML;MG/|LIQUID
SYRUP|
  GUAIFENESIN^00000000.000^^0000.000^
  CODEINE PHOSPHATE^.^^.

LIQUID|
  CODEINE PHOSPHATE^2.000000^MG^^
  GUAIFENESIN^20.000000^MG^1.000000^ML

LIQUID, ORAL (SYSTEMIC)|
  CODEINE PHOSPHATE^10^MG^5^ML
  GUAIFENESIN^100^MG^5^ML

LIQUID|
  CODEINE PHOSPHATE^10.0000^MG/5ML^^
  GUAIFENESIN^100.0000^MG/5ML^^

SYRUP|
  CODEINE PHOSPHATE^10^MILLIGRAM(S)^5^MILLILITER(S)
  GUAIFENESIN^100^MILLIGRAM(S)^5^MILLILITER(S)
Example of Mismatch

BUMEX INJECTION|0.25|MG|INJ-SOL AMPUL
BUMETANIDE^00000000.250^MG^0001.000^ML
INJECTION
SODIUM CHLORIDE, IV USE^0.850000^%^^
BUMETANIDE, INJECTABLE^0.250000^MG^1.000000^ML
INJECTION
BUMETANIDE^0.25^MG^1^ML
SOLUTION
BUMETANIDE^0.2500^MG/ML^^
SOLUTION
BUMETANIDE^0.25^MILLIGRAM(S)^1^MILLILITER(S)
Example of Mismatch

RECOMBIVAX HB ADULT FORMULATION INJECTION\textsuperscript{10} MCG INJ-SUS VIAL

HEPATITIS B VIRUS VACCINE\textsuperscript{10.000000} MCG\textsuperscript{0.001.000} ML INJECTION

HEPATITIS B SURFACE ANTIGEN\textsuperscript{10.000000} MCG\textsuperscript{1.000000} ML INJECTION

HEPATITIS B VACCINE-RECOMBINANT\textsuperscript{10} MCG\textsuperscript{1} ML INJECTION

HEPATITIS B VIRUS VACCINE RECOMBINANT\textsuperscript{10.0000} MCG/ML

SOLUTION

HEPATITIS B VACCINE RECOMBINANT\textsuperscript{10} MICROGRAM(S)\textsuperscript{1} MILLILITER(S)
Discussion

• Matching is still far from perfect
• Not surprising, given lack of standards for attribute values
• Next steps
Discussion: Next Steps

• Define some rules for each field
• Select new random sample
• Find subset with good overlap across terminologies
• Submit descriptions of new subset
Discussion: New Rules

- Dose forms: separate translation step
- Ingredients:
  - Right number
  - Specific chemical entity
  - Identifiers (UMLS?)
  - Don’t mix in route or concentration
- Strengths:
  - Conversion algorithms
  - Rules for defaults
  - Don’t mix route or concentration with strength
Conclusions

• Glass half empty:
  – How can we do automated translation of patient data?
  – Can drug order transfers and decision support be safe?

• Glass half full:
  – No attempt yet to standardize attribute terminology
  – Most translation was much better than 50%
  – Just getting started
  – Better than what we do now