Modifiers in i2b2
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In Version 1.6 of i2b2 we begin to use the modifier_cd column.

The use of this column allows a single fact to be modified with an unlimited number of codes:

A drug can be modified with dose, route, and frequency

A CPT procedure can be modified with attached codes such as a two surgeon team with anesthesia by anesthesiologist (62 and AA)

Essentially, the modifier is a way to extend the concept code. Much of what is expressed as a modifier could be expressed by making multiple concept-modifier combinations in the concept dimension, and this may be a better approach in many cases due to its simplicity. However, when modifiers are associated with values (like dose), or can occur in many combinations (like CPT or SNOMED modifiers) then it becomes simpler to use the modifier_cd column.

The representation of a modifier in the fact table is in the modifier_cd column. This column is a varchar(50) and its codes are generally 1-30 characters with a 3-19 character prefix (with a colon (":") between them). However, the only true constraint is that the code is 50 characters or less. The codes themselves can be the modifier, but often the code represents a modifier that will be specified by a value (like the numeric dose). The value is expressed in the columns of the fact table in the exact same way as the values associated with the concepts (such as lab tests).

When a modifier is associated with an observation, there may be multiple rows for a single observation in the observation_fact table. The modifier_cd column is used in conjunction with the instance_num column which is able to separate various facts into clusters, allowing several modifiers to be attached to the same fact. There are several options for use of the instance_num column, but in the simplest case it is an integer that ties together several rows that represent the same observation.

Here is an example where the code itself is the modifier, in this case for a CPT code of for a caesarian surgery performed on patient #123 at visit #107 on 3/4/2006

P_num|E_num|**Instance_num**|C_CD|S_d|**Modifier_CD**|ValType_CD|TVal|NVal
----
123|107|**1**|cpt:59622|20060304|**@**|<null>|<null>|<null>
123|107|**1**|cpt:59622|20060304|**cptmod:62**|<null>|<null>|<null>
123|107|**1**|cpt:59622|20060304|**cptmod:AA**|<null>|<null>|<null>

123|107|**1**|cpt:59622|20060304|**cptmod:TH**|<null>|<null>|<null>

As another example, a prescription is written for patient #123 at visit #567 for Aspirin 325 mg QD PO on 4/4/2010

P_num|E_num|**Instance_num**|C_CD|S_d|**Modifier_CD**|ValType_CD|TVal|NVal
----
123|567|**1**|med:aspirin|20100404|**@**|<null>|<null>|<null>
123|567|**1**|med:aspirin|20100404|**MED:DOSE**|N|E|325
123|567|**1**|med:aspirin|20100404|**MED:FREQ**|T|QD|<null>
123|567|**1**|med:aspirin|20100404|**MED:ROUTE**|T|PO|<null>

If the patient was written for another baby (83 mg) Aspirin BID PO on the same day, it would be represented as:

P_num|E_num|**Instance_num**|C_CD|S_d|**Modifier_CD**|ValType_CD|TVal|NVal
----
123|567|**2**|med:aspirin|20100404|**@**|<null>|<null>|<null>
123|567|**2**|med:aspirin|20100404|**MED:DOSE**|N|E|83
123|567|**2**|med:aspirin|20100404|**MED:FREQ**|T|BID|<null>
123|567|**2**|med:aspirin|20100404|**MED:ROUTE**|T|PO|<null>

So all together in the observation_fact table they look like:

P_num|E_num|**Instance_num**|C_CD|S_d|**Modifier_CD**|ValType_CD|TVal|NVal
----
123|107|**1**|cpt:59622|20060304|**@**|<null>|<null>|<null>
123|107|**1**|cpt:59622|20060304|**cptmod:62**|<null>|<null>|<null>
123|107|**1**|cpt:59622|20060304|**cptmod:AA**|<null>|<null>|<null>
123|107|**1**|cpt:59622|20060304|**cptmod:TH**|<null>|<null>|<null>
123|567|**1**|med:aspirin|20100404|**@**|<null>|<null>|<null>
123|567|**1**|med:aspirin|20100404|**MED:DOSE**|N|E|325
123|567|**1**|med:aspirin|20100404|**MED:FREQ**|T|QD|<null>
123|567|**1**|med:aspirin|20100404|**MED:ROUTE**|T|PO|<null>
123|567|**2**|med:aspirin|20100404|**@**|<null>|<null>|<null>
123|567|**2**|med:aspirin|20100404|**MED:DOSE**|N|E|83
123|567|**2**|med:aspirin|20100404|**MED:FREQ**|T|BID|<null>
123|567|**2**|med:aspirin|20100404|**MED:ROUTE**|T|PO|<null>

The only way to distinguish whether the 325 mg dose is QD or BID is to look in the instance_num column

By default, the value information and data in all the non-key columns will be assumed to pertain to the modified concept, so there should usually be included a row for the base concept with an "@" in the modifier column. This will allow value information to be applied to the base concept code. A modifier code is then only way that value information can be attached to the provider code.

The only change to a standard i2b2 database to enable it to work with modifiers is to add an instance number to the instance_num column. Most databases will begin with only one row per observation, and in those cases all rows can be initialized with an instance_num of "1".