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INTRODUCTION

The purpose of this document is to provide users of the UCRex Data Explorer information about the source data the system accesses when constructing a query with the I2b2 search tool. Selected source patient care data from each of the five University of California Health System campuses (Davis, Irvine, Los Angeles, San Diego and San Francisco) are reviewed and “harmonized” to support the i2b2 system, which uses a graphical user interface (GUI) that a researcher uses to construct a single query which produce a “federated query,” returning counts from each of the 5 health systems with a single query construction. The ‘hub’ of this technology is the i2b2 ontology cell to which all feeder systems are mapped to through the UCRex Data Harmonization process. This document aims to provide additional detail for users of the system regarding the ontology data targets in the ‘hub.’

This document is organized by the data classes included in UCRex Data Explorer. The major data classes are visible in the i2b2 interface as the hierarchical categories of data in the left navigation pane in the GUI query build view that may be selected. Within each of these major data groups are nested subclasses of data, which when expanded reveal subclasses of increasing specificity, with terminal “leaf” nodes being the most granular form of data for any particular class. Each section of this document contains a summary discussion of the major data classes, analyses conducted by the Data Harmonization Working Group and the decisions made regarding the “harmonized” or normal forms of data all of the feeder systems from across the five systems are mapped to. Additionally, each section provides a complete listing of the target values in the class that are used to build the target ontology cell.

UCREX ONTOLOGY REFERENCE

UC ReX Source Data Detail

| | UCSF | | | UCSD | | | UCLA | | | UCI | | | UCD | | |
|------------------------------|------------------|----------------|------------------|---------------------------|----------------|------------------|------------------|---------------------------|----------------------------|--------------------------------|-------------------------|------------------|--------------------------------|-----------------------|------------------|
| | Timeperiod | Source of Data | coding system(s) | Timeperiod | Source of Data | coding system(s) | Timeperiod | Source of Data | coding system(s) | Timeperiod | Source of Data | coding system(s) | Timeperiod | Source of Data | coding system(s) |
| Demographics | | | | | | | | | | | | | | | |
| Gender | 2012-2013 | Epic EMR | in-house | 2005-2013 | Epic EMR | in-house | 2006 - 2013 | Epic EMR | in-house | 1993-2013 | Clinical Data Warehouse | in-house | 2003-2013 | Epic EMR | in-house |
| Language | 2012-2013 | Epic EMR | in-house | 2005-2013 | Epic EMR | in-house | 2006 - 2013 | Epic EMR | in-house | 1993-2013 | Clinical Data Warehouse | in-house | 2003-2013 | Epic EMR | in-house |
| Marital Status | 2012-2013 | Epic EMR | in-house | 2005-2013 | Epic EMR | in-house | 2006 - 2013 | Epic EMR | in-house | 1993-2013 | Clinical Data Warehouse | in-house | 2003-2013 | Epic EMR | in-house |
| Race / Ethnicity | 2012-2013 | Epic EMR | OMB | 2005-2013 | Epic EMR | OMB | 2006 - 2013 | Epic EMR | OMB 1 & 2 question (mixed) | 1993-2013 | Clinical Data Warehouse | OMB | 2003-2013 | Epic EMR | OMB 2-question |
| Religion | 2012-2013 | Epic EMR | in-house | 2005-2013 | Epic EMR | in-house | 2006 - 2013 | Epic EMR | in-house | 1993-2013 | Clinical Data Warehouse | in-house | 2003-2013 | Epic EMR | in-house |
| Diagnosis | 2012-2013 | Epic EMR | ICD-9-CM | 2005-2013 | Epic EMR | ICD-9-CM | 2006 - 2013 | Epic EMR & Billing System | ICD-9-CM | 1993-2013 | Clinical Data Warehouse | ICD-9-CM | 2003-2013 | Epic EMR | ICD-9-CM |
| Procedures | 2012-2013 | Epic EMR | ICD-9-CM | 2005-2013 | Epic EMR | ICD-9-CM | 2006 - 2013 | Epic EMR | ICD-9-CM, CPT4 | 1993-2013 | Clinical Data Warehouse | ICD-9-CM | 2003-2013 | Epic EMR | ICD-9-CM |
| Laboratory Results | 2012-2013 | Epic EMR | LOINC | 2005-2013 | Epic EMR | LOINC | 2006 - 2013 | Epic EMR | LOINC | 1993-2013 | Clinical Data Warehouse | LOINC | 2003-2013 | Epic EMR | LOINC |
| Medications | 2012-2013 | Epic EMR | NDC | 2005-2013 | Epic EMR | NDC | 2006 - 2013 | Epic EMR | NDC | 1993-2013 | Clinical Data Warehouse | | 1993-2013 | Epic EMR | NDC |
| Vital Status | 2012-2013 | Epic EMR | none | 2005-2013 | Epic EMR | none | 2006 - 2013 | Epic EMR | none | 1993-2013 | Clinical Data Warehouse | none | 2003-2013 | Tethered Metaregistry | none |
| Data Not Yet Included | biospecimen data | | | imaging data | | | biospecimen data | | | imaging data | | | imaging data | | |
| | clinical notes | | | patient-reported outcomes | | | | | | biospecimen data | | | biospecimen data | | |
| | | | | biophysiologic data - EKG | | | | | | patient-reported outcomes | | | patient-reported outcomes | | |
| | | | | clinical notes | | | | | | biophysiologic data - EKG, EEG | | | biophysiologic data - EKG, EEG | | |
| | | | | | | | | | | clinical notes | | | clinical notes | | |
| | | | | | | | | | | clinical trials data | | | clinical trials data | | |

CLASS: DIAGNOSIS

DESCRIPTION

Diagnoses are the judgments of qualified clinicians based upon the presenting signs and symptoms for the patient of record. This is necessarily contrasted from diagnoses that indicate a family history of a disorder or a reason for visit / encounter. There is a recognition that diagnoses in patient records are created and stored in a number of ways: in problem lists, progress notes, billing documentation, justifications for payment among others, and that there some differences in what an active diagnosis in a problem list means versus the diagnosis assigned to an invoice or other administrative record. Further, there are differences in the encounter venue for which a diagnosis is associated: ambulatory records are typically different in terms of the types of treatments and observations recorded than those similar data created that represent an inpatient encounters.

The overwhelming source of diagnosis records in the UCReX system are encoded in the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) authored by the World health organization (WHO). It is the official system of assigning codes to diagnoses associated with hospital utilization in the US. ICD-9-CM has a section (Volume 3) which includes a classification of procedural codes. As such, there are some procedures data included in the diagnosis class & data set. Additionally, ICD-9-CM provides classifications for causes of injuries and poisoning and factors influencing health status and contact with health services.

By and large, ICD-9-CM records, unless associated with a problem list, represent a stated diagnosis or condition sufficient to justify an invoice for services. In other words, ICD-9-CM diagnoses are administrative in nature, as opposed to being clinically oriented in structure. At times, the most finite diagnosis available in ICD-9-CM will be what a clinician, particularly specialists, may consider to be a less-specific concept than they are used to working with or desire to build a query. This should be kept in mind, and the closest, most relevant concept should be selected.

ICD-9-CM can be downloaded from the Centers for Disease Control and Prevention:

<http://www.cdc.gov/nchs/icd/icd9cm.htm>

UCREX TARGET VALUES FOR DIAGNOSIS, INJURY & PROCEDURES

| Reference System: ICD-9-CM | |
|---|---------|
| Version: 2011 | |
| Target Classes: Diagnoses | |
| Infectious And Parasitic Diseases | 001-139 |
| Neoplasms | 140-239 |
| Endocrine, Nutritional And Metabolic Diseases, Immunity Disorders | 240-279 |
| Diseases Of The Blood And Blood-Forming Organs | 280-289 |
| Mental Disorders | 290-319 |
| Diseases Of The Nervous System And Sense Organs | 320-389 |
| Diseases Of The Circulatory System | 390-459 |
| Diseases Of The Respiratory System | 460-519 |
| Diseases Of The Digestive System | 520-579 |

| | |
|--|---------|
| Diseases Of The Genitourinary System | 580-629 |
| Complications Of Pregnancy, Childbirth, And Puerperium | 630-679 |
| Diseases Of The Skin And Subcutaneous Tissue | 680-709 |
| Diseases Of The Musculoskeletal System And Connective Tissue | 710-739 |
| Congenital Anomalies | 740-759 |
| Certain Conditions Originating In The Perinatal Period | 760-779 |
| Injury And Poisoning | 800-999 |

UCREX ONTOLOGY REFERENCE

| Reference System: ICD-9-CM | |
|---|-------|
| Version: 2011 | |
| Target Classes: Procedures | |
| Procedures and Interventions, Not Elsewhere Classified | 00 |
| Operations on the Nervous System | 01-05 |
| Operations on the Endocrine System | 06-07 |
| Operations on the Eye | 08-16 |
| Other Miscellaneous Diagnostic and Therapeutic Procedures | 17 |
| Operations on the Ear | 18-20 |
| Operations on the Nose, Mouth, and Pharynx | 21-29 |
| Operations on the Respiratory System | 30-34 |
| Operations on the Cardiovascular System | 35-39 |
| Operations on the Hemic and Lymphatic System | 40-41 |
| Operations on the Digestive System | 42-54 |
| Operations on the Urinary System | 55-59 |
| Operations on the Male Genital Organs | 60-64 |
| Operations on the Female Genital Organs | 65-71 |
| Obstetrical Procedures | 72-75 |
| Operations on the Musculoskeletal System | 76-84 |
| Operations on the Integumentary System | 85-86 |
| Miscellaneous Diagnostic and Therapeutic Procedures | 87-99 |

| Reference System: ICD-9-CM | |
|--|-----------|
| Version: 2011 | |
| Target Classes: External Causes Of Injury And Poisoning | |
| External Cause Status | E000-E000 |
| Activity | E001-E030 |
| Railway Accidents | E800-E807 |
| Motor Vehicle Traffic Accidents | E810-E819 |
| Motor Vehicle Nontraffic Accidents | E820-E825 |
| Other Road Vehicle Accidents | E826-E829 |
| Water Transport Accident | E830-E838 |
| Air And Space Transport Accidents | E840-E845 |
| Vehicle Accidents, Not Elsewhere Classifiable | E846-E849 |
| Accidental Poisoning By Drugs, Medicinal Substances, And Biologicals | E850-E858 |
| Accidental Poisoning By Other Solid And Liquid Substances, Gases, And Vapors | E860-E869 |
| Misadventures To Patients During Surgical And Medical Care | E870-E876 |
| Surgical And Medical Procedures As The Cause Of Abnormal Reaction Of Patient Or Later Complicati | E878-E879 |

| | |
|---|-----------|
| Without Mention of Misadventure at the Time Of Procedure | |
| Accidental Falls | E880-E888 |
| Accidents Caused By Fire and Flames | E890-E899 |
| Accidents Due To Natural and Environmental Factors | E900-E909 |
| Accidents Caused By Submersion, Suffocation, and Foreign Bodies | E910-E915 |
| Other Accidents | E916-E928 |
| Late Effects of Accidental Injury | E929-E929 |
| Drugs, Medicinal and Biological Substances Causing Adverse Effects in Therapeutic Use | E930-E949 |
| Suicide and Self-Inflicted Injury | E950-E959 |
| Homicide and Injury Purposely Inflicted By Other Persons | E960-E969 |
| Legal Intervention | E970-E979 |
| Injury Undetermined Whether Accidentally Or Purposely Inflicted | E980-E989 |
| Injury Resulting From Operations of War | E990-E999 |

| Reference System: ICD-9-CM | |
|--|---------|
| Version: 2011 | |
| Target Classes: Factors Influencing Health Status And Contact With Health Services | |
| Persons With Potential Health Hazards Related To Communicable Diseases | V01-V09 |
| Persons With Potential Health Hazards Related To Personal And Family History | V10-V19 |
| Persons Encountering Health Services In Circumstances Related To Reproduction And Development | V20-V29 |
| Liveborn Infants According To Type Of Birth | V30-V39 |
| Persons With A Condition Influencing Their Health Status | V40-V49 |
| Persons Encountering Health Services For Specific Procedures And Aftercare | V50-V59 |
| Persons Encountering Health Services In Other Circumstances | V60-V69 |
| Persons Without Reported Diagnosis Encountered During Examination And Investigation Of Individuals And Populations | V70-V82 |
| Genetics | V83-V84 |
| Body Mass Index | V85-V85 |
| Estrogen Receptor Status | V86-V86 |
| Other Specified Personal Exposures And History Presenting Hazards To Health | V87-V87 |
| Acquired Absence Of Other Organs And Tissue | V88-V88 |
| Other Suspected Conditions Not Found | V89-V89 |
| Retained Foreign Body | V90-V90 |
| Multiple Gestation Placenta Status | V91-V91 |

CLASS: GENDER

DESCRIPTION

Gender is represented as an administrative designation as opposed to a biological (genetic) definition of sex. Gender is used in hospital administrative systems for the purposes including appropriate disposition and census (rooming) and may not accurately reflect the genetic sex of an individual. As the source systems are administrative in nature, the definition is retained so as to differentiate from biologic sex should that kind of data become available in the future.

| | |
|----------------------------------|----------|
| Reference System: HL7 | |
| Version: v2.5 | |
| Target Values | |
| Male | M |
| Female | F |
| Unknown | U |
| <i>Ambiguous (not used)</i> | <i>A</i> |
| <i>Not Applicable (not used)</i> | <i>N</i> |
| <i>Other (not used)</i> | <i>O</i> |

Standard available from Health Level Seven

http://www.hl7.org/implement/standards/product_brief.cfm?product_id=144

UCREX TARGET VALUES FOR GENDER

Discussion in the harmonization group included the observation that the instances of gender in the source systems are typically labeled “sex.” Nonetheless the implied meaning of “sex” in the source systems clearly aligned with the concept of administrative gender as defined. The group noted that in cases where there may be a transgender individuals represented in the dataset, there were not values provided by any site that accommodated these instances. As such there was not a need to create a target value for transgender persons. Further, it was decided that values declared as “unknown” and null values will have the same value designation and thus, HL7 version 2 reference values of ‘Ambiguous’, ‘Not Applicable’ and ‘Other’ will not be used at this time.

| |
|---------|
| Male |
| Female |
| Unknown |

CLASS: LANGUAGE

DESCRIPTION

This is the primary spoken language of an individual. The target coding system considered is based upon the ISO 639 standard(s) for the names of languages. The ISO 639.2 standard represents a three character code for language names and 639.5 represents language families or groups. The ISO 639 standards are maintained by the US Library of Congress.

| |
|---|
| Reference System: ISO 639 |
| Versions: v2 & 5 |
| Target Values: available from Library of congress registration authority |
| ISO 639-2: http://www.loc.gov/standards/iso639-2/ |
| ISO 639-5: http://www.loc.gov/standards/iso639-5/ |

UCREX TARGET VALUES FOR LANGUAGE

When reviewing the source system content in each of the UC systems, the list was much shorter than the far more comprehensive set in the ISO 639 standards. For purposes of simplifying the UCReX user interface without sacrificing specificity inherent in the source data, a value set inclusive of all language represented in current UC systems was developed. Additionally, there are groups of related languages built into the navigation hierarchy, (i.e.: “creole” and “French creole” occurring in same nested sub-class) to allow selection of all or specific language desired in query. Null and “unknown” language values are to be included in the same node.

| 1st level | 2nd level |
|---------------------|-------------------------------------|
| Albanian | |
| Amheric (Ethiopian) | |
| Arabic | |
| Armenian | |
| Bengali | |
| Bosnian | |
| Bulgarian | |
| Burmese | |
| Cambodian (Khmer) | |
| Chavakano | |
| Chinese | |
| | Chinese (Mandarin) |
| | Chinese (Mien) |
| | Chinese (Other) |
| | Chinese, Cantonese (Inc Toishanese) |
| Croatian | |
| | |
| Creole | |
| | French Creole |
| Dari | |
| Dutch | |
| English | |

| 1st level | 2nd level |
|-----------------|-----------|
| Flemish | |
| Finnish | |
| French | |
| German | |
| Greek | |
| Gujarati | |
| Hebrew | |
| Hindi | |
| | Urdu |
| Hmong | |
| | Miao |
| Hungarian | |
| Ilocano | |
| Indonesian | |
| Italian | |
| Japanese | |
| Korean | |
| Lao | |
| Navajo | |
| Norwegian | |
| Pashto | |
| Persian (Farsi) | |
| Polish | |
| Portuguese | |
| Punjabi | |
| Romanian | |
| Russian | |

| 1st level | 2nd level |
|--------------------------|-------------------|
| | |
| Samoan | |
| Serbian | |
| Sign Language (American) | |
| Sign Language (Other) | |
| Spanish | |
| Swahili | |
| Swedish | |
| Tagalog | |
| | Filipino |
| Tamil | |
| Telugu | |
| Thai | |
| Tigrinya | |
| Tonga | |
| Turkish | |
| Ukrainian | |
| Vietnamese | |
| Vishavan | |
| Yiddish | |
| Yugoslav | |
| Other, Non English | |
| Unknown | |
| | Decline To State |
| | Unable To Respond |

CLASS: MARITAL STATUS

DESCRIPTION

Marital status is a legal designation. The reference standard reviewed is the HL7 V3 Marital Status Table. The specific definitions for each HL7 value are as follows:

- Divorce - Marriage contract has been declared dissolved and inactive
- Married - A current marriage contract is active
- Domestic partner - Person declares that a domestic partner relationship exists
- Never Married - No marriage contract has ever been entered
- Widowed - The spouse has died
- Annulled - Marriage contract has been declared null and to not have existed
- Interlocutory - Subject to an Interlocutory Decree
- Polygamous - More than 1 current spouse

| Reference System: HL7 | |
|--|---|
| Version: V3, 2011 Normative Ed. | |
| Target Values | |
| Divorce | D |
| Married | M |
| Domestic partner | T |
| Never Married | L |
| Widowed | W |
| Annulled | A |
| Interlocutory | I |
| Polygamous | P |

Standard available from Health Level Seven

http://www.hl7.org/implement/standards/product_brief.cfm?product_id=186

UCREX TARGET VALUES FOR MARITAL STATUS

The harmonization group discussion posited that source system data may or may not reflect the exact definitions proposed by HL7 at the time of data capture. For example, there are provisions in the UCSF source data that accommodate current as well registered domestic partnerships that have ceased to exist as separate values. To simplify the navigation, as well as lend consistency to the data it was decided that when there are values for past domestic partnerships, these will be mapped to the marriage equivalents of “divorced, widowed, etc. rather than creating an additional class of “past” or “widowed” domestic partnerships. Accordingly, marital Status for UCRex will include the HL7 value set and definitions with the exception of “Never Married” and “Polygamous.” The group noted that there were no source data reflecting declared polygamy, and that it was doubtful there would be such records in the foreseeable future. Also, “Single” was selected as the designation for “Never Married” with the understanding that many records of “Single” individuals may not actually reflect that they were never married. Null and “unknown” are to be included in the same target value.

| |
|----------------------------------|
| Divorced |
| Married |
| Partner |
| Separated |
| <i>Single (non-standard HL7)</i> |

| |
|---------------|
| Unknown |
| Widowed |
| Annulled |
| Interlocutory |
| Polygamous |

CLASS: RACE / ETHNICITY

DESCRIPTION

This is a blended data class reflecting one of the US Federal OMB recommendations for representation of race. This form blends the limited OMB definitions of Ethnicity (Hispanic vs non-Hispanic) with race OMB race definitions. These definitions are as follows:

American Indian or Alaska Native. A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.

Asian. A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

Black or African American. A person having origins in any of the black racial groups of Africa. Terms such as "Haitian" or "Negro" can be used in addition to "Black or African American."

Hispanic or Latino. A person of Cuban, Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race. The term, "Spanish origin," can be used in addition to "Hispanic or Latino."

Native Hawaiian or Other Pacific Islander. A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

White. A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

| Reference System: US Govt. Office of Management & Budget(OMB) |
|--|
| Version: One question format, 1997 |
| Target Values |
| American Indian or Alaskan Native |
| Asian |
| Black or African American |
| Hispanic or Latino |
| Native Hawaiian or Other Pacific Islander |
| White |

Reference

US Government Office of Management and Budget: http://www.whitehouse.gov/omb/fedreg_1997standards

UCREX TARGET VALUES FOR RACE / ETHNICITY

The definition of the source systems vary between the sites and in some cases within a single site with more than one source system. The best of fit scenario is the OMB one question format which 'lumps' the question of Hispanic ethnicity with the other race designations. This choice will require some data analysis and potentially conversion for each data source at each site. Null and "unknown" are to be included in the same value.

| |
|---|
| American Indian or Alaskan Native |
| Asian |
| Black or African American |
| Hispanic or Latino |
| Native Hawaiian or Other Pacific Islander |
| White |

CLASS: RELIGION

DESCRIPTION

Religion is the primary religion or spiritual affiliation of the individual. Religion is recorded as a means to provide appropriate pastoral support and other social services to the patients as well as the family, as necessary. At times, a religious designation may also indicate a dietary preference or indicate a belief system that may require accommodation the planning or delivery of health or decedent services. The reference standard reviewed is the HL7 V3 Religion Table.

| Reference System: HL7 | | | | | | | |
|--|------|----------------------|------|-----------------------------|------|-------------------------|------|
| Version: V3, 2011 Normative Ed. | | | | | | | |
| Target Values | | | | | | | |
| VALUE | CODE | VALUE | CODE | VALUE | CODE | VALUE | CODE |
| Adventist | 1001 | Disciples of Christ | 1067 | Messianic Judaism | 1031 | Shamanism | 1044 |
| African Religions | 1002 | Divination | 1016 | Methodist | 1073 | Shiite (Islam) | 1045 |
| Afro-Caribbean Religions | 1003 | Eastern Orthodox | 1068 | Mittraism | 1032 | Shinto | 1046 |
| Agnosticism | 1004 | Episcopalian | 1069 | Native American | 1074 | Sikism | 1047 |
| Anglican | 1005 | Evangelical Covenant | 1070 | Nazarene | 1075 | Spiritualism | 1048 |
| Animism | 1006 | Fourth Way | 1017 | New Age | 1033 | Sunni (Islam) | 1049 |
| Assembly of God | 1061 | Free Daism | 1018 | non-Roman Catholic | 1034 | Taoism | 1050 |
| Atheism | 1007 | Friends | 1071 | Occult | 1035 | Theravada | 1051 |
| Babi & Baha'i faiths | 1008 | Full Gospel | 1072 | Orthodox | 1036 | Unitarian Universalist | 1081 |
| Baptist | 1009 | Gnosis | 1019 | Paganism | 1037 | Unitarian-Universalism | 1052 |
| Bon | 1010 | Hinduism | 1020 | Pentecostal | 1038 | United Church of Christ | 1082 |
| Brethren | 1062 | Humanism | 1021 | Presbyterian | 1076 | Universal Life Church | 1053 |
| Cao Dai | 1011 | Independent | 1022 | Process, The | 1039 | Vajrayana (Tibetan) | 1054 |
| Celticism | 1012 | Islam | 1023 | Protestant | 1077 | Veda | 1055 |
| Christian (non-Catholic, non-specific) | 1013 | Jainism | 1024 | Protestant, No Denomination | 1078 | Voodoo | 1056 |
| Christian Scientist | 1063 | Jehovah's Witnesses | 1025 | Reformed | 1079 | Wicca | 1057 |
| Church of Christ | 1064 | Judaism | 1026 | Reformed/Presbyterian | 1040 | Yaohushua | 1058 |
| Church of God | 1065 | Latter Day Saints | 1027 | Roman Catholic Church | 1041 | Zen Buddhism | 1059 |
| Confucianism | 1014 | Lutheran | 1028 | Salvation Army | 1080 | Zoroastrianism | 1060 |
| Congregational | 1066 | Mahayana | 1029 | Satanism | 1042 | | |
| Cyberculture Religions | 1015 | Meditation | 1030 | Scientology | 1043 | | |

References

Standard available from Health Level Seven

http://www.hl7.org/implement/standards/product_brief.cfm?product_id=186

UCREX TARGET VALUES FOR RELIGION

The target value set includes all religions represented in current UC systems. This set is larger and more granular than the HL7 standard examined. To assist in smoothing the specificity of the source data, related religions are grouped into nested sub-hierarchies in the navigation. For example, "Roman Catholic" and "Non-roman Catholic" occur in same nested sub-class. This supports selection of all of a group or more specific religions desired in a query. Null and "unknown" are to be included in the same value.

| 1st level | 2 nd level | 3 rd level |
|-----------------------------|-----------------------|-----------------------|
| Adventist | | |
| | Seven Day Adventist | |
| African religions | | |
| Afro-Caribbean religions | | |
| | Voodoo | |
| AME Zion Church | | |
| Agnosticism | | |
| Ancestor Worship | | |
| Anglican | | |
| Animism | | |
| Apostolic Church | | |
| Assembly of God | | |
| Atheist | | |
| Babi & Baha'l faiths | | |
| Brethren | | |
| | Church of Brethren | |
| Baptist | | |
| | Southern Baptist | |
| Buddhist | | |
| | Zen Buddhism | |
| | Mahayana | |
| | Theravada | |
| | Vajrayana | |
| | | Tibetan |
| | | Bon |
| Cao Dai | | |
| Catholic | | |
| | Roman Catholic Church | |
| Christian | | |
| Christian Science | | |
| Confucianism | | |
| Cyberculture religions | | |
| Congregational Church | | |
| Divination | | |
| Disciples of Christ | | |
| Dutch Reformed | | |
| Episcopalian | | |
| Evangelical Covenant Church | | |
| Friends (Quaker) | | |
| Evangelical Free Church | | |
| Fourth Way | | |
| Gnosis | | |
| Hindu | | |
| | Veda | |
| Humanism | | |
| Independent | | |
| Islamic | | |
| | Shiite (Islam) | |
| | Sunni (Islam) | |
| Jainism | | |
| Jehovah Witness | | |
| Jewish | | |
| | Messianic Judaism | |

| 1st level | 2 nd level | 3 rd level |
|-------------------------|-----------------------|-----------------------|
| Lutheran | | |
| Mennonite | | |
| Methodist | | |
| | United Methodist | |
| Meditation | | |
| Mormon | | |
| | Latter Day Saints | |
| New age | | |
| Mittraism | | |
| Native American | | |
| Nazarene | | |
| | Holiness | |
| Non-denominational | | |
| No religious pref | | |
| Occult | | |
| Orthodox | | |
| | Non-Roman Catholic | |
| | Russian Orthodox | |
| | Eastern Orthodox | |
| | Greek Orthodox | |
| Other | | |
| Paganism | | |
| | Celticism | |
| | Druid | |
| | Wicca | |
| Pentecostal | | |
| | Church of God | |
| Presbyterian | | |
| The Process | | |
| Protestant | | |
| Reformed Church | | |
| Religious Science | | |
| Satanism | | |
| Scientology | | |
| Shamanism | | |
| Shinto | | |
| Salvation Army | | |
| Sikh | | |
| Taoism | | |
| Spiritualism | | |
| United Church of Christ | | |
| | Church of Christ | |
| | Iglesia Ni Cristo | |
| Universal Life Church | | |
| Unity Church | | |
| Unitarian Universalist | | |
| Yaohushua | | |
| Zoroastrianism | | |
| Unknown | | |
| Declines to state | | |

CLASS: LABORATORY RESULTS

DESCRIPTION

According to the JCAHO, more than 80% of an electronic medical record is comprised of laboratory results. As complete laboratory catalogs, particularly as are used in tertiary care and research facilities represented in UCRex, can number many thousands of tests it was decided that a select set of lab tests would populate the system first, followed by a more complete compliment of test results in later phases of the project. Some effort was put into developing a rationale for the most valuable laboratory tests to be represented in the system first. The goal was to develop a set of commonly ordered lab tests were targeted, as well as those lab tests that provided high research value, and particularly those used in quality measures were considered. When the overall volume of transactions at each site was analyzed, the vast majority of lab test results at all sites were in each site's "top 150" tests. The top set of tests from the sites were consolidated and refined, producing the first round of high volume test results to populate UCRex. One of the classes of laboratory tests that were considered as "high value" for research and particularly outcomes measures are the microbiology results. These were deferred to the next project cycle due to time and resource limitations.

The primary coding system used to represent laboratory results is Logical Observation Identifier Names and Codes (LOINC) produced by the Regenstrief Institute. As LOINC is designated by CMS as the required coding system for Meaningful Use, it was selected for use within UCRex and each site mapped their lab catalogs to LOINC to support the project. However, it was discovered that the appropriate LOINC codes from feeder systems were far more specific than the lab tests represented in the consolidated "top" labs from the five sites. As such, there are LOINC codes available for each feeder system in UCRex, but the LOINC coding system is not used to form the laboratory 'hub' in the ontology cell.

UCREX TARGET VALUES FOR LABORATORY RESULTS

The following are the target test results implemented thus far in UCRex

| | | | |
|------------------|-----------|--------------------|---------------------------|
| Laboratory Tests | | | |
| | Chemistry | | |
| | | Amylase | |
| | | Anion Gap | |
| | | Arterial Blood Gas | |
| | | | Arterial Measurement Site |
| | | | Fraction Inspired O2 |
| | | | Patient Temperature |
| | | | pH |
| | | | PCO2 |
| | | | PO2 |
| | | | Bicarb |
| | | | Oxygen Saturation |
| | | Base Excess | |
| | | C Reactive Protein | |
| | | Calcium | |
| | | Calcium, Ionized | |
| | | Carboxy Hemoglobin | |
| | | Creatine Kinase | |
| | | Creatinine | |
| | | Electrolytes | |
| | | | Chloride |
| | | | Sodium |
| | | | Potassium |
| | | | CO2 |

UCREX ONTOLOGY REFERENCE

Laboratory Tests, Continued

| | | | |
|--|--------------------------|----------------------------|--|
| | (Chemistry, continued) | | |
| | | Free Thyroxine | |
| | | Gamma Glutamyl Transferase | |
| | | Glomerular Filtration Rate | |
| | | | Glomerular Filtration Rate if African American |
| | | | Glomerular Filtration Rate if Caucasian |
| | | Glucose | |
| | | Hemoglobin A1C | |
| | | Hepatic Function Panel | |
| | | | Alanine Aminotransferase |
| | | | Albumin |
| | | | Alkaline Phosphatase |
| | | | Aspartate Aminotransferase |
| | | | Direct Bilirubin |
| | | | Total Bilirubin |
| | | | Total Protein |
| | | Lactate | |
| | | Lactate Dehydrogenase | |
| | | Lipase | |
| | | Lipid Panel | |
| | | | Cholesterol |
| | | | High-density Lipoprotein |
| | | | Low-density Lipoprotein |
| | | | Triglycerides |
| | | Magnesium | |
| | | Phosphate | |
| | | Thyrotropin | |
| | | Troponin | |
| | | Urea Nitrogen | |
| | | Vitamin D+Metabolites | |
| | Hematology / Coagulation | | |
| | | Coagulation | |
| | | | APTT |
| | | | Prothrombin Time |
| | | | Protime |
| | | | Fibrinogen |

| | | | |
|--|----------------------|------------------------------------|---|
| | Complete Blood Count | | |
| | | CBC with Auto Differential Panel | |
| | | CBC with Manual Differential Panel | |
| | | Hematocrit | |
| | | Hemoglobin | |
| | | Platelets | |
| | | % Polys | |
| | | Basophils | |
| | | Eosinophils | |
| | | Eosinophils | |
| | | Erythrocytes | |
| | | | Erythrocyte Distribution Width |
| | | | Erythrocyte Mean Corpuscular Hemoglobin |
| | | | Erythrocyte Morphology Finding |
| | | | Erythrocyte Sedimentation Rate |
| | | Leukocytes | |
| | | Lymphocytes | |
| | | Lymphocytes | |
| | | Macrocytes | |
| | | Microcytes | |
| | | Monocytes | |
| | | Neutrophils | |
| | | | Neutrophils.Segmented |

Laboratory Tests, Continued
 (Hematology / Coagulation, Continued)

| | |
|------------|--|
| | Anisocytosis |
| | Elliptocytes |
| | Mean Platelet Volume |
| | Methemoglobin/Hemoglobin.Total In Blood |
| | Poikilocytosis |
| Serology | Polychromasia |
| | HIV1 / HIV2 Antibody Screen |
| Urinalysis | |
| | Albumin UA |
| | Appearance UA |
| | Bacteria UA |
| | Bilirubin UA |
| | Blood UA |
| | Clarity UA |
| | Color UA |
| | Glucose UA |
| | Hemoglobin UA |
| | Ketones UA |
| | Leukocyte Esterase UA |
| | Mucous UA |
| | Nitrite UA |
| | pH UA |
| | Protein UA |
| | Specific Gravity UA |
| | Squamous Epithelila UA |
| | WBC UA |

CLASS: VITAL STATUS

DESCRIPTION

Vital Status is an indicator as to whether an individual is deceased or living. A majority of the time, we discovered that this was a flag or field in the UCRex source systems indicating that a person is “known deceased”. In some instances, rather than being a data element, a discharge disposition of “deceased” or “died” were the indicators that an individual had passed. Most of the time, patients seen in UC health systems do not die as a result of an encounter. In some rare instances there are indicators of death in EMR records that are entered as a result of information obtained through treatment or other follow-up, or as a result of a record being sent from an outside entity. As such an unknown but small percentage of records indicating death are a part of the UCRex source systems. And, as a result it was deemed most accurate to represent the dead as “known deceased per EMR” rather than indicate that a patient might be living if there were no decedent records present.

An informatics research sub-project in cooperation with the UC Davis Pathology Informatics group is seeking to discover if the California Electronic Death Registry System (CA-EDRS) can be used to populated vital status records in UCRex. It is hopeful that this more accurate reflection of the total number of living versus deceased patients in the system can be used to improve the quality of the decedent numbers represented.

UCREX TARGET VALUES FOR VITAL STATUS

Known Deceased per EMR

CLASS: MEDICATIONS

DESCRIPTION

Medications are one of the most important clinical interventions used for treatment. In EMR and other source systems there are several fundamental types of medication data: formularies, which describe and enumerate available drugs, medication orders, medication administration records (MARs) and dispensing records. A review of available source systems revealed that all UCRex sites had formularies and medication orders available, but MAR data and dispensing event records were not universally available. As we believe that researchers are interested in actual interventions prescribed and not what might be available, formulary information was eliminated as a possible source. Medications in UCRex are medication orders only at this time. It is assumed that medications ordered are also administered regardless for care venue. A small subset of medications from an actual research protocol was selected as our pilot foray into medication data. The “SCANNER Medication safety surveillance of Antiplatelet and Anticoagulation Medications” a research protocol being conducted at UCSD was selected for this purpose. Additional medication orders are planned for inclusion in UCRex at a later date.

Most source of the source systems use NDC codes or proprietary drug databases (such as First Data Bank or MediSpan) to populate their EMR and pharmacy systems. As NDC codes are modeled to support dispensing events in pharmacies, each code or entry is a particular dose and form of a drug. As such these codes are very specific and numerous when representing a single drug. Although this standard is common at all sites, the structure makes NDC coded data unsuitable as a target coding system for UCRex. Not all sites subscribed to the same proprietary drug reference provider. As such, these were also eliminated. The target coding system selected for medication is RXNorm, as it was developed to support additional analyses (such as mechanism of action or chemical component) than just dispensing and inventory of drugs.

UCREX TARGET VALUES FOR MEDICATIONS

Medications

Anticoagulants

- warfarin

- dabigatran

Antiplatelet Agents

- clopidogrel

- prasugrel

UCREX ONTOLOGY REFERENCE

Appendix A: Mapping for APeX

Reference and Other Terminology Mapping for APeX Common Clinical Terminology to support CCD C32 & Meaningful Use (provided by UCSF)

| Terminology Description | Ref Term Standard(s) | Chronicles Masterfile(s)/ Item(s) or Cat List | Clarity Table(s)/Item(s) | Currently mapped? | Comments |
|-------------------------------------|--|--|--------------------------|---------------------------------|--|
| Procedures | LOINC, SNOMED CT, CPT-4, ICD-9 | EAP/2000, 2005 | | Mapped for CPT-4 and ICD-9 Only | |
| Lab Result Components | LOINC | LRR/70 | | Yes | |
| Lab Result Components + Antibiotics | LOINC | LNC | | ? | LNC is a new masterfile compiled from records in the LRR masterfile and category list ORD 2210 |
| Result Value Unit | UCUM | ORD 2050 | | Model Content | |
| Immunization Route | NCI Thesaurus Concept Code | LPL 4030 | | Model Content | |
| Immunization Medication Type | SNOMED CT | ERX 90 | | ? | |
| Immunization Product Name Code | CVX | ? | | ? | Need to find out how Epic is going to map this |
| Diagnoses/Problems | SNOMED CT | EXM/210 & HLX/40 | | Yes | |
| Diagnoses | ICD9 | EDG/95 | | Yes | |
| Allergens | RXNorm (Medications) UNII (Food & Substances) NDF-RT (Medication Classes) | ELG/.1, 400, 660, 661, 662 | | ? | |
| Allergy/Adverse Event Type | SNOMED CT | ELG/30 | | Model Content | |
| Reaction | SNOMED CT | LPL 3008 | | Model Content | |
| Severity | SNOMED CT | LPL 3070 | | Model Content | |
| Medications | RXNorm | ERX/1530, 1531, 1532 | | ? | |
| Medication Route | NCI Thesaurus Concept Code | ORD 7025 | | Model Content | |
| Medication Dose Unit | UCUM | ORD 34017, ORD 34117, ECT 9010 | | Model Content | |
| Medication Quantity Ordered | UCUM | ORD 7046 | | Model Content | |
| Medication Type | SNOMED CT | ERX/90 | | Model Content | Only 2 choices; 73639000 Prescription and 329505003 OTC |
| Medication Product Name Code | RXNorm (if drug name known) NDF-RT (if only med class known) UNII (if only med ingredient known) | ERX/1530, 1531, 1532 ERX/5000,5001 NDC/.1, 300 | | ? | |

**Reference and Other
Terminology Mapping for APeX
Common Clinical Terminology to support CCD C32 &
Meaningful Use, Continued
(Provided by UCSF)**

| Terminology Description | Ref Term Standard(s) | Chronicles Masterfile(s)/ Item(s) or Cat List | Clarity Table(s)/Item(s) | Currently mapped? | Comments |
|--------------------------------|-----------------------------|--|---------------------------------|--------------------------|---------------------|
| Medication Brand Name Code | RXNorm or NDC | ERX/1530, 1531, 1532 ERX/5000,5001 NDC/.1, 300 | | Model Content | |
| Gender | HL7 Code Set | EPT 130 | | Model Content | |
| Marital Status | HL7 Code Set | EPT 140 | | Model Content | |
| Religion | HL7 Code Set | EPT 150 | | Model Content | |
| Race | CDC | EPT 145 | | Model Content | |
| Ethnicity | CDC | EPT 135 | | Model Content | |
| Language | The Internet Society | EPT 146 | | Model Content | |
| State | FIPS | EPT 70 | | Model Content | |
| Biomedical Device Variables | SNOMED CT or Clinical LOINC | | | | Under investigation |
| Nursing Documentation | SNOMED CT or Clinical LOINC | | | | Under investigation |