
RISK SERVICE USER GUIDE

developed jointly by the HughesRiskApps Group at the Massachusetts General Hospital
and the Bayes Mendel Lab at the Dana Farber Cancer Institute

prepared by Phil Bosinoff
Deep Code Consulting
phil@deep-code.com
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Overview

This is a brief user guide for the Risk Service. This web service provides risk calculations for multiple cancer risk models: BRCAPRO, MMRpro, PancPRO, and MelaPro from the BayesMendel R package, Tyrer-Cuzick (v6 and v7), and the NCI's Colorectal Cancer Risk Assessment Tool (CCRAT). Use of Tyrer-Cuzick may require separate licensing. Input and output messages to/from the service use the HL7 Family History (XML) format.

To access this web service, the user must have a valid user agreement and user license in place.

Contact Giovanni Parmigiani at DFCI to obtain a user license.

The Risk Service can be used free of charge by all academic institutions, research institutions, and health care providers.

Usage of the Webservice is free to health care providers to a maximum of 25 calculations per day. For centers expecting higher volume, we will need to develop a separate licensing agreement with an associated cost to offset our costs for hardware and upkeep of the service.

Direct interactions with the Risk Service by commercial products requires a commercial license. Results from the Service cannot be embedded in commercial software, or otherwise provided to third parties, without a commercial license.

Acknowledgement

Acknowledgement of use of this service in any promotional materials and at time of use is required. The acknowledgement must read as follows:

“Computations are provided by the Risk Web Service developed jointly by the HughesRiskApps Group at the Massachusetts General Hospital and the BayesMendel Lab at the Dana Farber Cancer Institute”

Invoking the Risk Service from client software

The Risk Service is invoked using the `getRiskHL7()` or `getRiskHL7Selected()` methods.

Here is the `getRiskHL7()` method signature:

```
getRiskHL7(string hl7String, string id, boolean testData, boolean researchUseOk)
```

Parameters:

```

    hl7String - Input HL7 (XML) String containing HL7 family history data
    id       - License Id
    testData - True for test data, false for real data
    researchUseOk - True if ok for DFCI to use family data for research
                  purposes, false if not

```

Return value:

a String consisting of an HL7 message consisting of the original HL7 message with risk calculation results appended. See Appendix C for an example.

`getRiskHL7Selected()` gives the client more detailed options regarding exactly which models she wishes to run, whether to run them for all family members or just the counselee (proband), and whether the BayesMendel hazard rate data is needed in the reply message. Here is the `getRiskHL7Selected()` method signature:

```
getRiskHL7Selected(string hl7String, string id, boolean testData, boolean
    researchUseOk, string[] models, boolean counseleeOnly, boolean noHazardRates)
```

Parameters:

```

    hl7String - Input HL7 (XML) String containing HL7 family history data
    id       - License Id
    testData - True for test data, false for real data
    researchUseOk - True if ok for DFCI to use family data for research
                  purposes, false if not
    models   - String array of models to run. For example:
              String[] {"BrcaPro", "MmrPro", "PancPro", "MelaPro"}
    counseleeOnly - True for probCarrier results on proband only, false for
                  probCarrier results for all family members
    noHazardRates - True to not include Hazard Rates in reply message, false to
                  include Hazard rates in reply message.

```

Return value:

a String consisting of an HL7 message consisting of the original HL7 message with risk calculation results appended. See Appendix C for an example.

Calling `getRiskHL7(hl7String, id, testData, researchUseOk)` is equivalent to calling `getRiskHL7Selected(hl7String, id, testData, researchUseOk, new String[] {"BrcaPro", "MmrPro", "PancPro", "MelaPro", "Tyrer-Cuzick", "ccrat"}, false, false)`. The `counseleeOnly` and `noHazardRates` options are applicable only to the BayesMendel models `BrcaPro`, `MmrPro`, `PancPro`, and `MelaPro`.

The `models` string array must specifically contain one or more of `"BrcaPro"`, `"MmrPro"`, `"PancPro"`, `"MelaPro"`, `"Tyrer-Cuzick"`, `"ccrat"`. Any other strings in the array will be ignored. Note that if `"Tyrer-Cuzick"` is included results for v6 and for v7 will be returned.

Refer to Appendix D for Disease Codes, Appendix E for Race Codes, and Appendix F for Gene Codes. Appendix D's disease codes show the relevant meaning for use within the risk models. For example, this subset of codes all mean "Breast Cancer"; there are other codes that mean Breast Cancer as well. If a clinical observation has SNOMED code 254837009, or NCI codes C4872, C9245, or C9119, it will be considered Breast Cancer:

```
<row>
  <code>254837009</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Breast Cancer</Mgh>
  <meaning>Breast Cancer</meaning>
</row>
<row>
  <code>C4872</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Breast Cancer</Mgh>
  <meaning>Breast Cancer</meaning>
</row>
<row>
  <code>C9245</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Breast Cancer (Invasive)</Mgh>
  <meaning>Breast Cancer</meaning>
</row>
<row>
  <code>C9119</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Breast Cancer (Medullary)</Mgh>
  <meaning>Breast Cancer</meaning>
</row>
```

The HL7 family history can have clinical observation codes which are not mentioned in the appendices; such observations will be ignored. Only the clinical observations with meanings will be used as relevant inputs to the risk models.

The input message must be a valid HL7 Pedigree (Clinical Genomics / Family History) message. If the request message is not HL7 compliant, an <Error/> reply message will be returned, and no further processing will take place. Any namespace schema declarations will be stripped from the source hl7String; they are not used. To actually send the hl7String payload in the SOAP message, be sure to escape any double quote symbols (") within the message string by preceding them with a backslash character (\). In this fashion, the entire HL7 document parameter is passed as a single string. This author has found that other special characters such as "<" (opening XML tag symbol), for example, do not typically need to be explicitly escaped in the client software, but will likely be escaped/converted automatically by the SOAP software.

Messages

The Risk Service reply message has a small text section at the start of the risk data, and within each risk model's output, which describes any assumptions that were made, such as an age that was used for input to the models when a relative's age or age of onset of cancer is unknown. See Appendix C for an example.

Errors

If a risk model does not run successfully to a normal completion or if a risk model is inapplicable, the portion of the reply message for that model result will contain an “Error” element, with a description of the error (or why the model is not applicable) for the supplied HL7 family history. For example, if the mother of a relative is male, BrcaPro will return this message:

```
<methodCode code="BRCAPRO" codeSystemVersion="2.0-813">
  <Error>BayesMendel brcapro message: Error: mother is not female.
  You need to contact your software vendor for more information.</Error>
</methodCode>
```

Model Inputs and Imputations

Most risk model input covariate values are required by the respective models, though some model inputs take a value of “Unknown”, a.k.a. “missing”, or “NA”. That is, a value of NA is an allowed input value, built into the design of the model. However, if a model input is required, and it is not available, for certain reasonable situations the Risk Service may attempt to use (impute) an appropriate value. For example, if a relative’s age of onset of breast cancer is missing, the relative’s current age, if alive, or age at death is used. If the relative’s current age is unknown, the age of onset of breast cancer is assumed to be age 50. All assumptions like this will appear in the output message section.

Sometimes risk models take inputs, which, while not directly supplied as clinical observations, are nevertheless computable from multiple other clinical observations using reasonable logic. Here’s an example:

For “CCRAT”, the Colorectal Cancer Risk Assessment Tool, the “NoEstrogen2Yr” (No Estrogen within last two years) input value is determined as follows:

Given the following clinical observation values (only a subset of which may be present):

- HRT Last Use (also used by Tyrer-Cuzick model) = number of years (fractions allowed) since last use of HRT. If more than one HRT Last Use clinicalObservation (CO) in FH, minimum HRT Last Use CO value is used.
- EstroUseFromHRT Status = explicitly codes ‘HRTUseWithinPastTwoYears’ or ‘No HRTUseWithinPastTwoYears’ as would be supplied in answer to that specific survey question
- Menopausal Status (also used by T-C) = pre, peri, post, or unknown (if specified as such, or not present in the FH)
- Menopause Age (also used by T-C) = age at Menopause (applicable only to post Menopausal)
- Date of Last Period = self explanatory, must be compared with ‘effectiveTime’ of HL7 to determine if within 2 years or not

Note that ages can be supplied with a low and high value in the HL7, in which case the average age is calculated, and that more than one clinical observation may be present for the same thing. Normally multiple clinical observations should only be present for a repeated disease at, say, a different age such as for bilateral breast cancer, but HL7 does allow for multiple different clinical observations of the same thing in general. If say, more than one Menopause Age is supplied, the minimum age is used. This is conservative, allowing for the possibility that the pt has no Estrogen in the past two years.

Given all the above inputs, some of which are unknown or not present in the Family History, the algorithm to compute ‘NoEstrogenUse2Yr’ (=‘0’ for yes estrogen during last 2 years, or =‘1’ for No estrogen during last 2 years) is summarized as follows (this is abbreviated for clarity). Note that this is three valued logic, where any input can have a value or be unknown (NA):

NoEstrogenUse2Yr =

if (menopausal status equals pre [still having periods]) then '0'
else if (last Period date within 2yrs of effectiveTime eq 'yes') then '0'
else if ((HRTLstUseValue <= 2) or (EstroUseFromHRTStatus = 'yes')) then '0'

else if (lastPeriod > 2Yrs From MenopauseAge)) then '1'
else if (last Period (from Date provided) Not Within 2 Yrs) then '1'
else if (HRTLstUse > 2 yrs) then '1'
else if (EstroUseFromHRTStatus = 'no') then '1'
else 'NA'

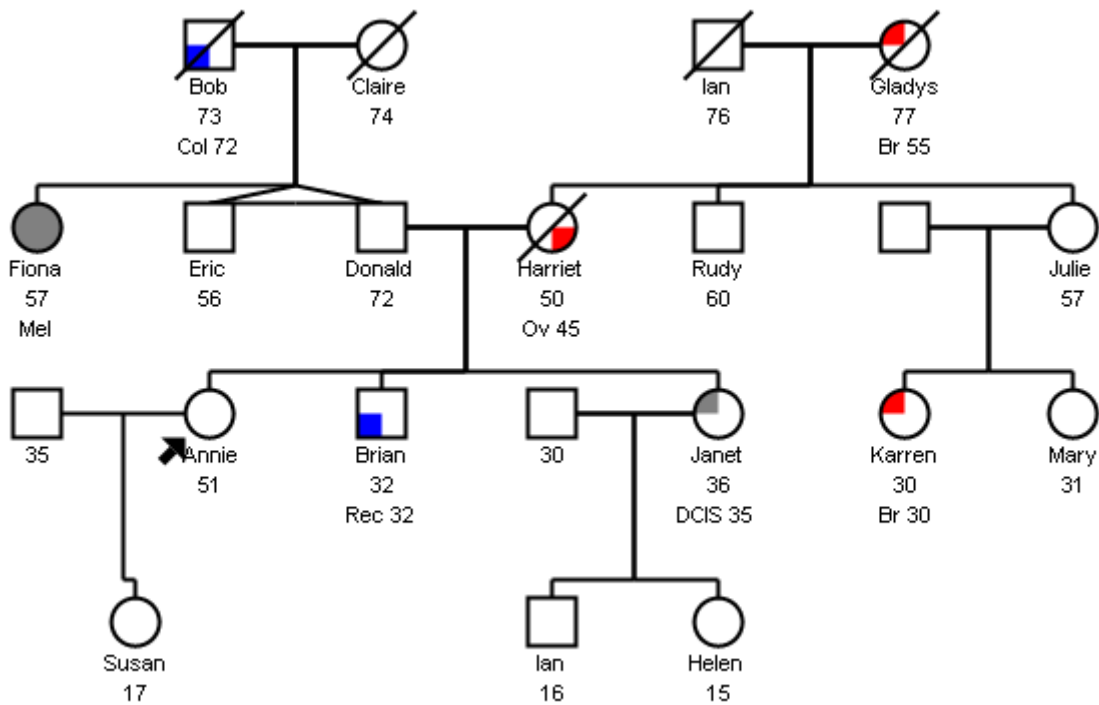
Demo Web Client

A demonstration web client is available at <http://bayesmendel.dfci.harvard.edu/risk>. You may copy/paste any valid input HL7 message or modify an existing sample input HL7 message in the input text area for processing.

Appendices

- A. [Example Pedigree](#)
- B. [Example HL7 Request Message](#)
- C. [Example HL7 Reply Message](#)
- D. [Disease Codes](#)
- E. [Race Codes](#)
- F. [Gene Codes](#)

Appendix A: Example Pedigree



Appendix B: Example HL7 request message

```
<?xml version="1.0" encoding="UTF-8"?>
<FamilyHistory classCode="OBS" moodCode="EVN">
  <id root="2.16.840.1.113883.6.117" extension="299"
    assigningAuthorityName="Avon Center Appointment Number"/>
  <code code="10157-6" codeSystemName="LOINC" displayName="HISTORY OF FAMILY MEMBER DISEASE"/>
  <text>This file was created by the Umass HL7-Mgh Translator</text>
  <effectiveTime value="2009040408"/>
  <subject typeCode="SBJ">
    <patient classCode="PAT">
      <id root="2.16.840.1.113883.6.117" extension="999999999"/>
      <patientPerson classCode="PSN" determinerCode="INSTANCE">
        <id extension="1"/>
        <name/>
        <telecom use="H" value=""/>
        <telecom use="WP" value=""/>
        <administrativeGenderCode code="F"/>
        <birthTime value="19600111"/>
        <deceasedInd value="false"/>
      </patientPerson>
    </patient>
  </subject>
</FamilyHistory>
```

```

<raceCode code="2106-3" codeSystemName="HL7" displayName="Caucasian or White"/>
<raceCode code="2131-1" codeSystemName="HL7" displayName="Ashkenazi"/>
<!--<ethnicGroupCode code="2135-2" codeSystemName="HL7" displayName="Hispanic"/>-->
<relative classCode="PRS">
  <code code="NMTH"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="2"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="true"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="4"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="5"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
</relative>
<subjectOf1 typeCode="SBJ">
  <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
    <value value="50"/>
  </deceasedEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="C4908" codeSystemName="NCI"
      displayName="Ovarian Carcinoma"/>
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age"
          codeSystemName="SNOMED CT"/>
        <value>
          <low value="45"/>
          <high value="45"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="NFTH"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="3"/>
    <name/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="6"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="7"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
</relative>

```

```

<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE"
      codeSystemName="LOINC"/>
    <value value="72"/>
  </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="313415001" codeSystemName="SNOMED_CT"
      displayName="Identical twin (person)">
    <qualifier>
      <value code="1"/>
    </qualifier>
  </code>
</clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="MGRMTH"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="4"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="true"/>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
      <value value="77"/>
    </deceasedEstimatedAge>
  </subjectOf1>
  <subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
      <code code="C4872" codeSystemName="NCI" displayName="Breast Carcinoma"/>
      <subject typeCode="SUBJ">
        <dataEstimatedAge classCode="OBS" moodCode="EVN">
          <code code="397659008" displayName="Age"
            codeSystemName="SNOMED CT"/>
          <value>
            <low value="55"/>
            <high value="55"/>
          </value>
        </dataEstimatedAge>
      </subject>
    </clinicalObservation>
  </subjectOf2>
  <subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
      <code code="3+" codeSystemName="HER2NeuIHC"/>
      <subject typeCode="SUBJ">
        <dataEstimatedAge classCode="OBS" moodCode="EVN">
          <code code="397659008" displayName="Age"
            codeSystemName="SNOMED CT"/>
          <value>
            <low value="55"/>
            <high value="55"/>
          </value>
        </dataEstimatedAge>
      </subject>
    </clinicalObservation>
  </subjectOf2>
  <subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
      <code code="Not_Amplified" codeSystemName="HER2NeuFISH"/>
      <subject typeCode="SUBJ">

```



```

        <dataEstimatedAge classCode="OBS" moodCode="EVN">
          <code code="397659008" displayName="Age"
            codeSystemName="SNOMED CT"/>
          <value>
            <low value="55"/>
            <high value="55"/>
          </value>
        </dataEstimatedAge>
      </subject>
    </clinicalObservation>
  </subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="MGRFTH"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="5"/>
    <name/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="true"/>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
      <value value="76"/>
    </deceasedEstimatedAge>
  </subjectOf1>
</relative>
<relative classCode="PRS">
  <code code="PGRMTH"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="6"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="true"/>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
      <value value="74"/>
    </deceasedEstimatedAge>
  </subjectOf1>
</relative>
<relative classCode="PRS">
  <code code="PGRFTH"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="7"/>
    <name/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="true"/>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
      <value value="73"/>
    </deceasedEstimatedAge>
  </subjectOf1>
  <subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
      <code code="C2955" codeSystemName="NCI"
        displayName="Colorectal Carcinoma"/>
      <subject typeCode="SUBJ">
        <dataEstimatedAge classCode="OBS" moodCode="EVN">
          <code code="397659008" displayName="Age"
            codeSystemName="SNOMED CT"/>
          <value>
            <low value="72"/>

```

```

                <high value="72"/>
            </value>
        </dataEstimatedAge>
    </subject>
</clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
    <code code="NBRO"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="8"/>
        <name/>
        <administrativeGenderCode code="M"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="2"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="3"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE"
                codeSystemName="LOINC"/>
            <value value="32"/>
        </livingEstimatedAge>
    </subjectOf1>
    <subjectOf2 typeCode="SBJ">
        <clinicalObservation classCode="OBS" moodCode="EVN">
            <code code="C9382" codeSystemName="NCI" displayName="Rectal Carcinoma"/>
            <subject typeCode="SUBJ">
                <dataEstimatedAge classCode="OBS" moodCode="EVN">
                    <code code="397659008" displayName="Age"
                        codeSystemName="SNOMED CT"/>
                    <value>
                        <low value="32"/>
                        <high value="32"/>
                    </value>
                </dataEstimatedAge>
            </subject>
        </clinicalObservation>
    </subjectOf2>
</relative>
<relative classCode="PRS">
    <code code="NSIS"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="9"/>
        <name/>
        <administrativeGenderCode code="F"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="2"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">

```

```

        <id extension="3"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE"
      codeSystemName="LOINC"/>
    <value value="36"/>
  </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="C2924" codeSystemName="NCI"
      displayName="Ductal Carcinoma In Situ of the Breast"/>
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age"
          codeSystemName="SNOMED CT"/>
        <value>
          <low value="35"/>
          <high value="35"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="NotAvailable"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="10"/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="false"/>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <livingEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="21611-9" displayName="ESTIMATED AGE"
        codeSystemName="LOINC"/>
      <value value="30"/>
    </livingEstimatedAge>
  </subjectOf1>
</relative>
<relative classCode="PRS">
  <code code="NEPHEW"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="11"/>
    <name/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="9"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="10"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE"

```

```

        codeSystemName="LOINC"/>
        <value value="16"/>
    </livingEstimatedAge>
</subjectOf1>
</relative>
<relative classCode="PRS">
    <code code="NIECE"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="12"/>
        <name/>
        <administrativeGenderCode code="F"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="9"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="10"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
<subjectOf1 typeCode="SBJ">
    <livingEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="21611-9" displayName="ESTIMATED AGE"
            codeSystemName="LOINC"/>
        <value value="15"/>
    </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
    <geneticLocus classCode="LOC" moodCode="EVN">
        <text>BRCA1 breast cancer 1, early onset</text>
        <value code="83990" displayName="BRCA1" codeSystemName="NCBI Entrez">
            <translation code="20473" displayName="BRCA1" codeSystem="HGNC"/>
        </value>
        <component3 typeCode="COMP">
            <sequenceVariation classCode="SEQVAR" moodCode="EVN">
                <interpretationCode code="Negative"/>
            </sequenceVariation>
        </component3>
    </geneticLocus>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
    <geneticLocus classCode="LOC" moodCode="EVN">
        <text>BRCA2 breast cancer 2, early onset</text>
        <value code="675" displayName="BRCA2" codeSystemName="NCBI Entrez">
            <translation code="1101" displayName="BRCA2" codeSystem="HGNC"/>
        </value>
        <component3 typeCode="COMP">
            <sequenceVariation classCode="SEQVAR" moodCode="EVN">
                <interpretationCode code="Negative"/>
            </sequenceVariation>
        </component3>
    </geneticLocus>
</subjectOf2>
</relative>
<relative classCode="PRS">
    <code code="NotAvailable"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="13"/>
        <administrativeGenderCode code="M"/>
        <deceasedInd value="false"/>
    </relationshipHolder>

```

```

<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE"
      codeSystemName="LOINC"/>
    <value value="35"/>
  </livingEstimatedAge>
</subjectOf1>
</relative>
<relative classCode="PRS">
  <code code="DAU"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="14"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="1"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="13"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE"
      codeSystemName="LOINC"/>
    <value value="17"/>
  </livingEstimatedAge>
</subjectOf1>
</relative>
<relative classCode="PRS">
  <code code="PUNCLE"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="15"/>
    <name/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="6"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="7"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE"
      codeSystemName="LOINC"/>
    <value value="56"/>
  </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="313415001" codeSystemName="SNOMED_CT"

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        displayName="Identical twin (person)">
        <qualifier>
            <value code="1"/>
        </qualifier>
    </code>
</clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
    <code code="PAUNT"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="16"/>
        <name/>
        <administrativeGenderCode code="F"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="6"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="7"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE"
                codeSystemName="LOINC"/>
            <value value="57"/>
        </livingEstimatedAge>
    </subjectOf1>
    <subjectOf2 typeCode="SBJ">
        <clinicalObservation classCode="OBS" moodCode="EVN">
            <code code="C3224" codeSystemName="NCI" displayName="Melanoma"/>
        </clinicalObservation>
    </subjectOf2>
</relative>
<relative classCode="PRS">
    <code code="MUNCLE"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="17"/>
        <name/>
        <administrativeGenderCode code="M"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="4"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="5"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE"
                codeSystemName="LOINC"/>
            <value value="60"/>

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        </livingEstimatedAge>
    </subjectOf1>
</relative>
<relative classCode="PRS">
    <code code="MAUNT"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="18"/>
        <name/>
        <administrativeGenderCode code="F"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="4"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="5"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE"
                codeSystemName="LOINC"/>
            <value value="57"/>
        </livingEstimatedAge>
    </subjectOf1>
</relative>
<relative classCode="PRS">
    <code code="NotAvailable"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="19"/>
        <administrativeGenderCode code="M"/>
        <deceasedInd value="false"/>
    </relationshipHolder>
</relative>
<relative classCode="PRS">
    <code code="MCOUSN"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="20"/>
        <name/>
        <administrativeGenderCode code="F"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="18"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="19"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE"
                codeSystemName="LOINC"/>
            <value value="30"/>
        </livingEstimatedAge>
    </subjectOf1>

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<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="C4872" codeSystemName="NCI" displayName="Breast Carcinoma"/>
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age"
          codeSystemName="SNOMED CT"/>
        <value>
          <low value="30"/>
          <high value="30"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="MCOUSN"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="21"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="18"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="19"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <livingEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="21611-9" displayName="ESTIMATED AGE"
        codeSystemName="LOINC"/>
      <value value="31"/>
    </livingEstimatedAge>
  </subjectOf1>
</relative>
</patientPerson>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
    <value value="51"/>
  </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="C19666" codeSystemName="NCI" displayName="Age at Menarche"/>
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="13"/>
          <high value="13"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">

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<clinicalObservation classCode="OBS" moodCode="EVN">
  <code code="C19667" codeSystemName="NCI" displayName="Age at First Live Birth"/>
  <subject typeCode="SUBJ">
    <dataEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
      <value>
        <low value="30"/>
        <high value="30"/>
      </value>
    </dataEstimatedAge>
  </subject>
</clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="126" codeSystemName="UML" displayName="Number of breast biopsies">
      <qualifier>
        <value code="2"/>
      </qualifier>
    </code>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="130" codeSystemName="UML" displayName="Menopausal Status"/>
    <!-- 0=pre-menopausal; 1=peri-menopausal; 2=post-menopausal; 3=Unknown -->
    <statusCode code="2"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="131" codeSystemName="UML" displayName="Menopause Age"/>
    <!-- Age at menopause in Years (integer) for post-menopausal -->
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="45"/>
          <high value="45"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="21840007" codeSystemName="SNOMED_CT"
      displayName="Date of last menstrual period">
      <!-- Date in YYYYMMDD format -->
      <qualifier>
        <value code="20060715"/>
      </qualifier>
    </code>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="132" codeSystemName="UML" displayName="Height">
      <!-- Height (in meters, to nearest cm i.e. 1.65) -->
      <qualifier>
        <value code="1.92"/>
      </qualifier>
    </code>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">

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<clinicalObservation classCode="OBS" moodCode="EVN">
  <code code="133" codeSystemName="UML" displayName="Weight">
    <!-- Weight (in kilograms) -->
    <qualifier>
      <value code="58.97"/>
    </qualifier>
  </code>
</clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="134" codeSystemName="UML" displayName="Usual Breast Hyperplasia"/>
    <!-- 1=history of hyperplasia (without atypia); 0=missing or unknown (equivalent
      to not including this clinical observation) -->
    <!-- 2=unknown benign breast disease -->
    <statusCode code="0"/>
  </clinicalObservation>
</subjectOf2>
<!--
Alternate way to specify benign breast disease/condition (known or unknown):
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="419307005" codeSystemName="SNOMED CT" displayName="Benign breast condition"/>
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="43"/>
          <high value="43"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
-->
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="135" codeSystemName="UML" displayName="HRT Use"/>
    <!-- 0=Never; 1=Previous user (more than 5 years ago); 2=Previous user (less
      than 5 years ago); 3=Current user -->
    <!-- 0 = not relevant, missing or unknown (equivalent to not including this
      clinical observation) -->
    <statusCode code="1"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="136" codeSystemName="UML" displayName="HRT Type"/>
    <!-- 1=estrogen; 2=combined; 0 = not relevant, missing or unknown (equivalent to
      not including this clinical observation) -->
    <!-- Note these codes differ slightly from the Tyrer-Cusick model input
      parameter codes, but are more consistently defined with other related codes
      (using 0 for unknown) and provide more information -->
    <statusCode code="1"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="137" codeSystemName="UML" displayName="HRT Length Past">
      <!-- Number of years, decimal allowed:
        i.e. 18 months should be entered as 1.5 years. -->
      <!-- 0 = not relevant, missing or unknown (equivalent to not including this
        clinical observation) -->
      <qualifier>
        <value code="1.5"/>
      </qualifier>
    </code>
  </clinicalObservation>
</subjectOf2>

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    </code>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="138" codeSystemName="UML" displayName="HRT Length Intent">
      <!-- Length of time woman intends to use HRT in the future
      (if current user) -->
      <!-- Number of years, decimal allowed:
      i.e. 18 months should be entered as 1.5 years. -->
      <!-- 0 = not relevant, missing or unknown (equivalent to not including this
      clinical observation) -->
      <qualifier>
        <value code="1.5"/>
      </qualifier>
    </code>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="139" codeSystemName="UML" displayName="HRT Last Use">
      <!-- Time since HRT last used (only relevant if previous HRT user) -->
      <!-- Number of years, decimal allowed:
      i.e. 18 months should be entered as 1.5 years. -->
      <!-- 0 = not relevant, missing or unknown (equivalent to not including this
      clinical observation) -->
      <qualifier>
        <value code="0.5"/>
      </qualifier>
    </code>
    <!-- And/Or whether HRT use within last two years -->
    <!-- Expected Codes are one of
    "HRTUseWithinPastTwoYears"
    "NoHRTUseWithinPastTwoYears"
    "UnknownHRTUseWithinPastTwoYears"      -->
    <!-- ***** -->
    <!-- *** If (statusCode element is present and code is
    "UnknownHRTUseWithinPastTwoYears") OR qualifier/value is not present,
    *** then will be considered Unknown -->
    <!-- ***** -->
    <statusCode code="HRTUseWithinPastTwoYears"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="C16450" codeSystemName="NCI" displayName="Colonoscopy"/>
    <!-- Either statusCode and/or subject/dataEstimatedAge must be present to
    specify the recency of the colonoscopy -->
    <!-- If neither are present, colonoscopy recency is unknown -->
    <!-- statusCode value, if/when present, must be one of
    "DuringPast10Years"
    "NotDuringPast10Years"      -->
    <statusCode code="DuringPast10Years"/>
    <!-- If subject/dataEstimatedAge is present and statusCode/@code is not, recency
    of colonoscopy will be calculated by subtracting from current age -->
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="32"/>
          <high value="32"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>

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<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="115" codeSystemName="UML" displayName="Colon Polyp-NOS"/>
    <!-- Either statusCode and/or subject/dataEstimatedAge must be present to
         specify the recency of a Polyp -->
    <!-- If neither are present, Polyp recency is unknown -->
    <!-- statusCode value, if/when present, must be one of
         "DuringPast10Years"
         "NotDuringPast10Years" -->
    <statusCode code="DuringPast10Years"/>
    <!-- If subject/dataEstimatedAge is present and statusCode/@code is not, recency
         of colonoscopy will be calculated by subtracting from current age -->
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="35"/>
          <high value="35"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="158" codeSystemName="UML"
         displayName="Aspirin or NSAID regular use"/>
    <!-- If this code is present, then meets CCRAT criteria for regular
         Aspirin/NSAID use defined as follows: -->
    <!-- During the past 30 days, have you taken aspirin, BUFFERIN, BAYER,
         or EXCEDRIN at least 3 times a week? (Do NOT include TYLENOL.) -->
    <!-- Expected statusCode/@code's are 'yes' (or 'Yes') or 'no' (or 'No')
         If this code is *not* present, then is unknown -->
    <statusCode code="Yes"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="159" codeSystemName="UML" displayName="Ibuprofen regular use"/>
    <!-- If this code is present, then meets CCRAT criteria for regular Ibuprofen
         use defined as follows: -->
    <!-- During the past 30 days, have you taken ADVIL, ALEVE, CELEBREX, IBUPROFEN,
         MOTRIN, NAPROXEN, or NUPRIN at least 3 times a week?
         (Do NOT include TYLENOL.) -->
    <!-- Expected statusCode/@code's are 'yes' (or 'Yes') or 'no' (or 'No')
         If this code is *not* present, then is unknown -->
    <statusCode code="Yes"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="141" codeSystemName="UML"
         displayName="Vigorous Exercise hours per week">
    <!-- Specify either a decimal number of hours per week in
         qualifier/value/@code or a category via statusCode/@code -->
    <!-- If want statusCode/@code only,
         remove qualifier element; code element must remain -->
    <qualifier>
      <value code="3"/>
    </qualifier>
  </code>
  <!-- And/Or one of these category statusCodes: -->
  <!-- "Zero"
       "GTZeroLE2"
       "GT2LE4"
       "GT4"

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    *** If the statusCode/@code is not one of the above, it is ignored. -->
<!-- *****
If more than one Vigorous Exercise hours per week in this FH,
then the worst (closest to zero)
over all clinicalObservations of this type and all qualifier/value/@codes
and statusCode/@codes contained therein will be used -->
<!-- ***** -->
    <statusCode code="GT2LE4"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="142" codeSystemName="UML" displayName="Cigarette Smoking years">
      <!-- Specify either a decimal number of years in qualifer/value/@code or a
      category via statusCode/@code -->
      <!-- If want statusCode/@code only,
      remove qualifier element; code element must remain -->
      <qualifier>
        <value code="38"/>
      </qualifier>
    </code>
    <!-- And/Or one of these category statusCodes: -->
    <!-- "Zero"
    "GTZeroLT15"
    "GE15LT35"
    "GE35" -->
    <!-- ***** -->
    <!-- *** If the statusCode/@code is not one of the above it is ignored. ** -->
    <!-- ***** -->
    If more than one Cigarette Smoking years qualifier/value/@codes
    or statusCode/@codes are in this FH, then the worst (highest) will be used
    ***** -->
    <statusCode code="GE35"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="143" codeSystemName="UML" displayName="Cigarettes per day">
      <!-- Specify either a decimal number of cigarettes in qualifier/value/@code
      or a category via statusCode/@code -->
      <!-- If want statusCode/@code only, remove qualifier element;
      code element must remain -->
      <qualifier>
        <value code="15"/>
      </qualifier>
    </code>
    <!-- And/Or one of these category statusCodes: -->
    <!-- "Zero"
    "GE1LT11"
    "GE11LE20"
    "GT20" -->
    <!-- ***** -->
    <!-- *** If the statusCode/@code is not one of the above it is ignored. *** -->
    <!-- ***** -->
    If more than one Cigarettes per day qualifier/value/@codes
    or statusCode/@codes are in this FH, then the worst (highest) will be used
    ***** -->
    <statusCode code="GE11LE20"/>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="144" codeSystemName="UML" displayName="Vegetable servings per day">
      <!-- Refers to this specific CCRAT survey question:
      In the past 30 days, about how many servings per week of vegetables or
      leafy green salads did you eat? INCLUDE raw, cooked, canned, and

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        frozen vegetables (including beans) and leafy green salads.
        DO NOT INCLUDE fried vegetables like French fries or fried potatoes.-->
<!-- Specify either a decimal number of servings in qualifer/value/@code or
a category via statusCode/@code -->
<!-- If want statusCode/@code only, remove qualifier element;
code element must remain -->
<qualifier>
  <value code="4"/>
</qualifier>
</code>
<!-- And/Or one of these category statusCodes:      -->
<!-- "LT5"
      "GE5"          -->
<!-- *** If the statusCode/@code is not one of the above it is ignored. *** -->
<!-- *****
If more than one Vegetable servings per day in this FH,
then the worst (closest to zero)
over all clinicalObservations of this type and all qualifier/value/@codes
and statusCode/@codes contained therein will be used
***** -->
  <statusCode code="LT5"/>
</clinicalObservation>
</subjectOf2>
<!-- Include one or more of these clinical observations or similar for the proband to
have a disease for which running CCRAT is Not Applicable -->
<!--
      <subjectOf2 typeCode="SBJ">
<clinicalObservation classCode="OBS" moodCode="EVN">
  <code code="72900001" codeSystemName="SNOMED_CT"
    displayName="Familial multiple polyposis syndrome"/>
  <subject typeCode="SBJ">
    <dataEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
      <value>
        <low value="35"/>
        <high value="35"/>
      </value>
    </dataEstimatedAge>
  </subject>
</clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="34000006" codeSystemName="SNOMED_CT" displayName="Crohn's Disease"/>
    <subject typeCode="SBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="35"/>
          <high value="35"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="64766004" codeSystemName="SNOMED_CT" displayName="Ulcerative Colitis"/>
    <subject typeCode="SBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="35"/>
          <high value="35"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="64766004" codeSystemName="SNOMED_CT" displayName="Ulcerative Colitis"/>
    <subject typeCode="SBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="35"/>
          <high value="35"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>

```

```

        </subject>
    </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
        <code code="315058005" codeSystemName="SNOMED_CT"
            displayName="Hereditary nonpolyposis colon cancer"/>
        <subject typeCode="SUBJ">
            <dataEstimatedAge classCode="OBS" moodCode="EVN">
                <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
                <value>
                    <low value="35"/>
                    <high value="35"/>
                </value>
            </dataEstimatedAge>
        </subject>
    </clinicalObservation>
</subjectOf2>
-->
</patient>
</subject>
</FamilyHistory>

```

Appendix C: Example HL7 reply message

```

<?xml version="1.0" encoding="UTF-8"?>
<FamilyHistory classCode="OBS" moodCode="EVN">
    <id root="2.16.840.1.113883.6.117" extension="299" assigningAuthorityName="Avon Center Appointment Number"/>
    <code code="10157-6" codeSystemName="LOINC" displayName="HISTORY OF FAMILY MEMBER DISEASE"/>
    <text>This file was created by the Umass HL7-Mgh Translator</text>
    <effectiveTime value="2009040408"/>
    <subject typeCode="SBJ">
        <patient classCode="PAT">
            <id root="2.16.840.1.113883.6.117" extension="999999999"/>
            <patientPerson classCode="PSN" determinerCode="INSTANCE">
                <id extension="1"/>
                <name/>
                <telecom use="H" value=""/>
                <telecom use="WP" value=""/>
                <administrativeGenderCode code="F"/>
                <birthTime value="19600111"/>
                <deceasedInd value="false"/>
                <raceCode code="2106-3" codeSystemName="HL7" displayName="Caucasian or White"/>
                <raceCode code="2131-1" codeSystemName="HL7" displayName="Ashkenazi"/>
                <relative classCode="PRS">
                    <code code="NMTH"/>
                    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                        <id extension="2"/>
                        <name/>
                        <administrativeGenderCode code="F"/>
                        <deceasedInd value="true"/>
                        <relative classCode="PRS">
                            <code code="NMTH"/>
                            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                                <id extension="4"/>
                            </relationshipHolder>
                        </relative>
                    </relative>
                    <relative classCode="PRS">
                        <code code="NFTH"/>
                        <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                            <id extension="5"/>
                        </relationshipHolder>
                    </relative>
                </relative>
            </patientPerson>
        </patient>
    </subject>

```

```

        </relationshipHolder>
    </relative>
</relationshipHolder>
<subjectOf1 typeCode="SBJ">
    <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
        <value value="50"/>
    </deceasedEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
        <code code="C4908" codeSystemName="NCI" displayName="Ovarian Carcinoma"/>
        <subject typeCode="SUBJ">
            <dataEstimatedAge classCode="OBS" moodCode="EVN">
                <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
                <value>
                    <low value="45"/>
                    <high value="45"/>
                </value>
            </dataEstimatedAge>
        </subject>
    </clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
    <code code="NFTH"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="3"/>
        <name/>
        <administrativeGenderCode code="M"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="6"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="7"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
            <value value="72"/>
        </livingEstimatedAge>
    </subjectOf1>
    <subjectOf2 typeCode="SBJ">
        <clinicalObservation classCode="OBS" moodCode="EVN">
            <code code="313415001" codeSystemName="SNOMED_CT"
                displayName="Identical twin (person)">
                <qualifier>
                    <value code="1"/>
                </qualifier>
            </code>
        </clinicalObservation>
    </subjectOf2>
</relative>
<relative classCode="PRS">
    <code code="MGRMTH"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="4"/>
        <name/>

```



```

        <administrativeGenderCode code="F"/>
        <deceasedInd value="true"/>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
            <value value="77"/>
        </deceasedEstimatedAge>
    </subjectOf1>
    <subjectOf2 typeCode="SBJ">
        <clinicalObservation classCode="OBS" moodCode="EVN">
            <code code="C4872" codeSystemName="NCI" displayName="Breast Carcinoma"/>
            <subject typeCode="SUBJ">
                <dataEstimatedAge classCode="OBS" moodCode="EVN">
                    <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
                    <value>
                        <low value="55"/>
                        <high value="55"/>
                    </value>
                </dataEstimatedAge>
            </subject>
        </clinicalObservation>
    </subjectOf2>
    <subjectOf2 typeCode="SBJ">
        <clinicalObservation classCode="OBS" moodCode="EVN">
            <code code="3+" codeSystemName="HER2NeuIHC"/>
            <subject typeCode="SUBJ">
                <dataEstimatedAge classCode="OBS" moodCode="EVN">
                    <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
                    <value>
                        <low value="55"/>
                        <high value="55"/>
                    </value>
                </dataEstimatedAge>
            </subject>
        </clinicalObservation>
    </subjectOf2>
    <subjectOf2 typeCode="SBJ">
        <clinicalObservation classCode="OBS" moodCode="EVN">
            <code code="Not_Amplified" codeSystemName="HER2NeuFISH"/>
            <subject typeCode="SUBJ">
                <dataEstimatedAge classCode="OBS" moodCode="EVN">
                    <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
                    <value>
                        <low value="55"/>
                        <high value="55"/>
                    </value>
                </dataEstimatedAge>
            </subject>
        </clinicalObservation>
    </subjectOf2>
</relative>
<relative classCode="PRS">
    <code code="MGRFTH"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="5"/>
        <name/>
        <administrativeGenderCode code="M"/>
        <deceasedInd value="true"/>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
            <value value="76"/>
        </deceasedEstimatedAge>
    </subjectOf1>

```

```

</relative>
<relative classCode="PRS">
  <code code="PGRMTH"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="6"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="true"/>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
      <value value="74"/>
    </deceasedEstimatedAge>
  </subjectOf1>
</relative>
<relative classCode="PRS">
  <code code="PGRFTH"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="7"/>
    <name/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="true"/>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <deceasedEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="39016-1" displayName="AGE AT DEATH" codeSystemName="LOINC"/>
      <value value="73"/>
    </deceasedEstimatedAge>
  </subjectOf1>
  <subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
      <code code="C2955" codeSystemName="NCI" displayName="Colorectal Carcinoma"/>
      <subject typeCode="SUBJ">
        <dataEstimatedAge classCode="OBS" moodCode="EVN">
          <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
          <value>
            <low value="72"/>
            <high value="72"/>
          </value>
        </dataEstimatedAge>
      </subject>
    </clinicalObservation>
  </subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="NBRO"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="8"/>
    <name/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="2"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="3"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">

```

```

    <livingEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
      <value value="32"/>
    </livingEstimatedAge>
  </subjectOf1>
  <subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
      <code code="C9382" codeSystemName="NCI" displayName="Rectal Carcinoma"/>
      <subject typeCode="SUBJ">
        <dataEstimatedAge classCode="OBS" moodCode="EVN">
          <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
          <value>
            <low value="32"/>
            <high value="32"/>
          </value>
        </dataEstimatedAge>
      </subject>
    </clinicalObservation>
  </subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="NSIS"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="9"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="2"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="3"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <livingEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
      <value value="36"/>
    </livingEstimatedAge>
  </subjectOf1>
  <subjectOf2 typeCode="SBJ">
    <clinicalObservation classCode="OBS" moodCode="EVN">
      <code code="C2924" codeSystemName="NCI"
        displayName="Ductal Carcinoma In Situ of the Breast"/>
      <subject typeCode="SUBJ">
        <dataEstimatedAge classCode="OBS" moodCode="EVN">
          <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
          <value>
            <low value="35"/>
            <high value="35"/>
          </value>
        </dataEstimatedAge>
      </subject>
    </clinicalObservation>
  </subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="NotAvailable"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="10"/>

```

```

        <administrativeGenderCode code="M"/>
        <deceasedInd value="false"/>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
            <value value="30"/>
        </livingEstimatedAge>
    </subjectOf1>
</relative>
<relative classCode="PRS">
    <code code="NEPHEW"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="11"/>
        <name/>
        <administrativeGenderCode code="M"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="9"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="10"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
            <value value="16"/>
        </livingEstimatedAge>
    </subjectOf1>
</relative>
<relative classCode="PRS">
    <code code="NIECE"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="12"/>
        <name/>
        <administrativeGenderCode code="F"/>
        <deceasedInd value="false"/>
        <relative classCode="PRS">
            <code code="NMTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="9"/>
            </relationshipHolder>
        </relative>
        <relative classCode="PRS">
            <code code="NFTH"/>
            <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
                <id extension="10"/>
            </relationshipHolder>
        </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
        <livingEstimatedAge classCode="OBS" moodCode="EVN">
            <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
            <value value="15"/>
        </livingEstimatedAge>
    </subjectOf1>
    <subjectOf2 typeCode="SBJ">
        <geneticLocus classCode="LOC" moodCode="EVN">
            <text>BRCA1 breast cancer 1, early onset</text>

```

```

    <value code="83990" displayName="BRCA1" codeSystemName="NCBI Entrez">
      <translation code="20473" displayName="BRCA1" codeSystem="HGNC"/>
    </value>
    <component3 typeCode="COMP">
      <sequenceVariation classCode="SEQVAR" moodCode="EVN">
        <interpretationCode code="Negative"/>
      </sequenceVariation>
    </component3>
  </geneticLocus>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <geneticLocus classCode="LOC" moodCode="EVN">
    <text>BRCA2 breast cancer 2, early onset</text>
    <value code="675" displayName="BRCA2" codeSystemName="NCBI Entrez">
      <translation code="1101" displayName="BRCA2" codeSystem="HGNC"/>
    </value>
    <component3 typeCode="COMP">
      <sequenceVariation classCode="SEQVAR" moodCode="EVN">
        <interpretationCode code="Negative"/>
      </sequenceVariation>
    </component3>
  </geneticLocus>
</subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="NotAvailable"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="13"/>
    <administrativeGenderCode code="M"/>
    <deceasedInd value="false"/>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <livingEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
      <value value="35"/>
    </livingEstimatedAge>
  </subjectOf1>
</relative>
<relative classCode="PRS">
  <code code="DAU"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="14"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="1"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="13"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
  <subjectOf1 typeCode="SBJ">
    <livingEstimatedAge classCode="OBS" moodCode="EVN">
      <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
      <value value="17"/>
    </livingEstimatedAge>
  </subjectOf1>
</relative>
<relative classCode="PRS">

```

```

<code code="PUNCLE"/>
<relationshipHolder classCode="PSN" determinerCode="INSTANCE">
  <id extension="15"/>
  <name/>
  <administrativeGenderCode code="M"/>
  <deceasedInd value="false"/>
  <relative classCode="PRS">
    <code code="NMTH"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
      <id extension="6"/>
    </relationshipHolder>
  </relative>
  <relative classCode="PRS">
    <code code="NFTH"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
      <id extension="7"/>
    </relationshipHolder>
  </relative>
</relationshipHolder>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
    <value value="56"/>
  </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="313415001" codeSystemName="SNOMED_CT"
      displayName="Identical twin (person)">
      <qualifier>
        <value code="1"/>
      </qualifier>
    </code>
  </clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="PAUNT"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="16"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="6"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="7"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
</relative>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
    <value value="57"/>
  </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="C3224" codeSystemName="NCI" displayName="Melanoma"/>
  </clinicalObservation>

```

```

    </subjectOf2>
  </relative>
  <relative classCode="PRS">
    <code code="MUNCLE"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
      <id extension="17"/>
      <name/>
      <administrativeGenderCode code="M"/>
      <deceasedInd value="false"/>
      <relative classCode="PRS">
        <code code="NMTH"/>
        <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
          <id extension="4"/>
        </relationshipHolder>
      </relative>
      <relative classCode="PRS">
        <code code="NFTH"/>
        <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
          <id extension="5"/>
        </relationshipHolder>
      </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
      <livingEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
        <value value="60"/>
      </livingEstimatedAge>
    </subjectOf1>
  </relative>
  <relative classCode="PRS">
    <code code="MAUNT"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
      <id extension="18"/>
      <name/>
      <administrativeGenderCode code="F"/>
      <deceasedInd value="false"/>
      <relative classCode="PRS">
        <code code="NMTH"/>
        <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
          <id extension="4"/>
        </relationshipHolder>
      </relative>
      <relative classCode="PRS">
        <code code="NFTH"/>
        <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
          <id extension="5"/>
        </relationshipHolder>
      </relative>
    </relationshipHolder>
    <subjectOf1 typeCode="SBJ">
      <livingEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
        <value value="57"/>
      </livingEstimatedAge>
    </subjectOf1>
  </relative>
  <relative classCode="PRS">
    <code code="NotAvailable"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
      <id extension="19"/>
      <administrativeGenderCode code="M"/>
      <deceasedInd value="false"/>
    </relationshipHolder>
  </relative>
  <relative classCode="PRS">
    <code code="MCOUSN"/>

```

```

<relationshipHolder classCode="PSN" determinerCode="INSTANCE">
  <id extension="20"/>
  <name/>
  <administrativeGenderCode code="F"/>
  <deceasedInd value="false"/>
  <relative classCode="PRS">
    <code code="NMTH"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
      <id extension="18"/>
    </relationshipHolder>
  </relative>
  <relative classCode="PRS">
    <code code="NFTH"/>
    <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
      <id extension="19"/>
    </relationshipHolder>
  </relative>
</relationshipHolder>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
    <value value="30"/>
  </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="C4872" codeSystemName="NCI" displayName="Breast Carcinoma"/>
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="30"/>
          <high value="30"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
</relative>
<relative classCode="PRS">
  <code code="MCOUSN"/>
  <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
    <id extension="21"/>
    <name/>
    <administrativeGenderCode code="F"/>
    <deceasedInd value="false"/>
    <relative classCode="PRS">
      <code code="NMTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="18"/>
      </relationshipHolder>
    </relative>
    <relative classCode="PRS">
      <code code="NFTH"/>
      <relationshipHolder classCode="PSN" determinerCode="INSTANCE">
        <id extension="19"/>
      </relationshipHolder>
    </relative>
  </relationshipHolder>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
    <value value="31"/>
  </livingEstimatedAge>
</subjectOf1>
</relative>

```



```

</patientPerson>
<subjectOf1 typeCode="SBJ">
  <livingEstimatedAge classCode="OBS" moodCode="EVN">
    <code code="21611-9" displayName="ESTIMATED AGE" codeSystemName="LOINC"/>
    <value value="51"/>
  </livingEstimatedAge>
</subjectOf1>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
    <code code="C19666" codeSystemName="NCI" displayName="Age at Menarche"/>
    <subject typeCode="SUBJ">
      <dataEstimatedAge classCode="OBS" moodCode="EVN">
        <code code="397659008" displayName="Age" codeSystemName="SNOMED CT"/>
        <value>
          <low value="13"/>
          <high value="13"/>
        </value>
      </dataEstimatedAge>
    </subject>
  </clinicalObservation>
</subjectOf2>
<subjectOf2 typeCode="SBJ">
  <clinicalObservation classCode="OBS" moodCode="EVN">
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  <pedigreeAnalysisResults classCode="OBS" moodCode="RSK">
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    <!-- Values used for missing data in the HL7 request and other informational messages and
assumptions are shown below -->
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Relative 19 age unknown; used 1</text>
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  <lifetimePancProbs>
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    <row age="61" pancreaticCancerRisk="0.00088854"/>
    <row age="66" pancreaticCancerRisk="0.00185201"/>
    <row age="71" pancreaticCancerRisk="0.0034444"/>
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</methodCode>
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    </messages>
    <familyTCProbs>
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            probBRCA2Mutation="0.0203226"/>
    </familyTCProbs>
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        <row age="56" breastCancerRisk="0.045259" populationBreastCancerRisk="0.0127669"/>
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    </lifetimeTCProbs>
</methodCode>
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    <messages>
        No TC Messages
    </messages>
    <familyTCProbs>
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            probBRCA2Mutation="0.021855"/>
    </familyTCProbs>
    <lifetimeTCProbs>
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        <row age="81" breastCancerRisk="0.211592" populationBreastCancerRisk="0.0968394"/>
        <row age="85" breastCancerRisk="0.230323" populationBreastCancerRisk="0.11229"/>
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</methodCode>
<methodCode code="CCRAT" codeSystemVersion="1.0">
    <messages>
        All relevant input covariates were specified, and No assumptions were needed
    </messages>
    <lifetimeCCRATProbs>
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        <row age="66" colorectalCancerRisk="0.01264502"/>
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        <row age="81" colorectalCancerRisk="0.04143119"/>
        <row age="86" colorectalCancerRisk="0.05157077"/>
        <row age="90" colorectalCancerRisk="0.05701728"/>
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</methodCode>
</pedigreeAnalysisResults>
</risk>
</FamilyHistory>

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Appendix D: Disease Codes

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    <meaning>Breast Cancer</meaning>
  </row>
  <row>
    <code>C4872</code>
    <codeSystem>NCI</codeSystem>
    <Mgh>Breast Cancer</Mgh>
    <meaning>Breast Cancer</meaning>
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  <row>
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    <codeSystem>NCI</codeSystem>
    <Mgh>Breast Cancer (Invasive)</Mgh>
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    <codeSystem>NCI</codeSystem>
    <Mgh>Breast Cancer (Medullary)</Mgh>
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    <Mgh>Breast Cancer (Invasive Ductal)</Mgh>
    <meaning>Breast Cancer</meaning>
  </row>

```

```
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  <Mgh>Breast Cancer (Lobular)</Mgh>
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<row>
  <code>313415001</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Identical twin</Mgh>
  <meaning>Identical twin</meaning>
</row>
<row>
  <code>C51590</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Bilateral Oophorectomy</Mgh>
  <meaning>Oophorectomy</meaning>
</row>
<row>
  <code>C4910</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Colon Cancer</Mgh>
  <meaning>Colon Cancer</meaning>
</row>
<row>
  <code>C2955</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Colon or Rectal Cancer</Mgh>
  <meaning>Colon Cancer</meaning>
</row>
<row>
  <code>363510005</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Colon or Rectal Cancer</Mgh>
  <meaning>Colon Cancer</meaning>
</row>
<row>
  <code>82</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Rectal Cancer</Mgh>
  <meaning>Colon Cancer</meaning>
</row>
<row>
  <code>254582000</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Rectal Cancer</Mgh>
  <meaning>Colon Cancer</meaning>
</row>
<row>
  <code>C9382</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Rectal Cancer</Mgh>
  <meaning>Colon Cancer</meaning>
</row>
<row>
  <code>363406005</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Colon Cancer</Mgh>
  <meaning>Colon Cancer</meaning>
</row>
<row>
  <code>156</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Colorectal Cancer</Mgh>
```



```
<meaning>Colon Cancer</meaning>
</row>
<row>
  <code>124</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Attenuated Familial Adenomatous Polyposis</Mgh>
  <meaning>Hereditary Colon Cancer Syndrome</meaning>
</row>
<row>
  <code>48</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Familial Adenomatous Polyposis</Mgh>
  <meaning>Hereditary Colon Cancer Syndrome</meaning>
</row>
<row>
  <code>C3339</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Adenomatous Polyposis Coli</Mgh>
  <meaning>Hereditary Colon Cancer Syndrome</meaning>
</row>
<row>
  <code>70921007</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Adenomatous polyposis coli</Mgh>
  <meaning>Hereditary Colon Cancer Syndrome</meaning>
</row>
<row>
  <code>72900001</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Familial multiple polyposis syndrome</Mgh>
  <meaning>Hereditary Colon Cancer Syndrome</meaning>
</row>
<row>
  <code>254589009</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Intestinal polyposis syndrome</Mgh>
  <meaning>Polyposis Syndrome</meaning>
</row>
<row>
  <code>28412004</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Nonfamilial multiple polyposis syndrome</Mgh>
  <meaning>Polyposis Syndrome</meaning>
</row>
<row>
  <code>315058005</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Hereditary nonpolyposis colon cancer</Mgh>
  <meaning>Lynch Syndrome</meaning>
</row>
<row>
  <code>64766004</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Ulcerative Colitis</Mgh>
  <meaning>Ulcerative Colitis</meaning>
</row>
<row>
  <code>34000006</code>
  <codeSystem>SNOMED_CT</codeSystem>
```

```
<Mgh>Crohn's Disease</Mgh>
<meaning>Crohn's Disease</meaning>
</row>
<row>
  <code>371973000</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Uterine Cancer</Mgh>
  <meaning>Uterine Cancer</meaning>
</row>
<row>
  <code>C3552</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Uterine Cancer</Mgh>
  <meaning>Uterine Cancer</meaning>
</row>
<row>
  <code>C3850</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Pancreatic Cancer</Mgh>
  <meaning>Pancreatic Cancer</meaning>
</row>
<row>
  <code>363418001</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Pancreatic cancer</Mgh>
  <meaning>Pancreatic Cancer</meaning>
</row>
<row>
  <code>C3224</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Melanoma</Mgh>
  <meaning>Melanoma</meaning>
</row>
<row>
  <code>372244006</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Melanoma</Mgh>
  <meaning>Melanoma</meaning>
</row>
<row>
  <code>130</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Menopausal Status</Mgh>
  <meaning>Menopausal Status</meaning>
</row>
<row>
  <code>131</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Menopause Age</Mgh>
  <meaning>Menopause Age</meaning>
</row>
<row>
  <code>C19666</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>startedMenstruating</Mgh>
  <meaning>Age at Menarche</meaning>
</row>
<row>
  <code>C19667</code>
```

```
<codeSystem>NCI</codeSystem>
<Mgh>ageFirstChildBorn</Mgh>
<meaning>Age at First Live Birth</meaning>
</row>
<row>
  <code>271603002</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Height</Mgh>
  <meaning>Height</meaning>
</row>
<row>
  <code>132</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Height</Mgh>
  <meaning>Height</meaning>
</row>
<row>
  <code>107647005</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Weight</Mgh>
  <meaning>Weight</meaning>
</row>
<row>
  <code>133</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Weight</Mgh>
  <meaning>Weight</meaning>
</row>
<row>
  <code>134</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Usual Breast Hyperplasia</Mgh>
  <meaning>Usual Breast Hyperplasia</meaning>
</row>
<row>
  <code>76197007</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Hyperplasia (no atypia)</Mgh>
  <meaning>Usual Breast Hyperplasia</meaning>
</row>
<row>
  <code>419307005</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Benign breast condition</Mgh>
  <meaning>Benign breast condition</meaning>
</row>

<row>
  <code>C8436</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Atypical Ductal Hyperplasia</Mgh>
  <meaning>Atypia</meaning>
</row>
<row>
  <code>C5195</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Atypical Hyperplasia</Mgh>
  <meaning>Atypia</meaning>
```

```
</row>
<row>
  <code>C4730</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Atypical Lobular Hyperplasia</Mgh>
  <meaning>Atypia</meaning>
</row>
<row>
  <code>39</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Severe ADH/Borderline DCIS</Mgh>
  <meaning>Atypia</meaning>
</row>
<row>
  <code>C4018</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>LCIS</Mgh>
  <meaning>LCIS</meaning>
</row>
<row>
  <code>135</code>
  <codeSystem>UML</codeSystem>
  <Mgh>HRT Use</Mgh>
  <meaning>HRT Use</meaning>
</row>
<row>
  <code>136</code>
  <codeSystem>UML</codeSystem>
  <Mgh>HRT Type</Mgh>
  <meaning>HRT Type</meaning>
</row>
<row>
  <code>137</code>
  <codeSystem>UML</codeSystem>
  <Mgh>HRT Length Past</Mgh>
  <meaning>HRT Length Past</meaning>
</row>
<row>
  <code>138</code>
  <codeSystem>UML</codeSystem>
  <Mgh>HRT Length Intent</Mgh>
  <meaning>HRT Length Intent</meaning>
</row>
<row>
  <code>139</code>
  <codeSystem>UML</codeSystem>
  <Mgh>HRT Last Use</Mgh>
  <meaning>HRT Last Use</meaning>
</row>
<row>
  <code>C16450</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Colonoscopy</Mgh>
  <meaning>SigmoidOrColonoscopy</meaning>
</row>
<row>
  <code>C64944</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Diagnostic Colonoscopy</Mgh>
```

```
<meaning>SigmoidOrColonoscopy</meaning>
</row>
<row>
  <code>C67057</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Screening Colonoscopy</Mgh>
  <meaning>SigmoidOrColonoscopy</meaning>
</row>
<row>
  <code>C17131</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Sigmoidoscopy</Mgh>
  <meaning>SigmoidOrColonoscopy</meaning>
</row>
<row>
  <code>C64959</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Therapeutic Colonoscopy</Mgh>
  <meaning>SigmoidOrColonoscopy</meaning>
</row>
<row>
  <code>C51588</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Flexible Fiberoptic Sigmoidoscopy</Mgh>
  <meaning>SigmoidOrColonoscopy</meaning>
</row>
<row>
  <code>45378-45392</code>
  <codeSystem>CPT</codeSystem>
  <Mgh>Colonscopy</Mgh>
  <meaning>SigmoidOrColonoscopy</meaning>
</row>
<row>
  <code>45330-45345</code>
  <codeSystem>CPT</codeSystem>
  <Mgh>Sigmoidoscopy</Mgh>
  <meaning>SigmoidOrColonoscopy</meaning>
</row>
<row>
  <code>118</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Adenomatous Colon Polyps 100 or more</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>64</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Adenomatous Colon Polyps 10-100</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>108</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Colon Polyp Adenomatous</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>110</code>
  <codeSystem>UML</codeSystem>
```

```
<Mgh>Colon Polyp Villous</Mgh>
<meaning>Polyp</meaning>
</row>
<row>
  <code>115</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Colon Polyp-NOS</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>C3864</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Colon Adenomatous Polyp</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>C3495</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Colon Villous Adenoma</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>C2954</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Colon Polyp</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>428054006</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Adenomatous polyp of colon</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>309084001</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Villous adenoma of colon</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>68496003</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Colon Polyp</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>C5679</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Colorectal Polyp</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>C3957</code>
  <codeSystem>NCI</codeSystem>
  <Mgh>Anal polyp</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>C3351</code>
```

```
<codeSystem>NCI</codeSystem>
<Mgh>Rectal Polyp</Mgh>
<meaning>Polyp</meaning>
</row>
<row>
  <code>399505005</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Polyp of large intestine</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>88580009</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Anal polyp</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>39772007</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Rectal polyp</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>428472008</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Polyp of sigmoid colon</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>197210001</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Anal and rectal polyp</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>312823001</code>
  <codeSystem>SNOMED_CT</codeSystem>
  <Mgh>Villous adenoma of rectum</Mgh>
  <meaning>Polyp</meaning>
</row>
<row>
  <code>158</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Aspirin or NSAID regular use</Mgh>
  <meaning>Aspirin or NSAID regular use</meaning>
</row>
<row>
  <code>159</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Ibuprofen regular use</Mgh>
  <meaning>Ibuprofen regular use</meaning>
</row>
<row>
  <code>141</code>
  <codeSystem>UML</codeSystem>
  <Mgh>Vigorous Exercise hours per week</Mgh>
  <meaning>Vigorous Exercise hours per week</meaning>
</row>
<row>
```

```
<code>142</code>
<codeSystem>UML</codeSystem>
<Mgh>Cigarette Smoking years</Mgh>
<meaning>Cigarette Smoking years</meaning>
</row>
<row>
<code>143</code>
<codeSystem>UML</codeSystem>
<Mgh>Cigarettes per day</Mgh>
<meaning>Cigarettes per day</meaning>
</row>
<row>
<code>144</code>
<codeSystem>UML</codeSystem>
<Mgh>Vegetable servings per day</Mgh>
<meaning>Vegetable servings per day</meaning>
</row>
<row>
<code>21840007</code>
<codeSystem>SNOMED_CT</codeSystem>
<Mgh>lastPeriodDate</Mgh>
<meaning>Date of last menstrual period</meaning>
</row>
</root>
```


Appendix E: Race Codes

```

<?xml version="1.0" encoding="UTF-8"?>
<dataroot>
  <Race>
    <HL7Code>2054-5</HL7Code>
    <HL7Display>Black or African American</HL7Display>
    <HL7CodeSystem>HL7</HL7CodeSystem>
    <Mgh>African American or Black</Mgh>
    <CaGene>AFRICAN AMERICAN</CaGene>
    <CGEngine>2</CGEngine>
    <Progeny>African-American</Progeny>
  </Race>
  <Race>
    <HL7Code>1002-5</HL7Code>
    <HL7Display>American Indian or Alaska Native</HL7Display>
    <HL7CodeSystem>HL7</HL7CodeSystem>
    <Mgh>American Indian/Aleutian/Eskimo</Mgh>
    <Progeny>American Indian</Progeny>
  </Race>
  <Race>
    <HL7Code>2028-9</HL7Code>
    <HL7Display>Asian</HL7Display>
    <HL7CodeSystem>HL7</HL7CodeSystem>
    <Mgh>Asian or Pacific Islander</Mgh>
    <CaGene>ASIAN AMERICAN</CaGene>
    <CGEngine>1</CGEngine>
    <Progeny>Asian</Progeny>
  </Race>
  <Race>
    <HL7Code>2075-0</HL7Code>
    <HL7Display>West Indian</HL7Display>
    <HL7CodeSystem>HL7</HL7CodeSystem>
    <Mgh>Caribbean/West Indian</Mgh>
  </Race>
  <Race>
    <HL7Code>2106-3</HL7Code>
    <HL7Display>White</HL7Display>
    <HL7CodeSystem>HL7</HL7CodeSystem>
    <Mgh>Caucasian or White</Mgh>
    <CaGene>CAUCASIAN</CaGene>
    <CGEngine>1</CGEngine>
    <Progeny>Caucasian</Progeny>
  </Race>
  <Race>
    <HL7Code>2131-1</HL7Code>
    <HL7Display>Other Race</HL7Display>
    <HL7CodeSystem>HL7</HL7CodeSystem>
    <Mgh>Other</Mgh>
    <Progeny>Other</Progeny>
  </Race>
  <Race>
    <Mgh>Unkown</Mgh>
  </Race>
  <Race>
    <HL7Code>2135-2</HL7Code>
    <HL7Display>Hispanic or Latino</HL7Display>
    <HL7CodeSystem>HL7</HL7CodeSystem>
    <Mgh>Hispanic</Mgh>
    <CaGene>HISPANIC</CaGene>
    <CGEngine>1</CGEngine>
    <Progeny>Hispanic</Progeny>
  </Race>
  <Race>
    <HL7Code>2131-1</HL7Code>
    <HL7Display>OTHER RACE</HL7Display>

```

```
<HL7CodeSystem>HL7</HL7CodeSystem>  
<Mgh>Ashkenazi</Mgh>  
<CaGene>Ashkenazi</CaGene>  
</Race>  
</dataroot>
```

Appendix F: GeneCodes

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- Per the HL7 spec example, some gene coding systems are referred to as 'codeSystemName', and
some as 'codeSystem' -->
<root>
  <Gene>
    <code>83990</code>
    <codeSystemName>NCBI Entrez</codeSystemName>
    <displayName>BRCA1</displayName>
    <text>BRCA1 breast cancer 1, early onset</text>
  </Gene>
  <Gene>
    <code>20473</code>
    <codeSystem>HGNC</codeSystem>
    <displayName>BRCA1</displayName>
    <text>BRCA1 breast cancer 1, early onset</text>
  </Gene>
  <Gene>
    <code>675</code>
    <codeSystemName>NCBI Entrez</codeSystemName>
    <displayName>BRCA2</displayName>
    <text>BRCA2 breast cancer 2, early onset</text>
  </Gene>
  <Gene>
    <code>1101</code>
    <codeSystem>HGNC</codeSystem>
    <displayName>BRCA2</displayName>
    <text>BRCA2 breast cancer 2, early onset</text>
  </Gene>
  <Gene>
    <code>4292</code>
    <codeSystemName>NCBI Entrez</codeSystemName>
    <displayName>MLH1</displayName>
    <text>mutL homolog 1, colon cancer, nonpolyposis type 2</text>
  </Gene>
  <Gene>
    <code>7127</code>
    <codeSystem>HGNC</codeSystem>
    <displayName>MLH1</displayName>
    <text>mutL homolog 1, colon cancer, nonpolyposis type 2</text>
  </Gene>
  <Gene>
    <code>4436</code>
    <codeSystemName>NCBI Entrez</codeSystemName>
    <displayName>MSH2</displayName>
    <text>mutS homolog 2, colon cancer, nonpolyposis type 1</text>
  </Gene>
  <Gene>
    <code>7325</code>
    <codeSystem>HGNC</codeSystem>
    <displayName>MSH2</displayName>
    <text>mutS homolog 2, colon cancer, nonpolyposis type 1</text>
  </Gene>
  <Gene>
    <code>2956</code>
    <codeSystemName>NCBI Entrez</codeSystemName>
    <displayName>MSH6</displayName>
    <text>mutS homolog 6</text>
  </Gene>
  <Gene>
    <code>7329</code>
    <codeSystem>HGNC</codeSystem>
    <displayName>MSH6</displayName>

```

```
    <text>mutS homolog 6</text>
  </Gene>
  <Gene>
    <code>1029</code>
    <codeSystemName>NCBI Entrez</codeSystemName>
    <displayName>P16</displayName>
    <text>cyclin-dependent kinase inhibitor 2A (melanoma, p16, inhibits CDK4)</text>
  </Gene>
  <Gene>
    <code>1787</code>
    <codeSystem>HGNC</codeSystem>
    <displayName>P16</displayName>
    <text>cyclin-dependent kinase inhibitor 2A (melanoma, p16, inhibits CDK4)</text>
  </Gene>
</root>
```