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ISTITUTO NAZIONALE
DEI TUMORI

Sistema Sanitario Regione Lombardia

IBM Advanced Content Analytics for Oncology Care Appropriateness

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Who's who

Founded in 1925, the **Fondazione IRCCS Istituto Nazionale dei Tumori (INT)** is a top-tier Scientific Research and Treatment Institution which has achieved renowned excellence in the field of pre-clinical and clinical oncology research and care.

In 2011 the Istituto performed:

- **13,630 in-patient** admissions (**415 beds**)
- 8,464 one-day-hospitalization admissions (67 beds)
- **1.1 milion out-patient treatments**
- 11,500 surgical operations

The **IBM Research Lab in Haifa (HRL)** has conducted decades of research that have been vital to IBM's success. R&D projects are being executed today in areas such as **healthcare and life sciences**, discovery, verification technologies, multimedia, active management, information retrieval, programming environments, business transformation, and optimization technologies. The Lab houses IBM's biggest research center outside the US, and employs over 500 people.

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The research project

Business needs:

- Huge amount of clinical data reported in **free-text** annotation
- Great need for **automatic tools** to monitor clinical appropriateness

The main goal is to provide **doctors and healthcare management** with a broad **view on care delivery process** and its **appropriateness**, non the less highlighting the clinical **outcome** and the **cost** for the organization

INT Clinical Units involved:

- Oncologia Medica Tumori Mesenchimali dell'Adulto, dott. Paolo Casali
- Oncologia Medica dei Tumori della Testa e del Collo, dott.ssa Lisa Licitra

Started in 2010, the project has been funded by the IBM's *First Of A Kind* (FOAK) since 2012

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Medical Treatment Programs:

- **Recommended**
- **Performed**

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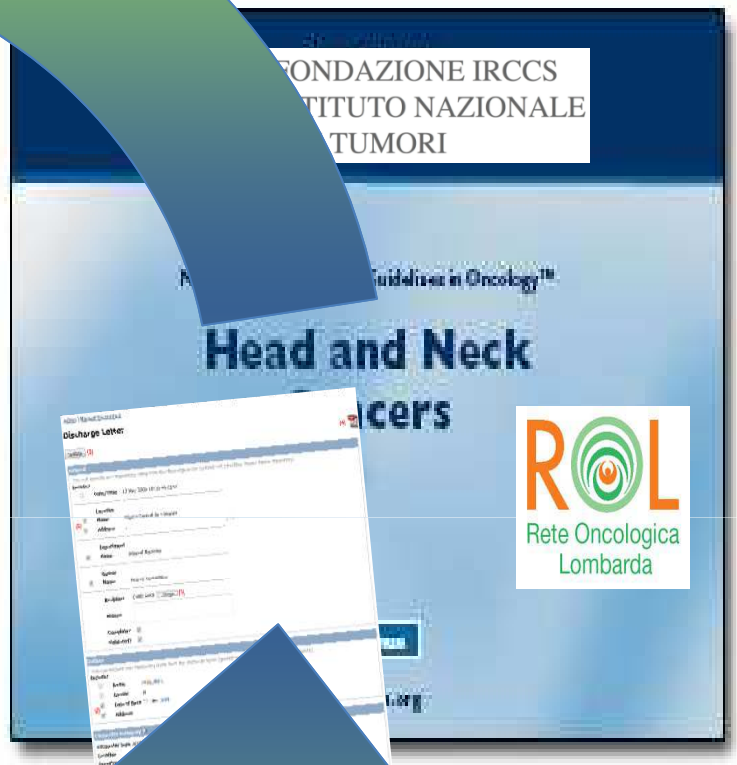
Treatment Programs (TP) Deviation Analysis

Identifies differences between **recommended** and **performed** treatments as documented in the clinical data by care givers.

Documented **T**reatment **P**rograms that have been analyzed can:

1. **adhere** to one of the recommended TPs (guidelines)
2. **do not adhere** to any recommended TPs (guidelines)



Clinical Tests

Clinical Best Practices based on Literature Review and Medical Consultations

ROL Guidelines

Patients' Discharge Letters

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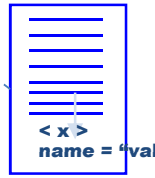
ROL clinical documents

- In-patient **discharge letter**
- Out-patient **observation report**

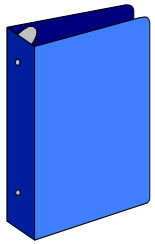
PDF
(digital signature)



XML-CDA2

INT Clinical Repository

Electronic Health Record (EHR)

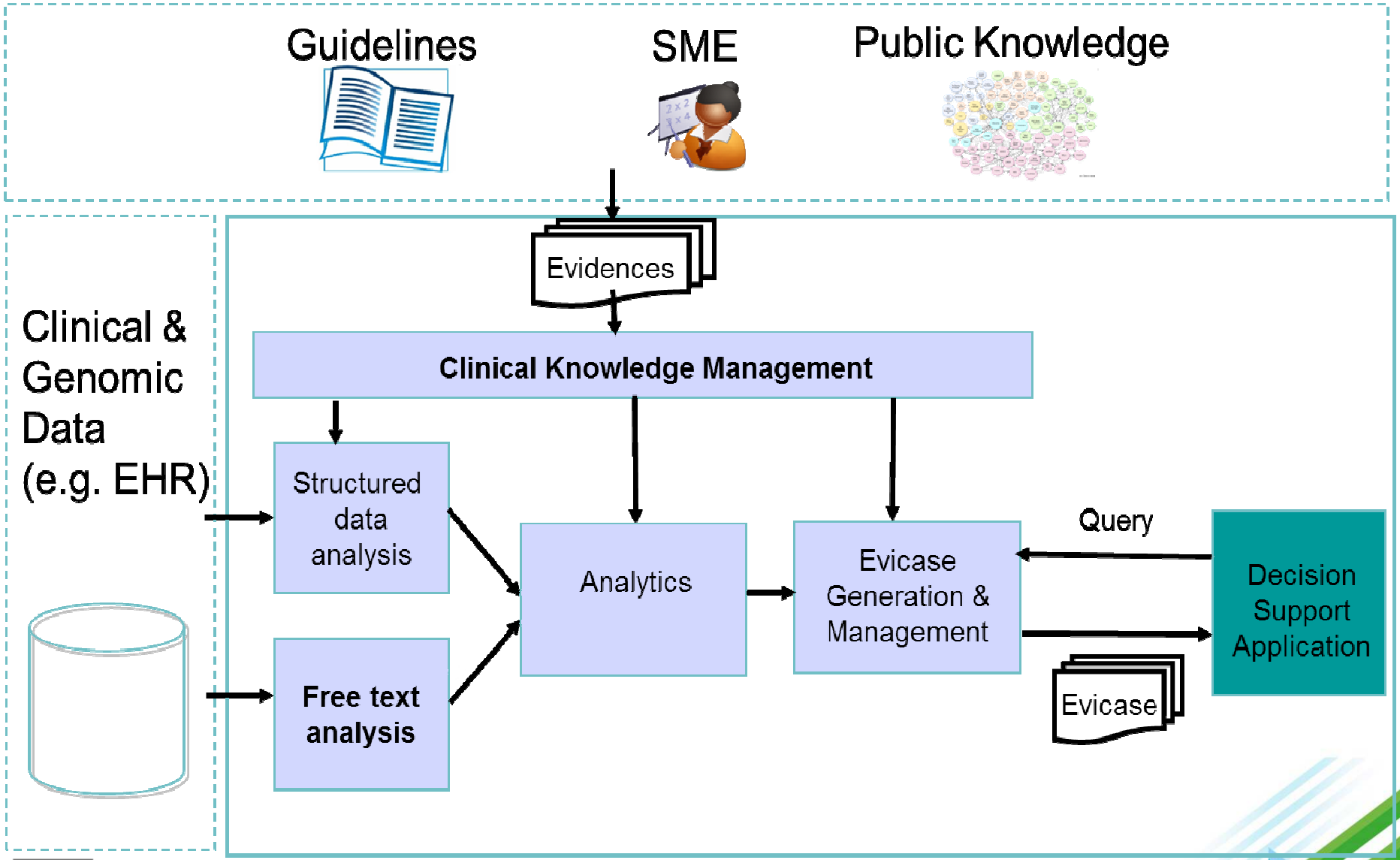


ROL clinical guidelines

Sharing classifications and semantics

- **Clinical Presentations (ROL classification)**
- Oncological clinical history
- Extra-oncological clinical history
- **Reccommended Treatment Programs (ROL classification)**
- Performed Treatments
- Patient's clinical status

Integrating Knowledge and Data for Decision Support



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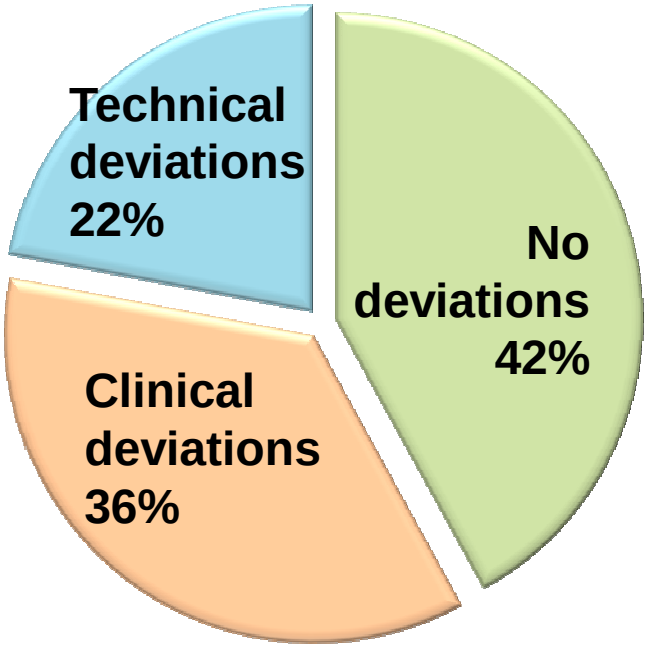
Content Analytics Applied to Report on AVE8062 Use

Il paziente è stato ricoverato per valutazione di malattia e programmazione terapeutica. E stata dunque effettuata una TC del torace e dell addome, con riscontro di incremento dimensionale del noto espanso nel contesto del muscolo gluteo sinistro (attualmente di circa 8 cm verso i precedenti 5,5 cm); appare invece immodificata la localizzazione ipodensa in regione lombare nel contesto del tessuto sottocutaneo di circa 30 mm. Il distretto toracico appare tuttora libero da malattia. In considerazione dell istotipo, dell estensione metastatica di malattia e dei pregressi trattamenti effettuati, è stata proposta al paziente la partecipazione ad uno studio clinico randomizzato in doppio cieco, che prevede l impiego di Cisplatino in associazione a placebo verso AVE8062, farmaco dotato di attività antivascolare. Il paziente ha accettato il programma proposto e firmato il relativo consenso informato. Si è somministrato pertanto il primo ciclo chemioterapico con Cisplatino ed AVE/placebo, soggettivamente ben tollerato. Nel corso del ricovero sono stati eseguiti inoltre prelievi seriati di farmacogenomica e farmacocinetica. Si dimette pertanto il paziente, in buone condizioni generali, con indicazione a proseguire il trattamento in regime ambulatoriale.</paragraph>

Measurements | Body Parts | Treatment Reasons

Conjunctions | Chemo Drugs | Chemo Cycles | Clinical Studies

CareView – Decisions Review



Period: 2006-2012
1.786 patients
2.295 Treatment programs
4.388 ROL documents

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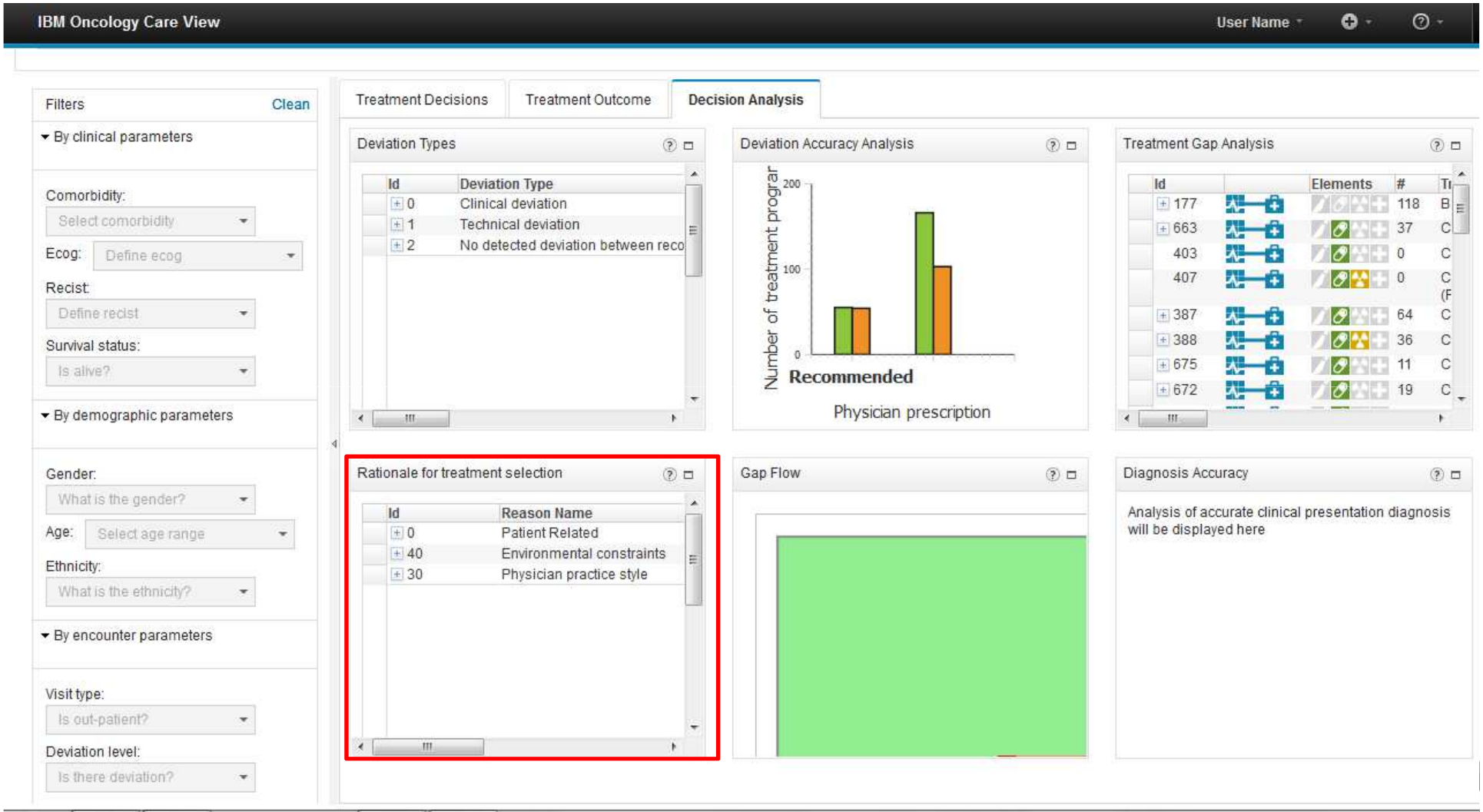
Difference between recommended and actual Treatment Program

Difference	Description
oldGuideline	The performed TP is according to a recommended TP but from an outdated guideline version
newGuideline	The performed TP is according to a recommended TP but from a newer guideline version
actClinicalStudy	**The performed TP** is according to a clinical study that **is not recommended** by the guidelines
order	**The order** of the elements in the preformed TP is not according to the order in the recommended TP
missingAndExtraT	The most similar recommended TP includes at least one element substitution
extraT	The preformed TP contains an element (drug/surgery/radio) that **is not part of the recommended TP**
missingT	The preformed TP is **missing an element** (drug/surgery/radio) that is part of the recommended TP
chemoDrug	The drug in the performed TP is not according to the recommended TP
surgeryType	**The surgery type** in the performed TP is not according to the recommended TP
dosageOfChemoDrug	**The dosage of the drug** in the performed TP is not according to the recommended TP
numberOfCycles	The number of drug cycles in the performed TP is not according to the recommended TP
recClinicalStudy	The performed TP is according to a clinical study but the name of study is not mentioned

IBM Oncology Care View



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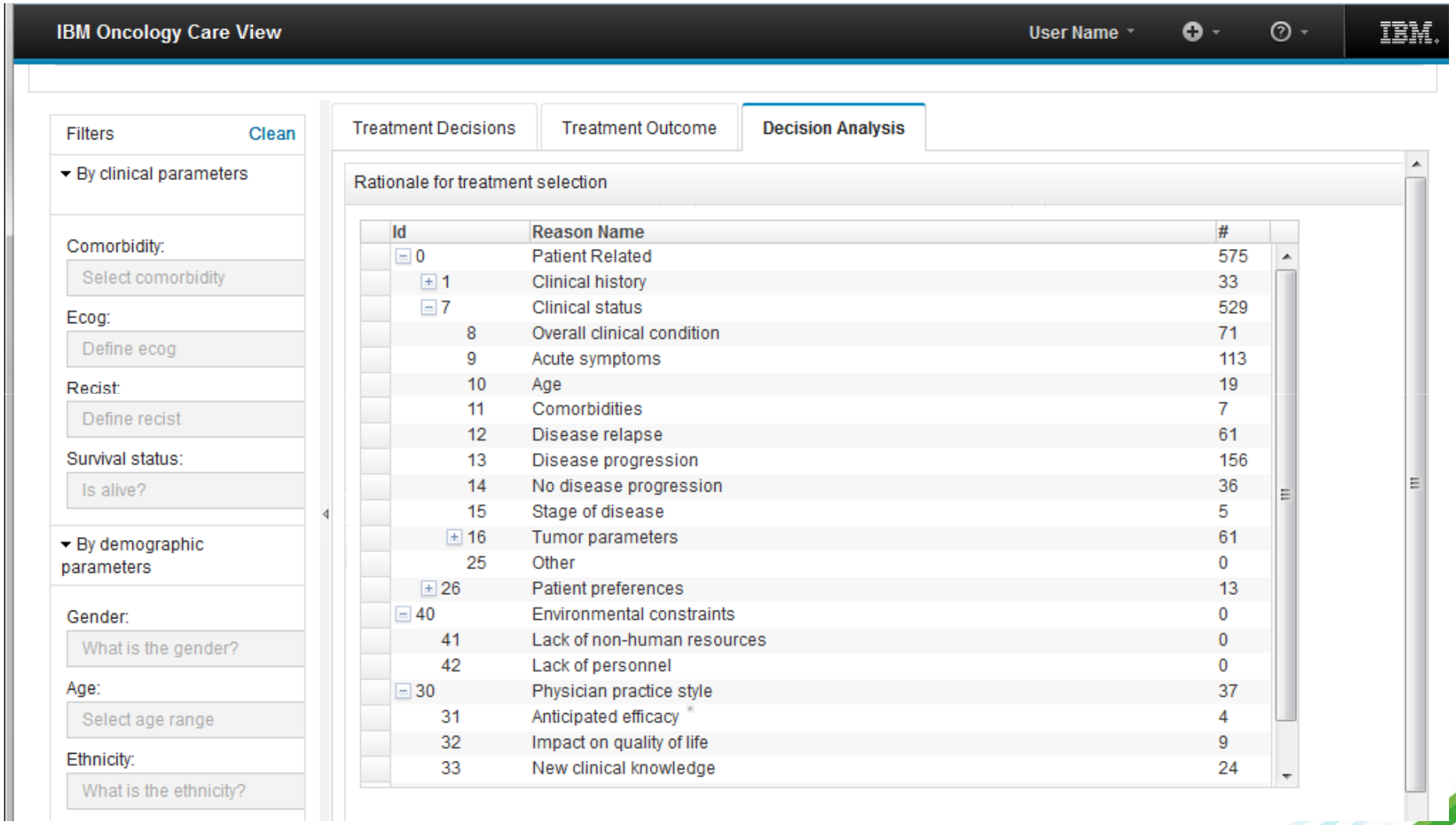
Reasons for deviation



Id	Reason Name	#
0	Patient Related	575
1	Clinical history	33
7	Clinical status	529
8	Overall clinical condition	71
9	Acute symptoms	113
10	Age	19
11	Comorbidities	7
12	Disease relapse	61
13	Disease progression	156
14	No disease progression	36
15	Stage of disease	5
16	Tumor parameters	61
25	Other	0
26	Patient preferences	13
40	Environmental constraints	0
41	Lack of non-human resources	0
42	Lack of personnel	0
30	Physician practice style	37
31	Anticipated efficacy	4
32	Impact on quality of life	9
33	New clinical knowledge	24

The IBM Onco Care Trio

IBM Oncology Care Edit

use to edit
oncology care guidelines

IBM Oncology Care Guide

use to guide
care decisions

IBM Oncology Care View

use to view
past care decisions

- Leverages the **IBM Advanced Content Analytics** (ICA) to perform free text analytics on patient's data
- Utilizes similar natural language processing (NLP) methods used in **IBM Watson**
- Has built-in **medical terminology** support (taxonomies / ontologies)
- By exploting ICA text analytic capabilities, we succeeded in processing **free-text** information **together** with **structured data**

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IBM Onco Care Trio aims

- **To carefully look at the data and learn from them** (identify trends, correlations and new insight from **“suspicious cases”**)
- **To fill the Gap between** the Ideal situation depicted by the **Guidelines and** the complex **real situations** presented to the physicians;
- **To develop Comparative Analysis**, to investigate and compare the outcomes of different treatment programs for the same presentation;
- **To enhance the awareness of the medical decision-making process** and to to foster the learning process and the **knowledge stratification** by leveraging on the interactions between best preactices investigation and guidelines refinements
- **To easily design and implement clinical trials** for fruitful scientific

Achievements:

- Collaboration among clinical and technical project people
- Sharing of a common semantics language and domain view
- Tools and insights for improvements: techincal refinements and training to clinicians

Future perspectives:

- Extension to other oncology care organization and other pathologies (i.e. Rete Oncologica Lombarda, Rete Nazionale Tumori Rari)
- Extension to include biomolecular data (parallel initiative funded by AIRC)
- Cost evaluation linked to performed treatments
- Comparison among oncology care organizations (outcome, case-mix, costs)

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Thank you!

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