



CAPABLE

CAnCER PATIENTS Better Life Experience

CAPABLE: Supporting Cancer Patients and Their Physicians

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The CAPABLE Team



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Consortium



1	UNIPV	University of Pavia
2	UoH	University of Haifa
3	BIOM	BIOMERIS s.r.l.
4	AMC	Academic Medical Center
5	IBM	IBM Israel – Science and Technology LTD
6	BIT	Bitsens, JSC
7	PUT	Poznan University of Technology
8	ICSM	Istituti Clinici Scientifici Maugeri
9	NKI	Netherlands Cancer Institute
10	DEON	Deontics Ltd
11	AIMAC	Associazione Italiana Malati di Cancro, Parenti e Amici
12	UPM	Universidad Politécnic de Madrid



Motivation

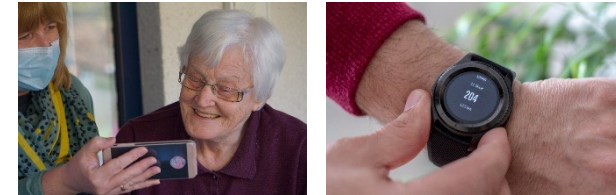


- Cancer becomes chronic disease with most treatments provided at home, follow-up visits and stays are occasional
- Patients between visits should be constantly monitored and provided comprehensive support
- Physicians should be offered support to address challenges associated with treatment planning and management

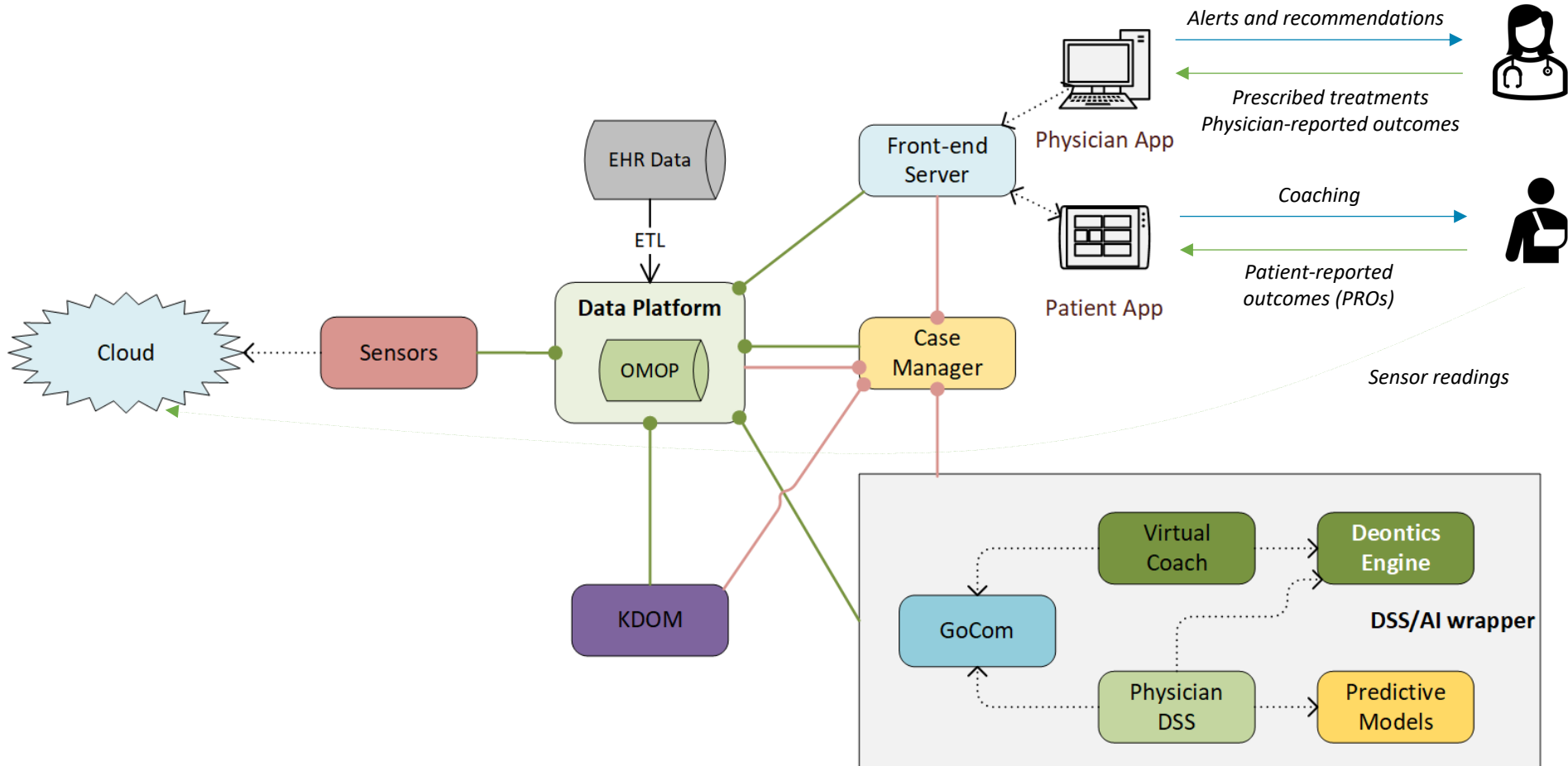
Objectives



- A system providing decision support, coaching and information for cancer patients and their physicians
 - Mobile and web apps for ubiquitous accessibility
 - Wearable sensors for unobtrusive monitoring
- Combination of domain knowledge (guidelines, behavior models, ...) with knowledge discovered from data [not included in clinical studies]
- Improving of the quality of care, patient wellbeing and engagement in interventions that results in better quality of life (QoL)



CAPABLE Architecture



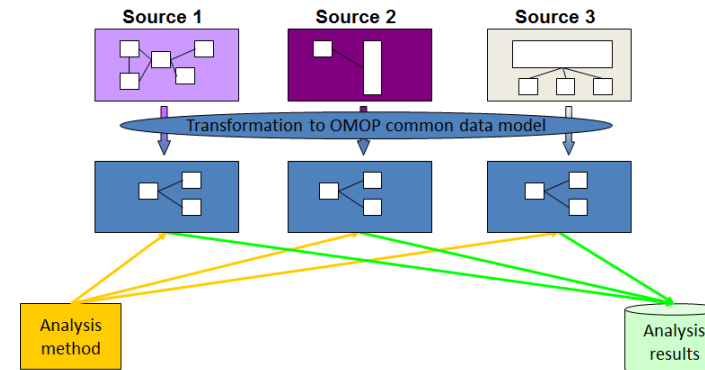
Data Platform (DP)



- Provides a shared data storage for all components
- Supports FHIR and OMOP Common Data Model (CDM) standards
 - FHIR for regular CRUD operations
 - OMOP for subsequent data sharing



<https://www.ohdsi.org/data-standardization/>



- Based on the customized OMOPonFHIR project <https://omoponfhir.org/>
- Integration with EHRs at specific institutions through ETL





Case Manager (CM)

- Monitors DP and notifies other components about data- and time-driven events
- Relies on rules provided at runtime by specific components that define relevant events
- Inspired by the concept of a blackboard system (DP = blackboard, CM = controller, other components = knowledge sources)
- Similarity to Arden Syntax Rules, but focus on modern standards (FHIR)

```
"eventExpression": "return comm.length > 0;",
"eventName": "intervention-tick",
"eventResources": [
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    "resourceType": "Patient",
    "resourceVarName": "pt",
    "searchParams": [
      {
        "paramName": "active",
        "paramValue": "true"
      }
    ]
  },
  {
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    "resourceVarName": "comm",
    "searchParams": [
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      },
      {
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      },
      {
        "paramName": "category",
        "paramValue": "VCOA"
      },
      {
        "paramName": "_source",
        "paramValue": "https://capable-project.eu/components/virtual_coach"
      }
    ]
  }
],
"fireAtDefinition": true,
"validity": 300,
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Knowledge-Data Ontology Mapper (KDOM)



- Transforms data and provides data abstractions (logical, temporal, ...) to other components
 - Administration of a class of drugs (e.g., targeted therapy)
 - Duration of a symptom episode given a specific reference point
- Abstractions allow for simplification of domain knowledge (guidelines, workflows) by capturing low-level details

13 Warning signs		Massive_dehydration
		Peritonitis
		Febrile neutropaenia
		Delirium
		Renal_impairment
		Sepsis
		Electrolyte_disturbances
		Dehydration
		Reduced_urine_output
		previous_admission_for_diarrhoea
	derivation ::if(Massive_dehydration = "true" or Peritonitis = "true" or patient_symptoms_list includesAny ["Febrile neutropaenia", "Delirium"] or Renal_impairment = "true" or Sepsis = "true" or Electrolyte_disturbances = "true" or (Nausea = "true" and Vomiting = "true" and Dehydration = "true" and Reduced_urine_output = "true") or previous_admission_for_diarrhoea = "yes";"true","false");	

Sensors



- Retrieves and preprocesses smartwatch data from the cloud-based repository (OmniCare provided by ASUS Life)
- ASUS VivoWatch 5 used in the study
 - Available sensors: PPG, ECG, GPS, altimeter, skin temperature
 - Measurement of pulse transition time (PTT) as a proxy for blood pressure
- Data from other sensors (air quality) handled by an additional app

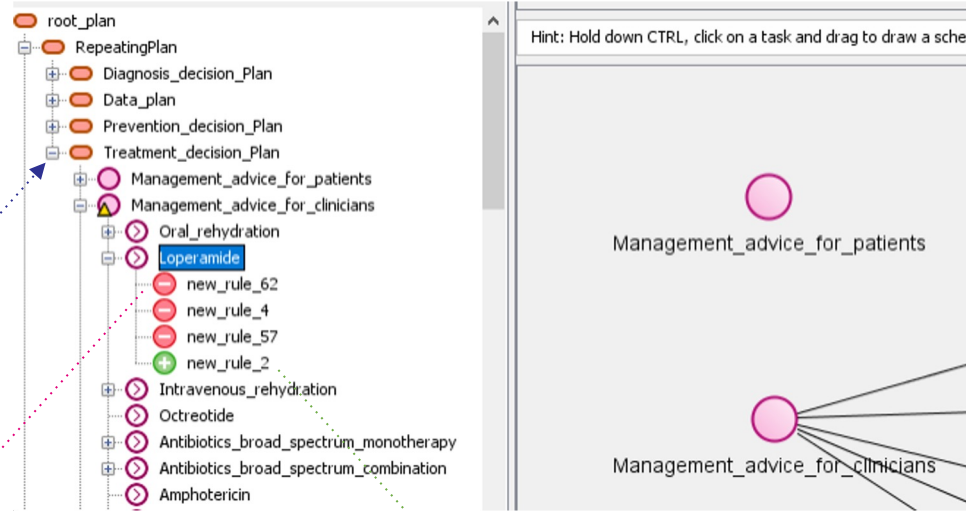
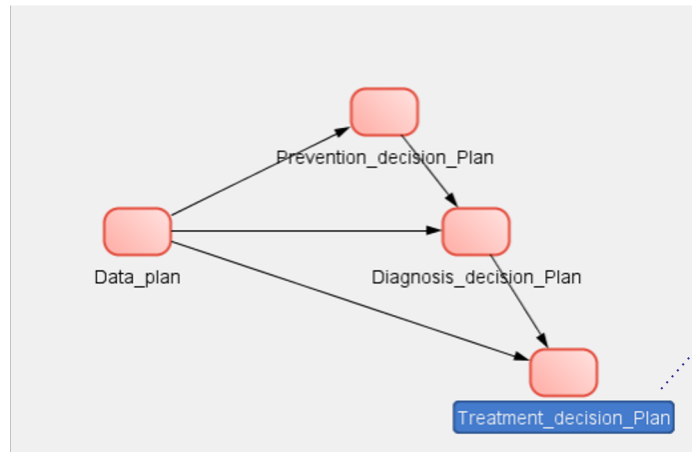


PROforma Formalism



- Representation language for clinical guidelines and workflows (computer-interpretable guidelines, CIGs)
 - Based on a task-network model with more flexible scheduling
 - Argument-based logic with weighted rules (arguments) for and against specific decision candidates
- Authoring and execution environment
 - CIG editor (Composer) with the ability of tagging text-based guidelines
 - Execution engine (Deontics Engine, DE) for running CIGs in interactive and non-interactive modes (simple UI, web-based API)
 - Support for selected standard terminologies (SNOMED CT, LOINC, ICD)

PROforma CIG – Example



Argument name:

Bound to Decision: Management_advice_for_clinicians

Candidate: Loperamide (preferred)

Evidence: allergy

Caption:

Condition:

Support mode: Symbolic

Weight: Against For

Argument name:

Bound to Decision: Management_advice_for_clinicians

Candidate: Loperamide (preferred)

Evidence: 1

Caption:

Condition:

Support mode: Symbolic

Weight: For Against

PROforma CIG – Example



DEONTICS Clinical futures

General Tester

Hide document < > Hide data

Pathway: Scenario_diarrhoea_2

Restart Home

Automatic Zoom

ESMO_DIARRHOEA

ery may be associated with diarrhoea. considered.

Volume 29 | Supplement 4 | October 2018 doi:10.1093/annonc/mdy145 | iv133

Clinical Practice Guidelines

Annals of Oncology

Specific clinical manifestations

Neutropenic enterocolitis

Neutropenic enterocolitis (also called necrotising enterocolitis or typhilitis) is an acute life-threatening complication of CHT, most commonly observed with high dose treatments in the setting of myeloablative therapies. However, it is also observed with non-myeloablative therapies, particularly with taxanes.

Neutropenic enterocolitis may occur when the absolute neutrophil count (ANC) falls below 500 cells/ μ L. Patients present with fever, abdominal pain, nausea, vomiting, diarrhoea and, not uncommonly, sepsis. Abdominal pain may be diffuse or localised to the right lower quadrant. Sometimes pain is absent, particularly if the patient has received steroid therapy.

Established standardised diagnostic criteria include the presence of neutropenia (ANC < 500 cells/ μ L), bowel wall thickening > 4 mm on radiographic imaging and the exclusion of other diagnoses such as *Clostridium difficile*-associated colitis, GVHD or other abdominal syndromes [V, A].

CT scanning is the preferred imaging modality [V, A]. CT scanning techniques can evaluate the entire abdomen for pathology, especially in patients with distended loops of bowel and ileus for whom ultrasound would not be possible. Scans commonly demonstrate concentric thickening of the bowel wall, a fluid filled caecum, pericolic fluid collections or abscesses, pneumatosis intestinalis and free air if an underlying perforation exists. Bowel wall thickening > 3-5 mm is considered abnormal and is consistent with, but not sufficient for, the diagnosis of necrotising enterocolitis. Indeed, *Clostridium difficile*-related colitis in neutropenic patients may be associated with wall thickening. *Pneumatosis intestinalis* along with caecal and colonic wall thickening is very suggestive of neutropenic enterocolitis.

Abdominal ultrasonography can identify thickening of the bowel wall. A study showed that the neutropenic enterocolitis related mortality rate was higher in patients with pathological wall thickening (29.5% versus 0%); moreover, a thickness > 10 mm had a significantly higher mortality rate (60%) than those with bowel wall thickness \leq 10 mm (4.2%) [32]. Ultrasound is useful as a follow up tool to assess the gradual decrease in bowel wall thickening [V, A]. Additionally, signs of pericolic fluid and intramural or abdominal free air often indicate perforation.

Ischaemic colitis (non-neutropenic enterocolitis)

Rarely, ischaemic colitis, in the absence of neutropenia, has been reported with docetaxel containing regimens. Patients present 4-10 days following administration with rapid onset of pain and tenderness over the affected bowel, followed by the development of rectal bleeding or bloody diarrhoea within 24 hours of the onset of pain.

people > 65 years of age during CHT, in a 5.6 month follow up period, 74% of patients reported diarrhoea [33].

In this frailter population, diarrhoea could more frequently lead to dehydration, electrolyte imbalance, renal function decline, malnutrition or pressure ulcer formation.

The most common causes of diarrhoea are CHT and targeted agents, as already reported. Older patients seem to have a moderately increased risk for 5-FU associated diarrhoea and may be at higher risk with irinotecan; dose reductions for patients \geq 70 years of age are recommended in some countries. About 30%-50% of elderly patients treated with capecitabine need dose reduction to improve tolerability.

With regard to targeted agents, no greater incidence of diarrhoea in elderly patients has been reported with EGFR TKIs, multitargeted TKIs (such as sunitinib or sorafenib) or with the Bcr-Abl TKI imatinib.

In the palliative setting

There are no specific data about the incidence of diarrhoea in elderly cancer patients with advanced disease; however, this is a less common symptom than constipation. Less than 10% of those with cancer admitted to hospital or palliative care units have diarrhoea.

Faecal impaction or partial bowel obstruction can manifest as alternating constipation and diarrhoea.

In the elderly, abuse of laxatives, malabsorption or previous surgery can be responsible for altered fluid absorption in the bowel and consequent diarrhoea.

Management

General principles of management of CHT-related diarrhoea (Figure 2)

Approach to uncomplicated diarrhoea. Patients with grade 1 or 2 diarrhoea with no other complicating signs or symptoms may be classified as 'uncomplicated' and managed conservatively with oral hydration and loperamide [V, A] [34, 35]. Initial management of mild to moderate diarrhoea should include dietary modifications (eg. eliminating all lactose containing products and high-omolax dietary supplements) and the patient should be instructed to record the number of stools and report symptoms of life-threatening sequelae (eg. fever or dizziness on standing). Special attention should be given to patients who are incontinent of stool due to the risk of pressure ulcer formation. Skin barriers should be used to prevent skin irritation caused by faecal material.

Loperamide should be started at an initial dose of 4 mg followed by 2 mg every 4 hours or after every unformed stool (not to exceed 16 mg/day) [V, A] [36].

API Information

Engine cycle: 2 of 2

DRE API URL: <https://deon-stable.deontics.com/dwe/application>

x-enactmentid: ce519e5c-e1be-4507-9139-53ff6

x-dressessionid: b13fb066-e84d-4b40-a41d-b5921

latest session id:

Note that all API calls need the x-

Data view

sort by name | value | last modified

Data Item	Value
weight	
Warning_signs	false
Vomiting	false
ultrasound_bowel_wall_thickness	
userID	
Unformed_stools	false
time_interval_between_chemo_a...	
Surgical_bowel_resection_in_the...	false
stool_frequency_24_hrs__number	
Smoker	false
Shock	false
Sepsis	false
Risk_factor_for_diarrhora	false
Renal_impairment	false
Receiving_pelvic_RT	false
Received_pelvic_RT_in_the_past	false
Rebound_tenderness	false
Radiation_proctopathy	false
problemActiveList	
prior_prolonged_hospitalisation	
previous_admission_for_diarrhoea	
presentingComplaintList	
Persistent_nausea_vomiting_deh...	false
Peritonitis	false
patientSymptomsList	
patientLocation	
patientID	
Past_use_of_any_of_50_diarrhoe...	false
past_procedure_list	

RepeatingPlan

Diagnosis

Investigations (for clinicians)

Cause of diarrhoea (for clinicians)

Investigations (for clinicians)

Candidates - Expand all -

- Creatinine urea
- Test for C Diffi, Shigella, Salmonella, Campylobacter, STEC, G, C and E H
- Total serum protein
- Electrolytes K Na Ca Mg
- CBC
- Blood culture
- CRP
- Serum albumin
- Test for CD
- Hb
- Physical examination
- TSH
- PCT
- Coagulation tests
- ACTH
- Endoscopy
- Sigmoidoscopy
- Colonoscopy
- Urinary output measurement
- Stool microbiology
- Abdominal CT

Supporting or opposing evidence

- CT abdomen has been performed.

Established standardised diagnostic criteria include the presence of neutropenia (ANC < 500 cells/ μ L), bowel wall thickening > 4mm on radiographic imaging and the exclusion of other diagnoses such as *Clostridium difficile*-associated colitis, GVHD or other abdominal syndromes [V, A].

Evidence sources: ESMO_DIARRHOEA page 9

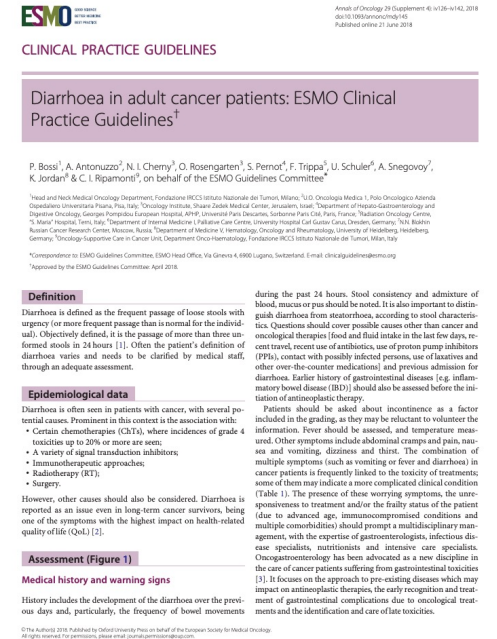
Downloaded from <https://academic.oup.com/annonc/advance-article-abstract/doi/10.1093/annonc/mdy145/5611887> by guest on 20 October 2018

CIGs in CAPABLE

- Based on text CPGs published by the European Society for Medical Oncology (ESMO)
- Management of prevalent toxicities related to cancer treatment (diarrhea, fatigue, ...)
- Physician- and patient-oriented CIGs
 - Physicians prescribe drugs or services
 - Patients activate pre-authorized (as needed) prescriptions
- Challenge associated with translating CPGs into CIGs → the SMART guideline initiative by WHO

<https://www.who.int/teams/digital-health-and-innovation/smart-guidelines>

S = Standards-based (FHIR), M = Machine-readable, A = Adaptive, R = Requirements-based, T = Testable



CIGs Execution



- A hybrid execution environment for CIGs
 - DE providing the core capabilities (CIG traversal, handling of decision tasks)
 - Dedicated “wrapper” components handling non-standard tasks, data (DP) access and events reported by CM
- Custom meta-properties associated with CIG tasks and data items

interventionType

- *Description:* indicates intervention represented by a given task
- *Example:* medication-proposal (a pharmacological treatment recommendation proposed by the system)

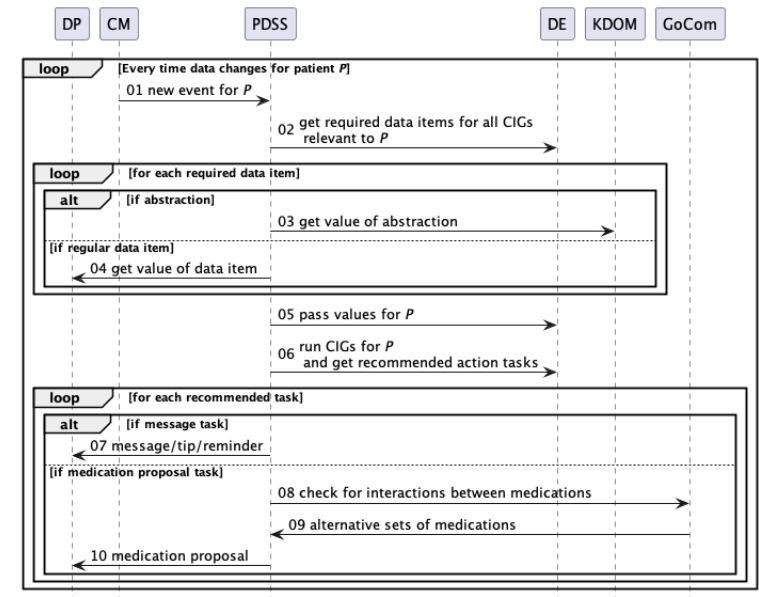
valueExpression

- *Description:* offers a bridge between FHIR and PROforma by specifying what property of a data item should be reported to DE
- *Example:* cancer-treatment-related (a flag in an Observation resource where the physician indicates if the symptom is related to the cancer treatment)

Physician DSS (PDSS)



- Provides active clinical decision support – responds to data-related events and runs physician-oriented CIGs
- Interacts with GoCom to check for interactions between ongoing and proposed treatments
- May invoke prediction models to obtain weights for specific arguments (survival time for a given treatment)





- Mitigates (identifies and solves) conflicts between ongoing and proposed (pharmacological) treatments
- Employs goal-oriented planning with action or physiological state goals (meta-properties in PROforma CIGs)
- Identifies contradicting physiological effects and actions using external ontologies (e.g., ND-RFT) and custom rules
- Generates *option sets* with possible treatments for consideration by physician (assistant/critic support mode)

GoCom Mitigation



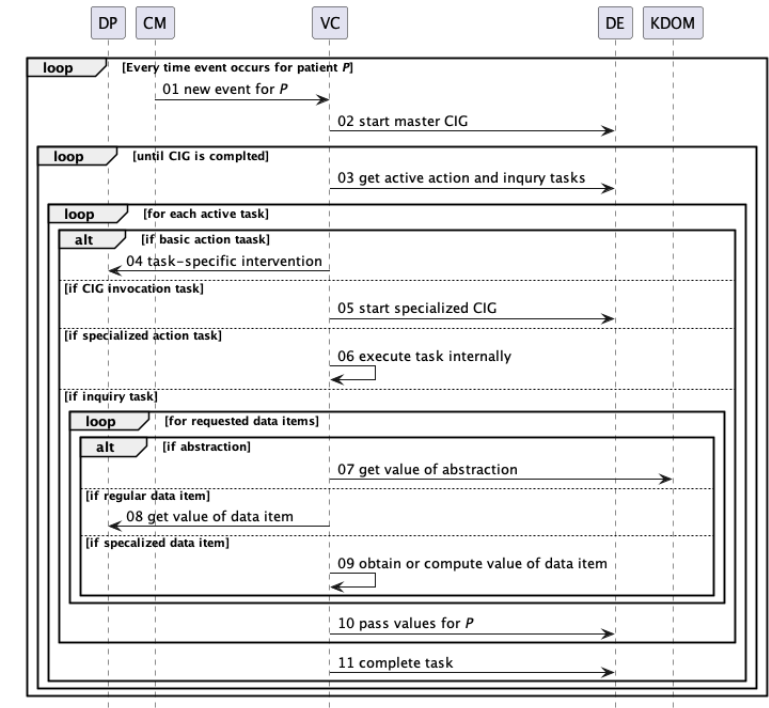
1. Patient on targeted therapy with loperamide prescribed as needed
2. Patient reports nausea and ondansetron is recommended
3. Recommendation is checked for conflicts and viable option sets are reported to physician

Goal	Option-set 1	Option-set 2
Treatment of Diarrhea	Prescribe Loperamide Loperamide can be started at an initial dose of 4mg followed by 2mg every 2–4 hours or after every unformed stool [II, B]...	Reject Loperamide recommendation An interaction has been found between Loperamide and Ondansetron: The metabolism of Ondansetron...
Treatment of Nausea	Reject Ondansetron recommendation An interaction has been found between Loperamide and Ondansetron: The metabolism of can be decreased when combined with Loperamide...	Prescribe Ondansetron Recommended doses of serotonin (5-HT) ₃ receptor antagonists: Ondansetron IV 8 mg or 0.15 mg/kg, Ondansetron Oral 16 mgs...

Virtual Coach



- Provides active coaching – responds to data- and time-related events and runs patient-oriented CIGs
- Diversified coaching interventions – recommendations, reminders, tips, alerts and rewards
- Differences between administrative workflows across institutions – runtime customization of specific CIGs

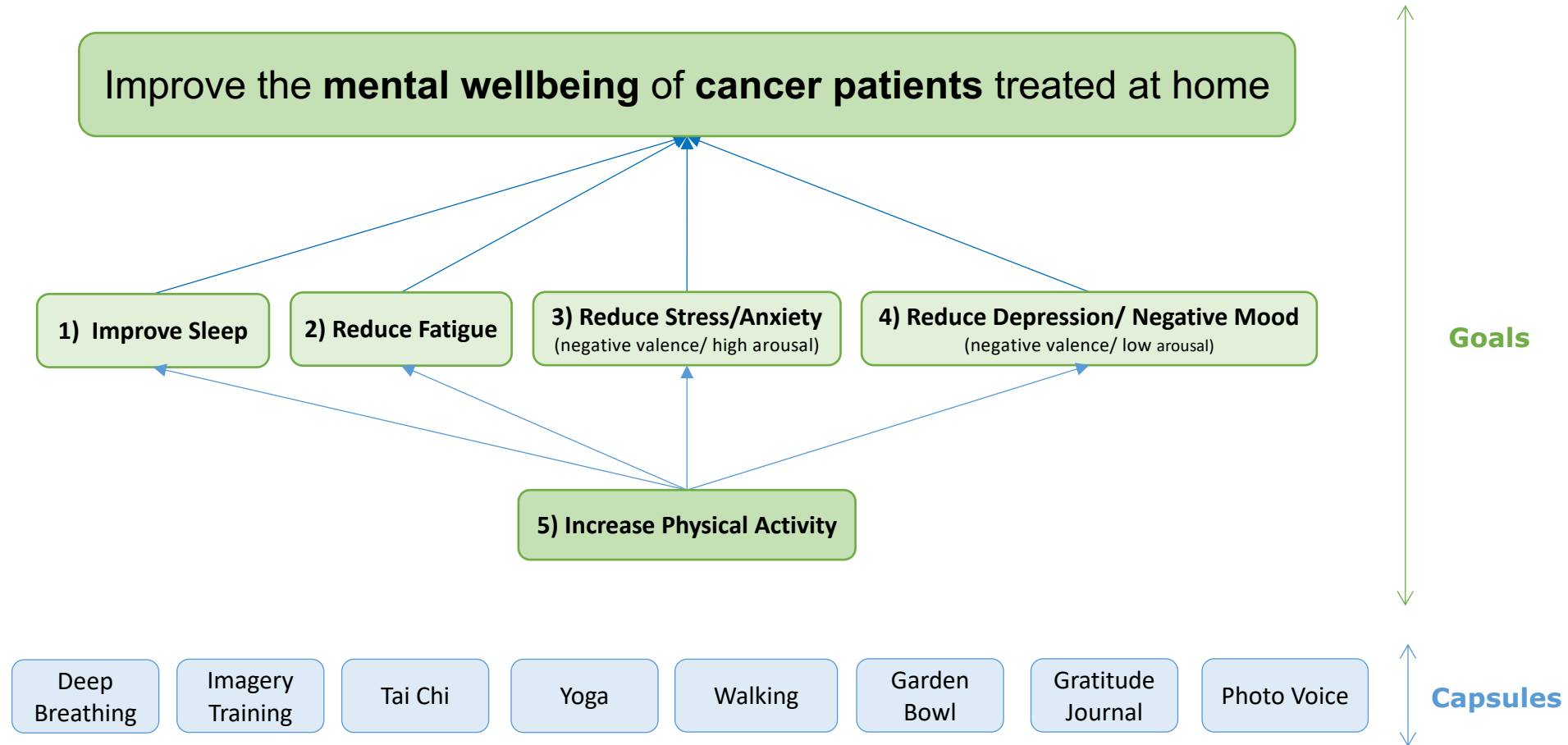


Virtual Capsules



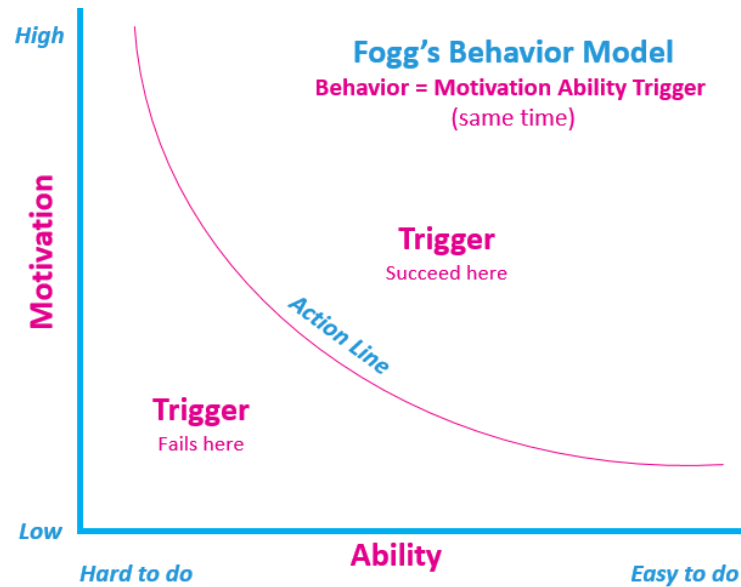
- Interventions aimed at improving mental and physical wellbeing
- Based on evidence and vetted by clinical psychologists
- Need to be approved during enrollment through shared decision-making (→ prescribed, contraindicated, up to patient)
- Direct (deep breathing) and indirect (walking) support in the system

Virtual Capsules





Fogg's Behavior Model



Fogg, B.J., Tiny Habits: The Small Changes That Change Everything, 2019.

- Used to model patient's behavior and to drive personalization of digital behavior change interventions (DBCIs) related to capsules
- Personalization limited to content and time of DBCIs



Simulating Patient Behavior

- No retrospective real-life data for health-related DBCIs
- Simulated data capturing the characteristics of patients – potential users of the CAPABLE system
- An environment (OpenAI Gym) simulating changes of patient behavior in response to triggers based on the Fogg's model



$$Behavior = \begin{cases} 1 & \text{if } (Motivation \times Ability \times Trigger) > \text{action threshold} \\ 0 & \text{otherwise} \end{cases}$$

Simulation Experiment



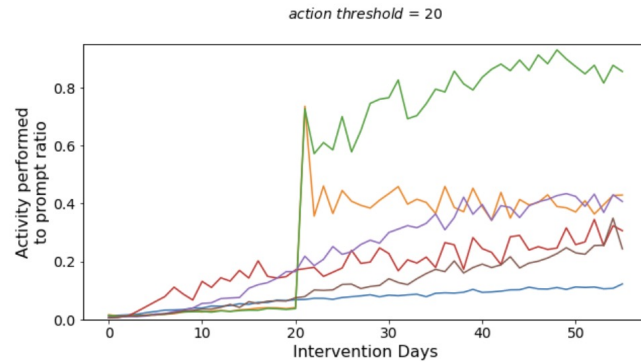
- Patient demonstrates a sedentary behavior
- Patient is willing to accept 3 notifications a day
- Patient is most likely to respond to a trigger (DBCI) around noon



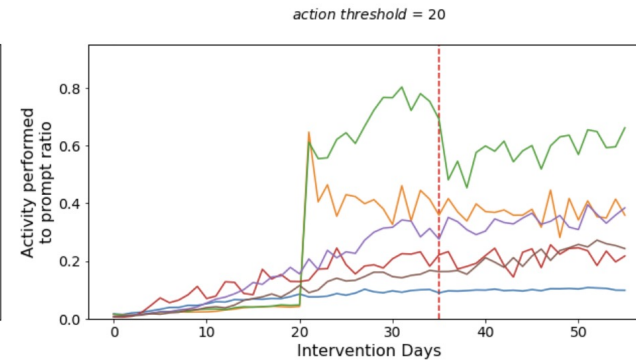
Goal: Learn a notification strategy to instill a walking habit within 60 simulated days

Compare efficacy and viability of supervised (SL) and reinforcement learning (RL) techniques

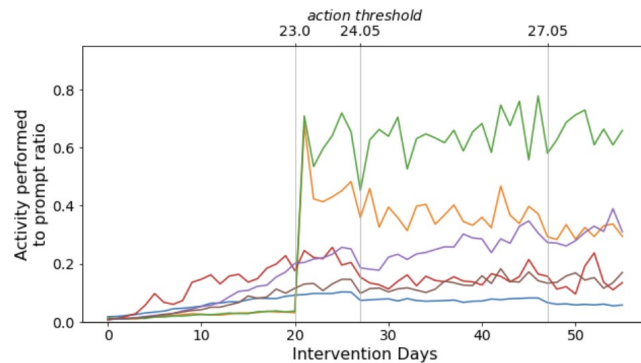
Simulation Results



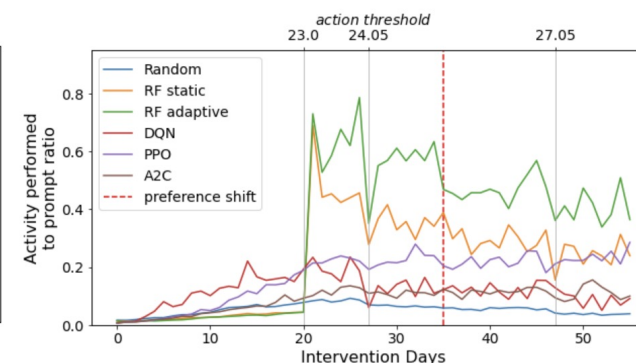
(a) Stable response pattern



(b) Preference shift



(c) Habituation



(d) Habituation + Preference shift

- SL most efficient, but not realistic in practice
- RL can be seen as alternative to static SL
- Warm start with patient preferences (?) and cross-patient transfer learning

A. Lisowska, Sz. Wilk, M. Peleg, From Personalized Timely Notification to Healthy Habit Formation: A Feasibility Study of Reinforcement Learning Approaches on Synthetic Data, in: SMARTERCARE 2021. Workshop Proceedings, CEUR-WS, vol. 360, CEUR, 2021, pp. 7-18.



Motivational Tips for Walking

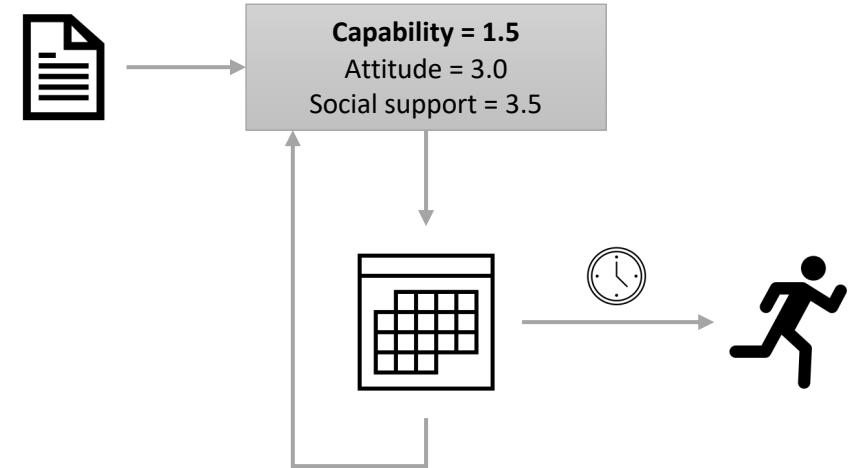
- Addressing attitude, capability and social support factors and choosing the most appropriate delivery time (→ Fogg's model)
- A pool of predefined tips (6 per factor) based on literature and verified by a clinical psychologist

Decision Factor	ID	Message (original from Mor/Aneta)	Message with the changes done by our psychologist (Paola Gabanelli)	Motivation for the change (NB:
Attitude	1	Living through cancer can be stressful, but you can manage the stress. Short nature walks can help you unwind and relax.	Living with cancer can be very difficult, but some activities can help. Short walks in nature or even around your home can help you unwind and relax. Are you feeling up to it at this time? Do you think it could help you?	1. In the psychologist's opinion, talking about "difficulty" or "dolour" is better than "stress" 2. "you can manage the stress" is too direct and it's not appropriate for patients that feel
	2	Feeling fatigued? It is normal when	Feeling fatigued? It is normal when going through the	The last sentence
	3	Walking improves cancer survivor	Walking improves cancer survivor wellbeing. If the	1. the app does
	4	Improve your sleep quality by taking	If you don't sleep well, know that discharging tension and	1. Put in this way,
	5	The weather looks good today. Take	If you feel like it, take 30 minutes to walk from time to	see line 4
	6	Going on a regular 30 minute walk is	This sentence in C7 has been accepted	This sentence has

Motivational Tips for Walking

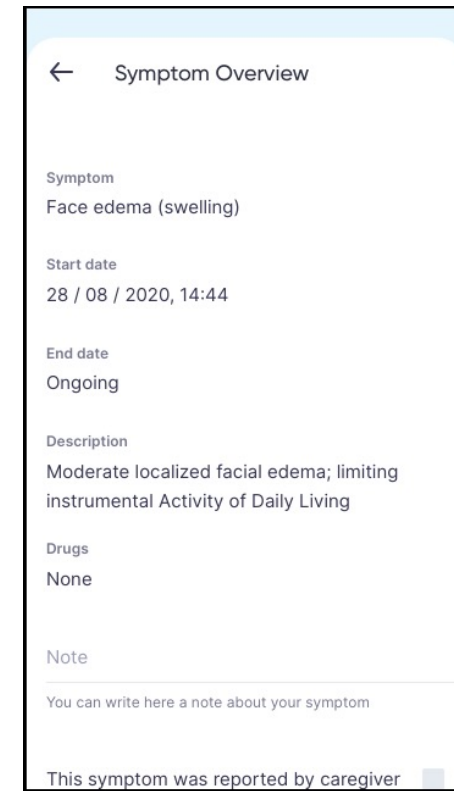
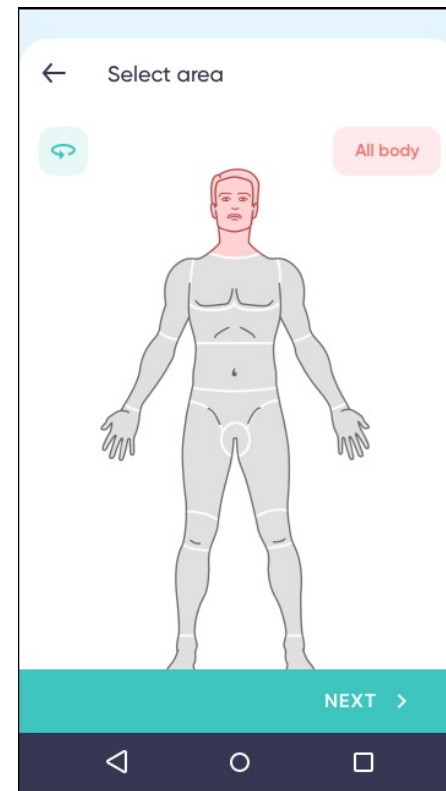
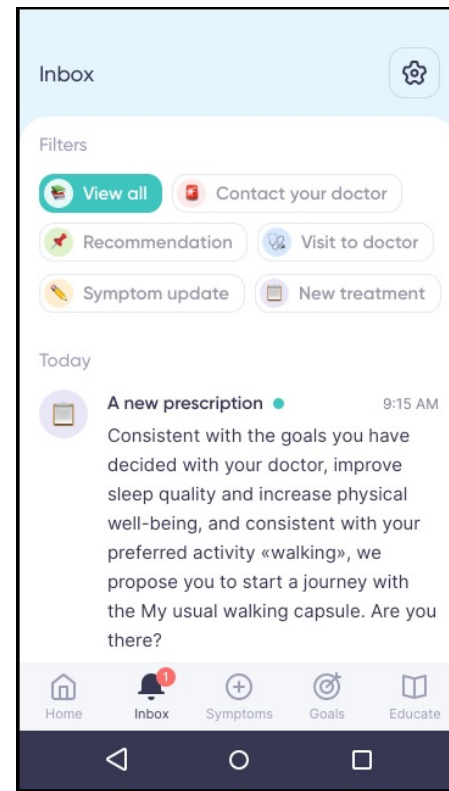
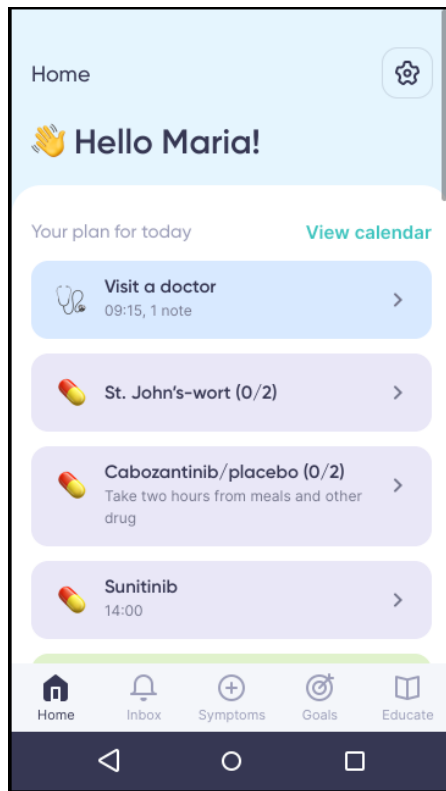


1. At enrollment, the patient fills in the BREQ2 questionnaire
2. Factors are scored and ordered (weakest to strongest)
3. Tips for a given factor are presented in a 2-week cycle
 - 3 messages per week, presented at fixed days
 - Presentation time based on the maximum activeness in the preceding period
- ...
4. At completion, the patient fills in the BREQ2 questionnaire again (to monitor the change of the factors)



- Tips may be evaluated as helpful or not helpful
- Factors with the majority of not helpful tips are dropped

Patient Application



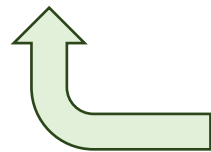
Patient Application



- Proper formulation of symptom descriptions – PRO-CTCAE translated to description levels

CTCAE = Common Terminology Criteria for Adverse Events

Patient symptom term	PRO-CTCAE match	Codes MedDRA / SNOMED CT	Description 1 EN	Description 2 EN	Description 3 EN	Description 4 EN
Decreased appetite	Yes	10002646	Mild decrease of appetite; I eat and/or drink as usual	Moderate decrease in appetite: I cannot eat and/or drink as usual, but I have not lost weight	Severe decrease in appetite; I cannot eat and/or drink as usual, and I have lost weight	-
Constipation	Yes	10010774	Mild constipation (stools that are hard to pass) that does not interfere or that interferes a little bit	Moderate constipation (stools that are hard to pass) that interferes somewhat with my usual or daily	Severe constipation (stools that are hard to pass) that interferes quite a bit with my usual or daily	Very severe constipation (stools that are hard to pass) that interferes with my usual self-care
Cough	Yes	10011224	Mild cough that does not interfere or that interferes a little bit with my usual or daily activities	Moderate cough that interferes somewhat with my usual or daily activities	Severe cough that interferes quite a bit with my usual or daily activities	Very severe cough that interferes with my daily self-care activities
Diarrhea (loose or watery stools)	Yes	10012727	Increase of <4 stools per day compared to usual amount of stools per day	Increase of 4 - 6 stools per day compared to usual amount of stools per day	Increase of >=7 stools per day compared to usual amount of stools per day	



CTCAE grade 1	CTCAE grade 2	CTCAE grade 3	CTCAE grade 4
Loss of appetite without alteration in eating habits	Oral intake altered without significant weight loss or malnutrition; oral nutritional	Associated with significant weight loss or malnutrition (e.g., inadequate oral caloric and/or fluid	Life-threatening consequences; urgent intervention indicated
Occasional or intermittent symptoms; occasional use of stool softeners, laxatives, dietary	Persistent symptoms with regular use of laxatives or enemas; limiting instrumental ADL	Obstipation with manual evacuation indicated; limiting self care ADL	Life-threatening consequences; urgent intervention indicated
Mild symptoms; not limiting ADL; nonprescription intervention indicated	Moderate symptoms, medical intervention indicated; limiting instrumental ADL	Severe symptoms; limiting self care ADL	-
Increase of <4 stools per day over baseline; mild increase in ostomy output compared to baseline; not	Increase of 4 - 6 stools per day over baseline; moderate increase in ostomy output compared to	Increase of >=7 stools per day over baseline; incontinence; hospitalization indicated; severe	Life-threatening consequences; urgent intervention indicated

Physician Application



LUIGI VERCOTTI
ID: 828
 1967 Apr 1 (56 y.o.) [Info](#)

Guidelines ▾ [Schedule next visit](#) [Prescribe new treatment](#) ⋮

Treatment Activity timeline Questionnaire results Symptoms Achievements

Current Past

Treatment for cancer

Systemic therapy
None

Surgery
None [✎](#)

Radiotherapy
None [✎](#)

Goals & Activities

Goals Activities

General goals

Physical Wellbeing
 Tai Chi, Yoga, My Usual walk, Physical activity promotion
 Up to Patient (default) Prescribed (by physician) Contraindicated (by physician)

Mental Wellbeing
 Tai Chi, Yoga, My Usual walk, Breathing Exercise, Imagery Training, Garden bowl, PhotoVoice, Vess of gratitude, Physical activity promotion
 Up to Patient (default) Prescribed (by physician) Contraindicated (by physician)

Recommendation for Mucositis 2023-05-30 07:58:19

Systemic pentoxifylline, administered orally, is not suggested to prevent oral mucositis in patients undergoing bone marrow transplantation (III).

[Review](#)

Recommendation for Mucositis 2023-05-01 10:20:59

Systemic pentoxifylline, administered orally, is not suggested to prevent oral mucositis in patients undergoing bone marrow transplantation (III).

[Review](#)

Recommendation for Mucositis 2023-04-28 17:01:41

Systemic pentoxifylline, administered orally, is not suggested to prevent oral mucositis in patients undergoing bone marrow transplantation (III).

[Review](#)

VALENTINA TEST
ID: 801
 2000 Aug 8 (22 y.o.) [Info](#)

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Treatment Activity timeline Questionnaire results Symptoms Achievements

Filter by: Month ▾ Date: April 2023 ▾ Filter by symptom name: No filter ▾ [Export XLSX](#) [+ Add new symptom](#)

< > April 2023

Symptom	Start date	End date	Description	Estimated CTCAE Grade	Drugs	Location	Notes	Reported by	Status	Edit
Rash Papulopustular or acneiform or maculo-papular, or pustular	05.04.2023 16:21	Ongoing		2	-	Right upper arm – front	-	Patient	Ongoing	✎
Hypertension	04.04.2023 15:43	Ongoing		3	-	-	-	Physician	Ongoing	✎
Diarrhea	04.04.2023 15:41	Ongoing		2	-	-	-	Physician	Ongoing	✎

Clinical Tests



- Started in March and April 2023 at ICSM and NKI
- Patients with different types of cancer (melanoma, renal carcinoma, breast...) – 30 participants per site in the intervention group
- 6 month follow up to observe a meaningful QoL change (multiple instruments, i.e., QLQ-C30, EQ-5D-5L, ...)
- Control group (baseline for comparison) already analyzed

Conclusions



- CAPABLE as response to a new model of care, benefitting patients and physicians — unofficial responses from patients are encouraging
- Methodological and ethical challenges associated with developing and deploying executable decision models
- Organizational challenges associated with clinical studies (not precise formal requirements), need for certified wearable devices
- Practical challenges for the system to be widely accepted by patients (BYOD) and clinicians (fitting the workflow and infrastructure)



Thank you

<https://www.capable-project.eu>