HORIZON 2020
The EU Framework Programme for Research and Innovation

CAPABLE

Cancer Patients Better Life Experience

Grant Agreement No. 875052
Start Date: 01/01/2020 (48 Months)

Deliverable No. 7.5
Third interim usability and acceptability evaluation report

Due Date: [31/8/2022]
Submitted On: [09/09/2022]

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Deliverable Type		
R	Document, report	**[X]**
DEM	Demonstrator, pilot, prototype	
DEC	Websites, patent fillings, videos etc.	
OTHER		
Dissemination Level		
PU	Public	**[X]**
CO	Confidential (Consortium members including the Commission Services)	
CI	Classified Information (Commission Decision 2015/444/EC)	

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Versions History

Version	Date	Author	Comments
1.0	9th August 2022	UPM	First version with integrated protocols and table of content
2.0	16th August 2022	UPM	Results of patient interviews
3.0	23rd August 2022	UPM	Results of health professional interviews
4.0	30th August 2022	UPM	Final version ready for internal revision
5.0	6th September 2022	BITSENS	Revised version
6.0	10th August 2021	UNIPV	Final submitted version

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1. Executive Summary

This deliverable shares the results of the third usability and user experience study of the CAPABLE prototypes as defined in previous deliverable D7.1.

During these activities, the ongoing developed interfaces of the final system provided by WP6 have been evaluated applying the two methods described in D7.1:

- **Interviews with patients.** These interviews gathered the feedbacks from the end users of the Patient App: Melanoma and Kidney cancer patients during the treatment phase. Considering the broader applicability of the app to any type of cancer patient, this iteration also included other types of oncological patients, cancer survivors (treatment finished since no more than 2 years). Overall, 17 patients have been interviewed.
- **Interviews with healthcare professionals (HCPs).** These interviews aimed to collect overall feedback about both doctors' and patients' solutions, understand if the clinical and patients' needs are covered, and revise the core functionalities that have been proposed in the current prototype. A total of 10 health professionals have been interviewed.

The structure of this document follows the presentation of the results of the 2 executed studies. The protocols of each study are attached in the annex. The document also presents the general conclusions from these validation activities and the next steps to follow in the future developments to satisfy the user experience needs emerged in this process.

Differently from the previous two rounds, the current pandemic situation allowed all the interviews to be performed in a presence. The following tools have been used:

- Online survey engine based on Limesurvey, used for the interviewer as guide.
- Online access to the clinical dashboards to inspect functionalities for the Health Care Professionals
- App installed on an Android device to test the functionalities for the patients
- An Asus Vivowatch 5 smartwatch

2. Interviews with patients

Participants' profile

The WP7 team interviewed 17 patients (64.7% female, 35.3% male) selected from the AIMAC network of patients (7), from ICSM hospital (8), and from NKI hospital (2). The participants were adults with an average age of 49 years (St. Dev 10.5 Min 24, Max 67). Five of them suffered from renal cell carcinoma, 2 from melanoma, 4 from breast cancer, 4 Non-Hodgkin Lymphoma, 1 Myeloma, 1 ovarian cancer. Seven patients survived the *acute* treatments and were in the follow-up phase (for example under tamoxifen treatment), 10 were still under treatment. 70.6% of the users lived together with the family (wife/ husband and/or children) and 29.4% reported to live alone.

In general, most of the participants (70.6%) were open to new technology. They used the internet on a daily basis, for entertainment and for searching the web. Most of them used the internet also for work and, in the last year, they experienced the increase in the usage of teleconference systems due to the pandemic. The remaining 29.41% declared to be less open to the technology, they use the smartphone just for basic functionalities (e.g., calls, emails, messages) and they have no technical skills for more advanced operations with the Smartphone. All the participants have a smartphone, 41.18% iOS and 58.82% Android based devices.

The 64.7% of the participants declared to use one or more medical or a wellness devices at home as Blood pressure Cuff (5), weight scale (1), pulsoximeter (3) or smartwatch (7). The medical devices have been used to monitor specific physiological data, especially during acute conditions (e.g., oxygen saturation during COVID-19), or during treatment (e.g., blood pressure-BP during chemotherapy) or to control the daily activities (sleep quality, daily steps), the latter using the smartwatch.

Overall feedbacks on the system

According to the scheduled protocol, the overall CAPABLE concept has been presented and an introduction of the app has been given to the interviewed people. Differently from the previous studies, the interviewer shown the two real patient devices: a Smartphone with the installed CAPABLE app and the smartwatch model Asus Vivowatch 5.

The following sections detail the answers about the two presented topics.

What do you think of the CAPABLE approach? Would it be useful?
Similarly to the previous interviews, the overall concept proposal received good acceptance, most of the patients understand the potential of CAPABLE to innovate the clinical practice. Most of the participants consider it as a tool to better communicate with the clinical teams and to access relevant information in an easy way. Patients also accepted the idea to have an unobtrusive physiological monitoring through the wearable sensor and they think that it could increase the knowledge over their overall health status.

Some patients stressed the fact that the technology is a very good advance but the key of the success is the medical team behind the system that should leverage on this information to support the patient.

Participants valued the goal of information provision greatly, indicating that the information about disease, side-effects and treatments would be helpful, especially at the start of their treatment. The idea to provide an additional tool to get information was very welcome also because in many cases patients reported to have difficulties to get the information form GP or oncologist at the proper time, in many cases they are difficult to reach with a phone call and a scheduled visit is required.

Some patients highlighted the fact that in many cases the patients are not aware of the severity of a specific health conditions, and it is crucial to provide personalized feedbacks.

One patient also suggested that another strong point of this system could be the data visualization for the health care professionals that can easily understand the evolution of the health condition of the patients.

The interviewer also asked specifically about the app and the smartwatch to understand their specific potential and perceived value.

The CAPABLE app in general is welcome, even if patients are not familiar with similar apps, they seem to be in line to the technical trends (there is an app for everything). However, one participant said that this could overload patients, requesting additional use of the technology. Since the app could be provided to the patient as a dedicated device (for example if he does not have a suitable smartphone), the interviewer also asked how participants will manage having more than one smartphone (the personal one and the CAPABLE one). In general, the patient would prefer to have the app in their personal mobile to avoid management of two different devices. Six patients stated that they would leave the new device at home in case that it would be not possible to install CAPABLE in their personal device. The interviewer asked all the participants to wear the device and play a bit with the available functionalities.

The smartwatch was also very welcome. Just 2 participants feel the device too much big and heavy, meanwhile other 5 explicitly likes to have a smartwatch of that size and weight. In general patients perceived the potential benefit to monitor specific physiological data (e.g. Heart Rate-HR, BP) and physical activity through the device. All patients are willing to wear it during the day, just one patient said that he would use it just a few hours in the day. For the night the position of patients is more variable, 7 of them stated that they would not wear it, some of them would wear it just if requested by their oncologist for medical purposes, the other 10 patients were happy to wear it all over the night.

When asked what the user most like of the 2 presented devices the participant expressed high interest on the Smartphone to find information and on the Smartwatch because it allows the collection of physiological data through a transparent interaction.

23,53% of patients declared they most unlike the fact to have CAPABLE in a dedicated device so having to manage more than one smartphone.

Unobtrusive tasks (think-aloud method)

Participants were asked to take the smartphone and open the app available on the desktop. They were asked to describe what they were seeing in the interface, to tell their opinions and to comment on possible problems or potential improvements. The interviewers took notes and/or analyzed the audio-recordings accordingly, with an emphasis on the feedback, the interactions with the prototype and whether the participants were able to complete the specific tasks. The patients were asked to execute the following 4 tasks:

- **Task 1**: Open the app and inspect the home screen explaining all the functional elements that are present in the interface.
- **Task 2**: Enter in the Inbox module, use the filtering functions and read the messages that are listed in the module.
- **Task 3**: Report three symptoms, i.e., fever, diarrhea, and skin rush (these three symptoms have been chosen for the test because they imply different data input modalities).
- **Task 4**: Check the lifestyle goals, perform a Thai Chi session, a basic breathing exercise, and report a walking activity.

Task 1

Introduction.

The participants have a good understanding of the home page functionalities and the information rendered on the screen. Nevertheless some misunderstanding have been identified:

- For Medications, some users asked if the number "1/2" close to the pill icon represents the number of intakes (e.g., "1 out of 2") or the proportion of a pill (e.g., half a pill) (2 participants).
- The name of the Capsules (3) was not clear for some users.
- The questionnaire that evaluates "your day" seems to refer to the overall day assessment instead of the Capsule evaluation (1).
- Report of my usual walk: when entering the activity duration, the users inserted by default the hours instead of the minutes, which generate errors. The button report is not clear to one patient. Another user asked to report the number of steps, another participant did not understand the emphasis on walking in the nature. Walking could be beneficial even not in the nature, and not all the patients will have close access to parks or natural spots.
- Not clear the difference between the daily activities and the weekly ones: for some users it seems a redundancy.
- For some patients the gratitude jar was not clear.
- Most of the interactive contents, references and tutorials are in English in the current version (they still have to be translated).
- Not clear if the vital signs are from the last hospital visit or from the wearable device.

The users provide the following suggestion to improve the app:

- Improve the graphical design somewhere.
- The home page is very long and there are complex functionalities as the Capsules that start more complex flows. There is the risk that users would not scroll through all the homepage functionalities (2).
- Some users requested to have a more personalized home page, being able to change background and icons in order to feel like they have a unique app.
- The title of the sections are not so clear, now they are in light grey. The text should be more graphically visible.
- Many functionalities, specially the Capsules, need to be introduced by a specialists (2).

Task 2

Task two requires the user to move to the inbox section, explore the example messages and play with the filter functionality. Five patients have problems accessing the functionality. In most of the cases they tried to access from the home page, but they did not find a shortcut. As soon as the participant identified the menu in the bottom part of the screen, he succeeded accessing the functionality, in two cases the interviewer had to suggest how to access to the inbox. One user said that the icon of the inbox is not properly explaining the message functionality, the participant suggests putting the icon of a letter envelope, as in the email messages.

Another issue that emerged during the test was that the filter functionality was not properly understood in 10 cases: the users considered the filter button as indicating possible actions in the app, instead of a semantic filter of the messages that appear in the top-down list the filter. One of the filter labels, namely 'contact your doctor', was systematically misunderstood.

Another user also reported that the filter section takes up much space of the screen and it should be resized properly and made clearer. Regarding the message content, all the users were able to understand the list of proposed messages and the possible required actions.

Task 3

This task required the users to report 3 symptoms in the app (fever, skin rush and diarrhea). Five patients have difficulties identifying the functionality in the horizontal menu. Other 3 participants reported problems pressing the button to add a symptom, since the "+" icon is also present on the symptom menu page and this generates confusion. Two

patients reported some problems using the body images to localize the symptom, one user complained on the granularity of the body segmentation (the user wanted to report a skin rush in the ankle that in the segmentation also includes the foot), one user had a problem identifying the *body functionality skip* button. After the symptom localization, users had to select a symptom from a list, some users had difficulties to find the symptom from the list, also because the list is not alphabetically ordered. Six users identified the possibility to search for a symptom, 2 users complained on the fact that the lens icon (on the top-right) is quite little and not so much visible. Also the bar that allows entering text, which also has the auto-completion facility, is light grey and not visible enough. Some users also considered unclear the way of grouping symptoms, and the difficulty to understand the type of categories (more appropriate separators and titles would make this section clearer). Two users also tried to report more than one symptom at the same time and only after a while they understood this was not possible, because the app supports the report on one symptom at a time. Finally, one user suggested to insert the possibility to add a symptom not present in the list, adding the 'other' option.

Task 4
This task required to access the *Objectives* section, check the specific page and see a Thai Chi lesson, a basic breathing exercise and report a walk activity.
Most of the users (except one) identified the proper button from the menu.
All the users understand the role of the filter functionality. Just one, similarly to the inbox functionality, considered the filter button as possible trigger of some activities instead of a filter on the list of objectives for the user.
The Thai Chi exercise was correctly executed. The main barrier was the fact that the video is launched in a YouTube page, and the (usual) advertising before the video was considered annoying by the users. Seven users were not able to come back to the objectives page because the video is not embedded in the app but launched as an external web page from the app. Some users also suggested to create a better introduction for the Thai Chi and support the video with clear subtitles and additional materials to clarify specific body positions to execute during the execution of the Thai Chi exercises.
The breathing exercise was successfully completed by all the patients. One user suggested providing voice instruction because in some cases the exercise could be performed also with closed eyes. Another user suggested to provide instructions on how to properly sit down before the session (the *rest* positions also very important).
The reporting of *usual walk* activity in general was performed correctly, but a criticality emerged about the input of the duration, which by default is done through a clock graphical format, in which the user had to insert first the hours and then the minutes. Ten users had difficulties to report and complain on this type of solution. Another user also requested a proper introduction of the intended activity. Another user remarked the fact that these activities should be linked with the Smartwatch data and it was not clear why it was necessary the report (in fact it is, because not all the patients will wear the smartwatch). One user (with a background of health phycologists) remarked the fact that all these activities need to be properly introduced and supported by the healthcare professionals. Just one patient stated that she/he would not perform those activities during the treatment period.

Overall easiness of the tasks

The participants scored from 1 (very difficult) to 5 (very easy) the performed tasks. The overall results are positive and the average values are above the positive threshold (3). The most difficult ones were tasks 2 and 3 :
- Most probably task 2 received the lowest score because of the misunderstanding of the filter functionality and on the texts of some messages of the inbox section.
- The users found some difficulties to find the proper symptom in the list and they had some difficulties because the categorization of the symptoms was not properly marked and ordered. For some users it was also difficult to find alternative actions as the *search* text bar.

Table 1 details the statistics of the easiness score.

Table 1: Easiness scores of the 4 tasks performed by the participants (1=very difficult-5 very easy)

	Mean	St Dev	Min	Max
Task 1	4,25	0,68	3,00	5,00
Task 2	3,60	1,06	1,00	5,00
Task 3	4,13	0,74	3,00	5,00
Task 4	4,20	0,56	3,00	5,00

Final questions

During this last part of the interview three types of information have been gathered:

- Qualitative feedback on missing functionalities and how system can be improved.
- Quantitative evaluation of the perceived values of the CAPABLE patient app.
- Quantitative evaluation of the overall system usability.

Missing functionalities and how to improve the app.
Nine out of 17 participants considered the app has all the main functionalities. The following suggestions have been mentioned by the participants for improvements:

- Add nutritional advice, personalized by the user's profile and preferences. Another user also suggested to track calories food intake.
- Provide an update on the therapies (this functionality is already present but not presented to the user because it is still under development).
- Provide a contact detail for emergency.
- Add blood tests summary in the part of physiological measurement.
- Some users requested to have the possibility to contact a health professional (oncologists or psychologist). The interviewer explained that this is done through the collection of symptoms and of the mood scale. The users requested an acknowledgement message that the health professional is aware of the reported information. A user also suggested connecting the psychological support with private services or Non-Governmental-Organizations (NGO), because in some hospitals there is a lack of resources for psychological support.
- Suggestion on overall improvement to make clearer some texts (e.g., the descriptive texts of the sections that are in a light grey and with small text).
- Suggestion on improvement of the overall user experience to make the app enjoyable and funny and avoid the feeling of the user to make a sort of homework. A user also suggested to use some gamification approaches.
- A user also recommended to use trustworthy information.
- Another users suggested to receive notification for the medication intake (this feature is already under development).

Perceived values
The participants filled in a questionnaire aimed to measure the acceptance and the perceived values. In general, all the proposed dimensions were well accepted and the scoring was a bit higher than the previous UX round. The most accepted statements were that the system would *help the health care team to better monitor patients during treatment*, that patients would like to *have the app in their personal phones*, and that the presented system would *improve the communication between patient and health professionals*. The participants were more skeptical on considering CAPABLE a system that would help to cope with cancer treatment, cope with daily problems, and help to manage negative emotions. The following chart summarizes the statistics of the responses.
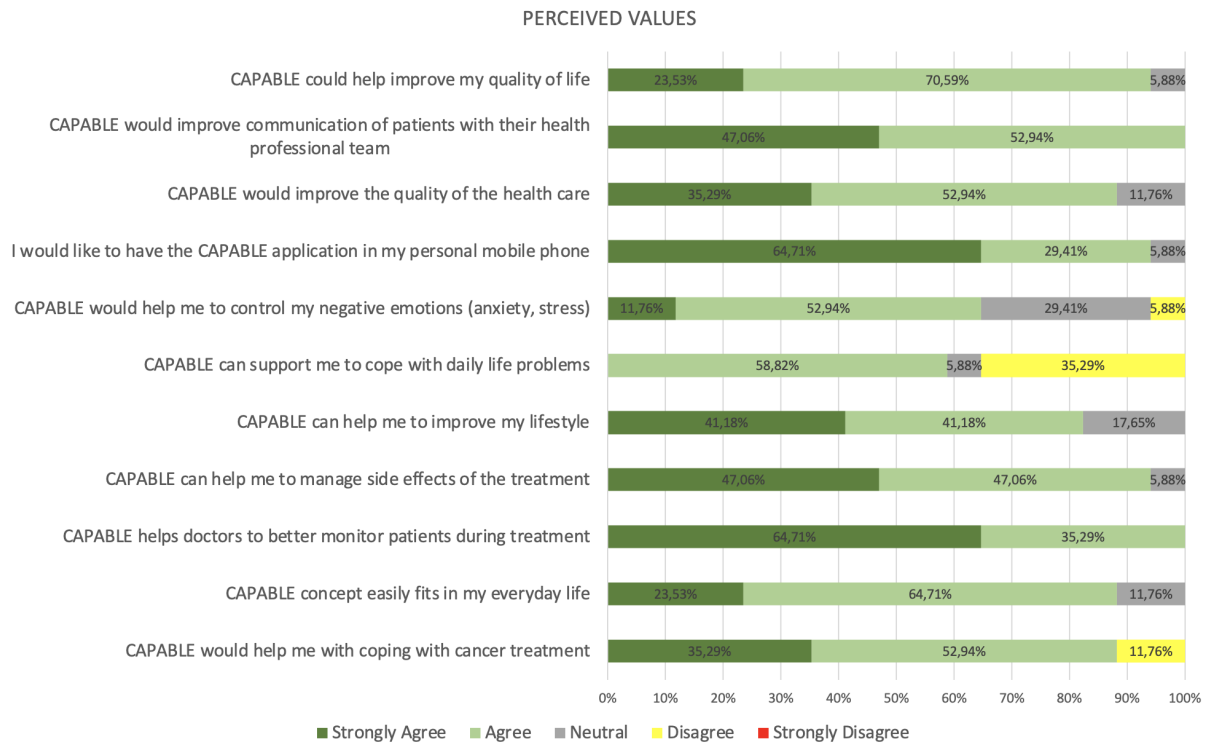
PERCEIVED VALUES

Figure 1: Chart of the perceived values of CAPABLE

Overall system usability

The last questionnaire of the interview was the standard questionnaire about system usability, the System Usability Scale[1]. The overall results are good even if a bit lower from the previous study (this is reasonable because the previous rounds exploited a mockup and not the real app, which in fact would require a preliminary training). Nonetheless, the system received close to excellent scores (thresholds is 80): the overall mean score of the SUS questionnaire is 77.65 (St.Dev. 7.37, Min 65, Max 92.5) that confirms that CAPABLE usability is high. Differently from the previous study, all patients considered the system acceptable (in the 2nd round one patient was not satisfied).

The dimensions that received most positive scores were related to not having inconsistency (mean 4.24) and to be cumbersome (mean 4.41; since the questions were negative the score has been reversed, 1= strongly agree and 5= strongly disagree). The statements that received lower scoring in the Likert Scale were the fact that the user *will not need the support from a technical person* (mean 3.82) and that the user is *feeling confident using the system* (mean 4). All the sentences have a very positive scoring in general, above the threshold (3, neutral). The bar chart in Figure 2 depicts the statistics, after normalization of the negative answers (the ones with the NOT prefix).

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[1] https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html
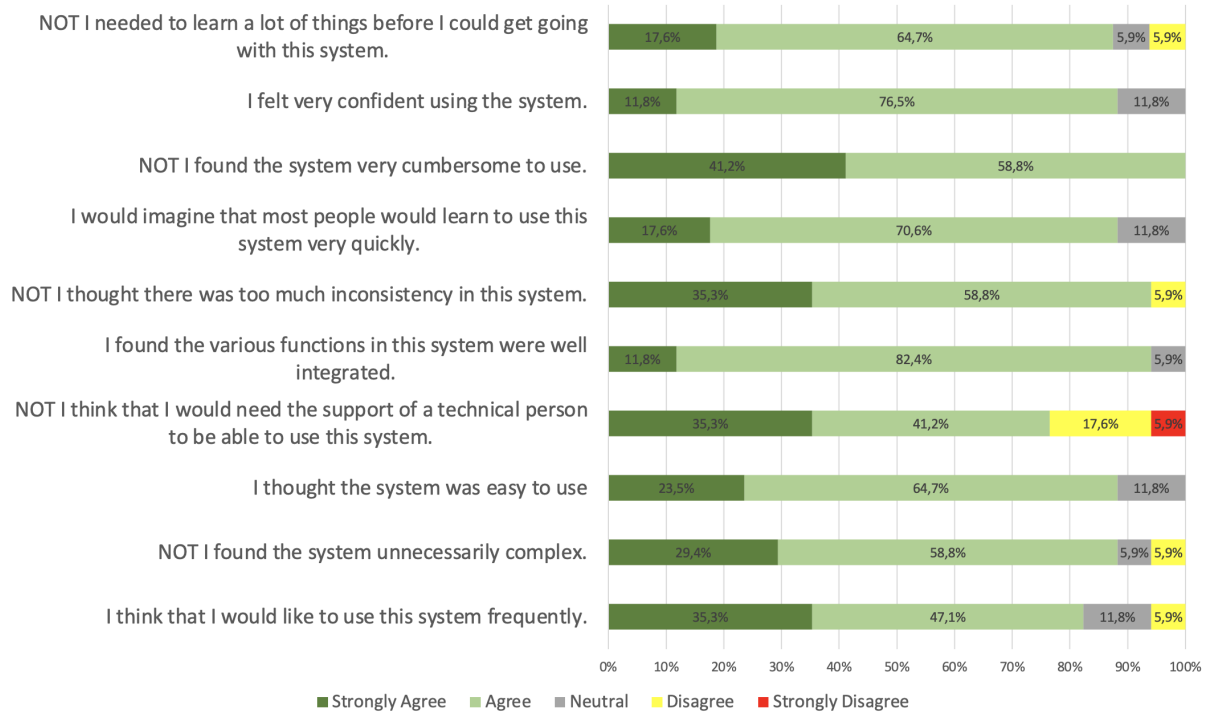
System usability scale

Figure 2: Chart of the System Usability Scale questions

3.Interviews with health professionals

Participants' profile

WP7 interviewed 10 health professionals (50% Males and 50% Females). The average age was 32 yrs (St. Dev. 6.75, Min 24, Max 47), lower than the patients' one and than the previous health professional cohort of the 2nd UX study. Out of the 10 interviewed people 8 were oncologists, 1 specialist in nutrition and 1 phycologist. Most of them (80%) were physicians in training.

Previous experience with health technology

All the users have experience with Hospital Information Systems to track the administrative processes of the patients, 80% with the Electronic Health Record. Half of the participants also mentioned using RIS/PACS. Forty % of the participants declared to have experience in telemedicine systems for oncology, both to perform remote visits and gather clinical information; 70% of participants had experience on Clinical Decision Support System and 30% used risk assessment calculators (e.g., Med Cal), 50% tools to support the definition of the therapy and 20% guidelines tools. All the participants are opened and interested in the use of technology, also to improve their work. All participants have an Android smartphone device. They use the device for communication purposes, as a support for daily work (e.g., check information on treatments, medical publications and guidelines) or for managing emails.

Overall feedback on the system

The interviewer introduced the overall CAPABLE system, showing at high level the solution for the patients (app and smartwatch) and the dashboard for health care professionals.

The participants agreed on the fact that a system like CAPABLE could be an asset to improve the quality of the healthcare service and to empower the patients at home. On this last aspect some participants remarked that patients' age could be a barrier to use the technology, and patients need to be trained to properly be able to use it correctly and provide the information related to their health status correctly. The more anxious patients most probably will tend to over report the health evolution. The information generated by CAPABLE will enrich the patient information in-between the control visits, giving the possibility to have more data, both objective and subjective. This will positively impact on the visit duration because it will not be required to the patient to report all the history of symptoms from the previous visit.

Another benefit of this system is to systematically collect in one place information that nowadays is fragmented in the health professional communication services as emails, messages, and phone calls. The use of this technology should also improve the protocol of communication with outpatients. The clinicians also appreciated the educational component of the CAPABLE app and the promotion of overall wellbeing through the CAPSULES functionality. They also consider important that this information is scientifically validated and completed, to avoid further search over the Internet. Another strong point of CAPABLE that has been identified by the participants is the link with nutritionists and psychologists, in addition to the oncologist. Finally, they appreciated the fact that the app can suggest to contact the hospital upon the occurrence of certain symptoms or certain combinations of symptoms.

The participants considered the clinical dashboard very useful, and special attention has been given to the predictive models and the overall clinical decision support tools. The predictive models are considered as a useful complementary tool for the daily practice, even if they have two main weaknesses: (1) they are unable to explain different patient trajectories of 'similar' patients; (2) the CAPABLE models are just for melanoma and renal

cancer, so they are not covering the overall cancer spectrum. The health professionals declared to be happy to have support to follow the clinical guidelines and to access the official documentation directly from the system.

Unobtrusive tasks

At this step of the interview the interviewer asked the participants to open a specific link of the Web Portal for health professionals[2] and the patient App installed in a Smartphone. The users were invited to describe what they were seeing in the interface and reported possible problems and improvements. The interviewer took notes of all the feedbacks and observed also how the prototype was used and if the user was able to complete the specific tasks. The proposed tasks were 5:

- **Task 1**: Enroll a new patient through the Web portal for health professional (Dashboard).
- **Task 2**: Insert treatment and goals (Capsule) of the new enrolled patient
- **Task 3**: Inspect the patient app and report diarrhea symptom
- **Task 4**: Follow up in the dashboard and check the patient reported symptom
- **Task 5**: Change cancer treatment and schedule a new visit.

As can be noticed, health professionals were requested to revise all the core use cases of the overall system, because their opinion is fundamental also in the design of the patient's app.

Task 1

The participants logged in to the web page of the dashboard. They properly understood the purpose of the patient list and the search and order functionalities. The information of the list was correctly understood, many professionals asked the purpose of the red button 'Action needed' present in all the patients. For many participants (4 out of 10) it was not clear (it should be better specified) and the button should go directly to the alert management (some users tried but it did not work).

The users were able to launch the pre-enrolment process, the button was identified in the patient's list page. The initial form of the inclusion was completed correctly by all the participants; one of them suggested to consider not only binary gender (male, female) and to include others. The second part of the task required the participant to finalize the enrolment inserting additional information on the patient's disease and lifestyle. All the HCPs were able to identify the new patient, just created, and they clicked on that to access the patient overview page. Here some HCPs (4) were not able to find the proper button to continue the task. Once it was identified or suggested by the interviewer all the users were able to fill in the form to complete the enrolment. In general it was not clear what to do when the user entered the patient page after the enrolment. Some users (2) for instance, instead of completing the enrolment, started filling in the therapy information. Other HCPs provided suggestions on how to improve the information required during the enrolment process: one suggested to better explain the score of the nutrition scale (MST), another one suggested rephrasing the question related to alcohol abuse (too much direct for the patient). Three participants asked if the CAPABLE system will access the Electronic Health Record of the enrolled patients, in order to access to the complete health information. For some users this feature would be required in order to get all the information that is not present in the forms and functionalities of the CAPABLE dashboard.

Task 2

The participants were asked to insert the treatment information of the newly enrolled patient. All of them accessed the patient overview, and they noticed the empty treatment information item. They had to find the new treatment functionality button from the horizontal menu and 2 users had difficulties to identify the button.

Some users complained about the fact that during the prescription it is not possible to know the end date of the treatment, meaning that the form end data should be optional and not mandatory.

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[2] https://demo.capable.appreciate-mvp.bitsensdev.com/login

Two users noticed that the treatment form opens a pop-up page that requires the scroll of the form to complete the action. When the user saves the data it is not possible to see the problem at the beginning of the page. This happens also with the end data that has been left empty by some participants.

A HCP suggested to add a section for pain treatment. Another user suggested for the scheduling of the medication to also insert a scheduling that requires an increase of the dosage over a certain frequency (e.g. a week).

The second part of the task requested the users to set up the goals of the new enrolled patient. Even if the section is inside the main page of the patient overview, some participants (4) had difficulty finding it. Once identified, they understood the organization of the goals and the activity, some users require some clarifications on the possible three options to activate the goal and activities.

Task 3

During the task HCPs inspected the patient app, focusing in general on the information available in the home page and on the symptom page. In general, the health professionals considered that the design of the app is clear and simple, and most of the users would be able to use it. One participant stated that age could be a barrier: elderly people could have some difficulties if they will not have experience with the smartphone technology. In general, all the health professionals were happy with the proposed structure of the app and the proposed contents. They experienced similar problems reported by the patients and they provided some suggestions to improve the patient solution.

For one HCP it would be interesting to have a functionality to know the missed medication. Patient should be able to report not only medications taken, but also the ones they forgot or decided to not take. Other users had difficulties accessing the symptom page using the main menu. One participant considered the graphical page to localize the symptom as not very useful because in some cases it is difficult to localize the symptoms. Another participant suggested to add the option to insert other type of medication used to manage the symptom (currently the app proposed a closed list of medications). Two participants reported a problem to report the duration in the 'my usual walk' activities, also in this case the problem was that the *clock-like* graphics.

Task 4

HCPs checked in the clinical dashboard the symptom they reported when playing the role of the patient in the previous task. In general, participants did not have any problem completing this task, the functionality was easily identified in the tab of the page of the selected patient. The clinicians provided some suggestions on the revised screens. The overall recommendations were to make more explicit the information used in the page and the requested actions for the health care professionals.

Specifically, 5 participants found the symptom chart unclear. A common issue was to understand the value of X and Y axis). Some participants had a problem in understanding the ongoing symptom in the table of symptoms. Another participant realized that the page missed part of the information reported in the app as the localization of the symptom or the feedback that the app automatically provided to the patient. Finally, 2 health professionals suggested to implement in the dashboard the management of the new symptoms, by advising the user (in this case the health professionals) that a new symptom has been reported and need to be revised and also to inform the patient when this has been done. Another overall recommendation is to guide the health professional to perform the task by adding alert in the home page and marked color in the section that need to be revised and eventually add functionality that confirms the revision by a HCP.

Task 5

In this last task the interviewer requested HCPs to prescribe a new treatment and to schedule a visit. Participants reported similar issues of task 2 for the treatment functionality, specifically they complained on the fact that end of the treatment is mandatory. Also they claimed, about administration time of loperamide for the diarrhea

management, that it should be after each stool and not after a certain time period. Another professional found the same problem and suggested to simplify the functionality related to the administration time of the treatment.

The functionality related to the scheduling of the visit has been performed easily by all the professionals.

Overall easiness of the tasks

The participants score from 1 (very difficult) to 5 (very easy) the performed tasks. The overall results are positive and above the positive threshold (3). The task that received lower score (4.30) was the one related to the treatment and Capsule set up, most probably due to the complexity of the prescription forms. The task that received the highest score was the one related to the visualization of the symptoms reported by the patient in the clinical dashboard.

Table 2: Easiness of the performed tasks

	Mean	St. Dev	Min	Max
Task 1	4,80	0,42	4,00	5,00
Task 2	4,30	0,95	3,00	5,00
Task 3	4,60	0,52	4,00	5,00
Task 4	4,89	0,33	4,00	5,00
Task 5	4,71	0,49	4,00	5,00

Final questions

Similarly to the patients' interview schedule, in last part of the interview three types of information have been gathered:

- Qualitative feedback on missing functionalities and how the system can be improved.
- Quantitative evaluation of perceived values of the CAPABLE systems.
- Quantitative evaluation of the overall system usability.

Missing functionalities and suggestions to improve the app.

All the participants were satisfied with the presented functionalities, and they thought that CAPABLE is a quite complete system.

The following suggestions have been provided to complete the system:
- Integrate CAPABLE with the Electronic Health Record of the patient to get information of lab and instrumental tests.
- Support the report of the interaction between pharmacological drugs. This can be a very useful tool during the prescription (this functionality will be implemented indeed).
- Improve the unit of measurement of the pharmacological prescription and add specific notes because there are some drugs that require special procedures of intake.
- Provide a support for allergies to specific treatment.
- Support the monitoring of the chronic pain.
- The scheduling of the pharmacological treatment should also support the ones taken "as needed" and the HCP should receive a notification.
- Support the report of a visit, not only the scheduling.
- Provide an online help for the clinical dashboard.
- Add a chart in the dashboard to show the evolution of the scores of the questionnaire.
- Suggest asking patient symptom the day before the visit.

● Simplify the menu of the patient, because it probably contains too many functions.

Perceived values

Participants responded to a questionnaire aimed to measure the acceptance and the perceived values. All the responses received a positive score, with higher score than the 2nd UX study. The dimensions that were less scored by the HCPs are 1) the fact that CAPABLE could *improve the communication among health care professionals* 2) the *CAPABLE process easily fits in the health care professional routine* (this is similar to the previous study). The most accepted sentences are the same of the previous study and were the idea that CAPABLE could *improve the quality of care* and *improve the communication with patients*. Figure 3 illustrates those results.
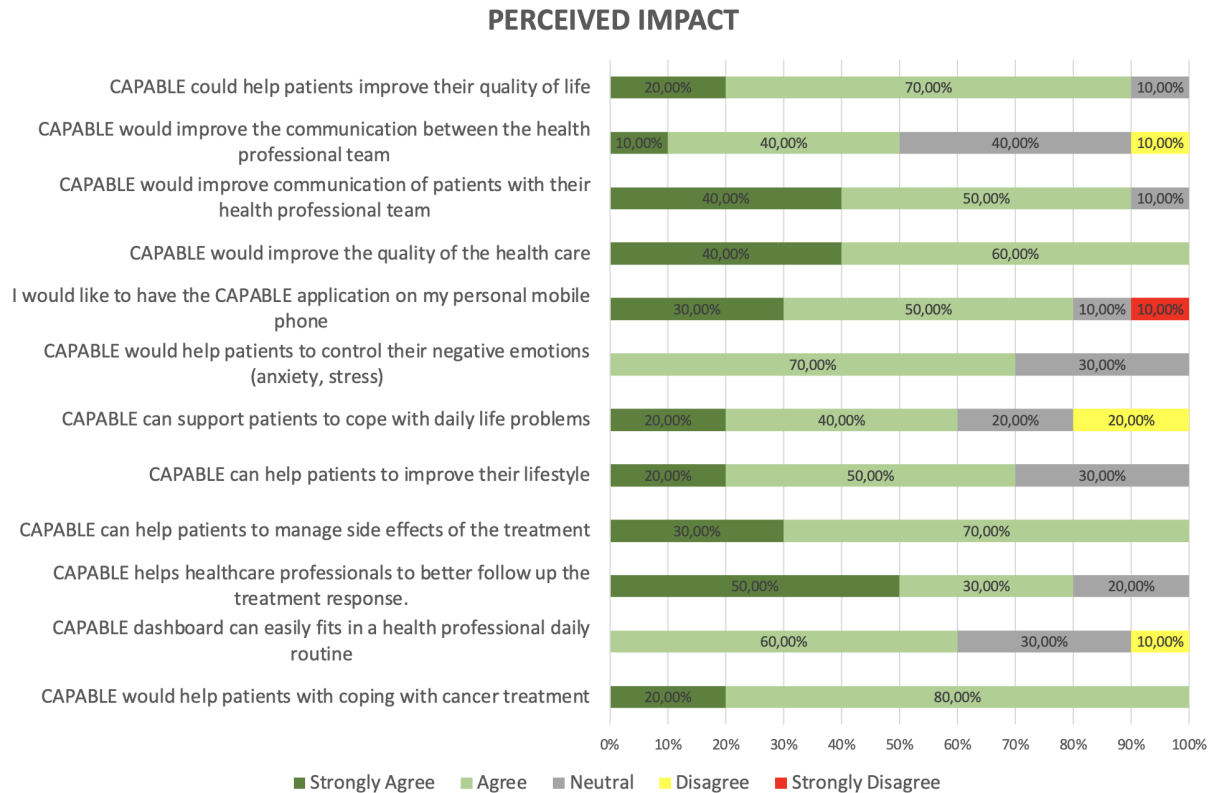

Figure 3: Chart of the perceived values of CAPABLE

Overall system usability

The last questionnaire of the interview was the standard SUS questionnaire about system usability. The overall results are good (Figure 4). The system received good scores (thresholds are between 68 and 80): the overall mean score of the SUS questionnaire is 77.75 (St.Dev. 9.37, Min 65, Max 90) that indicates that CAPABLE has good usability. This result is lower than the scored received in the second UX study (as for patients, this could be due do the use of a real system instead of a mockup).

From the analysis of the single metrics of the questionnaire it is possible to notice that the dimensions that received higher scores were about system (no) cumbersome and (no) need to have a technical support to use the system. The dimensions that received lower scoring were the idea that most of the users will learn to use the system quickly, the idea to use the system frequently and to feel that the functionalities was well integrated: even if with lowest scores the average value is positive. The highest and lower scored responses follow the trend of the previous study.
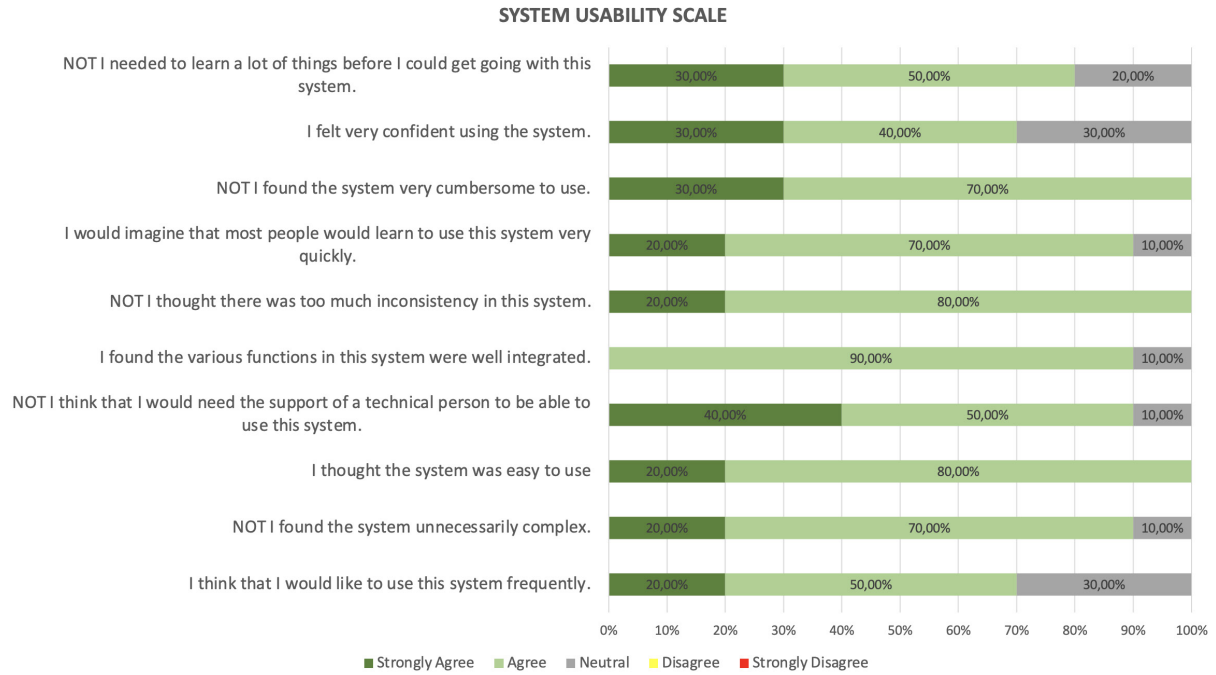
SYSTEM USABILITY SCALE

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |

Figure 4: Chart of the System usability questions

4.Conclusions

During this third iteration WP7 set up an exhaustive set of interviews that globally involved 27 participants distributed as follow:
- 17 patients selected from the AIMAC networks, from ICSM and NKI Hospital
- 10 health professionals from ICSM and NKI hospitals

Two different types of protocols have been applied, according to the participant profile (see documents in the annex). This third round differentiates from the previous ones for the type of prototype that has been validated and from the modality of the interview.

The interviewer showed the real CAPABLE solution that currently is under development. This decision was done to early assess the final solution and to refine continuously the solution until the delivery at the end of the year.

The overall results demonstrate that CAPABLE is a usable (patient app 77.65 and clinical dashboard 77.75 out of 100 in the SUS scale) and acceptable (average of 4.18 in patients, 3.98 in health professionals out of 5 of a specific scale of perceived values). From the previous study there was a decrease of the usability (mostly due to the fact that users used a real and still uncomplete prototype), while the acceptability slightly increased.

The proposed tasks were less complex than the previous study due to the fact that part of the functionality was not available because they are under development. The unique opportunity of this last UX study before the clinical study is that a real prototype has been early validated with the end users.

The interview took around 1 hour each, both for patients and health professionals as planned in the protocol. Many quantitative and qualitative information have been gathered under different perspectives. All these feedbacks will be used to improve the app and dashboard that are still under development.

5. Annexes

The following sections provide links to additional material related to the work described in this deliverable. The Subsections contain the link to the protocols that have been implemented (interviews with patients and health professionals) and a table that recaps all the issues on the prototypes that have been identified thank to these activities. Additionally, the links to the prototypes are provided.

Protocol of the patient interviews

https://docs.google.com/document/d/1C1rJ1luKgd3sI1D2k4YYp5vkODn0vTL-/edit

Protocol of the health professional interviews

https://docs.google.com/document/d/1DyH90taZMZY7Gj5o2C-OpWdPb5gYLGbE/edit?rtpof=true

Analysis of the issues of the prototypes

Wp7 created a BUG tracker document to report all the bugs and usability issues identified during the study preparation and during the interviews with patients and HCPs https://docs.google.com/spreadsheets/d/1KcHcwjyJNuR5bTF4zzGpdjSO-TIfyRA740zcL-4nYhA/edit#gid=0