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LIFECHAMPS: A Collective Intelligence Platform to Support Cancer Champions

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D2.1 - Vision scenarios and use cases definition

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TABLE OF CONTENTS

1 EXECUTIVE SUMMARY 10

2 INTRODUCTION 10

3 METHODOLOGY 11

3.1 OBJECTIVES 11

3.2 CONTENT AND SUPPORTING MATERIALS 12

3.3 MODALITIES OF INTERACTIVE ACTIVITIES WITH CLINICIANS 18

3.3.1 Workshops 18

3.3.2 Delphi method 18

3.4 RECRUITMENT OF PARTICIPANTS 21

3.5 TIMELINES 21

3.6 ETHICAL ASPECTS 22

4 RESULTS 22

4.1 VISION SCENARIOS AND USE CASES DEFINITION 23

4.1.1 PUC1: Predicting and understanding treatment tolerance based on real-world digital biomarkers and ePROMs (AUTH) 23

4.1.2 PUC2: Multiple assessment of psychological and lifestyle factors for a person-centred care in aging cancer survivors (APC) 30

4.1.3 PUC3: New AI to reduce mental burden and improve QOL for patients during/after cancer treatment (HULAFE) 34

4.1.4 PUC4: Predicting the effects of the interaction between late/persisting treatment-related symptoms and multimorbidity/polypharmacy on the frailty and independent living status of older people post-cancer treatment (UofG) 39

4.2 GENERAL RELEVANT FINDINGS 47

4.3 EVALUATION OF INTERACTIVE ACTIVITIES 50

5 CONCLUSIONS 53

6 REFERENCES 54

7 APPENDIX 56

7.1 INFORMATION ABOUT INTERACTIVE ACTIVITIES 56

7.1.1 PUC1 (AUTH) 56

7.1.2 PUC2 (APC) 58

7.1.3 PUC3 (HULAFE) 60

7.1.4 PUC4 (UOFG) 62

7.2 QUESTIONS USED DURING INTERACTIVE ACTIVITIES 65

7.2.1 PUC1 (AUTH) 65

7.2.2 PUC2 (APC) 66
7.2.3 PUC3 (HULAFE) 68
7.2.4 PUC4 (UOFG) 70

LIST OF FIGURES

Figure 1 Supporting slides for interactive activities (I) 12
Figure 2 LifeChamps promo video (CYBERLENS) 13
Figure 3 Supporting slides for interactive activities (II) 13
Figure 4 End-user mobile app video (SALUMEDIA) 15
Figure 5 Dashboard video (UPV) 15
Figure 6 Key points for use case definition 16
Figure 7 List of questions for use case definition 17
Figure 8 Supporting slides for interactive activities (III) 17
Figure 9 Delphi approach 19
Figure 10 4-point Likert Scale 20
Figure 11 Gantt chart of task 2.1 timelines 21
Figure 12 Summary of interactive activities at each use case site 22

LIST OF TABLES

Table 1 LifeChamps target use cases 10
Table 2 End-user mobile app functionalities 14
Table 3 Dashboard functionalities 14
Table 4 Workshop structure 18
Table 5 Delphi structure 19

ABBREVIATIONS LIST

Abbreviation	Meaning
4-AT	4 'A's Test
AI	Artificial Intelligence
AHP	Advanced Health Professionals
COVID-19	Coronavirus Disease 2019
CNS	Clinical Nurse Specialist
CT	Computed Tomography
DOA	Description of Action

EC	European Commission
ECOG	Eastern Cooperative Oncology Group
EHR	Electronic Health Record
EORTC QLQ-C30	European Organisation for Research and Treatment of Cancer Quality-of-life Questionnaire Core 30
EuroQoL	European Quality of Life Scale
FACT-B	Functional Assessment of Cancer Therapy – Breast Cancer
FAQ	Frequently Asked Questions
G8	Geriatric 8 Health Status Screening tool
GDPR	General Data Protection Regulation
GP	General Practitioner
HRQoL	Health-Related Quality of Life
IIEF	International Index of Erectile Function
LHRH	Luteinizing Hormone Releasing Hormone
MMSE	Mini Mental State Examination
MRI	Magnetic Resonance Imaging
QoL	Quality of Life
PG-SGA	Patient-Generated Subjective Global Assessment
PROMs	Patient Reported Outcome Measures
PSA	Prostatic Specific Antigen
PUC	Pilot Use Case
UTI	Urinary Tract Infection
UV	Ultraviolet

1 EXECUTIVE SUMMARY

The objective of this deliverable is to report on the activities developed within the scope of Task 2.1: "Scenario Thinking and Initial Technical & Business Requirements Definition". Specifically, this document describes in detail the approach followed to provide an initial definition of LifeChamps' pilot use cases by the four clinical partners sites: Aristotle University of Thessaloniki (AUTH), Academic Primary Health Care Centre (APC), Hospital Universitario La Fe (HULAFE), and University of Glasgow (UofG).

This task relied on the involvement of health care providers to decide the most suitable scenario to apply LifeChamps in each pilot site. Moreover, it served as a starting point to create a strategic collaboration with them as a key stakeholder to engage during the project lifecycle.

COVID-19 pandemic had a significant impact on this task due to the subsequent difficulties in the recruitment of clinicians and the development of interactive activities. Fortunately, this challenge was overcome by following a flexible methodology adapted to the specific situation of each clinical site.

The results of this task are reported in the present document. They are considered of major importance towards LifeChamps' development goals assuring that end-user requirements are integrated in the platform from the very beginning of the project.

2 INTRODUCTION

According to the Description of Action (DoA) – Part B, LifeChamps comprises 4 use cases (represented in Table I) that will be assessed in the form of pilots at each site.

The purpose of this task is to extend and refine use case scenarios starting from the initial description provided in the DoA to verify that are aligned with user expectations and requirements. Therefore, personnel from partner's organizations have been involved in interactive activities to define use cases and assess the expected added value of LifeChamps in their respective scenarios.

ID	Leader (Country)	Name
PUC1	AUTH (Greece)	*Predicting and understanding treatment tolerance based on real-world digital biomarkers and ePROMs*
PUC2	APC (Sweden)	*Multiple assessment of psychological and lifestyle factors for a person-centred care in aging cancer survivors*
PUC3	HULAFE (Spain)	*New AI to reduce mental burden and improve QOL for patients during/after cancer treatment*
PUC4	UofG (UK)	*Predicting the effects of the interaction between late/persisting treatment-related symptoms and multimorbidity/polypharmacy on the frailty and independent living status of older people post-cancer treatment*

TABLE 1 LIFECHAMPS TARGET USE CASES

All partners of the Consortium have been involved in this task assuring that output is valid to guide the subsequent developments. HULAFE has led the task in active collaboration with the other clinical partners (AUTH, APC and UofG).

The present deliverable is structured as follows: Section 3 explains in detail the methodology followed to accomplish the objectives of the task. Section 4 gathers the main outcomes of the task, including specific results from each use case site, general findings and evaluation results of interactive activities with health care professionals. Finally, in Section 5 conclusions and next steps are described.

3 METHODOLOGY

This task is aligned with the AGILE methodology adopted by LifeChamps, specifically, with *Phase 1 (Definition)*. The purpose is to involve experts in the definition of the use cases following a co-creation strategy to ensure a user-driven approach. In this way, the OBJ.1 of the project will be accomplished and the RISK.1 will be minimized:

- OBJ.1: "*to implement a rigorous software engineering approach that intensively incorporates the potential stakeholders/end-users in the whole process with the aim of yielding useful and user-friendly applications*".
- RISK.1: "*The developed solution does not meet its requirements*".

According to the DoA, the methodology was based on face-to-face workshops with professionals at each clinical site. However, due to the current covid-19 situation other methods have been discussed with the rest of the partners.

The final decision was to provide a flexible methodology to let each clinical site decide the most suitable approach. The following three options were considered:

- Face-to-face workshops
- Online workshops
- Delphi method

In the next subsections, the methodology used to define use cases is explained in detail, including objectives, contents, modalities of interactive activities, supporting materials that were prepared, information about recruitment of participants, timeliness and ethical aspects of the task. Moreover, additional information about the specific approach implemented at each clinical site is presented in *Appendix 7.1 "Information about interactive activities"*.

3.1 OBJECTIVES

The objectives of interactive activities conducted in Task 2.1 are:

1. Gather relevant information about the current use case scenario
2. Determine the potential added value of LifeChamps in each specific scenario
3. Familiarise clinicians with the project and stimulate involvement for the project development

3.2 CONTENT AND SUPPORTING MATERIALS

Despite the intrinsic differences of modalities, the following common contents were required to be addressed in interactive activities ensuring a comparable analysis of results between clinical sites:

1. Introduction of the project
2. Explanation of the initial use case
3. Demonstration of technology mock-ups related to the use case
4. Open-ended questions to define use cases

Moreover, common materials such as PowerPoint templates, demonstration videos, list of questions and templates of results were created and provided to clinical sites as supporting materials for their activities. In the following subsections, contents and materials are explained in detail.

3.2.1.1 Introduction to LifeChamps

Firstly, since these interactive activities represented the first clinician's encounter with LifeChamps, a clear description of the project was presented. It included the vision of the project, the overall methodology and the expected role of participants during pilots. The following supporting materials were provided:

- Several slides were prepared by HULAFE and provided to use case partners

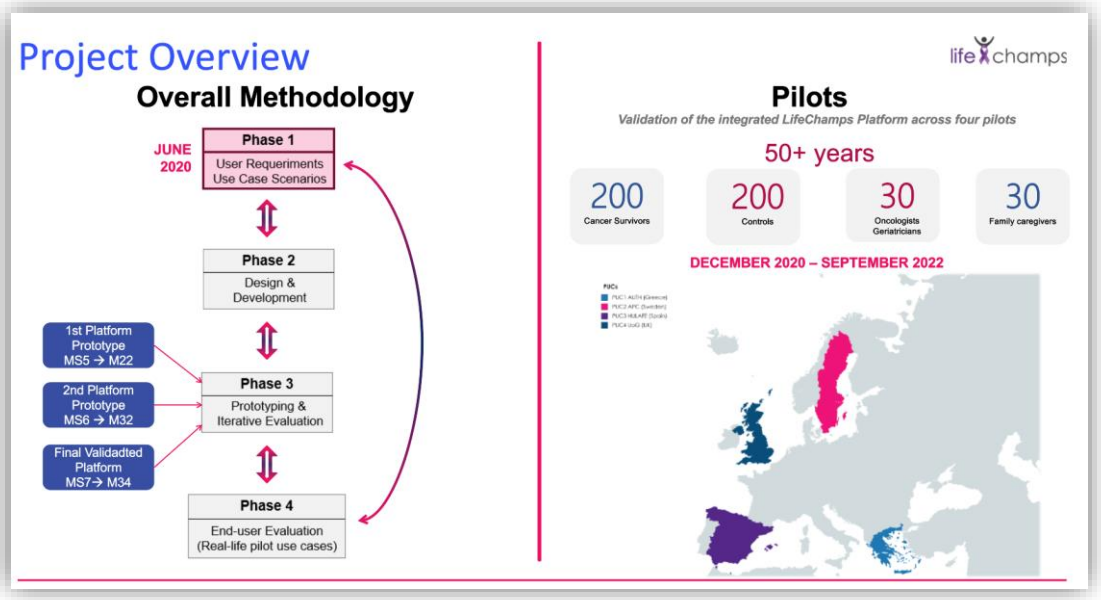

FIGURE 1 SUPPORTING SLIDES FOR INTERACTIVE ACTIVITIES (I)

- "*LifeChamps Promo Video*" (2:46 min) was created by CYBERLENS partner. Available at: https://www.youtube.com/watch?v=q6cRojdEd8I

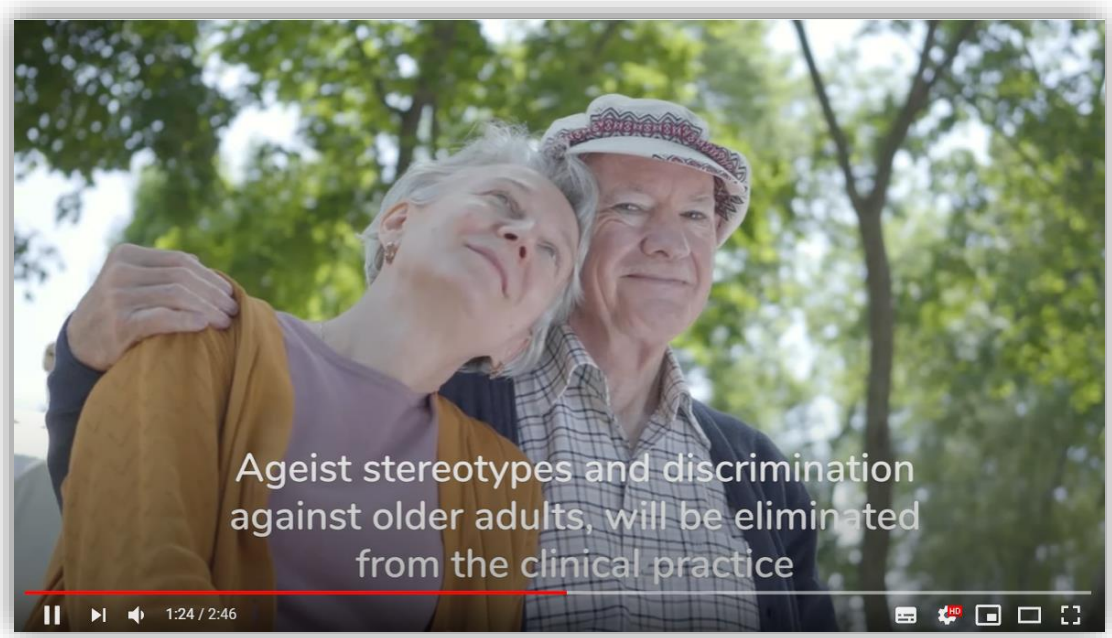

FIGURE 2 LIFECHAMPS PROMO VIDEO (CYBERLENS)

3.2.1.2 Explanation of the initial use cases

Secondly, each clinical site presented their initial pilot use case as described in the DoA. The idea was to explain clearly the target scenario, so the following open-ended questions were properly contextualized.

- Several slides were prepared by HULAFE as a template. Then each use case site prepared their specific content at their convenience.

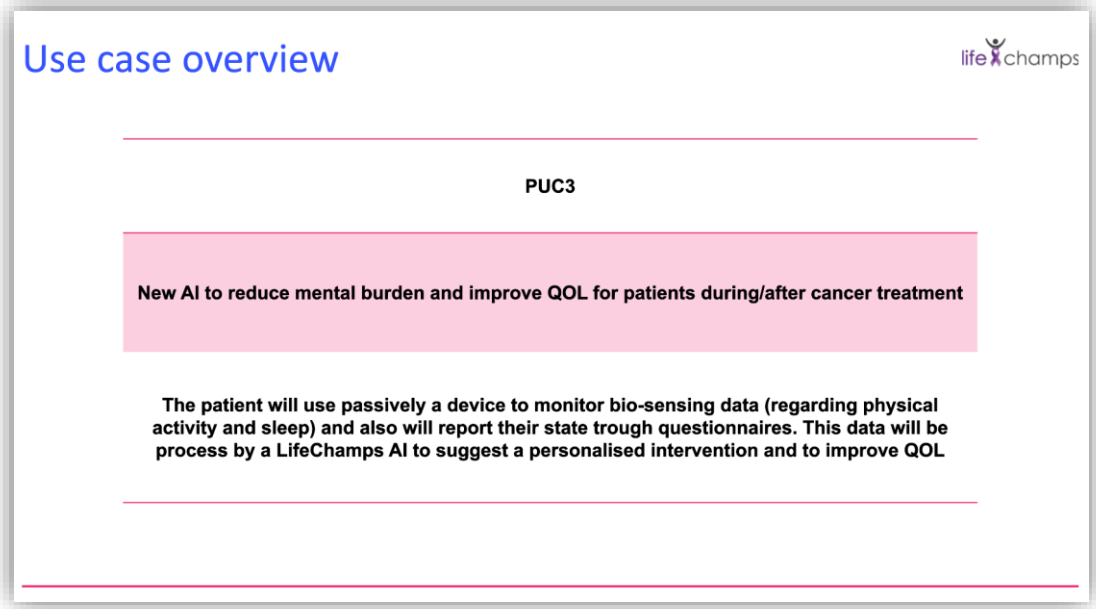

FIGURE 3 SUPPORTING SLIDES FOR INTERACTIVE ACTIVITIES (II)

3.2.1.3 Demonstration of technology mock-ups

According to the DoA, end-user applications will consist of mobile apps for patients and caregivers, and a dashboard for professionals.

Patients and informal caregivers will interact with LifeChamps through a mobile solution, including two apps, one for the patient (CP-app) and one for the informal caregiver (IC-app). The mobile apps will deliver behavioural interventions, education and mental well-being support tools to promote healthier lifestyles thus improving patients' QOL. The mobile apps will be the means to collect patient-reported outcomes, monitor continuous information, and any other feedback, while the web application will support healthcare professionals (i.e. nurses, GPs, oncologists) to better understand patients and caregivers behaviour and QoL based on the psychometric and biometric information gathered by the mobile apps. End-user mobile solution will be developed by SALUMEDIA, ALTPT and MDS partners.

CP-app functionalities	**IC-app functionalities**
• continuous information monitoring (i.e. sensors), • patient-reported outcomes (questionnaires) and • self-reported feedback (i.e. the user can rate the provided messages provided) • provide guidance, education and behavioural interventions for supporting cancer patients' quality of life • Supporting mental well-being (resilience, stress) and behavioural/psychological aspects (lifestyle, self-efficacy)	• provide information about the patient, about his/her progress and his/her reaction to specific interventions, • complementing patient information collected through the CP-app • to receive training for better caring patients with cancer • tool for caregivers to manage better their mental well-being

TABLE 2 END-USER MOBILE APP FUNCTIONALITIES

Clinicians will also interact with LifeChamps through a dashboard. The dashboard will allow to detect and obtain patient's progress over time and evolution in a qualitative and quantitative way. The dashboard will be developed by UPV, ALPT, HuLaFe, AUTH and SALUMEDIA partners.

Dashboard functionalities
• individual patient ill-health trajectory modelling • visual exploration of interacting cancer symptoms and comorbidities signs • patient stratification based on different subtypes of frailty phenotype, • quality of clinical cancer care service, combining PREMs, clinical events from EHR and patients' response to treatment

TABLE 3 DASHBOARD FUNCTIONALITIES

To present the abovementioned information in an appealing way and gather clinicians' opinion of desired functionalities, real-time demonstrations of end-user applications and mock-ups were initially considered. However, given the inability of conducting

real-time interactive activities in all clinical sites, an alternative plan was followed. Two videos were prepared by SALUMEDIA and UPV explaining the first idea of end-user applications and main functionalities.

- End-user mobile solution video (SALUMEDIA): *"Empowering oncological patients with real-world evidence precision digital therapeutics"* (5:08 min)

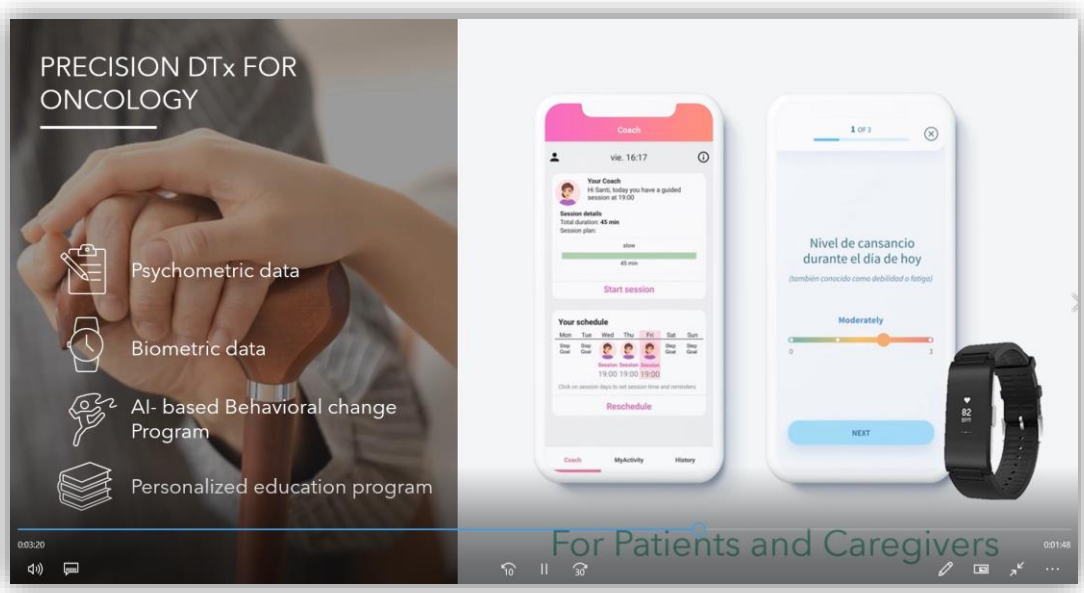

FIGURE 4 END-USER MOBILE APP VIDEO (SALUMEDIA)

- Dashboard video (UPV): *"What will LifeChamps dashboard offer"* (1:47 min). Available at: https://www.youtube.com/watch?v=xdNO3pCFmes

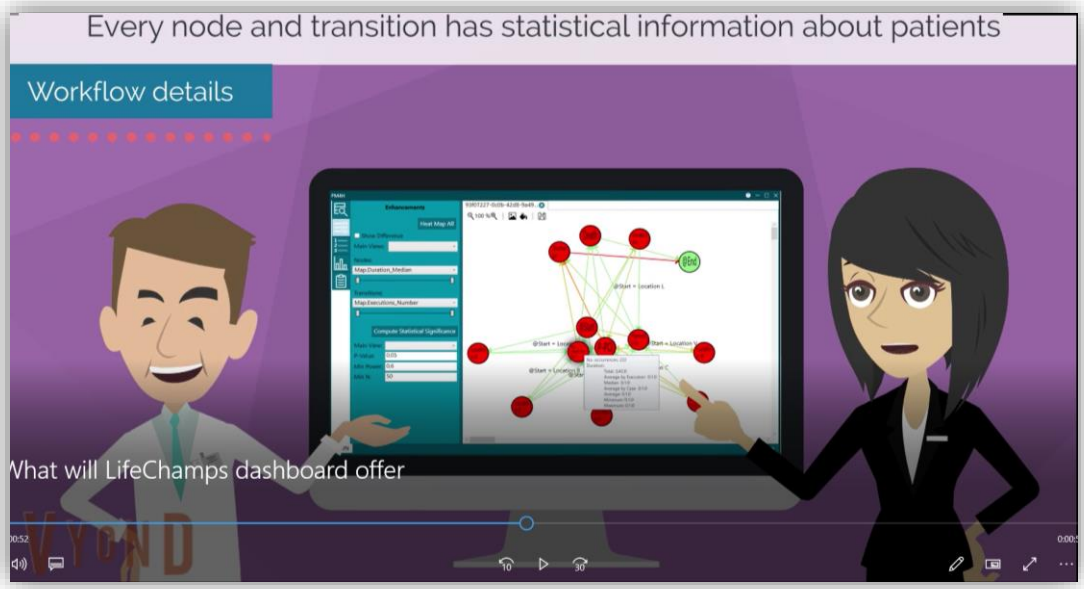

FIGURE 5 DASHBOARD VIDEO (UPV)

These two videos were available as supporting material to be presented during workshops and be included in the Delphi questionnaires.

3.2.1.4 Open-ended questions to define use cases

After explaining the context of the project, open-ended questions were asked to participants in order to achieve the initial definition of use cases. Although this part depended on the modality selected by each clinical partner, the same key points were addressed. Use cases were defined by the following 5 dimensions: Goal, Actors, Workflow, Expected measures and Technology.

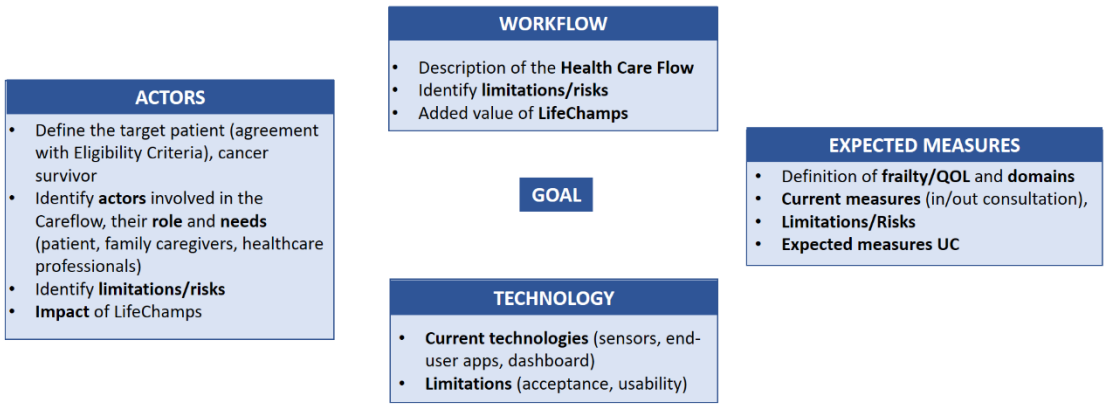

FIGURE 6 KEY POINTS FOR USE CASE DEFINITION

- *Goal*: It refers to the value of the use case. It is easily defined assessing the current limitations of care flow, understanding clinician's needs, and so, identifying the most effective scenario to apply LifeChamps.
- *Actors*: It refers to roles played by users or systems that are part of the use case. They are defined by identifying current stakeholders in the envisioned scenario, their function and potential additional ones to be involved in the use case.
- *Workflow*: It specifies the temporal development of the expected tasks in the primary scenario. Understanding the current care flow is vital to define the most convenient design of the use case.
- *Expected measures*: It refers to the measures that are assessed in the use case. Due to the scope of the project, there is need to understand which are the quality of life dimensions that clinicians are monitoring in the current care flow and the desired ones to be incorporated in the use case.
- *Technology*: It refers to the technical components that are part of the use case. Specifically, it is interesting to assess the use of technology in the current scenario and the potential added-value of LifeChamps technology solutions (i.e. sensors, mobile solution, dashboard)

In order to define the abovementioned dimensions, a list of questions was created as supporting material. All partners of the Consortium were invited to populate this list.

QUESTIONS FOR USE CASE DEFINITION		
UC DIMENSION	**QUESTION**	**KEY POINT**
GOAL	Considering the specifics of the use case scenario, in what ways do you think this use case will help you better understand frailty in patients with cancer?	understand frailty in cancer
GOAL	How do you think this use case will provide you with a tool to better monitor patients' outcomes? Why?	support better decissions
GOAL	How do you think this use case reflects the actual needs of cancer survivors?	identify needs of cancer survivors
GOAL	How do you think this use case will help you to overcome/diminish the "ageism" factor?	ageism
GOAL	How do you think this use case can help you to identify which aspects of HRQoL need breast/prostate/skin cancer survivors support?	identify key HRQoL points for patients
ACTORS	Do you think that older patients with breast, prostate or skin cancers require closer monitoring of their overall health and wellbeing out of the consultation and after treatment? Why or in which cases?	role of patient
ACTORS	Do you agree with our inclusion/exclusion criteria? What changes/clarifications might be needed? How easy or difficult will be for you to recruit #60 patients of this kind in a pilot	role of patient
ACTORS	What kind of further contribution could cargivers offer to the case?	role of caregivers
ACTORS	Do you think that family caregivers need adequate support and should be included? Why?	role of caregivers
ACTORS	Do you think that family caregivers will benefit from the use case and will be able to offer better support?	role of caregivers
ACTORS	Do you think more frequent indepth consultation /communication with patients will result in an enhanced delivery of clinical services and improve patient outcomes? Can you explain why more fully please?	role of healthcare professionals
ACTORS	Do you think now you are offering a personalized treatment for each patient? How are you accomplishing it? What kind of factors build the personalization of care in	role of healthcare professionals
ACTORS	Do you think that health professionals need also support in their daily medical routine and this will help them copying better?	role of healthcare professionals
ACTORS	Do you think that having all these data will assist clinicians to overpass the ageism factor	role of healthcare

FIGURE 7 LIST OF QUESTIONS FOR USE CASE DEFINITION

Finally, each clinical partner selected a set of questions based on their preferences. The list of questions used by each partner can be found in Appendix 7.2.

- Moreover, as in previous sections, HULAFE prepared some supporting slides that were provided to the rest of the partners.

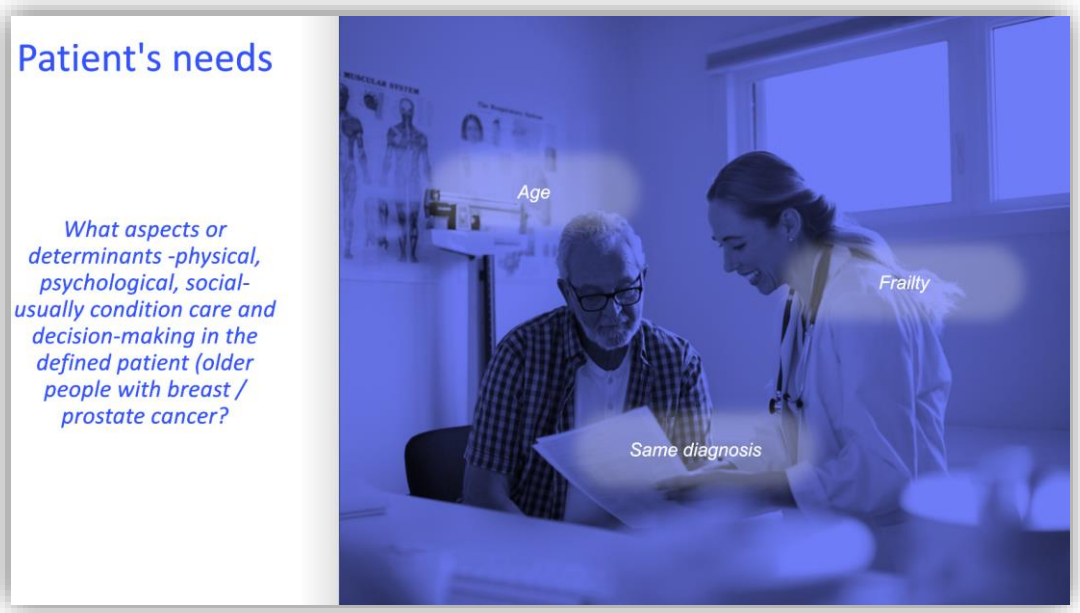

FIGURE 8 SUPPORTING SLIDES FOR INTERACTIVE ACTIVITIES (III)

3.3 MODALITIES OF INTERACTIVE ACTIVITIES WITH CLINICIANS

As mentioned, two modalities were suggested to clinical partners to conduct their interactive activities: workshops and Delphi study.

3.3.1 WORKSHOPS

Workshops are commonly-used activities to gather expert's opinion about a particular topic [1]. They allow natural interaction between participants through an open discussion guided by a facilitator. Moreover, consensus to define the different dimensions of the use case can be reached during the activity.

The general structure of workshops considering the contents and materials described in Section 3.2 is found in the following table, with an estimated duration of 60-90 min.

Section	**Duration (est.)**
A. Facilitator's welcome, introduction to the purpose of the workshop, declarations regarding participants' anonymity/privacy and ground rules	<5 mins
B. Introduction to LifeChamps	5 mins
C. Explanation of the initial use cases	5 mins
D. Demonstration of technology mock-ups	15 mins
E. Open discussion guided by a facilitator	40 mins
F. Concluding remarks and thanks	5 mins

TABLE 4 WORKSHOP STRUCTURE

AUTH and HULAFE selected workshops (online and face-to-face workshops, respectively) as modalities for their interactive activities. More information about their activities can be found in Appendix 7.1.

Consensus statements were used to define all dimensions of the use case. Results were transferred to HULAFE and are presented in Section 4.

3.3.2 DELPHI METHOD

The Delphi approach is a technique for collecting data from experts on a subject within their field of expertise [2][3]. In general, a Delphi survey begins with an open-ended questionnaire investigating experts' opinions on a specific topic. The structured second stage questionnaire then builds on the results from the first stage and assesses the level of consensus regarding the factors identified in the first stage. Successive rounds following the same process are developed until the desired consensus is accomplished.

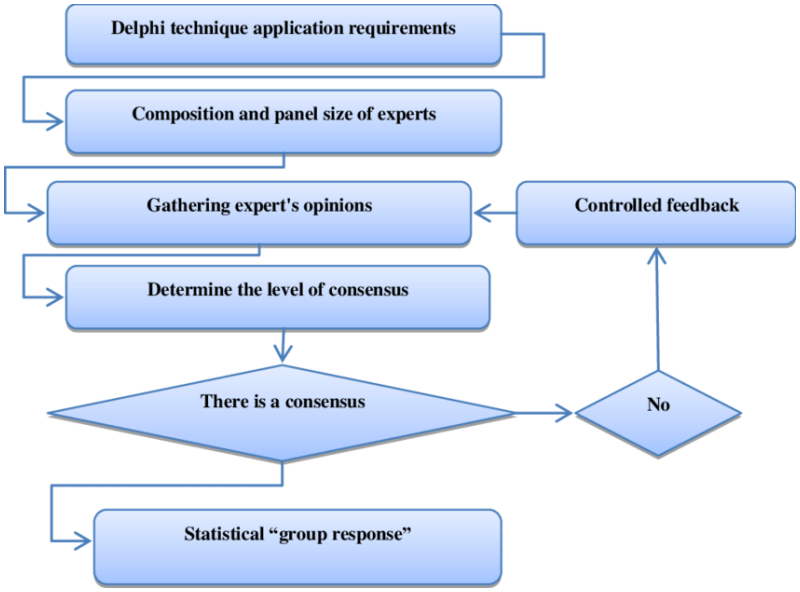

FIGURE 9 DELPHI APPROACH

According to discussion with WP2 partners, a web-based two-rounds Delphi survey was considered as an alternative to workshops. APC and UofG selected Delphi modality for their interactive activities. More information about their activities can be found in Appendix 7.1.

3.3.2.1 First round

In the first round, the facilitator sent a link to each participant with the access of the first questionnaire. This questionnaire contained the contents and materials described in Section 3.2.

Section	**Format**
A. Welcome, introduction to the purpose of the study, declarations regarding participants' anonymity/privacy and ground rules	Text
B. Introduction to LifeChamps	Text / Video
C. Explanation of the initial use cases	Text / Video
D. Demonstration of technology mock-ups	Video
E. Open-ended questions	Free text
F. Concluding remarks and thanks	Text

TABLE 5 DELPHI STRUCTURE

3.3.2.2 Analysis of first round results

The facilitator from the clinical site received questionnaires from each participant with argued responses and performed a qualitative content analysis by extracting statements and assigning a corresponding theme for each one.

- For example, the following statement: *"One risk of using a mobile app is that, perhaps, this kind of patient is not able to use it or will need strong support to use it independently"* was classified as "*Acceptability of technology*" theme.

This process is applied to all questionnaires. Those topics reported by at least two participants were considered for preparing the second round questionnaire.

- For example, if "*Acceptability of technology*" was mentioned by at least two participants, it was included in the second round questionnaire where participants were asked to rate the factors they consider that affect most to this issue (i.e. age, lack of experience, lack of confidence, mental diseases).

Moreover, a summary of first round results was transferred to the rest of the Consortium to assess if more information or detail was needed to be considered in the second round.

3.3.2.3 Second round

In the second round, the facilitator sent another questionnaire to each participant of the first round. In this case, it comprised closed-ended questions created from statements of the first round. In the description of the question, it will be included the frequency of participants that mentioned that statement in the previous round.

Each participant was asked to rank the statement using a 4-point Likert scale ('strongly agree', 'agree', 'disagree', 'strongly disagree'). Moreover, a 'no comment option' was included, considering the different background and knowledge of participants.

FIGURE 10 4-POINT LIKERT SCALE

3.3.2.4 Analysis of second round results

The facilitator from the clinical site analysed responses from all questionnaires. The consensus was defined as >66% (two third of participants) 'agreeing'/'strongly agreeing' or 'disagreeing'/'strongly disagreeing' with a statement in Round 2. Moreover, quantitative techniques were applied to analyse the distribution of results. The consensus was used to define all dimensions of the use case. Results were transferred to HULAFE and are presented in Section 4.

3.4 RECRUITMENT OF PARTICIPANTS

At each clinical site, health care professionals involved in the delivery of care services for older people with cancer were invited to join the activity. Following a multi-actor approach, the profile of the attendees was one of the following: *Oncology consultants, geriatricians, acute care nurses, community nurses, general practitioners, physiotherapists, health managers*.

Participants were recruited personally by e-mail invitations or by telephone calls explaining the purpose of the activity. Participants were also reminded about the activity two days before the session to confirm attendance and avoid last-minute cancellations and rescheduling the activity.

For workshops, the major concern was arranging a common time for all the stakeholders. To mitigate this risk, a poll was sent to agree on the most suitable schedule. If needed, several sessions of the same workshop for different groups of participants were developed.

For Delphi method, the major concern was engaging participants in all the expected rounds. To mitigate this risk, reminders and confirmatory emails were sent to participants.

More information about the recruitment at each site can be found in Appendix 7.1

3.5 TIMELINES

Considering the extension of three months due to COVID-19, timelines of Task 2.1 are presented in Figure 11 Gantt chart. The protocol was revised by all partners and agreed on M6. Required ethics approvals and amendments were prepared until M7. Three months (M5-M7) were given to develop interactive activities with health care professionals at each clinical site. Results were transferred to HULAFE until M10. Finally, D2.1 was internally reviewed and prepared to be submitted at the end of M11 (October).

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11
	Dec-19	*Jan-20*	*Feb-20*	*Mar-20*	*Apr-20*	*May-20*	*Jun-20*	*Jul-20*	*Aug-20*	*Sep-20*	*Oct-20*
Task 2.1 protocol revision					■	■					
Ethics approvals and amendments						■	■				
Interactive activities development							■	■	■		
Transfer of results to HULAFE									■	■	
Write D2.1 report										■	■
Submit D2.1 report											■

FIGURE 11 GANTT CHART OF TASK 2.1 TIMELINES

3.6 ETHICAL ASPECTS

In order to conduct both focus groups and online Delphi study research protocols were approved by local Ethics committees.

To fulfil with the General Data Protection Regulation (GDPR), the involvement of the members followed a strict procedure, guaranteeing the preservation of personal data of the potential participants, and avoiding its use without their express permission. Each clinical partner conducted interactive activities, ensuring that they followed the procedure established by their local research ethical committee.

It is not considered that there were any risks for the participants by being involved in this study, and it was anticipated that no harm would happen to participants. Participants were made fully aware of the topic of discussion before deciding whether they would like to take part, and they were made aware that they were free to withdraw at any time. If participants chose to withdraw from the study, any data already provided remained strictly confidential. Finally, all participants signed an informed consent.

4 RESULTS

This section presents the main outcomes of Task 2.1. Subsection 4.1 comprises results gathered at each site (AUTH, APC, HULAFE and UofG) about all the dimensions of their use cases: goal, actors, workflow, expected outcomes and technology. General findings and common conclusions between use cases are described in Subsection 4.2. Finally, the results from the evaluation of interactive activities at each clinical site are presented in Subsection 4.3.

In the following table, a summary of the methodology conducted at each site, the number of participants and their profile is represented. More information is available in Appendix 7.1.

	APC	AUTH	HULAFE	UofG
METHODOLOGY	Delphi	Workshop	Workshop	Delphi
MODALITY	Online	Online	Face-to-face	Online
RECRUITMENT	**7 participants**	**9 participants**	**7 participants**	**9 participants**
PROFILES	2 Dermatologist 2 Primary Care Physician 2 Oncologist 1 District nurse	4 Oncologist 1 Nutritionist 2 Nurses 1 Urologist 1 Breast Surgeon	1 Geriatrician 1 Nurse 2 Radiation Oncologist 1 Medical Oncologist 2 Primary Care Physician	1 Breast specialist Radiographer 1 Lead General Practitioner Cancer Care 1 Geriatrician 1 Oncogeriatrician 2 Clinical Oncologist 1 Specialist Nurse 1 Nurse Practitioner 1 Consultant Medical Oncologist

FIGURE 12 SUMMARY OF INTERACTIVE ACTIVITIES AT EACH USE CASE SITE

4.1 VISION SCENARIOS AND USE CASES DEFINITION

This section comprises results gathered at each site (AUTH, APC, HULAFE and UofG) about all the dimensions of their use cases: goal, actors, workflow, expected outcomes and technology.

4.1.1 PUC1: PREDICTING AND UNDERSTANDING TREATMENT TOLERANCE BASED ON REAL-WORLD DIGITAL BIOMARKERS AND EPROMS (AUTH)

GOAL
Main benefit to implement LifeChamps in the context of the use case scenario
To assist making a more objective geriatric assessment, by matching real-world data gathered by the technology with clinical tools used in clinical practice to measure Quality of Life (QoL) of older cancer patients. To be applied at diagnosis, during adjuvant or first line treatment and during follow up periods, in breast and prostate older cancer patients provided that there is at least one year of life expectancy. Repeated monitoring of a patient's state (in a continuous fashion and not fragmentary) is needed, as it is highly likely that immediate indications that this information (patient's state) has changed could exist, even before the patient himself/herself will be able to realize it. Evaluation of how treatment affect the patients' quality of life and their clinical status, including comorbidities. The evaluation of whether a patient can receive a certain therapy or not is considered as out of the scope of this pilot use case.

ACTORS
Target patients expected to be involved in the use case and their role
Female/Male cancer patients (breast or prostate cancer) after their primary treatment, during adjuvant (hormone therapy/radiotherapy /chemotherapy etc.), and during follow up periods, in breast and prostate older cancer patients, above the age of 65 (≥65), provided that there is at least one-year life expectancy. As elaborated during Session #2, even stage 4 cancer patients may have a life expectancy long enough to be eligible candidates. (Metastatic and early stage patients are both of interest since life expectancy is long enough in both cases, for both types of cancer (prostate and breast cancer)). The doctors expressed their concerns for the cut-off age of the patients' inclusion criterion in the study. According to the relevant guidelines, geriatric oncology is defined strictly for age 65 and above.

From our team's side, concerns were expressed regarding the possibility of lowering that age limit, for reasons that have to do with the digital literacy of patients above the age of 65 and consequently the consistency during the pilot tests. Strictly setting the cut-off age to 65 may put constraints to recruitment and result in the higher dropout rate and lower compliance. Age is one of the most important inclusion criteria which we need to consider. *Maybe, the focus should be on metastatic cases since in adjuvant therapy a patient always feels the quality of life has deteriorated.
Other actors expected to be involved in the use case and their role
Caregivers are key actors for the extra information that cannot be measured directly from objective measurements Differences are observed between genders in the way they cope with their condition. Male patients seem more reluctant and distanced, while female patients are more prone to show interest and are more involved and active during their treatment. For prostate cancer patients, usually, there is a need to involve a caregiver in their treatment. Oncologists [medical and clinical (Radiotherapists)], urologists (for prostate cancer) and breast cancer surgeons (for breast cancer) are involved in the processes of treatment and monitoring/follow up. Nurses are also involved in these processes, quite frequently. Radiotherapists are involved as well, although not systematically during the follow up of the patients. For rural areas, the patient's general practitioner is, also, usually involved.
Potential benefits of the use case identified for these actors
Monitoring the course of a patient's quality of life and preventing other disorders and comorbidities by gaining access to valuable information in a continuous and timely manner. At the moment, clinicians do not usually use QoL scales or relevant tools to monitor changes in a patient's status. Geriatric assessment of cancer patients, in general, is insufficient. Relevant to this is the fact that geriatric oncology does not exist as a specialty in Greece.
Limitations identified for these actors in the use case
Regarding the patients, the main concerns are related to the average digital literacy of the patients over the age of 65. Also, the reluctancy and unwillingness that could be shown by those patients regarding the monitoring of their life with digital means (wearables, sensors etc.) It was highlighted that digital literacy, and general literacy of patients and caregivers, should be assessed as an inclusion criterion, since they can pose serious obstacles hindering their capacity to complete their therapy. Having attended the necessary level of education is a minimum acceptable inclusion criterion. Finally, cognitive

status should also be assessed, setting a minimum performance threshold for a patient to be included.

Another issue was that patients from remote areas (e.g. islands) would have difficulties participating in such a use case.

Health care professionals did not identify any limitation regarding their side.

WORKFLOW
Current health care flow for patients considered in the use case
Patients' follow up is performed by the oncologists and/or other cancer specialists (urologists, breast cancer surgeons) in specific intervals (e.g. 3-monthly, 4-monthly, 6-monthly). After curative treatment, follow-up appointments will usually include a clinical examination, blood tests and CT or MRI scans. Adverse events and late toxicity, as well as signs of disease recurrence, are assessed during follow-up appointments. In addition, it was reported that breast cancer patients who underwent surgery for early-stage disease, they usually have to undergo adjuvant treatment including chemotherapy, radiotherapy, and hormonotherapy, either one or a combination of them. Chemotherapy is usually given through a port placed in the patient's chest. This machine has to be looked at by the nurses at regular intervals even after the adjuvant chemotherapy has been completed. Thus, nurses that work in such departments may see patients much more often than doctors; every time patients visit the clinic for their treatment (e.g. every 4-6 weeks). For patients ≥65, with prostate cancer, who have surgery (prostatectomy) as their primary treatment, follow-up mainly includes continuous monitoring of PSA (starting from the first month, in case of surgery, and from the third month otherwise, performed every 3 months). Patients with locally advanced disease, sometimes have to undergo radiotherapy and/or hormonotherapy (ranging from 6 months to 2-3 years). These protocols are followed regardless of a patient's age. For breast cancer, the main therapy (usually surgery for patients aged over 65 years old), is followed by radiotherapy and in some other cases by chemotherapy and/or hormonotherapy. The follow up is usually performed every 3-6 months with a visit to the doctor's office and annually with medical imaging methods (e.g. MRI, x-rays, mammography).
Limitations detected in the current health care flow
Insufficient attentiveness from the patient's environment. Family and caregivers have a crucial role in providing additional information to the doctor, but also to help patients in general (e.g. with their transportation due to reduced mobility). Regarding self-management issues, clinicians assess that patients often do not comply with their treatment and their doctor's advice. Medication management

issues are common and there is a big need to support patients in that area (e.g. reminders to take their medication).

Patients, especially female patients, are taking diet very seriously as they understand it is a lifestyle parameter they can regulate in order to improve their health condition. In their effort to adopt better eating habits, they fall victims of misinformation, eventually harming themselves. Also, their effort to identify such information and understand what could help them becomes a stressful procedure. Diet is a complicated issue for older patients with comorbidities, such as diabetes. This makes it even harder and not as effective to follow a fixed diet.

Older patients quite frequently present with comorbidities, which most of the time results in polypharmacy. Furthermore, the function of the body's organs has been affected. Thus, the personalized treatment approach is needed, not only concerning the adjuvant treatment but also to the supportive medicines and interventions. This is a difficult task with the means that currently exist.

Potential added value of LifeChamps in this workflow

To complement the inability of doctors to access this information and to access it without the intervention of a doctor who does not have the time to do so. To provide information automatically, without further effort from a patient who may not be able to use digital data recording tools actively. Additionally, patients could benefit from tools that assist them in their daily living actively by enabling them to provide their clinicians and caregivers with much more precise information about their current state.

Expected workflow of the use case

Patients will use the sensors designed for them (e.g., wearables, home sensors, etc.) to monitor variables regarding their QoL status and their frailty levels. For the variables that are not automatically monitored (e.g. PROMS/PREMS) by the aforementioned system, patients or their caregivers will use an app designed for them. Doctors will be able to access and assess the patients' QoL and frailty patterns through a dashboard, which will present all these variables in a summarized and visualized way exploiting graphs and statistics. Different frailty levels will determine which QoL aspects the patient's app should ask the patient to self-monitor.

Additional information

It became quite clear, that patients come emotionally closer to nurses. Patients are much more open to them about what they agonize over, seeking advice from them.

The area the patients live and their ability to access hospitals and clinical facilities is a factor that clinicians also consider when deciding for the course of the therapy and follow-up (mainly regarding metastatic patients).

EXPECTED OUTCOMES
QOL/Frailty variables currently measured for these patients
Nutrition, nausea, vomiting, fitness, toxicity, mobility, hair loss, Daily Living Activities (e.g., shopping etc.), pain. When a patient arrives in a clinic and his/her history is recorded, it is also recorded if the patient can walk alone, with the help of a cane or not at all, if the patient seems to be eating well or not, and their potential comorbidities. Regarding the diet of patients, it was mentioned that currently only their weight is being measured. Oncologists use a performance status index (e.g. Karnofsky [4], ECOG [5] etc.), not always measured in the same way from every oncologist, in order to assess their patients. Regarding patients' nutrition, a questionnaire (PG-SGA [6]) is used to assess the risk of undernourishment. The main variables urologists measure, at the moment, regarding QOL, is incontinence and erectile dysfunction. According to breast surgeons, a very important variable for breast cancer patients regardless the age, is the perceived body image since that impacts the patient's sexual life, social life, and their emotional status. It became clear though that no technological mean is used to manage patients and their QoL. Thus, doctors resolve to questionnaires that patients fill on their own. For breast cancer, BREAST-Q [7] was mentioned (usually filled once after the surgery). For prostate cancer, IIEF [8] was mentioned, but it was noted that no holistic tool/questionnaire is being used (at least for Greece).
Limitations encountered with the current QOL/Frailty measures
There is not a way to measure them continuously and efficiently. Besides, the nutritionist who mentioned that in order to assess patient's fragility it is necessary to measure also other clinical parameters (she mentioned muscle mass and imaging modalities to identify sarcopenia)
Expected outcomes of the use case
Hematological data, neuropathy, mucositis, anorexia, weight loss, fatigue, oxygen saturation, calories, mood, mobility, levels of physical activity. The ability to measure calories as well as body fat and lean mass levels would be useful on a weekly basis. Also, through a CT scan of the O3 vertebra, the body fat and lean mass levels can be seen, and these are used to assess sarcopenia, so that these variables would be useful. Nurses would like to measure pain levels (with a pain visual analogue scale ranging from 1 to 10) on a daily basis. Also, they would like on a daily basis, the measurement of vital signs (e.g. pulse, SpO2 etc), body temperature and sleep pattern. Also, they

would like to know, every week, if there was any change in the patients' physical state (e.g. constipation) and their psychological state (e.g. signs of depression such as isolation).

For breast cancer patients, a variable that could be easily measured remotely and would be useful is the perimeter of the arm (from the side that mastectomy was performed) associated with lymphedema.

Learn the details and track small changes in the patient's condition in a timely way.

Additional information

Mapping results from tools that provide qualitative data (e.g., questionnaires) to tools that provide quantified data such as digital biomarkers (e.g., wearables, sensors etc.) is important.

Regarding QOL, two important parameters for breast and prostate cancer patients are their sex life and their body image, since they greatly affect their mental/emotional wellbeing. These are significant even for older patients.

Personalization of variables to collect depend on the frailty of the patient. A prioritization should be made accordingly. For instance, for someone with low mobility, other QoL aspects matter more than others.

Questionnaires could show different results depending on whether the patients fill them on their own or a doctor (or a healthcare professional) explains their content and assists the patients to fill them in.

TECHNOLOGY

Technologies currently used to manage these patients and their QOL

Currently, the participants do not use any technology to manage their patients and their QoL. At the moment, anorexia, mobility, diet and weight loss are measured the most. They are measured once at the beginning, and after that they track it only through conversation, few times with the use of questionnaires, and many times empirically by observation.

Perception of LifeChamps technologies (sensors, mobile solution and dashboard)

Participants considered that smartwatches should be easy to implement and give useful information (e.g. number of steps regarding mobility). For sensors at home, there were doubts about whether patients will accept them.

For variables that are not passively recorded but require the intervention of a patient or caregiver (e.g. calories), there were doubts whether it would be applicable.

The dashboard, should give a visualization of the recorded variables with graphs and statistics.

Participants expressed their concerns about the capability of older patients to use new technologies and suggested the implementation of a training period. A training period of a few months (e.g. 1-2) would be sufficient but also is expected to be critical for patients and caregivers to be able to make a right use of the proposed technology.
Additional information
The collection of toxicity data, through digital media, has only been used in the context of clinical trials, with limited success. No tool with any kind of dashboard has ever been used. A "nursing protocol guide" (created by nurses) was mentioned, which among other things includes instructions and information that patients can use to find answers like FAQs. They provide this as a leaflet for the patient to study at home, before any clinical encounter.

4.1.2 PUC2: MULTIPLE ASSESSMENT OF PSYCHOLOGICAL AND LIFESTYLE FACTORS FOR A PERSON-CENTRED CARE IN AGING CANCER SURVIVORS (APC)

GOAL
Main benefit to implement LifeChamps in the context of the use case scenario
The participants reached a consensus that the use case scenario presented to them seemed relevant and reflected the actual needs of skin cancer (melanoma) survivors. They also agreed that the use case should include/consider several other chronic diseases, as these have an impact on elderly patients HRQoL as well. What concerns the issue of ageism addressed by the use case it was not fully understood or envisioned by all participants. However, still, the majority thought that it was covered in the melanoma use case. Additionally, the experts identified a clear need for a holistic approach to comprehensively cover all aspects of the pilot use case for the study of HRQoL in cancer survivors.

ACTORS
Target patients expected to be involved in the use case and their role
For the skin cancer use case, it was recommended to focus only on Melanoma patients since this cancer type has similar follow up all over Europe and can act as a homogenous group when applying findings from the pilot study. Other skin cancers have a different treatment, prognosis, etc and therefore different impact on QoL, so at this stage, it was deemed better to limit and focus on one cancer type. The age inclusion criterium from 50+ was considered relevant by the majority of the expert respondents. There was no consensus between the experts whether the proposed inclusion criteria should be more specified and clearer in their intention to include melanoma survivors after diagnosis and the initial treatment, but within a given timeframe – i.e. within 12 months from diagnosis and initial treatment.
Other actors expected to be involved in the use case and their role
The patient's caregivers were thought by the experts to benefit from the proposed use case. If involved, they envisioned them benefiting from better caregiver support, advice and education about the cancer survivors' condition and individual needs. Within the pilot use there was no consensus about involving a multi-professional team, with a GP, oncologist and nurse. However, a contact nurse and/or pilot coordinator for the cancer survivors seemed more relevant to them and was considered to be the main contact also in a real-life setting.
Potential benefits of the use case identified for these actors

As already mentioned, the benefits were early support for caregivers and a contact nurse that monitors HRQoL changes and follow up after treatment. Support could be in the form of digital instructions for skin examination and education for detecting new and risky skin lesions (melanomas).
Limitations identified for these actors in the use case
One major concern or limitation from the experts was about the type of information and how it was presented to the patient/cancer survivor. The patients must also want the support offered from the health care professionals (HCPs), the contact nurse, as well as the caregivers. An important issue is also the patient need to consent to share their information with all other actors, as well as withdrawing their consent according to the GDPR.

WORKFLOW
Current health care flow for patients considered in the use case
The current care flow of suspicious skin lesions (potential melanomas) usually starts by the patient that notices a change or evolution of a pigmented lesion on their skin. They usually pay a visit to their health care centre and consult a GP about the specific lesion. Depending on the experience and knowledge of the GP, highly suspicious skin lesion can be excised directly at the health care centre. In Region Stockholm, there is an ongoing collaborative project between primary care physicians and hospital dermatologists with the use of teledermoscopy as a consultancy tool for more accurate preliminary diagnosis and a decision whether to make a diagnostic excision or not. After the diagnostic excision in primary care, the histopathologic examination defines the preliminary diagnosis and recommendations for any additionally expanded excision by a dermatologist. The dermatologist then gives the final diagnosis and staging. Depending on the location (e.g. face) of the melanoma and the staging, a second revised excision can be made by a plastic surgeon if needed and an oncologist visit scheduled if needed respectively. The Melanoma patients are followed up by the dermatologists more frequent the first year, then yearly. Earlier stage melanomas that have been successfully removed and with no recurrence of the disease can be referred to as outpatients and monitored by their GPs or by themselves with self-examination of the skin for new suspicious lesions.
Limitations detected in the current health care flow
The follow-up and psychological assessment varies between clinicians for all patients and is not routinely done after the cancer treatment. Especially earlier stage melanomas, that are treated as outpatients, an individual plan with QoL assessment is not always performed.
Potential added value of LifeChamps in this workflow

The experts agreed that we will learn more about the QoL of individual patients and give better support for the end-users, in order to feel more secure. All actors will learn more about how to manage the disease after treatment more efficiently.
Expected workflow of the use case
After treatment, follow up could be done every month up to every three months the first year. Then sparser until the patient can self-manage with support from the LifeChamps mobile solution. This solution could provide continuous support from the beginning regarding self-examinations and support for detecting new and risky lesions, additionally, it should assess the user satisfaction of the LifeChamps mobile solution as well.

EXPECTED OUTCOMES
QOL/Frailty variables currently measured for these patients
In the current melanoma process and care flow, QoL is seldom measured. In the case of advanced treatments for later stage (invasive) melanomas the patients get an individual treatment plan at the hospital that includes QoL questionnaires and more frequent follow-ups with a contact nurse.
Limitations encountered with the current QOL/Frailty measures
N/A
Expected outcomes of the use case
The Delphi study participants thought that better, continuous follow up, with monitoring of, e.g. pain and/or scarring after surgery could be an expected outcome with the LifeChamps mobile solution. Also, better follow up with access to psychological and behavioural data. More data will provide a better tool for tailored discussions with the patients. The mobile solution will help to provide better and repeated communication between HCP and patient, which will help patients keep motivated to preventive instructions, provide psychological support and alert if a decline in QoL is detected - all for a better and quicker referral to specialized support, e.g. to a psychologist. Altogether, repeated information and educational support through the mobile solution could help cancer survivors deal with the issue of “fear of recurrence”.
Additional information
Some of the experts pointed out that developing a solution to monitor QoL, one has to take into account if there will be unnecessary stress from QoL reminders and the interaction with the application daily. The solution might not be suitable for all

patients and measurement for satisfaction/anxiety from app-reminders should therefore be added as well in the pilot.

TECHNOLOGY
Technologies currently used to manage these patients and their QOL
There is not much use of any new technologies besides the normal communication channels for patients and HCPs (phone, message through the secure site)
Perception of LifeChamps technologies (sensors, mobile solution and dashboard)
The experts agreed upon that information from environmental sensors, such as sun and UV exposure could be helpful, in order for the LifeChamps mobile solution to deliver behavioural interventions for patients to promote the adherence to a healthier lifestyle. Other sensors were not fully envisioned by the experts, and considered that they might be seen as a burden for the patients. Through the mobile solution, they envision an overall better contact channel between the HCP and the cancer survivors. Also, better self-management and self-examination info, powered with AI analytics. This would overall increase home monitoring and autonomy of the melanoma survivors.
Additional information
The experts urged that the app should use a common, not too complicated language/phrasings, maybe an idea could be to include a word lexicon in the app. Look at similar health care patient services sites like 1177.se

4.1.3 PUC3: NEW AI TO REDUCE MENTAL BURDEN AND IMPROVE QOL FOR PATIENTS DURING/AFTER CANCER TREATMENT (HULAFE)

GOAL
Main benefit to implement LifeChamps in the context of the use case scenario
The purpose of this use case is to understand better patients' needs and priorities regarding their quality of life. Patient-reported information will help clinicians to understand better the real perception of patients, effects of treatments and make personalized and proactive decisions based on this information. Also, older patient's technical skills will be assessed to know their potential and determine if they are currently underestimated.

ACTORS
Target patients expected to be involved in the use case and their role
Inclusion criteria • Patients with locally advanced prostate cancer (Stage III) or breast cancer in treatment with curative intent. • Patients > 65 years old • Diagnosed within 3 years prior to study participation • Able to use their own smartphone during the study • Able to read, write and understand Spanish • Deemed by a member of the multidisciplinary team as physically and psychologically fit to participate in the study Exclusion criteria • Presence of metastases • No terminal stage of cancer - prognosis of ≥18 months from the point of recruitment • Major diagnosed mental or cognitive disorder affecting the ability to participate in the study • Unable to provide written informed consent
Other actors expected to be involved in the use case and their role
Clinical oncologists and radiation oncologists as experts of cancer treatments and progression of the disease. Geriatricians and primary care practitioners as experts of quality of life assessment and follow-up of the patient during the daily practice. Also, caregivers can act as a reliable source of information complementing patient's perceptions. Moreover, they can report information about themselves and be

benefited by receiving personalized recommendations to cope with the situation better.
Potential benefits of the use case identified for these actors
Clinicians will be benefited as they will understand better which are the real priorities for patients during and after their treatment, especially regarding their quality of life. For patients, the main benefit will be the support that the platform can provide to them. They are expected to feel more controlled than in the current practice. Also, if it is proven that they are comfortable using technology, the same method could be applied to future patients and so benefit them. Caregivers will be supported not only on how to look after patients but also on how to care for themselves. Currently, clinicians are not paying enough effort to identify a decrease in caregiver's quality of life, so that this use case can make a good impact on their well-being.
Limitations identified for these actors in the use case
Age and related syndromes can affect the normal workflow of the use case.
Additional information
Role of the caregiver: Clinicians advised that the role of the caregiver varies between patients. Some patients are dependent on a caregiver, some are not dependent, and others do not count with any caregiver. Therefore, we should not force any "caregiver" role as sometimes is not in line with reality.

WORKFLOW
Current health care flow for patients considered in the use case
For both types of cancer (breast and cancer) a multidisciplinary team is composed of primary care practitioners, surgical oncologists, medical oncologists, radiation oncologists, nurses, pathologists. They participate in diagnosis, staging, treatment planning and follow-up care plan. Especially for this use case, we will consider the moment of treatment, care after the treatment and recovery. At this moment, oncologists, urologists (for prostate cancer), nurses and primary care practitioners are the most closely involved personnel in the care of the patient. A follow-up care plan is established for each patient depending on the stage of cancer and progression (i.e. visits each 3 to 6 months). Also, there are support services that can help patients in other dimensions apart from treatment. For example, the Rheumatology service is available for prostate cancer patients as osteoporosis is a common complication of androgen suppression therapy. Psycho-oncologists are also available to support patients, but they only participate in high-risk situations.

Limitations detected in the current health care flow
Currently, quality of life is not deeply integrated in the care flow for these patients. All services involved in the care of the patient should make an effort to gather information about the patient's quality of life. Also, it is crucial that is the patient the one that report information about their quality of life. Clear protocols are needed. For example, to monitor effectively long-term effects of radiotherapy. This needs to include all dimensions of the patient's quality of life. Not only basic and instrumental activities of daily living, but also consider the psychological and social dimension of the disease (impact of diagnosis, depression, sexual health) Out of the consultation objective longitudinal information is needed by geriatricians to enrich the knowledge of patient's physical activity, medical adherence and mental health, as now they only have access to information during the visit and to subjective information reported by the patient.
Potential added value of LifeChamps in this workflow
As the quality of life is not currently well-assessed, LifeChamps can help to provide information to clinicians and support them in their decisions. Also, out of the consultation measures can help to measure variables objectively that are not available now.
Expected workflow of the use case
Patients need to see LifeChamps as an extension of their care. Therefore, all the components of the workflow need to be integrated into the normal care flow. Patients will use the mobile solution to report data and receive personalized recommendations. Also, sensors out of the consultation will collect data related to the patient's frailty and well-being. All this information will be shown to clinicians through the dashboard. They will receive an alert if a dangerous situation happens with the patient, and they will participate in validating the recommendations for the patient and the caregiver. Finally, the caregiver (if exists) will complement the information provided by the patient. Also, they will report their status and receive recommendations to improve their QoL.

EXPECTED OUTCOMES
QOL/Frailty variables currently measured for these patients
Geriatricians are the professionals most involved in measuring QoL in these patients. They use comprehensive geriatric assessment (clinical, functional, nutritional, mental and social assessment). In this assessment, they use some devices (i.e. dynamometers

to measure strength) and scales (i.e. EuroQoL [9], RockWood [10], Barthel [11], Charlson [12])
Limitations encountered with the current QOL/Frailty measures
Quality of life is not currently assessed during daily practice and check-up visits. Also, only clinician-reported information is provided, so the perception of the patient is not correctly considered. Finally, there is a need to count with more sensitive questionnaires as the current ones can be generic for this type of patients.
Expected outcomes of the use case
Clinicians are interested in measuring all dimensions of quality of life (functional, emotional, cognitive, nutritional, social and sexual well-being) and geriatric syndromes. Some suggestions were: • Functional: Physical activity (strength, fatigue, daily steps, gait velocity, energy expenditure), sleep (quality and duration), basic activities, instrumental activities. • Nutritional: weight, body composition (fat, muscle mass), calories • Geriatric syndromes: frailty, falls, hearing loss, visual loss, dementia, incontinence • Emotional: stress level, indoor/outdoor location, vital signs, behavioural changes • Treatment-related measures: Medication adherence, pain, fear of recurrence • Environment (opportunities for leisure, weather)

TECHNOLOGY
Technologies currently used to manage these patients and their QOL
Some devices are used in health care centres (i.e. to measure strength or gait velocity). However, no technologies are being applied in daily practice as LifeChamps is considering.
Perception of LifeChamps technologies (sensors, mobile solution and dashboard)
In general, clinicians are willing to apply technology to improve the care that they can provide. They highlighted that they want to participate in the selection, design and validation of technologies in order to achieve the most beneficial solutions and results. Sensors • Clinicians are interested in using sensors to gather objective information out of the consultation in all of the dimensions described in the section of expected outcomes, especially about physical activity, sleep quality and nutritional status.

- The condition they highlighted is that these devices need to be transparent to the user, (i.e. wristbands, a sensor in a belt or in a handbag). Patients should not be responsible for turning on, connecting or charging the device as these tasks could overstep their skills. Also, they are interested in incorporating sensors in health centres where patients could go to measure themselves, e.g. weighting machine, dynamometer.

Patient App

- Clinicians are interested in an app for making recommendations to the patient as long as personalized recommendations are provided, and patients are not overwhelmed with many of them. Nutrition, physical activity and psychological recommendations are regarded as interesting factors to be included.
- The key for the patient to be adhered is that the app is designed and perceived as an extension of their care. They need to be confident of using the app and clinicians were willing to participate in the design and validation of recommendations. Also they want to monitor the recommendations that the patient is receiving and the feedback of the result.

Caregiver App

- As described in the section of the caregiver, it will be important to identify if there exists the figure of the caregiver and the specific role for each patient. They may be an essential source of information about the patient providing their insight and validating patient-reported information.
- Also, they want to use the app to assess the quality of life of the caregivers at all levels of detail. Personalized recommendations should be provided on how to cope with the situation and it can also be used to educate the caregiver on how to care for the patient and how to care for themselves.

Dashboard

- They want the dashboard to provide longitudinal information about the status of the patient regarding all dimensions. It will be important to provide not only an initial and a final status report of the patient, but all the evolution to anticipate high-risk situations (i.e. lack of medication adherence) and detect which are the real dimensions of quality of life that are affecting treatment results.

4.1.4 PUC4: PREDICTING THE EFFECTS OF THE INTERACTION BETWEEN LATE/PERSISTING TREATMENT-RELATED SYMPTOMS AND MULTIMORBIDITY/POLYPHARMACY ON THE FRAILTY AND INDEPENDENT LIVING STATUS OF OLDER PEOPLE POST-CANCER TREATMENT (UOFG)

GOAL
Main benefit to implement LifeChamps in the context of the use case scenario
Background of the LifeChamps project was explained via the video introduction. Our goal was to create and develop a system using artificial intelligence to support older people post-cancer treatment. It was explained how this first stage was crucial as it was open to expert clinicians to be involved at the grass root level and give their perspectives on a project that may improve older patient outcomes. Our use case scenario was to explore how late cancer treatment effects, multimorbidity and polypharmacy may affect active independent living after the end of treatment for breast or prostate cancer. Particularly when existing chronic health problems may be exacerbated or when people may be dealing with multiple drug related side effects. We were looking for a contribution towards building our pilot study in a way that would identify the requirements of clinicians to most support these specific patients and consider the potential barriers and facilitators.

ACTORS
Target patients expected to be involved in the use case and their role
We explained that we are expecting to pilot the technology to monitor and predict interaction between persisting or late treatment-related side effects for breast and prostate cancer, frailty and multimorbidity on active daily living in older adults aged 65 years and above. Participants also suggested to include the following criteria: • Identify in the inclusion criteria level of independence of living • A measure of comorbidity (Charlson [12]) - not all comorbidities are equal • Body Mass Index • Fitness level • Aim to include/engage participants from deprived areas (access to internet, literacy) • Consider cognition / sensory impairment limiting the use of technology • Establish polypharmacy – how many drugs? • A few co-prescriptions will be independent of comorbidities. Specific to prostate cancer:

- Over 65+ will capture 95% of all prostate cancers, but we should consider the different needs depending on diagnosis (advanced disease, receiving treatment for early disease, completed treatment for the early disease). A simple way would be to include only those who are receiving treatment (including LHRH agonists/antagonists).

The second round revealed agreement consensus of the following criteria to include in the pilot study: a definition for co-morbidities, e.g., Charlson criteria, current activity/fitness levels, level of cognition and a definition for polypharmacy. Also, to monitor falls and any cognitive problems.

Other actors expected to be involved in the use case and their role

The clinicians used in this task provided expertise from a multidisciplinary background based in secondary care. Breast cancer patients are only reviewed once post-radiotherapy for any short-term effects. The AHP involved in breast cancer sees older patients at radiotherapy review, and we anticipate that we may identify some participants here. For adjuvant breast cancer patients, long term follow up is performed via the breast surgical team. Due to the lack of breast CNS participation in this task, the UofG team will need to explore this via Task 2.2 to understand more about the patient pathway and feasibility for the pilot study. Only metastatic patients are followed up at the The Beatson West of Scotland Cancer Centre (BWoSCC, secondary care). However, quality of life or frailty is not formally assessed, and they have many patients that could be picked up for this proposed pilot study.

The oncology elderly care specialist nurses involved may identify participants they see in their own Elderly Liaison Clinic, depending on if patients are referred to them from breast/prostate cancer teams. In the second round we explored this by including a statement to see if there was lack of awareness and the majority agreed (66.7%) that clinicians at the BWoSCC seeing patients for breast/prostate cancer are aware that they can refer patients to the Cancer Older People's service (COPS). However, on closer inspection of the data, those who agreed were involved directly with COPS, those who disagreed were in the breast/prostate cancer teams, thus identifying a gap in the current pathway.

To identify patients with prostate cancer, we may need to include either urology consultants who specialise in prostatectomies and/or clinical oncologists who specialise in radical radiotherapy for curative intent. General practitioners may possibly assist with identification of older patients treated for breast/prostate cancer in primary care practice as they will be the first person contacted to address any late effect/frailty issue in the community. However, the second round of the Delphi questionnaire revealed agreed consensus that there are few links between secondary care and primary care for the management and care of older patients post cancer treatment who have multimorbidity and/or polypharmacy.

From the clinician's perspectives, caregivers/family should be involved and should be included as they are key to managing patients at home and know them best and are aware of changes in mood, appetite, pain, nausea, and mobility. In the second round, there was an agreed consensus that family caregivers objectively inform

clinicians on how patients are managing. It was also an agreed consensus that family caregivers often have little support. In round one, some clinicians perspectives were that major stressors in families seemed to be around eating and food and dispelling myths, which may be found in Task 2.2 by including the views and experiences of patients/families.

Potential benefits of the use case identified for these actors

Having motivated and informed patients/families to monitor and get in touch for help would be empowering for them and very helpful for clinicians. Family caregivers are included so they know how to support/care/monitor the patient was the statement included in the second round, which obtained agreed consensus.

If patients are still being followed up at the clinic, clinicians could manage symptoms better and monitor changes to see how patients were improving and how long it took them to feel 'normal'. This was explored further in the second round, there was agreed consensus that this technology could help clinicians in the short-term monitor change in the quality of life, symptoms and improvements/decline of older patients.

Information gleaned from the first round suggested actors/clinicians envisaged that information from the use case could be passed on to health link workers or health care assistants before reviews so this could be escalated to the clinician required for example dietician, counsellor, physiotherapist, pharmacist and only involve doctors, if required. Thus, in the second round there was an agreed consensus that the information collected from monitoring the patient indicators, using this technology, could help identify the care/referral needed to improve or support the quality of life.

Similarly, it was outlined that the timing of the review could be variable according to treatment type, adverse reactions and symptoms. The second round obtained agreed consensus that the information collected from monitoring the patient indicators could help dictate when patients may need to be reviewed.

The actors felt it would be beneficial to monitor long term effects of treatment. The second round reached agreement consensus that this technology could help them set long term goals with patients to improve their quality of life. Whilst treatment choices are currently made with the patient, it is with limited data to back up long term health concerns and quality of life. One participant noted that breast cancer patients who have co-morbidities are often excluded from trials, so it would be interesting to have evidence that may make treatment decisions easier.

In round one, it was suggested that frailty scores would be useful over time as they can already see polypharmacy information. Documentation and monitoring of multi-morbidities was dependant on the clinician. This was explored further in the second round, the consensus revealed that clinicians disagreed that polypharmacy review was currently being monitored, but agreed that some clinicians lack confidence, experience, time/resources to manage older people with multimorbidity and/or polypharmacy post breast/prostate cancer treatment.

Limitations identified for these actors in the use case

For clinician's limitations were that some clinics have poor WiFi, mobile phone access and often we have no internet connection. Time to access information and get the information to the right health care staff. Potential problems with getting some doctors to engage and getting patients to comply with the use of technology. Production of too much data increasing burden on clinicians. Elderly patients may struggle with apps. Privacy and data protection of the technology would need to be considered.

Involving families/carers should be at the discretion of the patient which is often overlooked (e.g., widowers wish to exclude children from their health care decisions, men choosing not to bring spouses to their appointments). Not all patients would like their families to monitor their activity, etc. as privacy is important.

WORKFLOW
Current health care flow for patients considered in the use case

The consensus was that current health care flow is patient specific and not based on age alone, which was confirmed by achieving100% agreement in round two.

At the BWoSCC new patients have assessment/s by the oncologist and clinical nurse specialist including performance status (WHO definitions), medication and known comorbidities. The agreed consensus was that new patients are assessed by an oncologist, and polypharmacy is the most important topic.

There is an oncogeriatric service, involving two geriatricians (6 hours each, per week) and two band 4 nurses. They can see any patient referred to their outpatient service. A comprehensive geriatric assessment is conducted which most notably includes a polypharmacy review. Information on potential drug interactions is taken from specialist pharmacy consultants and with advice from our local pharmacists.

Specialist nurses for older adults conduct an assessment of the need to ensure patients get support throughout treatment. They provide help with other health conditions or manage treatment-related side effects such as nausea, pain, breathlessness and constipation.

For prostate cancer, patients aged 75 years or above are considered older adults. Age does not define treatment but rather the stage of the disease. Co-morbidity and general performance status can have a significant influence on treatment. The choices are often made according to the individual patient's expectations and priorities. Older men often have different expectations and priorities than younger men and, irrespective of other factors; this difference alone accounts for much of the age-related differences in care.

In primary care (GP's) currently, cancer is not widely recognised as a chronic long-term condition so patients do not get regular input compared to others for example, patients with diabetes. New GP contracts should be focusing on delivering patient-centred health care with outcome measures rather than target-based medicine.

Limitations detected in the current health care flow
The limitations with current health care was that often oncology teams don't have direct links to provide care after treatment and are not always aware of all medics involved and health conditions largely relying on limited electronic health records and patients giving accurate history. Factors leading to frailty need to be recognised earlier as patients are only referred to the oncogeriatrician service during cancer treatment when it has already become an issue. The service relies on referrals from cancer teams and when clinical time is limited this may be missed. They do not routinely follow up patients, only those who have been referred to this service, which has mainly been haemato-oncology patients and has not extended to older adults with breast or prostate cancer. However, the consensus agreed that clinicians at the BWoSCC seeing patients for breast/prostate cancer are aware that they can refer patients to the Cancer Older People's service. Thus, in relation to our potential pilot, there could be recruitment opportunities by tapping into this gap/service. There is no support in primary care services and cancer is not widely recognised as a chronic condition despite treatment-related side effects occurring years later. There is a need for awareness and increased support for monitoring of side effects. There was agreed consensus in the second round that assumptions are made on the fitness of older adults pre/post breast/prostate cancer treatment. Much falls to primary care for the management of multi-morbidities, polypharmacy after the follow-up period has exceeded. In round one, whilst there was a general consensus to involve family member/s in appointments the second round explored the extent of their involvement. Round one, there was an awareness that some patients do not want family involved in their health/treatment decisions, but this did not meet consensus to be included in the statements of the second round.
Potential added value of LifeChamps in this workflow
Actors saw the potential added value of LifeChamps as due to the geography of where people live, access to help can be limited. The second round found that clinicians agreed that closer monitoring of older patients post breast/prostate cancer should be available locally. The potential level of monitoring would depend on many patient factors such as their clinical and social situation, not just age, as some are more robust at certain ages than others. In the second round, it was agreed that more holistic monitoring of the older patient with comorbidities and/or polypharmacy, following treatment for breast/prostate cancer should be available. Advice on small adjustments can be vital to maintain balance as cancer care does not end when treatment finishes. For some patients, there are lots of missed opportunities/interactions with clinicians that could improve QoL and screening for frailty is not currently done except on admission to hospital, by which time problems

have fully manifested. The second round of the Delphi questionnaire established that frailty, polypharmacy review and cognitive assessment was not currently being monitored with older patients with breast/prostate cancer in their follow-up appointments at the BWoSCC.

Expected workflow of the use case

Actors were asked how they believed LifeChamps could contribute to the management of patients and expected workflow. There was disagreement between perspectives, concerns were expressed over the amount of data collected, how or when they would access it. Some felt updates daily/weekly would increase work and may be challenging to manage and additional funding or resources would be needed and felt timing should be round review (varies between 6 – 12 weeks, this would need to be clarified for any future pilot study). The majority agreed that short-term updates would provide objective information to see if patients have declined or improved and help set goals for the long term. Access would be preferred through EHR or able to access it via computer if patients' information could be uploaded. In the second round, clarification was sought, and the agreed consensus was that clinicians wanted information collected from monitoring the patient's indicators presented to them at the patients' next appointment. Also, the information should be accessible via the computer at any time. Clinicians did not want access to the patient indicators by the patient bringing a summary with them to their appointment.

EXPECTED OUTCOMES

QOL/Frailty variables currently measured for these patients

In the metastatic breast cancer clinic, they do not formally measure QoL or frailty, and they rely on WHO performance status. They are currently exploring the use of global QoL tools such as FACT-B [13] and EQ-5D [9] for all metastatic patients, which would include older patients.

GP's often assess frailty, but due to the lack of time they do not use calculators or questionnaires.

Elderly care liaison nurses use EORTC QLQ-C30 [14] to monitor patients pre, during and post treatment, G8 scoring tool [15] and a mini mental state examination (MMSE) [16]. Other reported no specific tool beyond ECOG performance status.

Geriatricians use HIS frailty tool, 4-AT (cognitive impairment and delirium) [17], have used the G8 questionnaire (Geriatric oncology) [15] and Rockwood (frailty index) [10].

In the second round, no consensus was reached with the statements generated from round one, suggesting a gap in this area.

Limitations encountered with the current QOL/Frailty measures

With our target population, no routine assessments of frailty or QoL. Some assessments were via subjective questions or adapted versions of the questionnaire and no routine follow-ups unless referred to the oncogeriatric service where a comprehensive geriatric assessment is conducted.
Expected outcomes of the use case
Actors reported a range of later treatment effects what they would like to measure. This included fatigue, functional decline, falls and frailty scores which can impact more in elderly patients after radiotherapy. Cardiovascular health, as this could be affected by both chemotherapy and radiotherapy. Weight loss, fluid retention and when blood pressure is dropping. Adherence and compliance to medication, such as how many medications patients are taking and do patients understand why they are taking them. Late effects of endocrine therapy such as UTI's, bone health, long term androgen deprivation. The second round established consensus agreement for the monitoring/measuring of five areas: fatigue, weight, sleep/insomnia, bone health and cardiac effects. Although it was not ascertained what specific measures of 'bone health' or 'cardiac effects' clinicians would want to monitor.

TECHNOLOGY
Technologies currently used to manage these patients and their QOL
A few participants reported trying to get patients on wards to access "NHS near me"[2] via smartphones, only 3% managed. No participant reported using any technologies to manage older patients with prostate or breast cancer during or post-cancer treatment.
Perception of LifeChamps technologies (sensors, mobile solution, dashboard)
Potential added value would be monitoring of: • Decline in frailty • QoL changes – resulting in increasing dependence on family • Fatigue • Falls • Reduction in mobility/physical activity • Number/type of medications taken by the patient • Activity levels (steps per day) • Blood pressure / vital signs

[2] https://www.nhshighland.scot.nhs.uk/NHSNEARME/Pages/Welcome.aspx

- Weight loss/gain
- Poor appetite
- Sleep problems
- Pain
- Cognitive decline (memory)
- Mood changes

In the second round consensus agreement was reached for technologies that could help monitor medication compliance, co-morbidities, frailty scores. Although 75% of participants were unsure of what is achievable.

Potential limitations identified were:

- some older people cannot use a computer or have access to the internet or are less technology literate.
- Concerns over the security of data were reported.
- Many older people have Smartphones but are unfamiliar with apps.
- Poor vision and dexterity can make it hard to read/operate small screens.
- Risk of increased anxiety if the device does not work or shows abnormal readings.
- Older people with hearing impairment may not interact with a device if it makes a noise.
- The motivation of older adults to interact may be dictated by their levels of activity so we would need a comparable population.
- Equipment would have to be user friendly for the older adults.

In the second round consensus agreement that the technology developed needs to be user friendly for older adults (vision, hearing, dexterity) and the main potential limitations would be accessing and/or affording technology (computer, phone, internet), participants understanding, confidence, compliance and potential anxiety.

Additional information

The major issue was selection bias with concerns that the technology being developed is not just accessible by those that are comfortable with technology or more middle class/affluent patients who are least likely to benefit and less likely to be the ones with significant issues. The second round reached 100% agreeance suggesting clinicians are concerned that the technology developed will suit middle class/affluent and not target the people who are likely to benefit most in the socioeconomically deprived populations.

4.2 GENERAL RELEVANT FINDINGS

In this Section, general findings and common conclusions between use cases are presented. This part is useful for technical partners as it comprises valuable information to guide their developments. Statements are grouped by topics (represented in the first column) and partners that reported the finding are indicated in the third column.

ACTORS		
Topic	*Finding*	*Partner*
Patients	Consider over 65 years old criteria to assess geriatric syndromes in breast/prostate cancer	HULAFE, UofG
	Consider over 65 years old criteria but not strictly to avoid constraints during the recruitment	AUTH
	Consider >50 years old criteria in melanoma cancer patients	APC
	Other dimensions are more determinant than age as inclusion criteria (stage of cancer, treatment, co-morbidities, cognitive impairment)	APC, AUTH, HULAFE, UofG
	Presence of metastasis is an exclusion criterion	HULAFE
	Presence of metastasis is not an exclusion criterion	AUTH
	Importance of patient-reported information (patient's perception is not correctly considered) and individual treatment plans (not general questionnaires)	APC, HULAFE
	Interested in testing technology capabilities (digital literacy concern or challenge)	AUTH, HULAFE
Caregivers	Key actors for the extra information about patients (i.e. changes in mood, appetite, pain nausea and mobility) and about themselves that cannot be measured directly from objective measurements	AUTH, APC, HULAFE, UofG
	Can be benefited by receiving personalized recommendations to cope with the situation better (not only on how to look after patients but also on how to care themselves)	AUTH, APC, HULAFE, UofG
	Understand the role of the caregiver, it varies between patients (not force any "caregiver" role, and let patients decide if they want to share their information). Not all patients would like their families to monitor their activity, etc. as privacy is important.	APC, HULAFE, UofG

Professionals	Involve a diverse group of clinicians (not only oncologists)	AUTH, APC, HULAFE, UofG
EXPECTED MEASURES		
Topic	*Finding*	*Partner*
QoL measures	Importance of integrating QoL assessment in daily practice (currently not well assessed, geriatric assessment insufficient)	AUTH, APC, HULAFE, UofG
	Perception of the patient not well considered	AUTH, HULAFE
	Importance to evaluate how treatment affects QoL and also how QoL affects treatment evolution	HULAFE, UofG
	Need to monitor side effects and long-term effects and importance of frailty scores	UofG
	Functional: Physical activity (strength, fatigue, daily steps, gait velocity, energy expenditure), sleep (quality and duration), basic activities, instrumental activities. Nutritional: weight, body composition (fat, muscle mass), calories. Geriatric syndromes: frailty, falls, hearing loss, visual loss, dementia, incontinence. Emotional: stress level, indoor/outdoor location, vital signs, behavioural changes. Treatment-related measures: Medication adherence, pain, fear of recurrence. Environment (opportunities for leisure, weather)	ALL
TECHNOLOGY		
Topic	*Finding*	*Partner*
Technology	There is not much use of technology in daily practice	AUTH, APC, HULAFE, UofG
	LifeChamps technologies can help to improve communication between patients and HCP, allow better self-management and self-examination info	APC
	Involve clinicians in selection, design and validation of technologies	HULAFE
	Need for implementing a training period for patients and caregivers	AUTH
	Detect small changes in the patient's condition in a timely way	AUTH, HULAFE

App	The patient needs to perceive the app as an extension of their healthcare. The app should use a common, not too complicated language/phrasings. Add measurements for satisfaction/anxiety from app-reminders. Risk of increased anxiety if the device does not work or shows abnormal readings.	APC, HULAFE, UofG
	Personalized recommendations, not overwhelming and validation from clinicians.	APC, HULAFE
Sensors	Devices should be transparent and user-friendly to the patient. Importance of using objective measures out of the consultation (devices).	APC, HULAFE, UofG, AUTH
	With sensors at home, there are doubts about whether patients will accept them.	AUTH
Dashboard	Dashboard to contain longitudinal information (evolution, immediate indications to anticipate risks)	AUTH, HULAFE
	The dashboard should give a visualization of the recorded variables with graphs and statistics.	AUTH, HULAFE

4.3 EVALUATION OF INTERACTIVE ACTIVITIES

In order to assess the quality of results and detect possible biases, each clinical site evaluated three dimensions of their interactive activities: accomplishment of the objective, level of participation and encountered limitations. In the following table, evaluation results are presented:

Objective	
Do you think the objective of the activity has been achieved? (*Gather information about all the dimensions to define the use case and engage clinicians for next interaction activities)*	
AUTH	The objective was mostly achieved. Further clarifications about the exact variables that need to be measured would complete the objective fully. Our inclusion criteria (e.g., the ageing criterion) should be further explored according to current guidelines.
APC	Partly yes, since the asynchronous Delphi study questionnaire did not give any possibility for clarifications and to answer additional questions.
HULAFE	Yes, the objective of the activity was achieved. The project was presented and well perceived by participants who were active in discussing all the dimensions of the use case. At this point in the project, we think this is a good starting point to understand the context of the use case and the best scenario to be applied.
UofG	The main objective to engage clinicians' perspectives on the use case was achieved. Clinicians perspectives of what are priorities may be different from what we find from patients/families. In secondary care there are clinicians that are willing to engage with the pilot study and there should be access to patients pending on the current pandemic. Recruitment will involve presence at the clinic's due to time/staff constraints for recruitment of older patients to buy into the new technology we are hoping to pilot. Primary care may be more difficult to engage with. The activity has highlighted that we need to engage more CNSs from the breast/prostate teams. Metastatic breast cancer clinics may be the best place for us to identify participants with comorbidities/polypharmacy. We still need to explore options for the involvement of clinicians and patients with prostate cancer.
Participation	
1) Do you think that recruited participants had the correct profile to answer those questions? 2) What level of participation did you detect? 3) Was it easy or difficult to reach consensus on the different dimensions?	

AUTH	1) The recruited participants were oncologists with clinical experience and a good understanding of the cancer-related issues. Doctors from the other specialities (e.g. radiologist, surgeon) and the paramedical staff gave additional insights since they are often responsible for following up cancer survivors. 2) High level of participation was observed in all 3 sessions. All 9 participants were actively participating and answering questions. 3) Participants seemed to largely agree on the topics raised.
APC	1) Yes, all recruited participants are involved in the cancer care pathway and treatment of melanoma patients. 2) For the responding participants, all questions were answered, and some more extensively. 3) Based on the responses only two statements did not reach consensus by the expert participants: one regarding 'the need to specify more stringently the inclusion/exclusion criteria, if the pilot use case intends to measure QoL after diagnosis and initial treatment' and the other regarding ' the need to include a multi professional team of health care professionals (HCPs) in the pilot use case, since the melanoma survivors meet several of them after their initial diagnose'.
HULAFE	1) Absolutely, the recruited participants are experts on their domain. The oncologists were selected according to the type of cancer of interest (breast and prostate). The variety of profiles allowed to provoke discussion among participants, and interesting conclusions were derived. 2) High level. On average, 5 people participated in each question. 3) It was easy. They all made different suggestions, but it was easy to get a general common idea for each question
UofG	1) Yes, we recruited a broad range of participants that represented a multidisciplinary team and were involved with the care of patients for our use case. However, due to COVID-19 and subsequent disruption to staff shortages, clinical caseloads and annual leave periods, we could not recruit clinical nurse specialists from breast or prostate cancer teams. Ideally, we would have also recruited a clinical oncologist or surgeon treating patients with prostate cancer with curative intent to explore their perspectives on the LifeChamps project. 2) Level of participation was high, and all participants answered each question. Question 10 regarding recruitment to the pilot study would have been more informative if we could have got access to the breast/prostate clinical nurse specialists. Question 11, we detected the least active participation as there appeared to be difficulty envisaging how the dashboard will work.

	3) At this stage, it was relatively easy as clinicians had similar goals to improve patient outcomes and were similar in the type of indicators they wished to measure.
Limitations	
Did you encounter any limitations/biases when carrying out the activity? If so, please explain what and why you think it happened.	
AUTH	No
APC	The Delphi questionnaire was composed of sometimes complex questions, and the asynchronous session made it impossible to ask for any clarifications during each survey.
HULAFE	Sometimes, high-level responses were done. This is understandable as it is an initial activity. If we had made more specific questions (i.e. asking about the type of sensors, instead of what they want to be measured in general) probably we could have got more specific responses. This limitation is expected to be overcome in future workshops.
UofG	Limitations was only one representative from primary care involved in oncology. This may be due to a lack of understanding of long-term effects of cancer treatment and that cancer is not recognised or followed up compared to other conditions. In addition, only one representative from prostate cancer.

5 CONCLUSIONS

According to evaluation results, the objective of Task 2.1 has been accomplished in all use case sites. Despite derived difficulties from COVID-19, the flexible methodology allowed us to develop interactive activities with clinicians, understand use case scenarios and provide an initial definition of all use case dimensions. Detailed results reported in the present deliverable are the input information for related tasks that will be able to integrate end-user requirements in their developments. Use cases will continue to be defined in further tasks, especially in task 2.4 regarding user stories and use cases, technical dimensions and in Task 7.1 regarding the design of pilot use cases.

In summary, this task has served to verify clinician's interest in LifeChamps use cases as a valuable tool to improve the patients' quality of life in daily practice.

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7 APPENDIX

7.1 INFORMATION ABOUT INTERACTIVE ACTIVITIES

7.1.1 PUC1 (AUTH)

Number of sessions and methodology				
Session ID	**Methodology**	**Modality**	**Duration (mins)**	**Date**
S1	Workshop	Online	109	16/07/2020
S2	Workshop	Online	106	23/09/2020
S3	Workshop	Online	62	24/09/2020
Number of participants, Role of participants, Organization				
Session ID	**Participant ID**	**Role**	**Organization**	
S1	P1	Oncologist	HESMO	
S1	P2	Oncologist	HESMO	
S1	P3	Oncologist	HESMO	
S1	P4	Oncologist	HESMO	
S2	P1	Oncologist	HESMO	
S2	P5	Nutritionist	Private Practice	
S2	P6	Nurse	Papageorgiou Hospital of Thessaloniki	
S2	P7	Nurse	Papageorgiou Hospital of Thessaloniki	
S3	P1	Oncologist	HESMO	
S3	P8	Urologist	Private Practice	
S3	P9	Breast Surgeon	Private Practice	
Organization				
Number of organisers				

3
Roles of organisers
☒Moderator ☒Assistant Moderator (taking notes, recording…)
Recruitment
Recruitment approach
Email
Number of people contacted
S1: Recruitment was held centrally by Hellenic Society of Medical Oncologists (HESMO), therefore we are not sure about the exact number of healthcare professionals they have reached out. S2: Recruitment was made using the network of contacts from the group of oncologists that participated in S1. 5 persons were contacted, 3 of them participated (a nurse and a psychologist could not attend). S3: Recruitment was made using the network of contacts from the group of oncologists that participated in S1. 5 persons were contacted, 2 of them participated (a physician, a breast surgeon and a radiotherapist could not attend).
Were participants informed about content and purpose of the activity during recruitment?
Yes
Did participants accept informed consent of the activity?
Yes
Materials
Materials used during the activity
☒Teleconference program (Skype, Teams, Zoom….) ☒PowerPoint ☒Video (to present the mobile app demo)

7.1.2 PUC2 (APC)

Number of sessions and methodology				
Session ID	**Methodology**	**Modality**	**Duration (mins)**	**Date**
S1	Delphi Survey	Online - asynchronous	Own paced	July 2020
S2	Delphi Survey	Online - asynchronous	Own paced	August-September 2020

Number of participants, Role of participants, Organization			
Session ID	**Participant ID**	**Role**	**Organization**
S1	P1	Dermatologist	KUH/RS
S1	P2	Primary Care Physician	Private PHCC/RS
S1	P3	District nurse	APC/RC
S1	P4	Oncologist	N/A
S1	P5	Dermatologist	KUH/RS
S1	P6	Oncologist	KUH/RS
S1	P7	Primary care physician	Private PHCC/RS

Your Role
How many of you participated during the activity? (as organisers)
2
Which roles did you have during the activity?
☒Delphi Facilitator

Recruitment
How did you recruit participants?
Email

How many people did you contact? (*This is to get an idea about the engagement rate)*
11
Did you inform participants about content and purpose of the activity during recruitment?
Yes
Did participants accept informed consent of the activity?
Yes
Materials
Which materials did you use during the activity? (Select as many as you used)
☒PowerPoint ☒Video ☒Online questionnaire

7.1.3 PUC3 (HULAFE)

Number of sessions and methodology				
Session ID	**Methodology**	**Modality**	**Duration (mins)**	**Date**
S1	Workshop	Face-to-face	60	25/06/2020
S2	Workshop	Face-to-face	80	01/07/2020

Number of participants, Role of participants, Organization			
Session ID	**Participant ID**	**Role**	**Organization**
S1	P1	Geriatrician	Hospital La Fe Valencia
S2	P2	Nurse	Hospital La Fe Valencia
S2	P3	Radiation Oncologist	Hospital La Fe Valencia
S2	P4	Radiation Oncologist	Hospital La Fe Valencia
S2	P5	Medical Oncologist	Hospital La Fe Valencia
S2	P6	Primary Care Physician	Hospital La Fe Valencia
S2	P7	Primary Care Physician	Hospital La Fe Valencia

Your Role
How many of you participated during the activity? (as organisers)
2
Which roles did you have during the activity?
☒Moderator ☒Assistant Moderator (taking notes, recording…)

Recruitment
How did you recruit participants?
Email

How many people did you contact? (*This is to get an idea about the engagement rate)*
9
Did you inform participants about content and purpose of the activity during recruitment?
Yes
Did participants accept informed consent of the activity?
Yes
Materials
Which materials did you use during the activity? (Select as many as you used)
☒PowerPoint

7.1.4 PUC4 (UOFG)

Number of sessions and methodology				
Session ID	**Methodology**	**Modality**	**Duration (mins)**	**Date**
S1 -ID 1	Delphi	Online	4232:32	12.07.2020
S1 – ID2	Delphi	Online	2609:22	16.07.2020
S1 – ID3	Delphi	Online	15:35	17.07.2020
S1 – ID4	Delphi	Online	6011:33	21.07.2020
S1 – ID 5	Delphi	Online	24:51	22.07.2020
S1 – ID6	Delphi	Online	80:41	24.07.2020
S1 – ID 7	Delphi	Online	90:51	24.07.2020
S1 - ID 8	Delphi	Online	19:13	26.07.2020
S1 – ID 9	Delphi	Online	291:54	28.07.2020

Number of participants, Role of participants, Organization			
Session ID	**Participant ID**	**Role**	**Organization**
1	1	Breast specialist Radiographer	The Beatson West of Scotland Cancer Centre (BWoSCC)
1	2	Lead General Practitioner Cancer Care	Greater Glasgow & Clyde National Health Service (NHS)
1	3	Oncogeriatrician	Glasgow Royal Infirmary
1	4	Clinical Oncologist – Breast cancer Lead	BWoSCC,

1	5	Specialist Nurse – Oncology/Elderly care	BWoSCC
1	6	Nurse Practitioner – Oncology/Elderly care	BWoSCC
1	7	Consultant Medical Oncologist (Urology) / Professor Cancer Clinical Trails	BWoSCC
1	8	Clinical Oncologist – Breast cancer	BWoSCC
1	9	Geriatrician	Glasgow Royal Infirmary

Your Role	
How many of you participated during the activity? (as organisers)	
2	
Which roles did you have during the activity?	
☒Delphi Facilitator ☒Other, indicate: Development of questionnaire to suit user case scenario (UK), Engagement, recruitment and retention of participants.	
Recruitment	
How did you recruit participants?	
Email	Through clinical contacts and snowball sampling to engage those with expertise in the main areas across primary and secondary care (Greater Glasgow & Clyde).
How many people did you contact? (*This is to get an idea about the engagement rate)*	
A total of 35 people were contacted;13 clinicians did not reply; 4 declined; 3 were due for annual leave; 4 unable due to short time frame; 2 initially agreed but due to clinical commitments could not proceed. Nine clinicians agreed to participate and completed the first and second round of the Delphi questionnaire for Task 2.1.	

Did you inform participants about content and purpose of the activity during recruitment?	
Yes	
Did participants accept informed consent of the activity?	
Yes	Emailed agreeance to participate, formal informed consent obtained on accessing the Delphi questionnaire via webropol.
Materials	
Which materials did you use during the activity? (Select as many as you used)	
☒PowerPoint *(This was the first 8 slides in accordance with APC introduction with UofG voiceover)* ☒Online questionnaire	

7.2 QUESTIONS USED DURING INTERACTIVE ACTIVITIES

7.2.1 PUC1 (AUTH)

#	Questions
Q1	ACTORS: Do you agree with the inclusion / exclusion criteria?
Q2	ACTORS: If not, what changes / additions do you think are needed?
Q3	ACTORS: How easy or difficult do you find including 40 patients who meet the criteria for inclusion to the pilot stage?
Q4	CAREFLOW: Can you describe the processes from the end of the basic treatment and afterwards, for the patient profile presented earlier?
Q5	CAREFLOW: What factors (physical, psychological, or social) influence the above processes as well as the decision making for an elderly patient with breast or prostate cancer? How important is a patient's age?
Q6	LIMITATIONS: What kind of problems / limitations do you find for the care (clinical, self-) of these patients?
Q7	QOL MEASURES: What (qualitative) quality of life variables are you currently evaluating in middle-aged and older patients with breast or prostate cancer?
Q8	QOL MEASURES: What additional variables do you evaluate in patients with frailty? How do you currently assess the physical activity of frail patients?
Q9	TECHNOLOGY: What approaches do you use to monitor patients' quality of life and their physical condition?
Q10	DASHBOARD: What variables related to the quality of life, but also the physical condition of elderly patients, would you like to see visualized and analysed on a control screen?
Q11	SENSORS: Have you ever used a wearable device to monitor patients in your clinical practice? If so, what did you use and what was your experience?

7.2.2 PUC2 (APC)

#	Questions
Q1	GOALS: How do you think this use case reflects the actual needs of skin cancer survivors regarding HRQoL and outcome monitoring? What would you change?
Q2	GOALS: How do you think this use case will help clinicians to overcome/diminish the "ageism" factor?
Q3	ACTORS: Do you agree with our inclusion/exclusion criteria? What changes/clarifications might be needed?
Q4	ACTORS: In which aspects do skin cancer survivors require closer monitoring of their overall health and wellbeing after treatment?
Q5	ACTORS: In what way do you think that family members or caregivers will benefit from the use case and will be able to offer better support to the care process?
Q6	ACTORS: Could you please describe which HCPs (e.g. Primary Care Physician, Dermatologist. Oncologist, District/Oncology Nurse, other) should participate in our use case and their potential role in the care process?
Q7	FLOW: Can you please explain in high level the current care process followed by skin cancer patients from diagnosis to follow-up? (i.e services involved in healthcare, frequency of patient visits etc.)
Q8	FLOW: Can you please describe how the psychological assessment is integrated in the care flow now and how it should be improved?
Q9	FLOW: Which methods/indicators are currently in use to assess skin cancer survivors quality of life? How often is it clinically assessed and what would you recommend for our use case?
Q10	FLOW: Can you please describe what kind of factors build the personalization of care in skin cancer survivors?
Q11	FLOW: How do you think this platform will add value in the management of skin cancer survivors?
Q12	OUTCOMES: Which are the physiological, behavioural and environmental indicators you believe that HCPs should have access to when they are consulting skin cancer survivors? How often and in which intervalls should these indicators be documented ?
Q13	OUTCOMES: Are there any specific late treatment effects that HCPs would primarily want to monitor in skin cancer survivors? Which ones?

Q14	OUTCOMES: Considering the specifics of the use case scenario, in what ways do you think this use case will help you better understand and manage frailty in skin cancer survivors?
Q15	OUTCOMES: How do you think that the assessment of "fear of recurrence" could help us support overall QoL in skin cancer survivors?
Q16	OUTCOMES: In LifeChamps, we are willing to monitor skin cancer survivors' health status out of the consultation by using sensors (i.e. physical activity, sleep, falls, anxiety, stress). In which ways do you believe information from sensors contribute in short-term and long-term outcome prediction? How often should HCPs receive this information? (i.e daily, weekly)
Q17	OUTCOMES: How do you suggest that we should tailor our use case to cover skin cancer survivors needs under COVID-19 pandemic?
Q18	TECH: In what way do you think the use of technology in clinical practice can be helpful to monitor skin cancer survivor's status? Which patient groups do you think might benefit most from the use of technology?
Q19	TECH In LifeChamps, we will use an artificial intelligence (AI) tool to support more personalized care? What are your thoughts and/or experience with AI decision support systems?
Q20	TECH How do you think that visualization of skin cancer survivors progress could help you to monitor frailty and QoL better? Which kind of indicators do you consider important to be included in the LifeChamps clinician's dashboard for this use case?
Q21	TECH What are your thoughts and/or experience with wearable devices to monitor patients with cancer in home/non clinical environment?
Q22	LIMIT: What kind of limitations/problems could patients with cancer encounter when using a device within their home/non clinical environment? (i.e. understanding the operation of the device, time of use, engagement, etc.). What might encourage or discourage the patients' use of biosensor equipment?
Q23	LIMIT: Which ethical considerations do you foresee for the scenario and the patients of this use case? (i.e. security of patient-generated data)
Q24	ADDITIONAL: Is there anything else you might want to add before the end of the survey? Please write additional comments, thoughts and ideas here.

7.2.3 PUC3 (HULAFE)

#	Questions
Q1	PATIENT PROFILE*: Do you agree with our inclusion/exclusion criteria? What changes/clarifications might be needed? How easy or difficult will be for you to recruit #60 patients of this kind in a pilot study?*
Q2	CAREFLOW*: Can you explain in high level or draw how is the process followed by cancer patients from diagnoses to follow-up and its relation with you care assistance? (i.e services involved in care assistance, frequency of patient visits)*
Q3	CAREFLOW*: What kind of conditioning factors appear in the care decision process of this kind of patients?*
Q4	CAREFLOW*: What kind of limitations do you encounter in the care of this kind of patients?*
Q5	CAREFLOW & QOL*: How is psychological assessment now integrated in the careflow? Is it the responsibility of any service or is it a collaborative effort between all the services involved? Do you think this dimension of the patient's health is now well monitored? How do you think it could be improved?*
Q6	QOL*: Currently, what dimensions of quality of life are you evaluating in these patients? (physical activity, nutrition status, psychological status, social activity…) What means do you use in that process (evaluation scales, devices, interviews with the patient…)*
Q7	FRAILTY*: Regarding frailty, how are you evaluating now physical activity in this kind of patients?*
Q8	IOT DEVICES*: Have you ever used a device to monitor patients in your clinical practice? (YES/NO), e.g. Tablet, Smartphone, Blood pressure wearable? If so, what exactly and what was your experience with it?*
Q9	PATIENT-APP*: Regarding the app for the patient, do you think that this kind of technology will be accepted by the users? What limitations can be foreseen? In what context do you think this technology should be more useful?*
Q10	CAREGIVER-APP*: What kind of information do you think is useful for family members about the status of the patient? Do you communicate this kind of information now to them during clinical practice (i. e. during the visit of the patient do you pay special attention to make recommendations to the caregiver?)*
Q11	CAREGIVER*: What is the role of the informal caregiver in the care process? What kind of recommendations will be useful for them to receive? (support on how to care the patient, how to care themselves, psychological support…)*

Q12	DASHBOARD*: Regarding the dashboard, are you able to visualize the progress of a patient currently at your service/organization? Does this information help you to monitor frailty/QOL about the patient? Which kind of information do you consider important to be included in the LifeChamps Dashboard for this use case?*
Q13	GOAL*: Considering the specifics of the use case scenario, in what ways do you think this use case will help you better understand frailty in patients with cancer?*

7.2.4 PUC4 (UOFG)

#	Questions
Q1	CARE PROCESS: Describe the current health care management of older patients, with breast / prostate cancer, who have mulmorbidity / polypharmacy post cancer treatment?
Q2	ACTORS: From your own clinical experience, what are the limitations in the health care management of older patients with breast / prostate cancer, who have mulmorbidity / polypharmacy post cancer treatment?
Q3	CARE PROCESS: Which indicators and signs are you monitoring for in older patients with breast / prostate cancer during their follow-up visits?
Q4	ACTORS: Do you think that family caregivers need adequate support and should be included during these follow-up visits? Why?
Q5	EXPECTED OUTCOMES: Are there any specific late treatment effects that you would primarily want to monitor in older patients with breast / prostate cancer? Which ones?
Q6	EXPECTED OUTCOMES: How are you assessing frailty and quality of life in older patients with breast / prostate cancer during their treatment / follow-up visits? Which method / indicator / questionnaire do you use?
Q7	EXPECTED OUTCOMES: We propose reduced physical activity, increased dependence on family, social isolation, depression and poor overall quality of life as indicators of frailty in older patients with breast or prostate cancer. Do you agree with these indicators? What other indicators of frailty might you want to be able to monitor?
Q8	EXPECTED OUTCOMES: Do you think that older patients with breast or prostate cancers require closer monitoring of their overall health and wellbeing out of the consultation and after treatment? Why or in which cases?
Q9	ACTORS: We plan to pilot the technology to monitor / predict the effects of the interaction between late / persisting treatment-related symptoms and multimorbidity / polypharmacy on the frailty and active daily living of older adults (aged 65 years +), post treatment for both breast cancer (n=30) and prostate cancer (n=30). What eligibility criteria (inclusion / exclusion) for patients do we need to consider?
Q10	EXPECTED OUTCOMES: We aim to recruit 60 older patients from outpatient clinics. In your role, consider how can we best access these patients? How easy or difficult would it be for you, or your clinical team, to recruit patients to this kind of pilot study?

Q11	TOOLS/TECHNOLOGY: Which kind of indicators would you want included in the LifeChamps Dashboard to help you monitor multimorbidity / polypharmacy and for use in this pilot study?
Q12	TOOLS/TECHNOLOGY: What kind of limitations or problems do you think older patients with breast / prostate cancer could experience when using this technology / device within their home environment? (e.g., encourage or discourage the use of sensors or mobile app in everyday life)
Q13	TOOLS/TECHNOLOGY: In LifeChamps, if we develop a system for monitoring and collecting indicators you identified by using sensors, apps, dashboard (e.g., physical activity, sleep, falls, etc.), in what ways do you believe this technology could contribute to: The "short term" and "long term" management of older patients with breast/prostate cancer? How often would you like to receive this information? (e.g., daily, weekly, etc) How would you like to access this information? (e.g., patients come with their own smartphone showing the screening with a summary of what you wished to know, as you wished to know.)
Q14	EXPECTED OUTCOMES: What limitations do you foresee in running this type of pilot study?
Q15	Are there any other comments you would like to add?