A Guide to Digitising Access to Resources via an RPA Powered Chatbot: A Case Study

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Executive Summary

This is a guide to digitising access to information through the use of a robotic process automation (RPA) enabled chatbot. It is informed by the experience of developing a prototype system to digitise the physical activity content of the MECC Lifestyle Behaviour Services and Resources Booklet created by HSE Health and Wellbeing (Community Healthcare Organisation Dublin North City and County) and the creation of a chatbot that can seek out particular information that a user may be seeking out. This guide has been developed to aid others who may embark on a similar project in the future.

Within this report we describe the key steps taken in completing this project, from the planning stages (incorporating the drafting and narrowing of the scope and requirements) through to the delivery of a minimal viable prototype. We outline how the information in the aforementioned booklet is currently stored, gathered, and disseminated along with the challenges that this creates (chapter 1). The steps taken to repurpose this information to create a database is provided in chapter 2. This includes a description of how data was cleaned, data features were selected and how it was transformed to enable it to sit onto the content management system used by the HSE Digital Communication Team.

An iterative approach was taken throughout the project. In chapter 3 an overview of this process is provided, with the necessary technical stages in the prototype chatbots delivery laid out for others to learn from. The software company UiPath, the HSE Digital Communications Team and the HSE Robotic Process Automation Centre of Excellence all collaborated with the Project Team during the development phase. Other key stakeholders who aided the user acceptance testing of the prototype chatbot were also engaged, which is also described in chapter 3.

Through our engagement with these groups and organisations, we outline the steps needed to successfully undertake a similar project to develop an RPA powered chatbot and provide suggestions on how to future proof this work.

Chapter 4 provides a detailed description of the chatbot and discuss the salient features of the technology giving examples and insights so as to aid future project teams by helping them understand the functionality of the prototype.

While this guide covers a large amount of information it is not intended to cover every aspect of this project. We have endeavoured to highlight the critical pieces of work involved in a project such as this but there are areas such as the development of requirements, tree testing and focus groups with users which are mentioned here but not discussed in as much detail. While this may be a slight limitation to the guide we felt it was necessary to make the guide usable.

Our conclusion, having completed this project, is that the concept of utilising the HSE's own Content Management System as a central store of information should be considered for any new project that is looking to digitise information. The need to provide people with access to clinical information to help support their long-term conditions is more acute than ever. Chatbots provide a means to deliver access to this type of information across a range of platforms and in a way that can provide analytical information to help better understand the needs of people. The capability to connect the communications architecture and the emergent RPA technology, is possible within the HSE and presents an immediate and achievable opportunity to improve the dissemination of information to people accessing healthcare in Ireland.

Abbreviations

AI	Artificial Intelligence
API	Application Programming Interface
CHO DNCC	Community Health Organisation Dublin North City and County
CMS	Content Management System
CoE	Centre of Excellence
CORMAC	Community Online Resources Made Accessible to the Consumer (chatbot name)
DCT	Digital Communications Team
H&W	Health & Wellbeing
HSE	Health Service Executive
MECC	Making Every Contact Count
NLP	Natural Language Processing
OoCIO	Office of the Chief Information Officer
PID	Project Initiation Document
POC	Proof of Concept
RPA	Robotic Process Automation
SUI	Simplified User Interface
SUS	System Usability Scale
UAT	User Acceptance Testing
UL	University of Limerick
UX	User Experience
VPN	Virtual Private Network

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Section 1: Introduction

Dissemination and management of information regarding MECC programme resources is costly, inefficient and difficult to keep accurate.

1.1 Current Situation

During routine consultations, health professionals ask patients about lifestyle behaviours related to chronic diseases. There are approximately 30 million 'contacts' in the Irish health service every year and a key component of each contact is directing people to appropriate resources in their local area to help them manage their condition(s). The goal of these 'contacts' is to address risk factors for chronic diseases by helping patients achieve positive long-term behaviour change.

The key risk factors health professionals address during these contacts are:

- Smoking
- Alcohol and drug use
- Unhealthy eating
- Physical activity

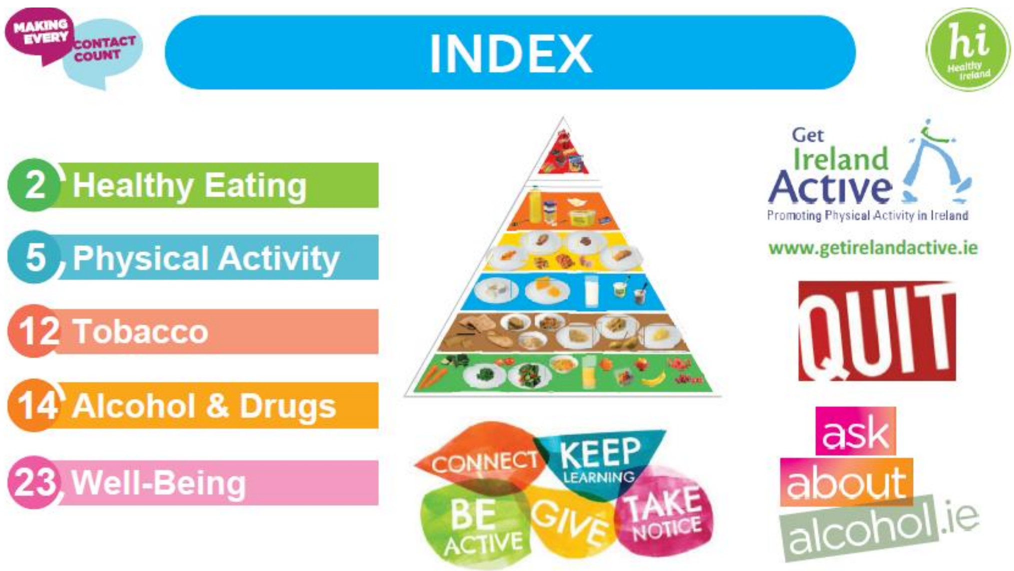
Currently the management of chronic diseases is placing an unsustainable pressure on Irish health services. The Making Every Contact Count (MECC) programme was established by the Health Service Executive (HSE) in 2016, with the aim of empowering patients to self-manage their condition(s). This in turn could relieve pressure on the healthcare system by helping lessen the impact of chronic diseases on individuals. However, organising and disseminating information to support the MECC programme has proved a challenge.

At a national level there is no single online source of accurate, reliable information for high-quality resources to support clinicians during clinical contacts.

Since 2017, the MECC programme has produced only one verified repository of information via the HSE Health & Wellbeing (H&W) which relates to services within Dublin North City and County (CHO DNCC). This repository is called the CHO DNCC MECC Lifestyle Behaviour Services and Resources Booklet, from this point onwards, it will be referred to as the *MECC Booklet*.

The MECC Booklet[1] comprises five chapters and contains information on approximately 200 community-based resources (cf. figure 1). It represents a significant step forward in collating information from a range of HSE approved service providers and recognises the need to support people in their self-management of chronic diseases. The range of information contained in the MECC Booklet represents a holistic approach to health and wellbeing. It has been distributed to health centres and clinicians working in CHO DNCC.

Figure 1: MECC Booklet (HSE, 2020)



[1]HSE (2020). *Community Healthcare Organisation Dublin North City and County MECC Lifestyle Behaviour Services and Resources.* https://www.hse.ie/eng/about/who/healthwellbeing/making-every-contact-count/order-resources/mecc-lifestyle-behaviour-services-and-resources-directory-dncc.pdf. [Accessed 1 April 2022.]

While the MECC Booklet marks an important step in providing information to clinicians and the public, in its current format it presents several challenges:

- Information is presented under four headings but is not consistent throughout the booklet, with a range of data grouped under the following headings: Resource, Service, Location/Contact and Comments as show in Figure 2.

Figure 2: Headings in the MECC Booklet (HSE, 2020)

Resource	Service	Location/Contact	Comments
Literature: **healthpromotion.ie**	Health literature available to order online on a large range of topics including healthy eating, active living, smoking, drugs, alcohol and mental health. Professionals can register to order larger quantities (if available).	For further information go to: www.healthpromotion.ie	
Programme: **Specialist Weight Management service**	Public Weight Management Service in St. Columcille's Hospital Loughlinstown, Co. Dublin for people with a BMI >40. (or >35 with a obesity related co-morbidity e.g. diabetes). Multidisciplinary lifestyle and behaviour change programme delivered by a dietitian, physiotherapist and psychologist. It involves 9 appointments.	See their website for information on how to refer to the service http://weightmanagement.ie/index.html	
Literature: **Healthy Eating HSE**	HSE Healthy Eating Guidelines and the Food Pyramid.	Find detailed information about the Healthy Eating Guidelines and resources relating to the guidelines here	
Programme: **Healthy Food Made Easy**	Community Cookery programme. Runs for 2½ hours weekly for 6 weeks. A fun and practical course which focuses on fostering basic knowledge about healthy eating.	Finglas, Ballymun and Cabra. Contact Leon Kelly in Dublin North West Area Partnership, Ph: 01-8361666	Note: In general, the programme is delivered to pre-formed groups.

- HSE H&W calculated that it takes staff 150 hours per year to maintain the information in the MECC Booklet. This level of resource is unsustainable and not scalable on a national level.
- Information quickly comes out of date (cf. Figure 3)

Figure 3: Out of date class information in the MECC Booklet (HSE, 2020)

Programme: **Healthy Food Made Easy**	Community Cookery programme. Runs for 2½ hours weekly for 6 weeks. A fun and practical course which focuses on fostering basic knowledge about healthy eating.	Fingal. Contact Suzanne Bailey in Empower, Ph: 01-8209550	Note: In general, the programme is delivered to pre-formed groups, but Empower offer courses to the public. Mountview FRC, starting Friday 28th Feb 2020 and Holywell Community Centre [illegible]ing Friday 28th Feb 2020

Our key findings:

- Paper booklets are difficult to disseminate (cf. Appendix 4: Focus group feedback)
- The online resource is difficult to find (cf. Appendix 3: Tree testing data)
- The public are not generally aware the MECC Booklet is available, and typically require the assistance of a healthcare professional to access it (cf. Appendix 4 Focus group feedback).

1.2 Opportunity for Change

Recent technological developments within the HSE provided an opportunity to support the MECC Programme. Specifically, the HSE Digital Communications Team (DCT) are currently developing a central Content Management System (CMS) to support increased quality and standardisation of information relating to healthcare in Ireland. The hosting architecture they are building is based on Wagtail, an open-sourced CMS. In parallel to this work, the HSE have set up a Robotic Process Automation (RPA) Centre of Excellence (CoE) to promote and support the use of automation in the healthcare system. As part of this development the CoE has allocated a license for an RPA powered chatbot to be developed and hosted on the HSE's own architecture.

Our project team identified the potential opportunity to collaborate with both the HSE's DCT and RPA CoE to explore the feasibility of a different approach to the dissemination of information to support self-management of long-term conditions.

1.3 Proof of Concept

This case study documents a cross service collaborative proof of concept, that aimed to digitise one chapter (physical activity) of the MECC Booklet, storing this on the HSE's CMS and building an RPA powered chatbot to access this digital database.

The core tasks completed as part of this work are as follows

- Converting an unstructured dataset (MECC Booklet) into a structured database that could be hosted on the HSE's CMS via the following steps:
    - Data cleaning (cf. Section 2.2)
    - Feature selection (cf. Section 2.3)
    - Data transformation (cf. Section 2.4)
    - Data specification (cf. Section 2.5)
    - Taking an iterative approach to data transformation (cf. Section 2.6)
- Submitting project proposal to the HSE RPA CoE (cf. Section 3.2)
- Bringing together a multiservice team from across the HSE and external organisations that could deliver the requisite deliverables (cf. Section 3.3)

- Developing a realistic and achievable set of functional requirements for a prototype chatbot that could integrate with the HSE's CMS, Wagtail (cf. Section 3.4)
- Establishing access to the CMS for the software development team (cf. Section 3.5)
- Creating high level use cases that were used map a workflow for the chatbot's development (cf. Section 3.6)
- Prepare a user acceptance testing (UAT) protocol as part of the overall test strategy agreed with the software development team (cf. Section 3.7)

This case study can be considered as a first step in exploring the feasibility of using digital tools such as RPA and an open-sourced CMS to improve patient access to information and to support people to self-manage their condition(s). It highlights the potential to improve efficiencies, building solutions that can scale, and enable higher productivity. For digital transformation to succeed, organisations must lead the change through proactive communication, partnership, and collaboration[2].

[2] Hewitt, L.R. et al. (2021). *RPA: A force for good in healthcare.* Available: http://nectar.northampton.ac.uk/16068/1/Hewitt_etal_Automation_anywhere_2021_RPA_force_for_good_in_healthcare.pdf. [Accessed 30 March 2022.]

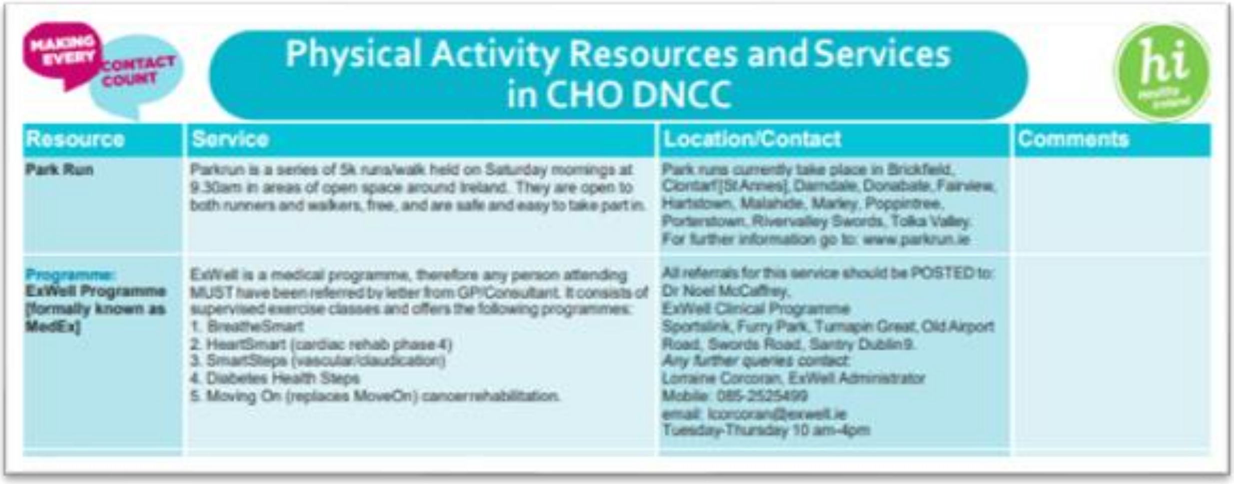
Section 2: Data Preparation

Data preparation is the transformation of raw data into a form that is more suitable for modelling. Although time-consuming, data preparation is a critical part of the process towards implementing RPA.

2.1 Data Source

Preparing the data enabled us to both better visualise and understand the data. We began this process by converting the unstructured dataset (physical activity chapter of the MECC Booklet) into a structured database. This process began with the development of a spreadsheet of the existing data, taking account of a wider set of attributes than the original four contained in the MECC Booklet (Resource, Service, Location/Contact, Comments) (cf. Figure 4). A sample dataset (cf. Figure 5) of the physical activity services was developed as a starting point in the data preparation process.

Figure 4: MECC Booklet: Physical Activity Resources and Services (HSE, 2020)



Resource	Service	Location/Contact	Comments
Park Run	Parkrun is a series of 5k runs/walk held on Saturday mornings at 9.30am in areas of open space around Ireland. They are open to both runners and walkers, free, and are safe and easy to take part in.	Park runs currently take place in Brickfield, Clontarf[St Annes], Darndale, Donabate, Fairview, Hartstown, Malahide, Marley, Poppintree, Porterstown, Rivervalley Swords, Tolka Valley. For further information go to: www.parkrun.ie	
Programme: ExWell Programme [formally known as MedEx]	ExWell is a medical programme, therefore any person attending MUST have been referred by letter from GP/Consultant. It consists of supervised exercise classes and offers the following programmes: 1. BreatheSmart 2. HeartSmart (cardiac rehab phase 4) 3. SmartSteps (vascular/claudication) 4. Diabetes Health Steps 5. Moving On (replaces MoveOn) cancerrehabilitation.	All referrals for this service should be POSTED to: Dr Noel McCaffrey, ExWell Clinical Programme Sportslink, Furry Park, Turnapin Great, Old Airport Road, Swords Road, Santry Dublin 9. *Any further queries contact:* Lorraine Corcoran, ExWell Administrator Mobile: 085-2525499 email: lcorcoran@exwell.ie Tuesday-Thursday 10 am-4pm	

Figure 5: MECC Physical resources dataset

A	B	C	D	E
lumber	Resource	Resource Type	Service Provider	Service Description
	healthpromotion.ie	Online resource	Department of Health Promotion	Health literature available to order online on a large range of topics
	Siel Bleu Falls Prevention	Falls prevention class	Siel Bleu	Siel Bleu Ireland Physical Trainer will help patients to maintain and improve balance and coordination to ensure they have the tools to feel confident on their feet
	Men on the Move	Exercise Group	Men on the move, Health Promotion Officer	This is a free physical activity programmes aimed at adult men who have been inactive for a sustained period and want to get back to exercising and improve their fitness levels in a sociable environment. It involves 2 weekly exercise sessions made up of a combination of aerobic, strength and flexibility components
	Tai Chi	Tai Chi classes		Open to everyone. Tai Chi classes
	Fitness Class	Fitness Class		Fitness Class Over 55s
	Fitness Class	Fitness Class		Fitness Class Over 55s
	Fitness Class	Fitness Class		Fitness Class Over 55s
	Nordic Walking Workshops	Walking workshop	Fingal Sports Office	Nordic walking is a sociable and effective exercise technique, which is suitable for everyone. Nordic walking works your upper and lower body at the same time, strengthening your back and abdominal muscles, legs and arms and reducing neck and shoulder tension, all while improving the health of your heart and lungs. Nordic workshops can be organised in your area and run by a certified Nordic walking trainer.
	Fingal Festival of Football	Football	Fingal Sports Office	An annual event run in conjunction with the FAI Development Officers. The event is a girls-only fun festival, open to teams aged U8-U13, which provides an opportunity to play for a club for the first time, or can be used as part of a pre-season for the more established teams. It is free to attend.
	Nationwide Walk	Walking	Fingal Sports Office	Sport Ireland in partnership with RTÉ's Operation Transformation and Fingal Sports Office holds a nationwide 3km walk every January. Venues include Castleknock, Swords, Balbriggan.
	Fingal Pitch & Putt League	Pitch & Putt	Fingal Sports Office	Established by the Sports Office in 2015, this league competition is delivered over 10 weeks during the summer. It is a social outlet for all participants. Open to everyone.
	Golf for Visually Impaired	Golf		Golf lessons for people with visual impairment and runs for 10 weeks. This programme is free and open to children and adults with a visual impairment.
	Disability Awareness in Sport	Education	CARA	2-hour workshop designed to build awareness around people with disabilities participating in community sport and physical activity. Follow the link to the CARA website for information on the training.

A shared folder was created on Google Drive to enable document sharing/version control and collaboration amongst the team to work collectively on the dataset, which included the following stages:

- Data cleaning (cf. Section 2.2)
- Feature selection (cf. Section 2.3)
- Data transformation (cf. Section 2.4)
- Data specification (cf. Section 2.5)
- Taking an iterative approach to data transformation (cf. Section 2.6)

2.2 Data Cleaning

The Project Team created the original MECC file from HSE H&W into *.csv* format (cf. Figure 6). The team extracted data from the **"Physical Activity"** section in the most recent edition of the MECC Booklet and restructured the content in preparation for uploading onto the SQLite database in Wagtail.

It is often the case that raw data is not immediately suitable to be used in a final dataset. It may need to be cleaned first. This process can involve identifying, marking, removing and imputing missing values in the dataset. It is imperative to identify and manage missing and corrupt data values in order to achieve the optimal performance with the final dataset. Failure to clean the data will most likely make the data inconsistent and incomprehensible to the chatbot.

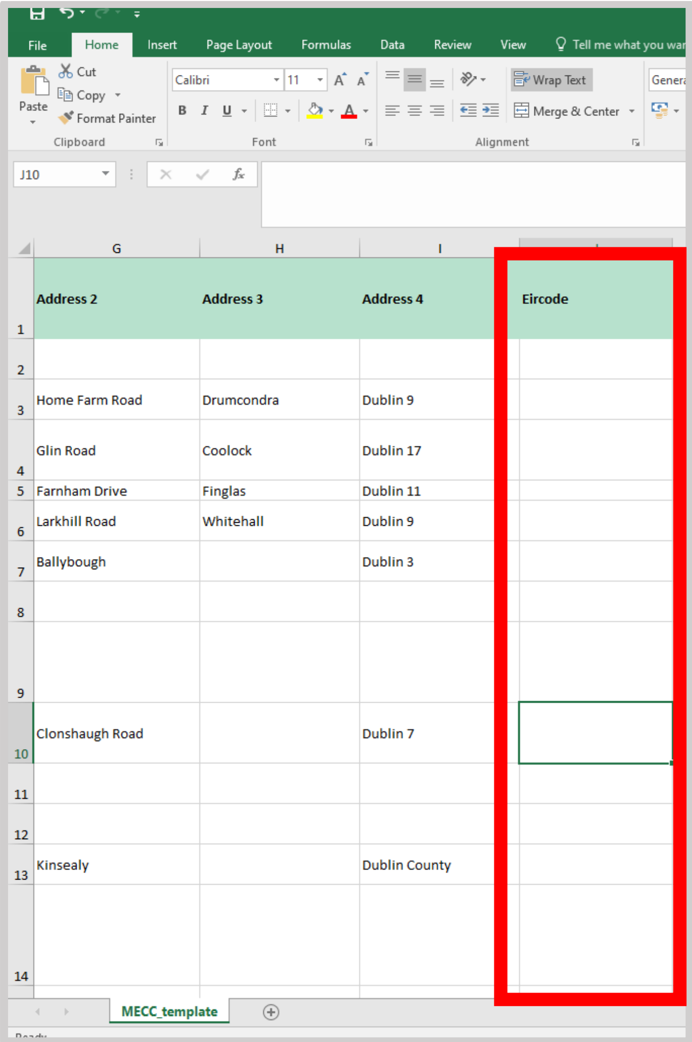
Our data cleaning process identified several attributes with missing values (cf. Figure 6) which were marked 'ABSENT'. Where possible the team imputed missing data with information related to that attribute/instance. The Project Team worked together to come to a consensus as to which data and attributes to include in the final dataset. The team created a more sophisticated structure for the physical activity content for the database by including more detailed and descriptive attributes (for example Address 1, Address 2, etc.).

Figure 6: Missing values

	F	G	H	I	J
1	Address 1	Address 2	Address 3	Address 4	Eircode
2	ABSENT	ABSENT	ABSENT	ABSENT	ABSENT
3	Corpus Christi Parochial Hall	Home Farm Road	Drumcondra	Dublin 9	ABSENT
4	Glin Road Sports Complex	Glin Road	Coolock	Dublin 17	ABSENT
5	Erins Isle GAA Club	Farnham Drive	Finglas	Dublin 11	ABSENT
6	Larkhill Scout Den	Larkhill Road	Whitehall	Dublin 9	ABSENT
7	Ballybough Community Centre	Ballybough	ABSENT	Dublin 3	ABSENT
8	Clontarf (CCA)	ABSENT	ABSENT	ABSENT	ABSENT

Through this process we identified all instances with missing values. Some attributes, e.g. Eircode (cf. Figure 7) had missing values for most of the instances.

Figure 7: Missing values for "Eircode" attribute



2.3 Feature Selection

The process of selecting features in your data to use in your dataset is called feature selection. Advantages of feature selection include:

→ Improves data quality

→ Removes the redundant, irrelevant or noisy data

→ Performance improvement[3].

[3] Khalid, S. & Nasreen, S. (2014). A survey of feature selection and feature extraction techniques in machine learning, *2014 Science and Information Conference*, 2014, pp. 372-378, doi: 10.1109/SAI.2014.6918213. Available: https://ieeexplore.ieee.org/abstract/document/6918213. [Accessed 1 April 2022.]

The initial part of the feature selection was undertaken when the project team made the decision to limit the dataset to **"Physical Activity"** resources as it was beyond the scope of the project to include all five sections of the MECC Booklet in a proof of concept.

Linking in with HSE DCT and the chatbot developer is an important part of this process, as it allows for full understanding of their data requirements for the first iteration of the database and how it will eventually be exploited by the chatbot. Not having certain data features selected at this point may hinder progression at a later stage of development and as such all stakeholders should be consulted, and agreement reached.

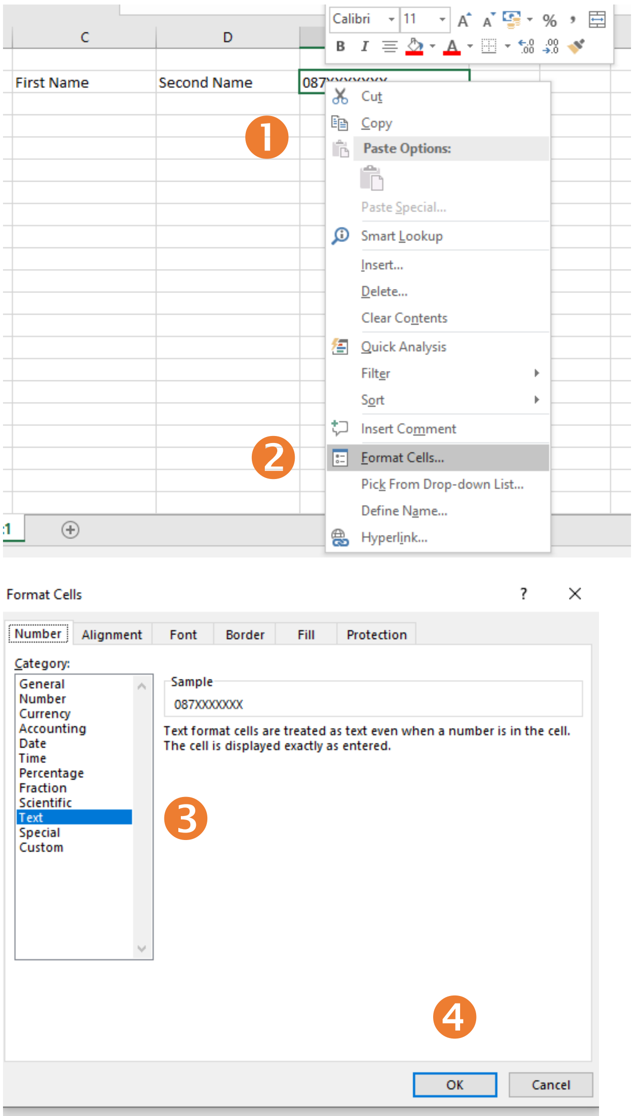
2.4 Data Transformation

Data transformation involves standardising your raw data. This stage of data preparation considers how to better standardise and organise the dataset. Standardisation of numerical data must always be considered to best ensure successful information retrieval for the end-user. Some attributes will need to have rules applied. Examples of data you may need to standardise include:

→ Mobile phone numbers: do you want a space between code and number?
086 xxxxxxx ***OR*** 086xxxxxxx
When entering data in Excel, the initial "0" (zero) is often automatically omitted if the cell is not correctly formatted (cf. Figure 8).

→ Age groups: would it be useful to include an attribute specifically for age groups? Some of the physical activities sourced from the MECC Booklet were aimed at specific age groups. The Project Team considered the addition of an attribute for "*age groups*" but as most of the instances didn't include this data, a decision was made to move any age group related data to the "*service description*" attribute (cf. Figure 5).

Figure 8: Formatting cells in Excel



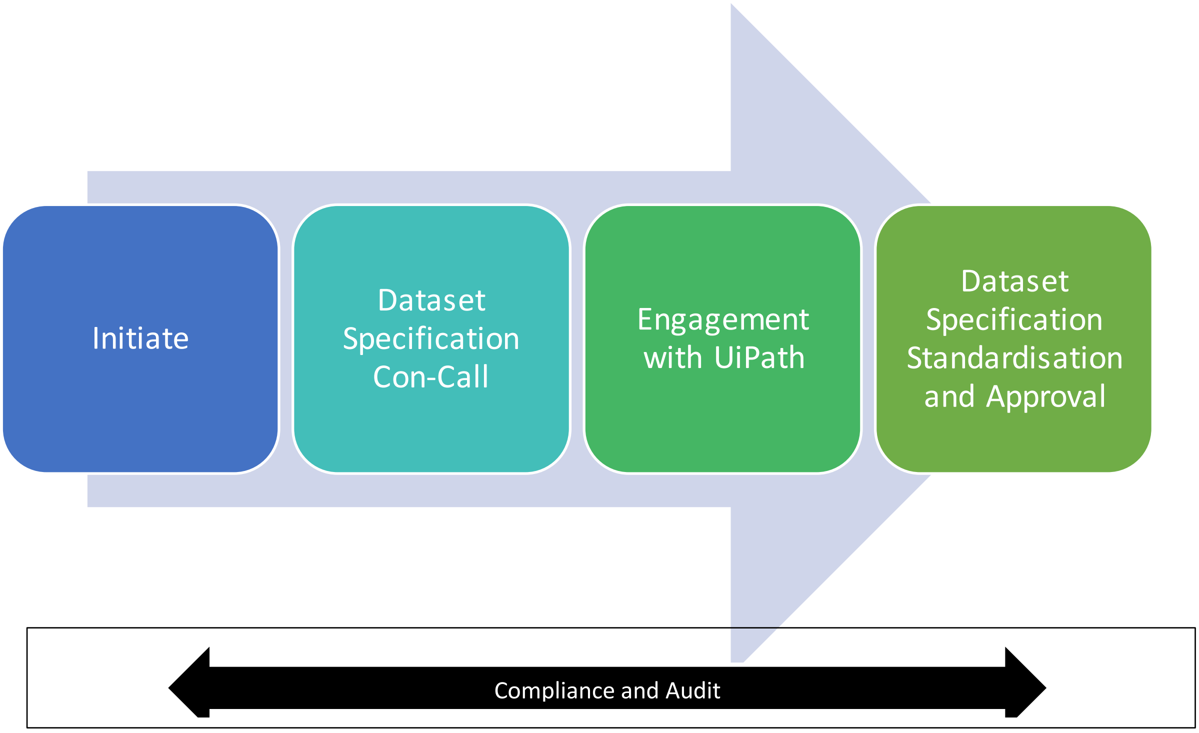
1. Enter the number into the cell (cf. Figure 8).
2. Right-click the mouse and from the list of options, select Format Cells.
3. From the list of options in the drop-down menu, select Text.
4. Finally, click OK.

2.5 Data Specification

With the data transformation complete, the Project Team contacted the HSE DCT to ascertain the dataset specification. We improved the quality of our data on our spreadsheet and engaged HSE DCT to ensure that the data was usable for the CMS, Wagtail (which is an open-source CMS to structure and manage the content of data within the HSE infrastructure).

The booklet is aligned with existing data governance to support agreed data standards for medical and health service terminology. There is a **Dataset Specification Management Process**[4] outlined in Figure 9.

Figure 9: Dataset Specification Management Process



With the support of a Dataset Co-ordinator from the HSE DCT, the Project Team completed the **Dataset Specification Management Process**. The purpose of this is to ensure standardisation and consistency of the dataset and that it will be compatible with the HSE digital architecture. This enabled the process of translating the dataset into a SQLite database on the HSE's CMS, Wagtail. This involves the migration of the raw data as a *.csv file* into Wagtail, which the Dataset Co-ordinator enters via a form on the **Enterprise Architecture Portal** (cf. Figures 10 - 13).

[4] HSE and eHealth Ireland (2022). Standardising data for the future. Available: https://www.ehealthireland.ie/news-media/news-archive/2022/dsmp-report-final-2022-.pdf. [Accessed 19 April 2022.]

Figure 10: MECC's "Physical Activity" data *(.json file)*

[{"id": 56, "name": "Park Tennis", "service_is_active": "1", "phone_one": "085 1076 000", "detail_one": "Tara Congdon", "phone
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Figure 11: MECC's "Physical Activity" data *(.csv file)*

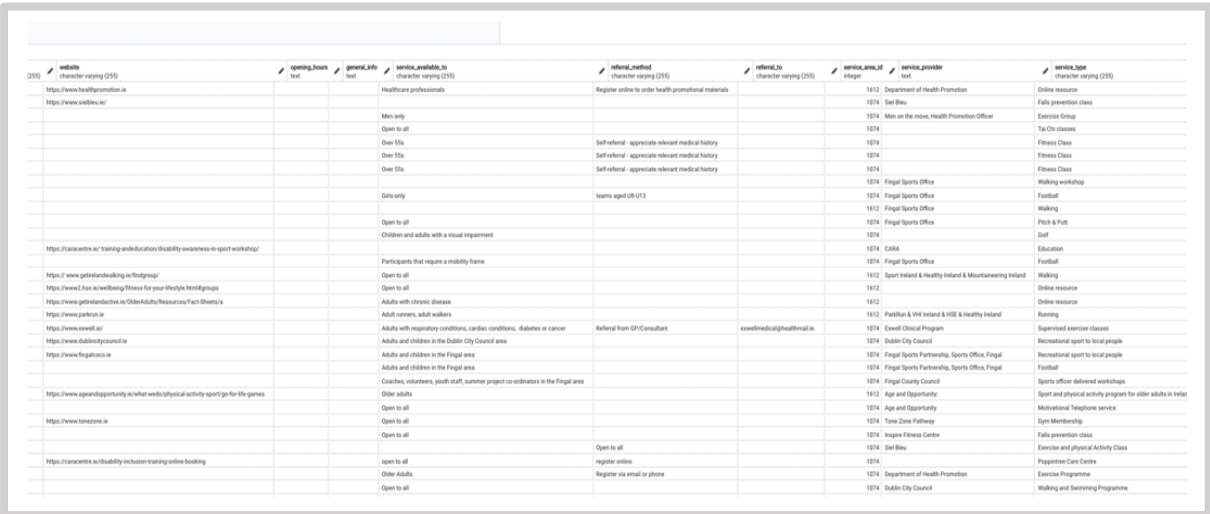
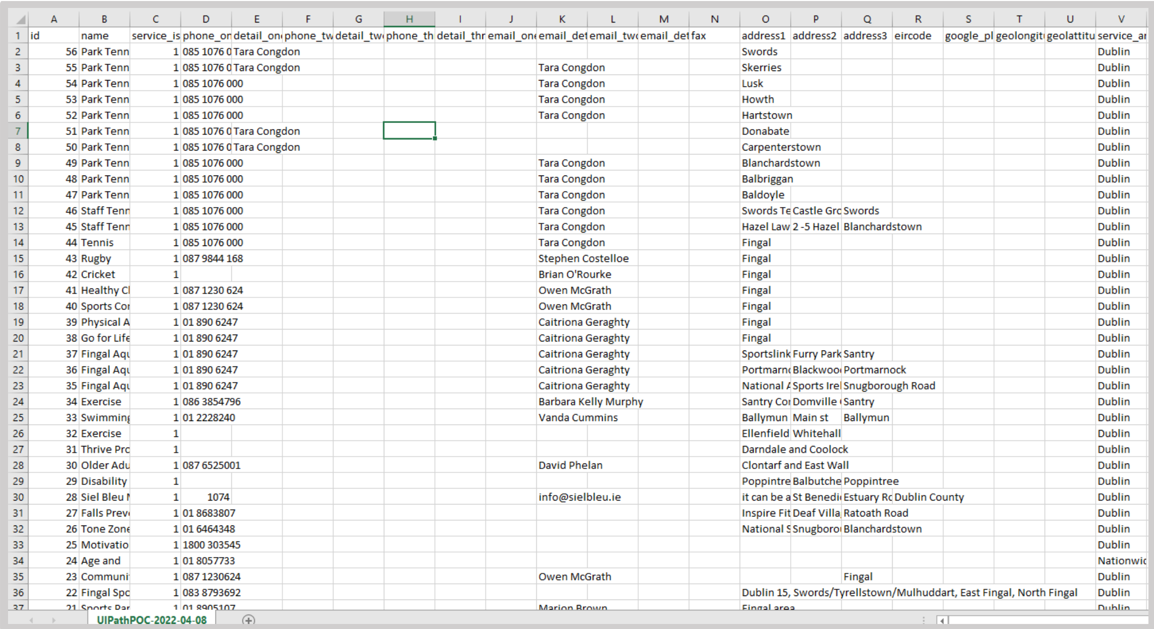


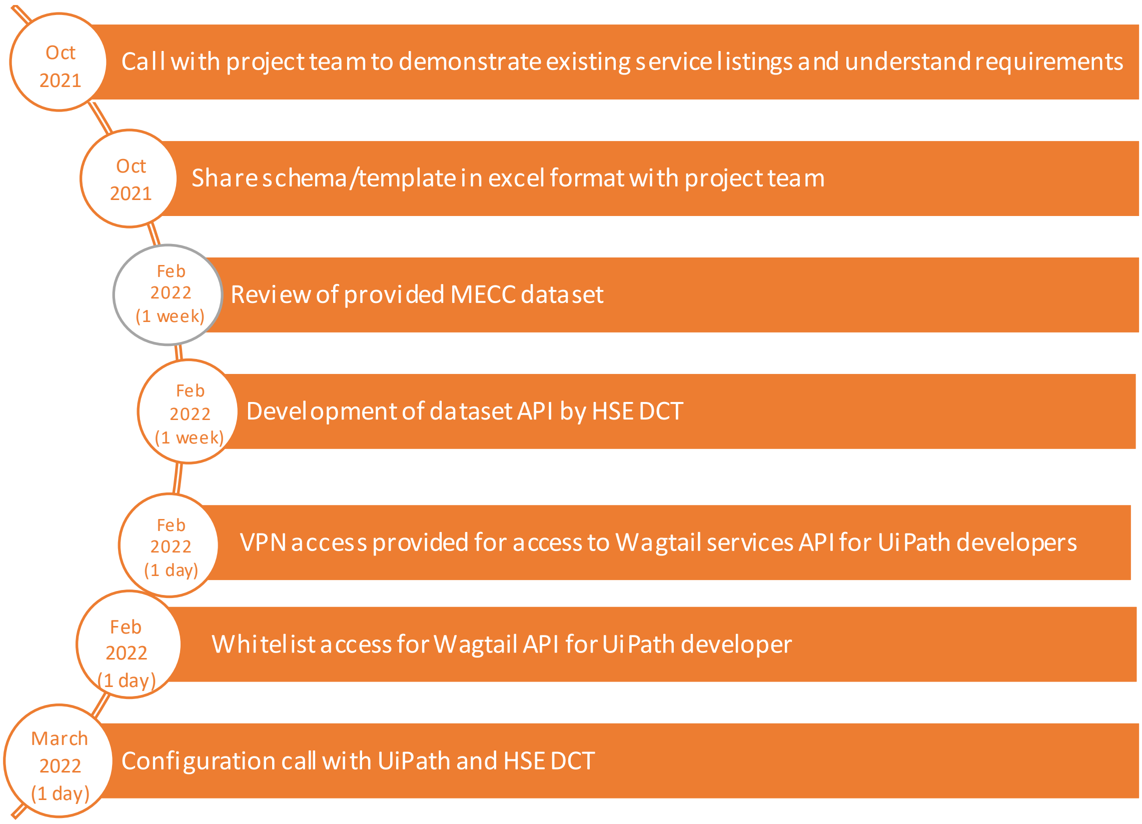
Figure 12: Prototype database for UiPath



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	id	name	service_is	phone_on	detail_on	phone_tw	detail_tw	phone_th	detail_thr	email_one	email_det	email_two	email_det	fax	address1	address2	address3	eircode	google_pl	geolongit	geolattitu	service_ar
2	56	Park Tenn	1	085 1076 0	Tara Congdon										Swords							Dublin
3	55	Park Tenn	1	085 1076 0	Tara Congdon						Tara Congdon				Skerries							Dublin
4	54	Park Tenn	1	085 1076 000							Tara Congdon				Lusk							Dublin
5	53	Park Tenn	1	085 1076 000							Tara Congdon				Howth							Dublin
6	52	Park Tenn	1	085 1076 000							Tara Congdon				Hartstown							Dublin
7	51	Park Tenn	1	085 1076 0	Tara Congdon										Donabate							Dublin
8	50	Park Tenn	1	085 1076 0	Tara Congdon										Carpenterstown							Dublin
9	49	Park Tenn	1	085 1076 000							Tara Congdon				Blanchardstown							Dublin
10	48	Park Tenn	1	085 1076 000							Tara Congdon				Balbriggan							Dublin
11	47	Park Tenn	1	085 1076 000							Tara Congdon				Baldoyle							Dublin
12	46	Staff Tenn	1	085 1076 000							Tara Congdon				Swords Te	Castle Grc	Swords					Dublin
13	45	Staff Tenn	1	085 1076 000							Tara Congdon				Hazel Law	2 -5 Hazel	Blanchardstown					Dublin
14	44	Tennis	1	085 1076 000							Tara Congdon				Fingal							Dublin
15	43	Rugby	1	087 9844 168							Stephen Costelloe				Fingal							Dublin
16	42	Cricket	1								Brian O'Rourke				Fingal							Dublin
17	41	Healthy Cl	1	087 1230 624							Owen McGrath				Fingal							Dublin
18	40	Sports Co	1	087 1230 624							Owen McGrath				Fingal							Dublin
19	39	Physical A	1	01 890 6247							Caitriona Geraghty				Fingal							Dublin
20	38	Go for Life	1	01 890 6247							Caitriona Geraghty				Fingal							Dublin
21	37	Fingal Aqu	1	01 890 6247							Caitriona Geraghty				Sportslink	Furry Park	Santry					Dublin
22	36	Fingal Aqu	1	01 890 6247							Caitriona Geraghty				Portmarn	Blackwoo	Portmarnock					Dublin
23	35	Fingal Aqu	1	01 890 6247							Caitriona Geraghty				National A	Sports Irel	Snugborough Road					Dublin
24	34	Exercise	1	086 3854796							Barbara Kelly Murphy				Santry Co	Domville (	Santry					Dublin
25	33	Swimming	1	01 2228240							Vanda Cummins				Ballymun	Main st	Ballymun					Dublin
26	32	Exercise	1												Ellenfield	Whitehall						Dublin
27	31	Thrive Pro	1												Darndale and Coolock							Dublin
28	30	Older Adu	1	087 6525001							David Phelan				Clontarf and East Wall							Dublin
29	29	Disability	1												Poppintre	Balbutche	Poppintree					Dublin
30	28	Siel Bleu I	1	1074							info@sielbleu.ie				it can be a	St Benedi	Estuary Rc	Dublin County				Dublin
31	27	Falls Prev	1	01 8683807											Inspire Fit	Deaf Villa	Ratoath Road					Dublin
32	26	Tone Zone	1	01 6464348											National S	Snugboro	Blanchardstown					Dublin
33	25	Motivatio	1	1800 303545																		Dublin
34	24	Age and	1	01 8057733																		Nationwic
35	23	Communi	1	087 1230624							Owen McGrath						Fingal					Dublin
36	22	Fingal Spc	1	083 8793692											Dublin 15, Swords/Tyrellstown/Mulhuddart, East Fingal, North Fingal							Dublin
37	21	Sports Par	1	01 8905107							Marion Brown				Fingal area							Dublin

UIPathPOC-2022-04-08

Figure 13: HSE Digital Comms: Tasks and timescales



2.6 Development of Use Cases

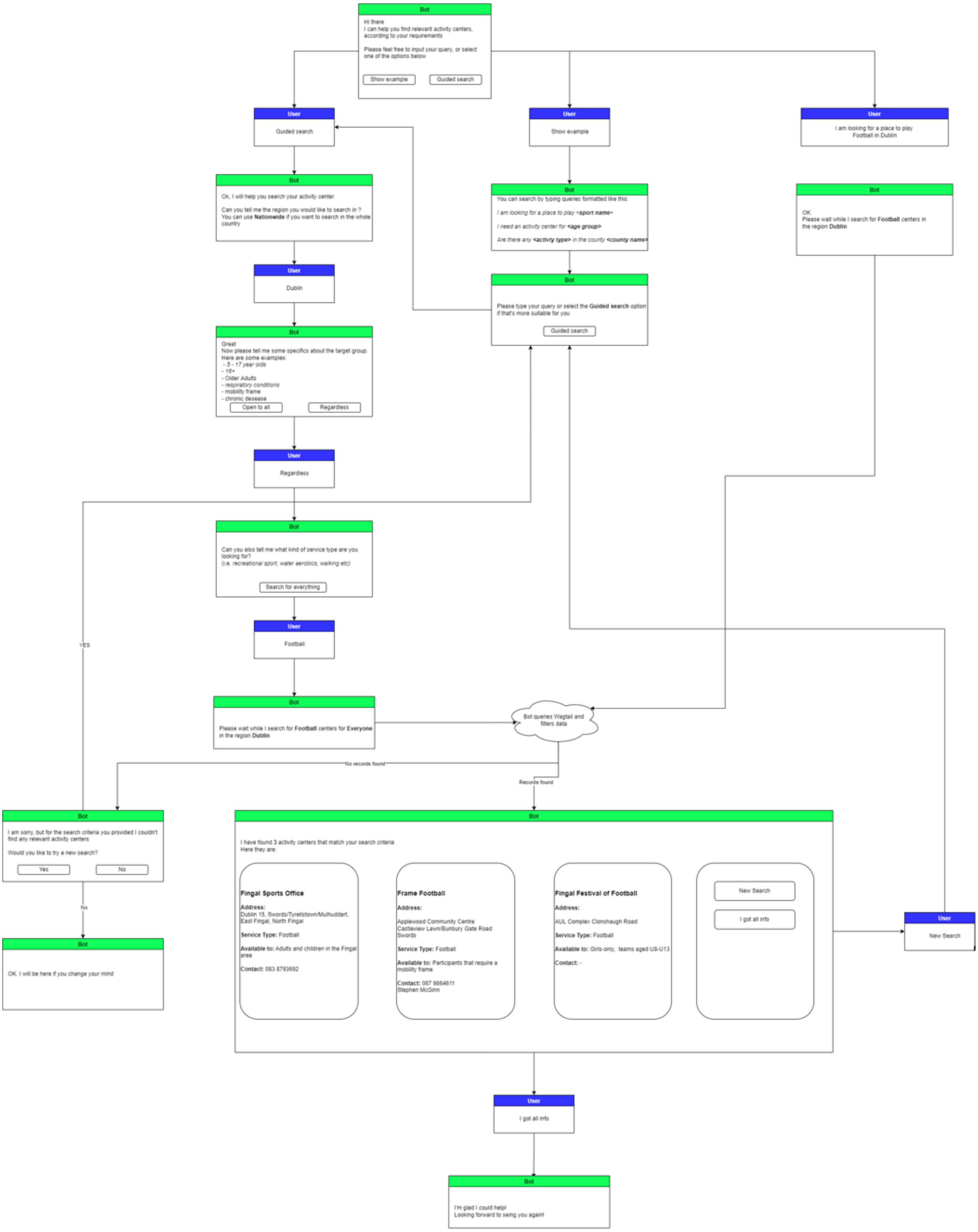
UiPath facilitated enablement workshops to demonstrate the development of the prototype chatbot. Following configuration with UiPath and HSE DCT (Wagtail integration), the Project Team conducted UAT on the chatbot test site (cf. Figure 14). This provided the Project Team with an opportunity to review the chatbot at an early stage of its development and return feedback to UiPath. The use cases were created from a healthcare provider and patient perspective for the benefit of the developer.

Figure 14: Example of a high-level use case

Use Case Number	**2**
Persona	45-year-old male, not linked to healthcare services, who is looking to get more active in January
HealthCare Management or Situation	Wants to join an exercise group with other men or join a social sports team as a new year's resolution. Used to be very active in his 20s but has fallen out of the habit of regular exercise. Overweight, no other health conditions
Communications or System Interaction	Search example by keyword: Age 45, Men's, football, running, return to sport
Potential outputs	Direct website: "Men on the Move" program, Fingal Sports Office Football program, https://www.parkrun.ie *Sample Text* "Men on the Move" is a free physical activity programme for men who have been inactive for a sustained period and want to get back to exercising in a social environment. Please contact david.phelan6@mail.dcu.ie directly for further information about how to join. Looking to join a football team for a kickabout? Contact Paul Breen on 083 8793692 for more information about social football leagues in your area. Parkrun is a series of 5k runs/walk held on Saturday mornings at 9.30am in areas of open space around Ireland. They are open to both runners and walkers, free, and are safe and easy to take part in. Please click the link below for more information https://www.parkrun.ie

These use cases identified several issues with syntax, keywords and synonyms, which the Project Team needed to revise and amend. This iterative approach enabled the Project Team to meet with the developer to ensure alignment on functional and technical aspects of the chatbot. From this exercise, stakeholders agreed the workflow for the chatbot (cf. Figure 15).

Figure 15: Chatbot workflow



2.6.1 Use of Synonyms

Early consideration should be given to including keywords and synonyms in the dataset. This would enable the chatbot to optimise retrieval of relevant physical activity resources and identify the most appropriate results. In the case of our chatbot, the search function is made using the entire construction, input by the user and is not broken down into words that will be searched individually. So, if a user inputs “walking group”, the chatbot will look for the whole construction as opposed to searching “walking” and “group” separately in the dataset provided. Consequently, there is a need for a clear set of attributes, especially if there is a multifactor construction related to service criteria e.g. “adultover55”.

An iterative approach to creating a list of synonyms and keywords associated with defined attributes was agreed with the developers. UiPath used their software, without the need for editing the dataset on Wagtail to include this information on the chatbot. An alternative approach would have been to engage the HSE DCT to have this modified on Wagtail. This would involve changing the search function to “contains” instead of “equals”.

The project team highlight two columns “service_available_to” (cf. Figure 16) and “service_type” (cf. Figure 17), removed duplicates and then added a list of synonyms for each of these to help overcome this potential issue.

Figure 16: Raw data of “service_available_to”

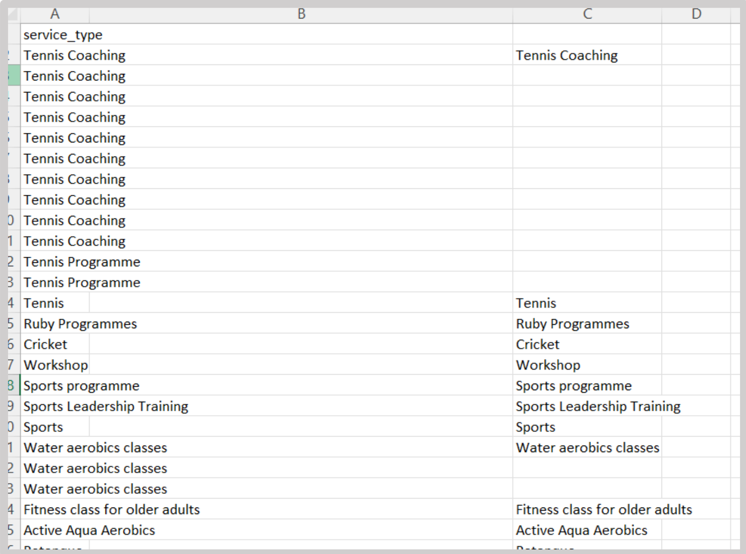
AG
service_available_to
5-17 year olds
5-17 year olds
5-17 year olds
5-17 year olds
5-17 year olds
5-17 year olds
5-17 year olds
5-17 year olds
5-17 year olds
5-17 year olds
Fingal County Council Staff
Fingal County Council Staff
Schools and tennis clubs
Primary and secondary schools
Leinster
Parents
Children
18+?
55+ year olds?
Over 55s/Fingal residents
Over 55s/Fingal residents
Over 55s/Fingal residents

Figure 17: Raw data of “service_type”

AE
service_type
Tennis Coaching
Tennis Coaching
Tennis Coaching
Tennis Coaching
Tennis Coaching
Tennis Coaching
Tennis Coaching
Tennis Coaching
Tennis Coaching
Tennis Coaching
Tennis Programme
Tennis Programme
Tennis
Ruby Programmes
Cricket
Workshop
Sports programme
Sports Leadership Training
Sports
Water aerobics classes
Water aerobics classes
Water aerobics classes
Fitness class for older adults
Active Aqua Aerobics

We first created two separate .csv files of these two columns, using one .csv file per column. Starting with “service_type”, we first removed all duplicates from the list (cf. Figure 18).

Figure 18: Identification of duplicates



A	B	C	D
service_type			
Tennis Coaching		Tennis Coaching	
Tennis Coaching			
Tennis Coaching			
Tennis Coaching			
Tennis Coaching			
Tennis Coaching			
Tennis Coaching			
Tennis Coaching			
Tennis Coaching			
Tennis Coaching			
Tennis Programme			
Tennis Programme			
Tennis		Tennis	
Ruby Programmes		Ruby Programmes	
Cricket		Cricket	
Workshop		Workshop	
Sports programme		Sports programme	
Sports Leadership Training		Sports Leadership Training	
Sports		Sports	
Water aerobics classes		Water aerobics classes	
Water aerobics classes			
Water aerobics classes			
Fitness class for older adults		Fitness class for older adults	
Active Aqua Aerobics		Active Aqua Aerobics	

We then removed the original list (cf. Figure 19), leaving us with no duplicated data (cf. Figure 20).

Figure 19: Use of “Remove Duplicates”

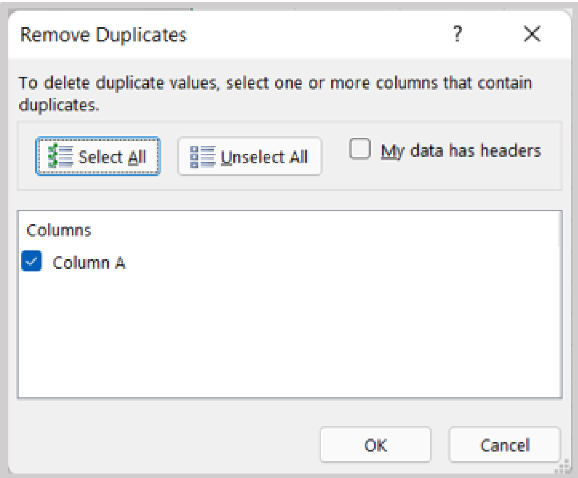
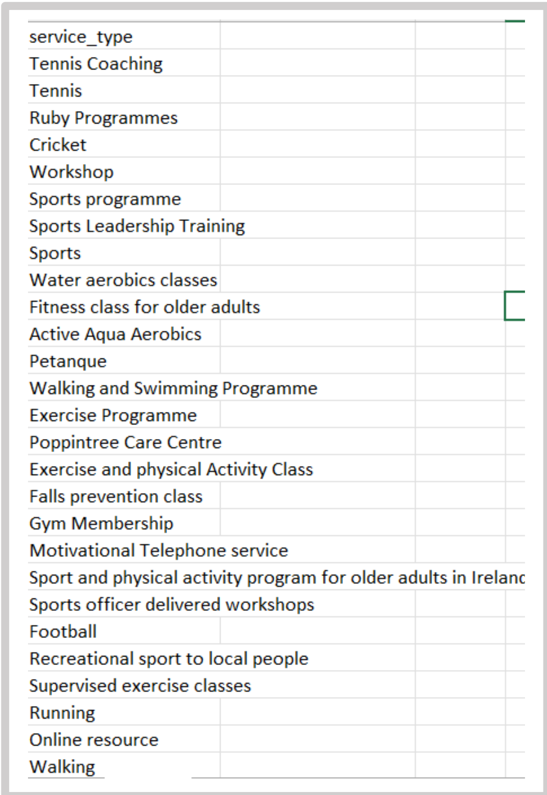


Figure 20: New version of “service type” with no duplicated items



service_type
Tennis Coaching
Tennis
Ruby Programmes
Cricket
Workshop
Sports programme
Sports Leadership Training
Sports
Water aerobics classes
Fitness class for older adults
Active Aqua Aerobics
Petanque
Walking and Swimming Programme
Exercise Programme
Poppintree Care Centre
Exercise and physical Activity Class
Falls prevention class
Gym Membership
Motivational Telephone service
Sport and physical activity program for older adults in Irelanc
Sports officer delivered workshops
Football
Recreational sport to local people
Supervised exercise classes
Running
Online resource
Walking

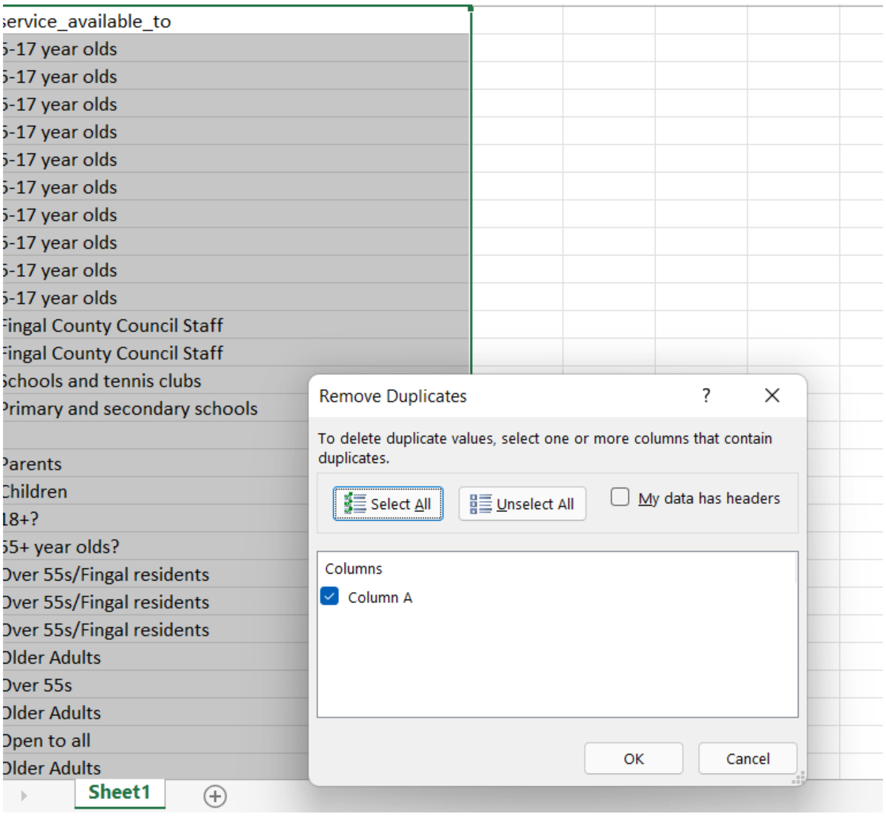
We then listed a range of possible synonyms for these **categories** in the corresponding row (cf. Figure 21).

Figure 21: Listing of synonyms for "service_type

service_type	
Tennis Coaching	|tennis| |tennis_coaching| |coaching|
Tennis	|tennis| |tennis_coaching| |coaching|
Ruby Programmes	|rugby| |rugby_coaching|
Cricket	|cricket| |cricket_coaching|
Workshop	|workshops| |training|
Sports programme	|sports_program|
Sports Leadership Training	|training_program| |leadership_training| |leadership|
Sports	|all_sports|
Water aerobics classes	|aqua_aerobics| |water_aerobics|

This process was repeated for the "service_available_to" (cf. Figure 22), removing all duplicates and then creating our list of synonyms.

Figure 22: Removal of duplicates for "service_available_to"



2.6.2 Standardisation of Address Attributes

The software developers, UiPath, highlighted that the current structure of addresses had some inconsistencies. The chatbot had been taking information from “service_area” not “address1” “address2” “address3” (cf. Figure 23). Therefore, the current version of the chatbot is only able to search under “Dublin” or “Nationwide” as these are the only two options under “service_area”. This was chosen as there were blank spaces and inconsistencies in how addresses were structured, with some addresses only having three levels and others two.

The possibility of using geolocation data was discussed with the developer e.g. to avoid a situation where someone searching for a group in one area receives no results but there is an existing service in a geographically close area. This was out of scope of the current version of this project but could be included in a future iteration if the website hosting the chatbot made the user’s global co-ordinates accessible. It could then give coordinates to the chatbot and allow it to identify services near the user in a specific distance range.

Figure 23: Standardisation of location attributes

O	P	Q	R	S	T	U	V
address1	address2	address3	eircode	google_pl	geolongitu	geolattituc	service_area
National Aquatic Centre	Sports Ireland Campus	Snugborough Road					Dublin
Santry Community Resource Centre	Domville Court	Santry					Dublin
Ballymun Sports & Fitness Centre	Main st	Ballymun					Dublin
Ellenfield Park	Whitehall						Dublin
Darndale and Coolock							Dublin
Clontarf and East Wall							Dublin
Poppintree Community Sports Centr	Balbutcher Lane North	Poppintree					Dublin
it can be an aerobic class from a coı	St Benedictâ€™s	Estuary Road	Dublin County				Dublin
Inspire Fitness Centre	Deaf Village Ireland	Ratoath Road					Dublin
National Sports Campus	Snugborough Road	Blanchardstown					Dublin
							Dublin
							Nationwide
		Fingal					Dublin
Dublin 15, Swords/Tyrellstown/Mulhuddart, East Fingal, North Fingal							Dublin
Fingal area							Dublin
Dublin City Council area							Dublin
							Dublin
Nationwide							Nationwide
Nationwide							Nationwide
Nationwide							Nationwide
Nationwide							Nationwide
Applewood Community Centre	Castleview Lawn/Bunbury Gat	Swords					Dublin
							Dublin
Drynam Golf Academy	Kinsealy						Dublin
							Dublin
Nationwide							Nationwide
AUL Complex	Clonshaugh Road						Dublin

In summary, the benefits of an iterative approach to data preparation include:

- → Standardised uniform process to facilitate new and existing dataset specifications
- → Quality assurance process for new and existing dataset specifications
- → Opportunity for early input from downstream functions to enhance service planning, analytics and reporting
- → Reduction in costs due to errors and omissions in dataset specifications.

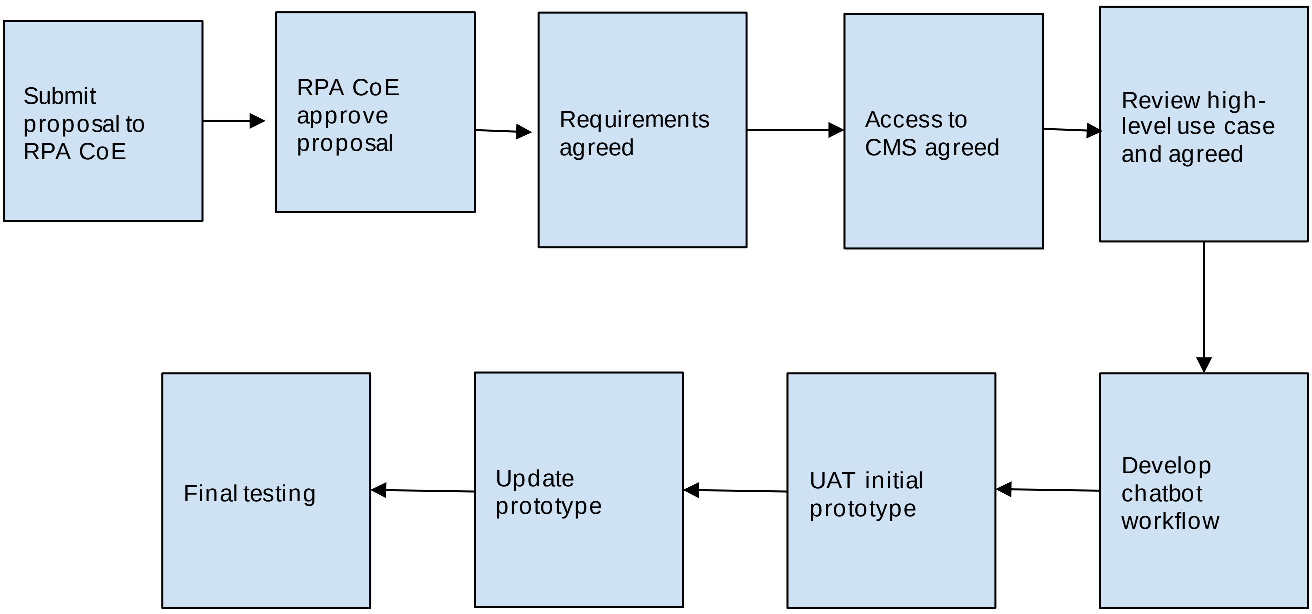
Section 3: Critical Tasks

This section outlines the other tasks that were necessary to complete the delivery of the chatbot.

3.1 Overview of Critical Tasks

This section outlines tasks, outside of the data preparation, that we identified as critical to the delivery of the prototype chatbot. Figure 24 outlines the critical stages that needed to be completed in order to produce a minimal viable prototype chatbot. Each task will be discussed and supported with evidence.

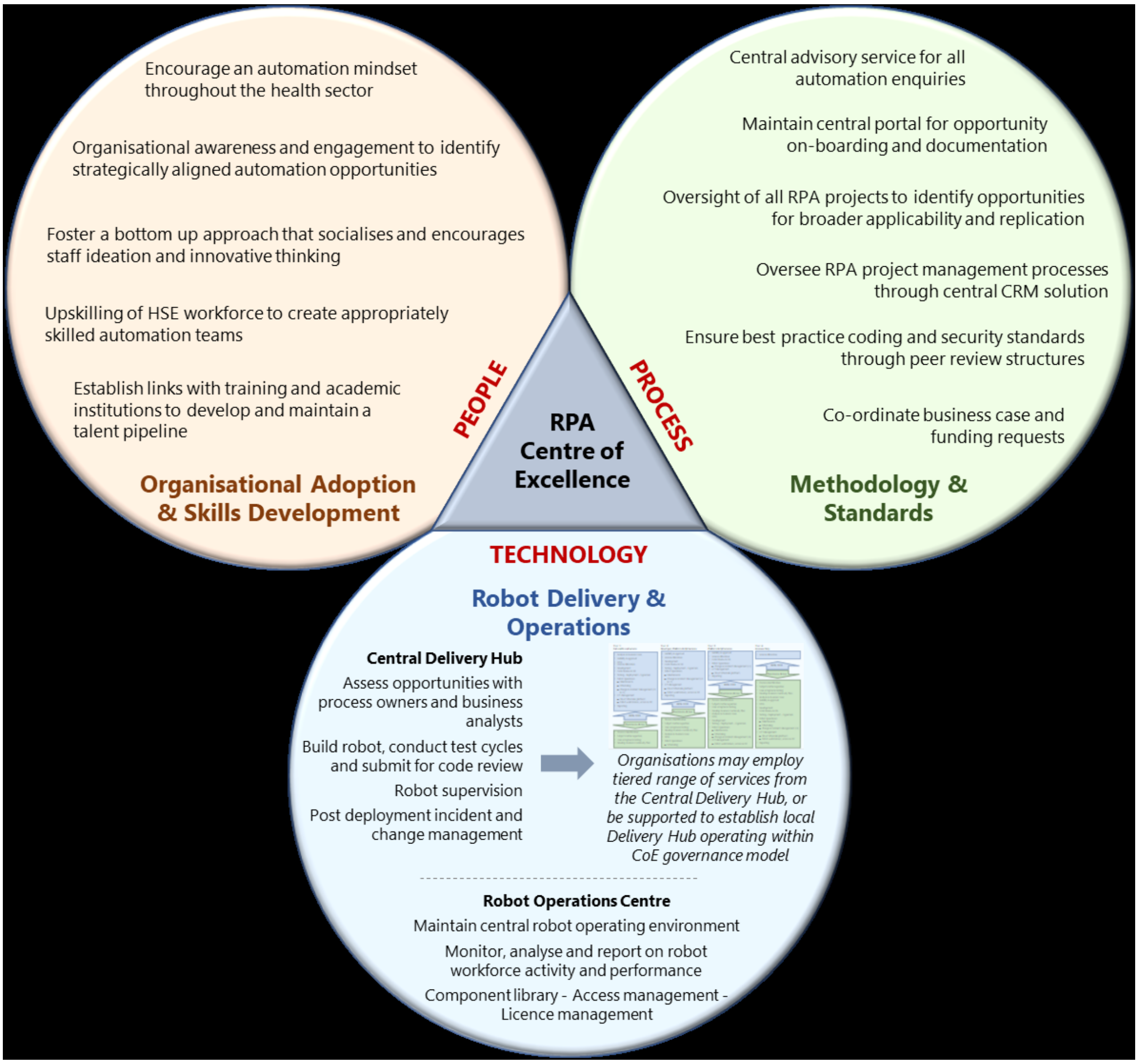
Figure 24: Critical tasks



3.2 Proposal Submission

The HSE RPA CoE is a shared service function that provides management and oversight to the rollout of RPA across the health service. The CoE has overall responsibility for the rollout of RPA within the HSE. In order to develop any RPA technology within the HSE, a project must first get approval from the HSE RPA CoE, whose operational model is outlined in Figure 25.

Figure 25: Model for HSE RPA CoE (HSE, 2022)[5]

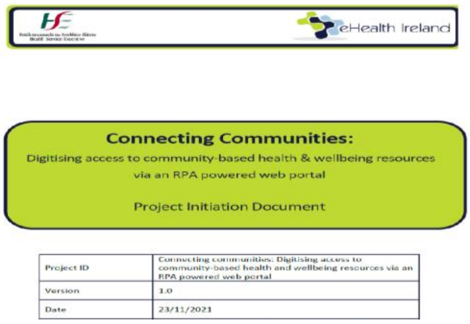


[5] HSE (2022). *RPA Operating Model, HSE RPA Centre of Excellence.* Available: https://www.hse.ie/eng/about/who/healthbusinessservices/hbs-business-relationship-management/robotic-process-automation-rpa-centre-of-excellence-coe-.html. [Accessed 26 April 2022.]

As this was a proof of concept, we initially pitched our idea using an animated video (cf. Figure 26) which explained the idea in principle. This was then followed up by a submission made in the form of a project initiation document (PID) (cf. Figure 27) and a modified business case.

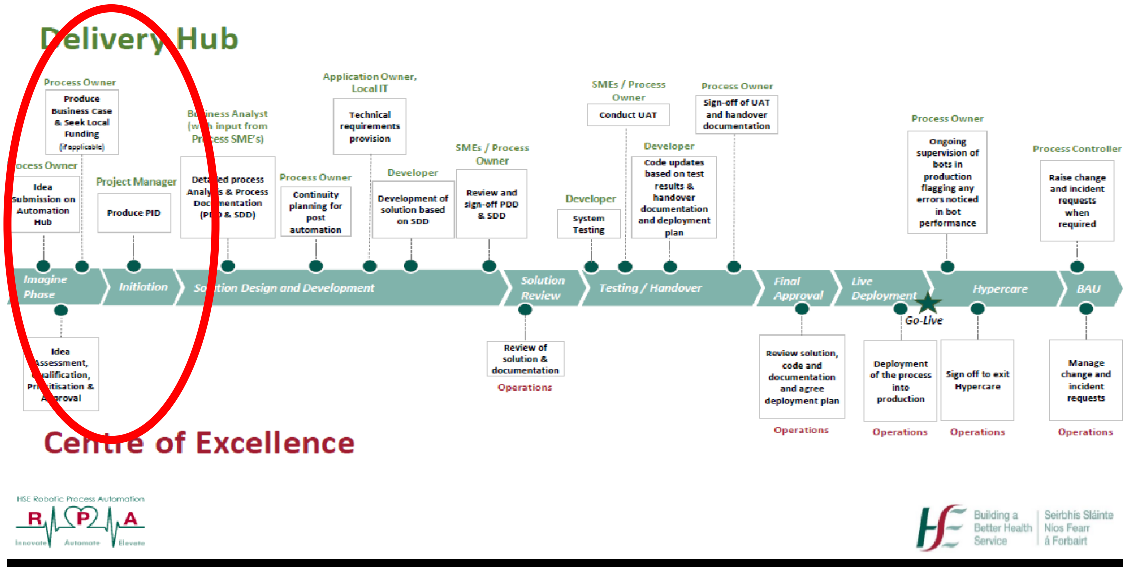
Figure 26: Screen shot from animated video

Figure 27: PID



The standard process for submission of ideas to the RPA CoE is shown in Figure 28. Highlighted in red is the point of the process where the idea is submitted.

Figure 28: Process of approval by RPA CoE (HSE, 2021)[6]



[6] HSE (2021). *Delivery Hub Establishment: RPA Delivery Hub.* Available: https://www.hse.ie/eng/about/who/healthbusinessservices/hbs-business-relationship-management/robotic-process-automation-rpa-centre-of-excellence-coe-.html. [Accessed 26 April 2022.]

3.3 Establish a Multi-Service Team

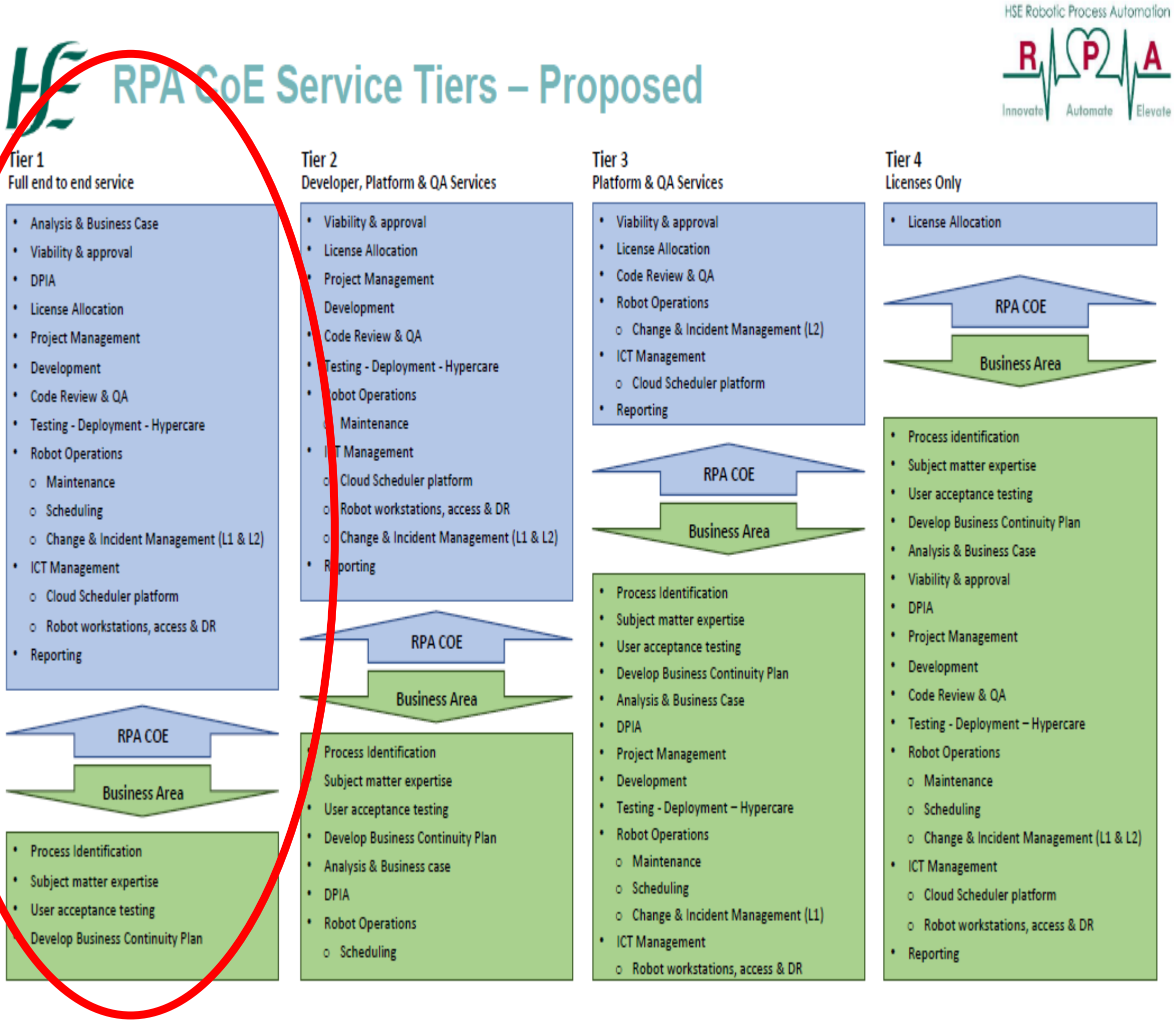
Building a chatbot requires engagement from a specific set of stakeholders, ensuring the necessary service teams are engaged and committed to the project is essential before any project can commence. The key partners in this case study were as follows:

- **Service Sponsor**: Any chatbot will be accessing information that relates to a particular service area or organisation. This partner will provide the source information and will be the final arbiter on quality and accuracy of the output of any chatbot. It is essential that appropriate resources and senior decision makers are dedicated to the project from the outset up to final testing/delivery.

- **HSE Digital Communications Team**: In order to deliver a chatbot that integrates with the HSE central communication database, the HSE DCT must be engaged and grant approval. In order for any digital system or service, such as a chatbot to access data stored on this CMS, it must be granted access to an application programming interface (API). The CMS used by the HSE, Wagtail, utilises SQLite code to create its database. Any new dataset that is to be uploaded onto the HSE's CMS must be migrated from its current format, in our case Excel onto SQLite.

- **HSE RPA Centre of Excellence**: As outlined in section 3.2, any RPA project within the HSE requires approval from the RPA CoE. The license to run and operate any form of chatbot within the HSE is held by the CoE and access can only be gained after approval from the CoE. A key stage to agreement on the type of service provided by the CoE must be agreed in advance. The tiers of service provided by the RPA CoE are shown in Figure 29. This prototype was delivered under a Tier 1 model. Costs differ with each service tiers and this should be taken into account at the outset of any chatbot project.

Figure 29: HSE RPA CoE service tiers (HSE, 2022)[7]



- **Software Development team:** In this case study the software development work was carried out by UiPath. It was necessary to have frequent discussions with the developers to ensure agreement on scope, deliverables, timelines, and requirements at the earliest point possible. If any of the above teams are not fully engaged and resourced to deliver on a chatbot project, it will not be possible to deliver any functional technology within a reasonable timeline.

[7] HSE (2022). *RPA Operating Model, HSE RPA Centre of Excellence.* Available: https://www.hse.ie/eng/about/who/healthbusinessservices/hbs-business-relationship-management/robotic-process-automation-rpa-centre-of-excellence-coe-.html. [Accessed 26 April 2022.]

3.4 Agree Requirements

One of the initial tasks in the project was to agree on a refined set of functional requirements that could be delivered with the resources available and within the time limits stipulated. For this task, the key stakeholders in this regard were the Project Team, the HSE DCT and HSE RPA CoE. The original submission outlined 35 functional requirements for the prototype chatbot across 10 criteria. The original functional requirements are in Appendix 2.

Based on these discussions, the following functional requirements criteria were removed:

- Deploying the chatbot across multiple social media channels
- Automating the updating of the source data
- Delivering a website to host the chatbot
- Integrating with Amazon Connect API for a cloud-based solution.

Obtaining this consensus early on in the project was essential to ensuring that a prototype could be delivered within the given timeframe and resources. The removal of these requirements were related to the capabilities of the hosting environment as well as the time available for development and testing. Such considerations should be taken into account at the earliest opportunity.

3.5 Agree Access to CMS

Accessing the CMS requires agreement on the technical set up between the chatbot developers and the data hosts, in this case the HSE DCT. It is crucial that the test and host environments are agreed and that the technical requirements for accessing data are clear on both sides. This is a key milestone to achieve for any project team, aiming to deliver a chatbot in the future.

As part of this case study it was agreed that HSE DCT would host a test database on their CMS (Wagtail) and that the chatbot would have access to this test database via a restful API. Each integration would need to be agreed on a project by project basis. Once access to the test environment was established the next stage was to agree the workflow.

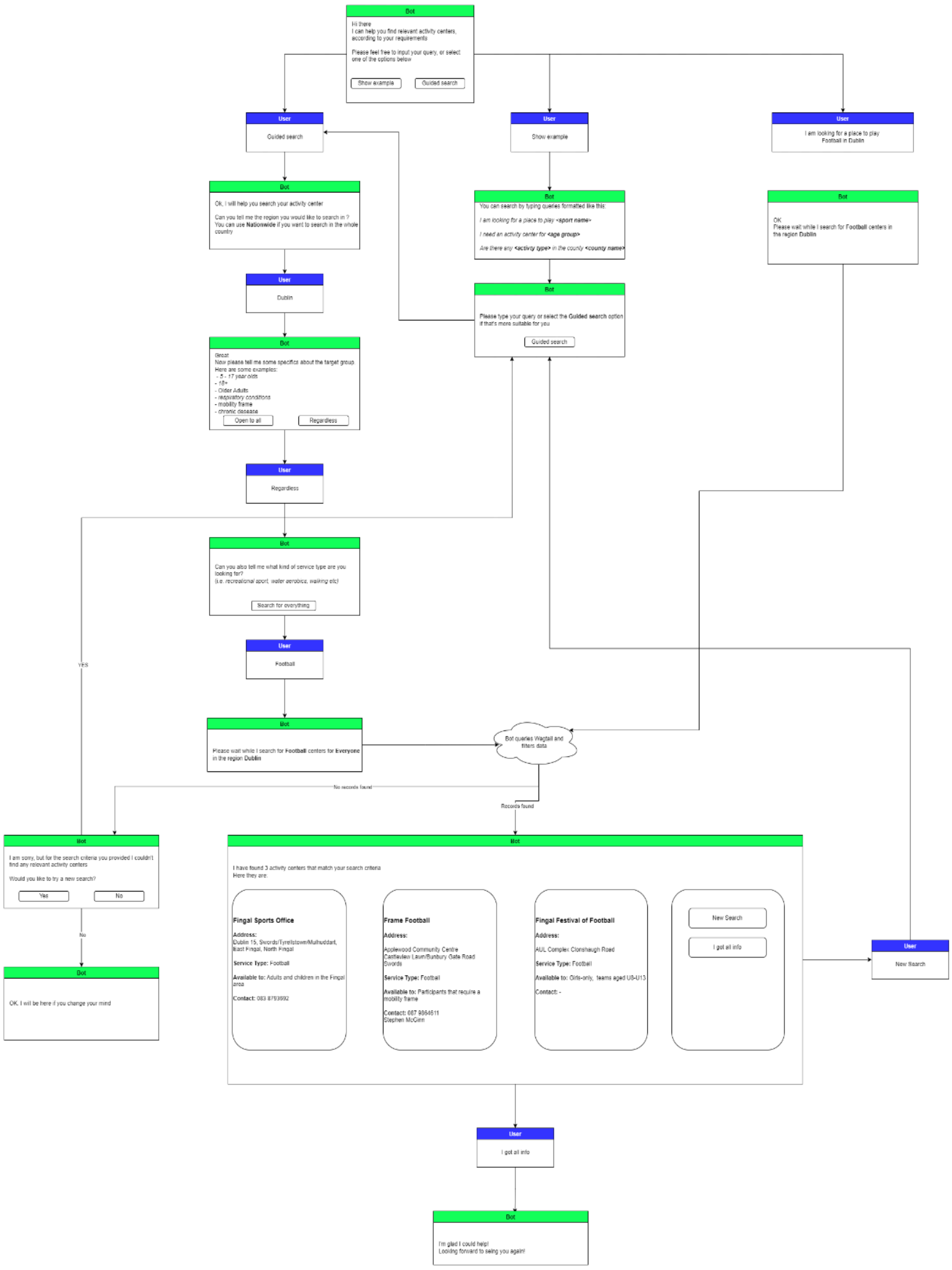
3.6 Agree Chatbot Workflow

The chatbot workflow is a functional visualisation (cf. Figure 31) of the decisions and responses that the chatbot will make and deliver respectively. This workflow formed the basis for the development of the initial prototype and is a key stage in the delivery of the final prototype. The workflow was produced during development workshops and design meetings with the software development team. These discussions were based on analysis of high-level use cases provided by the Project Team. A high-level use case and the resultant workflow are shown in Figure 30 and Figure 31 respectively.

Figure 30: High-level use case

Use Case Number	1
Persona	Primary Care Physiotherapist, working with older adults in the community
HealthCare Management or Situation	Due to discharge client from physiotherapy services after completing rehabilitation post fall. Physiotherapist is looking for a way to link service user with a local exercise group appropriate to the client's needs that will help reduce the risk of future falls and allow the client to stay physically active.
Communications or System Interaction	Search example by keyword: age> 65, walking group, active age group, falls prevention, cardiac condition, respiratory condition, referral needed, medically supervised exercise program
Potential outputs	Direct website: sielbleu.ie , getirelandwalking.ie, exwell.ie, *Sample Text* Siel Bleu run falls prevention classes in your local area. Click the link below to access their website for further information https://www.sielbleu.ie/ There are walking groups running in your local area! Click the link below to view the Facebook page for Get Ireland Walking and you can find your local walking group https://www.facebook.com/getirelandwalking You may be interested in a medical supervised exercise program. You will need a GP or consultant referral to access ExWell Medical, please discuss a referral with your GP or consultant and ask them to email exwellmedical@healthmail.ie.

Figure 31: Chatbot Workflow



3.7 User Acceptance Testing

Once a prototype was delivered, initial UAT is required. This is the earliest set of testing from a business perspective. In this case study, the initial UAT was carried out using a simple template and the cases were designed to cover the range of scenarios where users would interact with the chatbot. This process is not designed to be complete or cover all scenarios, but it is crucial to provide a structure to understanding how the first iteration of the chatbot is functioning, how the data is being accessed, and assessing the look and feel of the chatbot.

The testing was carried out using a template (cf. Figure 32) with a range of scenarios mapped out. In all, 14 test cases were created and these were then altered by four different testers who used different language to ask similar questions of the chatbot.

Figure 32: Test template

Test Case Number	3
Test Case Name	Service Search by type
Test Case Description	Pt/public Search for a service by type
Input	I am looking for a walking group
Excepted Output	The Chabot will return all walking resources stored on the database
Actual Output	

In this case study, the output from the UAT resulted in a change to the structure of the source database in relation to how addresses were recognised (cf. Figure 33). The overall test strategy is outlined in Section 4.

Figure 33: UAT for searching service by location and identifying problem with address retrieval

Test Case Number	5 – WIP – the area/location was matched only on the information "service_area" and not on "address1"/"address2"/"address3". We need to discuss about what fields to use in the search
Test Case Name	Pt search by location
Test Case Description	Pt search by location
Input	What activity can I do in Fingal
Expected Output	service 35-44/
Actual Output	I'm sorry, but I couldn't catch what kind of service you are looking for. Please try with another service or use all sports to search for all services. Doesn't retrieve any information

As a result of executing another test case, a further update was made to the database, relating to the categorisation of service type data by adding a list of synonyms to describe activities. Figure 34 shows the developer feedback from UAT that led to the inclusion of synonyms to search activity.

Figure 34: Learning example from UAT

Test Case Number	4 – WIP – Issue with differentiating between "walking" and "exercise group" when searching for "walking group" ATTENTION: it will be nearly impossible to match "Walking and swimming programme" or "walking workshop" when the search is performed with the keywords "walking group" Chatbot will try to match the entire search construction to something in the list of Service Types. It will not try to search for ANY word.
Test Case Name	Service Search by type
Test Case Description	Pt/public Search for a service by type
Input	Where can I find a walking group
Expected Output	Service by type 3/8/15/31
Actual Output	Only returns service 3 - misses out on 8/15/31

There were also updates to the number and type of results returned when searching for service by condition. In this case the chatbot was looking for a direct match in relation to words rather than words containing a certain phrase Figure 35 demonstrates how this was highlighted during the UAT.

Figure 35: UAT for searching for a service by condition

Test Case Number	10 - WIP – Improving searching of type "contains" instead of "equals"
Test Case Name	health condition case 1
Test Case Description	Pt should be able to search for a service related to their health condition
Input	What services are available for people with Cancer
Expected Output	service 19 - Exwell
Actual Output	The region you specified isn't present in our database of centres. Use nationwide for searching all regions or type a specific region or try to specify a different region.

Each of these examples demonstrate the importance of structuring your UAT and engaging in early and detailed design discussions in relation to chatbot development. A key focus in any project should be getting a working prototype, accessing a small but representative dataset as soon as possible. This approach will yield more meaningful progress than developing a larger dataset or pre-empting functional developments based on theoretical assumptions.

Section 4: Technical Stages of Software Development

4.1 Introduction

This section outlines the key features of the chatbot that was designed as part of this case study. The chatbot was named CORMAC, after the ancient king of Ireland, Cormac Mac Airt who was famed for his wisdom and was said to be the codifier of the Brehon Laws of ancient Ireland.

CORMAC is a digital assistant which is designed to be used on top of existing applications and systems running within the HSE. This solution helps citizens of Ireland locate relevant healthcare services by location, according to their age group, medical condition or desired service type.

At a high-level CORMAC has implemented the following features:

- Named Entity Recognition (NER) – CORMAC is able to extract from user intents the search criteria required to filter the activity centres list
- Integration with the HSE's CMS, Wagtail through a Restful API

This section outlines the following features of CORMAC:

4.2 Channels (cf. Section 4.2)

4.3 User roles (cf. Section 4.3)

4.4 Chatbot skills description (cf. Section 4.4)

4.5 Guided search (cf. Section 4.5)

4.6 Displaying results (cf. Section 4.6)

4.7 Reports and conversation analysis (cf. Section 4.7)

4.2 Channels

The chatbot will be available on the channels highlighted in Figure 36.

Figure 36: Chatbot channels

Bot	User Roles	Bot identity	Channels
CORMAC	Users	- Icon - Background - Avatar - Colors	Web / Internet

4.3 User Roles

The user role that can interact with CORMAC are anonymous citizens who access CORMAC from a public website.

4.4 Chatbot Skills Description

4.4.1 Named Entity Recognition by Service Type

CORMAC has been trained with the following values for Service Type (cf. Figure 37).

Figure 37: Named entity recognition by service type

Id	service_type	Synonyms
1	Active Aqua Aerobics	|aqua aerobics|water aerobics|
2	Cricket	|cricket|cricket coaching|
3	Education	|educate|learn|class|train|training|
4	Exercise and physical Activity Class	|exercise class|exercise classes|fitness class|fitness classes|
5	Exercise Group	|exercise groups|exercise|fitness group|fitness|
6	Exercise Programme	|physical activity programme|keep fit programme|keep fit class|
7	Falls prevention class	|balance|coordination|
8	Fitness Class	|exercise class|exercise classes|fitness class|fitness classes|
9	Fitness class for older adults	|exercise class|
10	Football	|soccer|
11	Gym Membership	|gym|workout|
12	Motivational Telephone service	|motivation|motivate|support|
13	Online resource	|internet|website|
14	Petanque	|bowls|bowling|boules|
15	Poppintree Care Centre	|community sports centre|
16	Recreational sport to local people	|community|fun|teamsports|
17	Rugby Programmes	|rugby|rugbyc oaching|
18	Running	|jogging|run|jog|
19	Sport and physical activity program for older adults in Ireland	|sport|sports|exercise|fitness|olderpeople|old|elderly|
20	Sports	|all sports|
21	Sports Leadership Training	|training program|leadership training|leadership|
22	Sports officer delivered workshops	|workshops|training|
23	Sports programme	|sports program|

24	Supervised exercise classes	|exercise class|exercise classes|fitness class|fitness classes|
25	Tai Chi classes	|low intensity|shadow boxing|
26	Tennis	|tennis|tennis coaching|coaching|
27	Tennis Coaching	|tennis|tennis coaching|coaching|tennis club|
28	Walking	|hiking|
29	Walking and Swimming Programme	|walking|walking and swimming|swimming|walk|swim|
30	Walking workshop	|walk|walking group|
31	Water aerobics classes	|aqua aerobics|water aerobics|
32	Workshop	|workshops|training|

Using NER, CORMAC can identify the service type from user intents (cf. Figure 38).

Figure 38: Named entity recognition by service type from user intents

I am looking for a place to play [[ServiceType]].service_type
are there any [[ServiceType]].service_type places
are there special places for [[ServiceType]].service_type
I love [[ServiceType]].service_type where can I do that
I am interested in [[ServiceType]].service_type and want to see where I can do that
what options are there for [[ServiceType]].service_type
can I see a list of [[ServiceType]].service_type places
what centers have [[ServiceType]].service_type activities
I would like to improve my [[ServiceType]].service_type where can I do that
where are the [[ServiceType]].service_type clubs?

4.4.2 Named Entity Recognition by Group Type

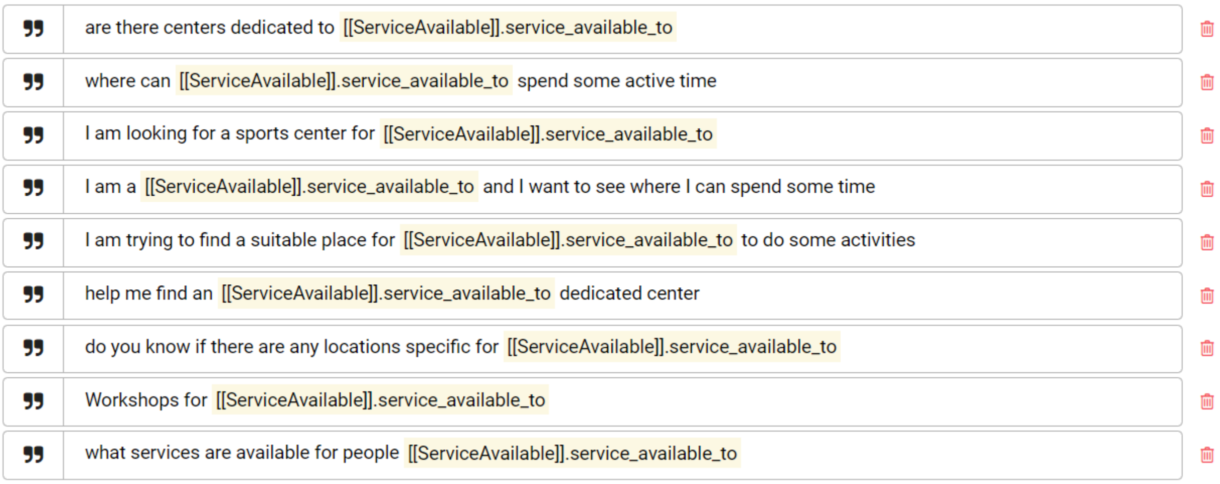
CORMAC has been trained with the following values of the target group i.e. (service_available_to) in the dictionary (cf. Figure 39).

Figure 39: Named entity recognition by group type

Id	service_available_to	Synonyms
1	18+?	|over 18|adult people|persons over 18|
2	5-17 year olds	|school aged children|aged 5 to 17|
3	55+ year olds?	|older adults|55+|65+|
4	Adult runners, adult walkers	|adult runners|adult walkers|over 55|over 60|over 65|
5	Adults and children in the Dublin City Council area	|Dublin City Council residents|
6	Adults and children in the Fingal area	|Fingal residents|living in Fingal|
7	Adults with chronic disease	|adults with chronic disease|adults with chronic illness|
8	Adults with respiratory conditions, cardiac conditions, diabetes or cancer	|adults with respiratory conditions|adults with chest problems|adults with cardiac conditions|adults with heart problems|adults with diabetes|diabetic adults|adults with cancer|
9	Children	|school aged children|5 to 12 year olds|12 to 17 year olds|
10	Children and adults with a visual impairment	|all age groups|visually impaired|
11	Coaches, volunteers, youth staff, summer project co-ordinators in the Fingal area	|coaches|volunteers|youth staff|project coordinators|Fingal|
12	Fingal County Council Staff	|Fingal staff|
13	Girls-only	|school aged girls|girls aged 12 to 17|
14	Healthcare professionals	|ordering health promotion materials|
15	Men only	|men-only|adult males|
16	Older Adults	|older adults|55+|65+|
17	Open to all	|open to all|all ages|
18	Over 55s	|older adults|55+ year olds|55+|65+|
19	Over 55s/Fingal residents	|older adults Fingal|living in Fingal|
20	Parents	|parents|guardians|
21	Participants that require a mobility frame	|mobility frame|walking aid|outdoor walker|dour wheeled walker|
22	Primary and secondary schools	|school aged children|primary school|secondary school|
23	Schools and tennis clubs	|school aged children|tennis club members|

Using NER, CORMAC can identify the service type from user intents (cf. Figure 40).

Figure 40: Named entity recognition by service from user intents



4.4.3 Recognising Locations

CORMAC has been trained with the following values of the Locations Dictionary (cf. Figure 41).

Figure 41: CORMAC's use of values from the Locations Dictionary

Id	service_area
1	Applewood Community Centre Castleview Lawn/Bunbury Gate Road Swords
2	AUL Complex Clonshaugh Road
3	Balbriggan
4	Baldoyle
5	Ballybough Community Centre Ballybough
6	Ballymun Sports & Fitness Centre Main st Ballymun
7	Blanchardstown
8	Carpenterstown
9	Clontarf (CCA) Clontarf
10	Clontarf and East Wall
11	Corpus Christi Parochial Hall Home Farm Road Drumcondra
12	Darndale and Coolock
13	Donabate
14	Drynam Golf Academy Kinsealy
15	Dublin

16	Dublin 15, Swords/Tyrellstown/Mulhuddart, East Fingal, North Fingal
17	Dublin City Council area
18	Ellenfield Park Whitehall
19	Erins Isle GAA Club Farnham Drive Finglas
20	Fingal
21	Fingal area
22	Glin Road Sports Complex Glin Road Coolock
23	Hartstown
24	Hazel Lawn 2 -5 Hazel Lawn Blanchardstown
25	Howth
26	Inspire Fitness Centre Deaf Village Ireland Ratoath Road
27	it can be an aerobic class from a combination of seated and standing positions or even a circuit class! St Benedict's Estuary Road
28	Larkhill Scout Den Larkhill Road Whitehall
29	Lusk
30	National Aquatic Centre Sports Ireland Campus Snugborough Road
31	National Sports Campus Snugborough Road Blanchardstown
32	Nationwide
33	Poppintree Community Sports Centre. Balbutcher Lane North Poppintree
34	Portmarnock Sports and Leisure Club Blackwood Lane Portmarnock
35	Santry Community Resource Centre Domville Court Santry
36	Skerries
37	Sportslink Santry Furry Park Santry
38	Swords
39	Swords Tennis Club Castle Grounds Swords

Using NER, CORMAC can identify the service type from user intents (cf. Figure 42).

Figure 42: Named entity recognition for service type by user intents

99	I am looking for something to do in [[ServiceArea]].service_area
99	what activity centers in [[ServiceArea]].service_area are available
99	what can I do in [[ServiceArea]].service_area
99	are there activities available [[ServiceArea]].service_area
99	what kind of activities one can do [[ServiceArea].service_area.
99	show me the activity centers available [[ServiceArea]].service_area
99	I am searching for any places for sport in [[ServiceArea]].service_area
99	i live in [[ServiceArea]].service_area and I am looking for places to spend my time
99	show me all the centers in [[ServiceArea]].service_area
99	what activity can I do in [[ServiceArea]].service_area
99	What is available in [[ServiceArea]].service_area

4.4.4 Identification of Multiple Possible Values from User Intent

The user is not required to use exactly the intents or the values with which chatbot has been trained. The user can formulate the intents in a natural language, using partial words from the dictionaries, and CORMAC will do its best to identify as many possibilities as it can and it will ask the user to select the desired choice (cf. Figure 43).

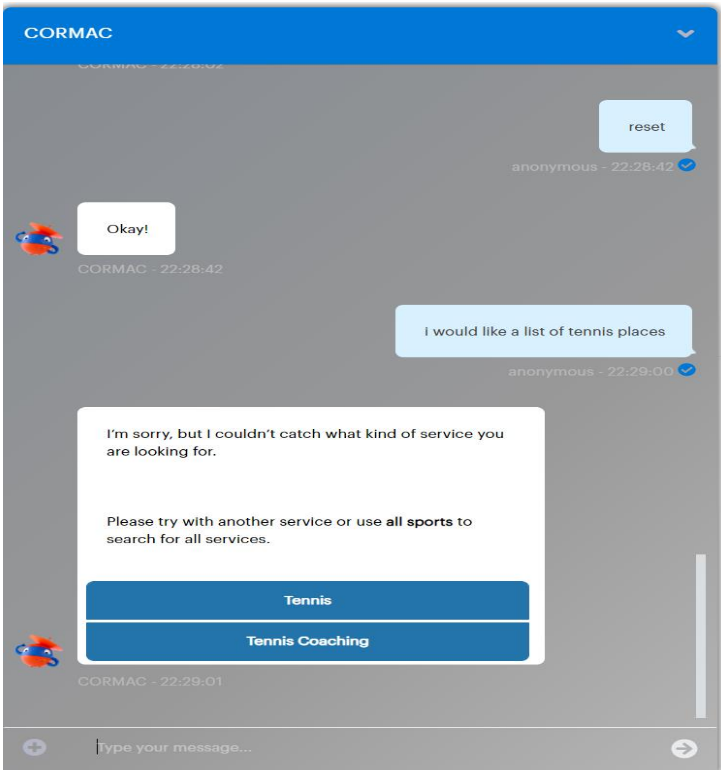
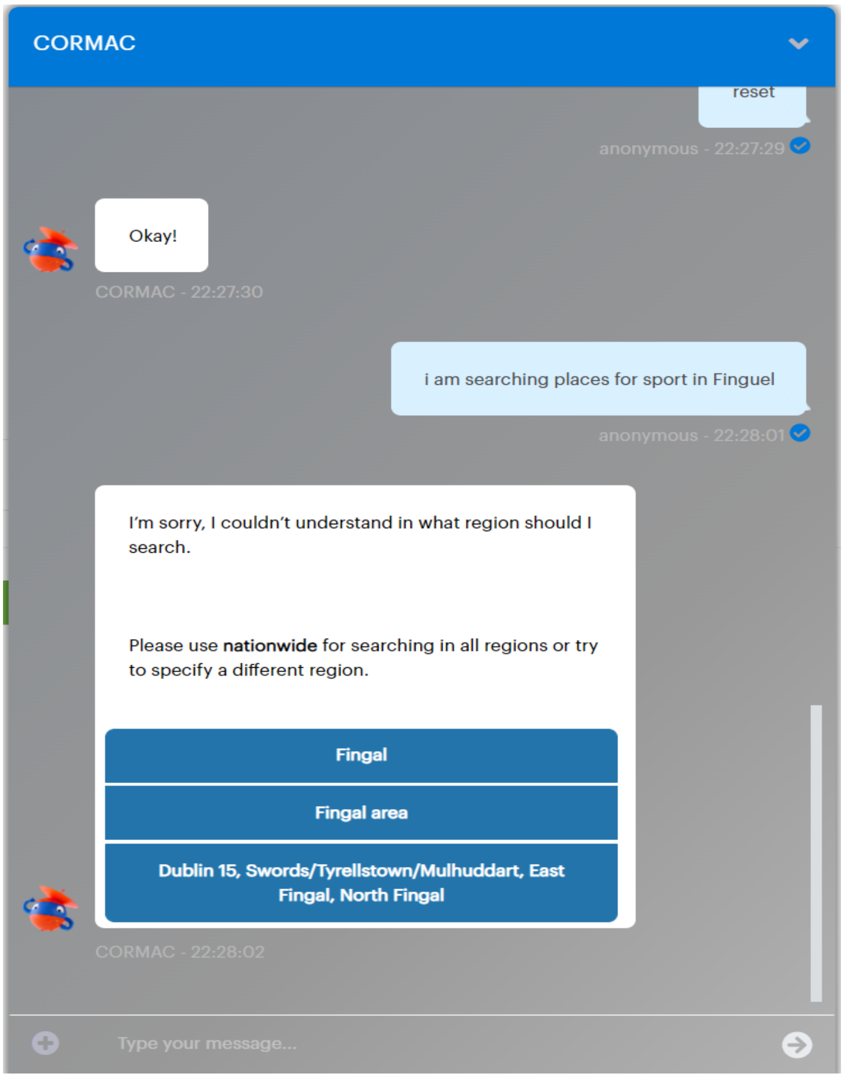


Figure 43:

Identification of multiple possible values from user intent

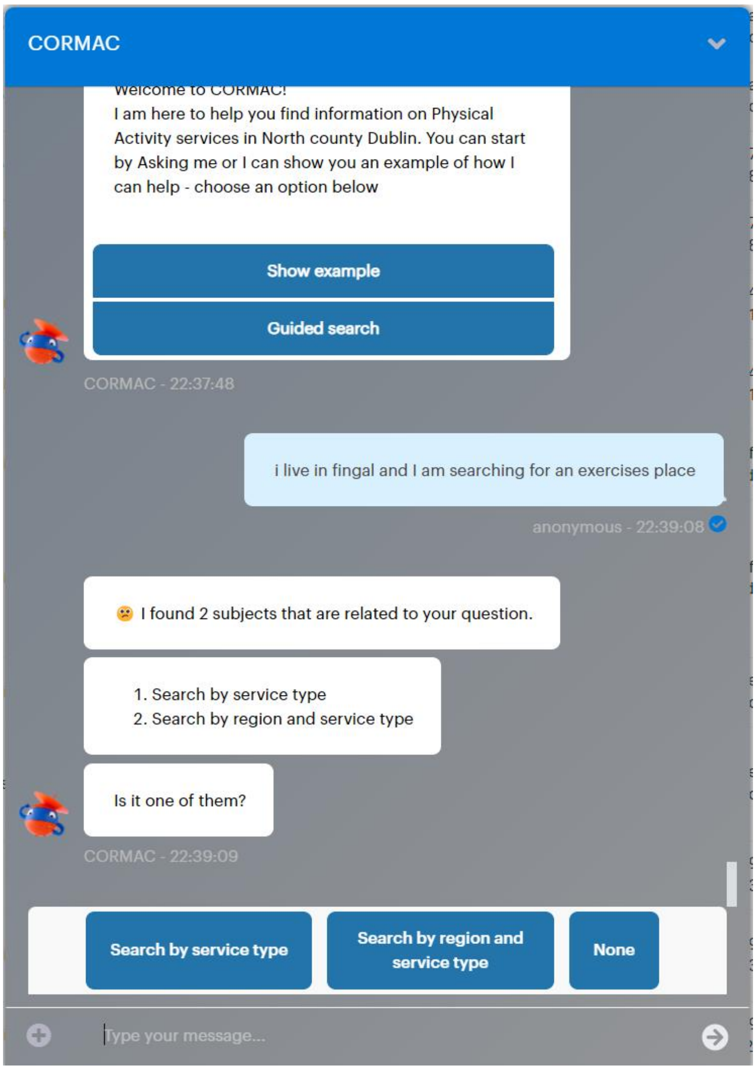
Spelling mistakes are also handled by CORMAC (cf. Figure 44).

Figure 44: CORMAC's handling of spelling mistakes



In case CORMAC gets confused by the user's intent, it will present the user with the possibility to select which type of search he/she wants performed (cf. Figure 45).

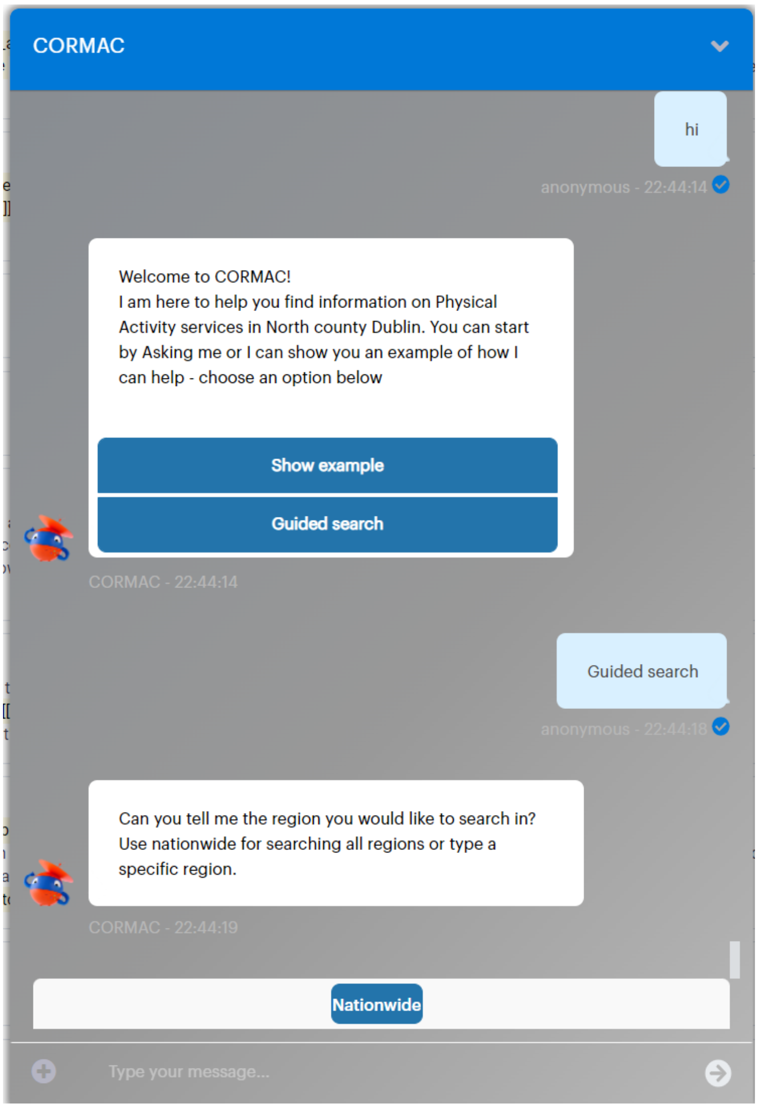
Figure 45: CORMAC offers various search options



4.5 Guided Search

In the welcome message, CORMAC displays the possibility for a user to opt for a guided search (cf. Figure 46).

Figure 46: CORMAC's Guided search



In this guided process, the user is sequentially asked to input values for all the search criteria, in this order:

- Region/Location
- Target group (service_available_to)
- Service type

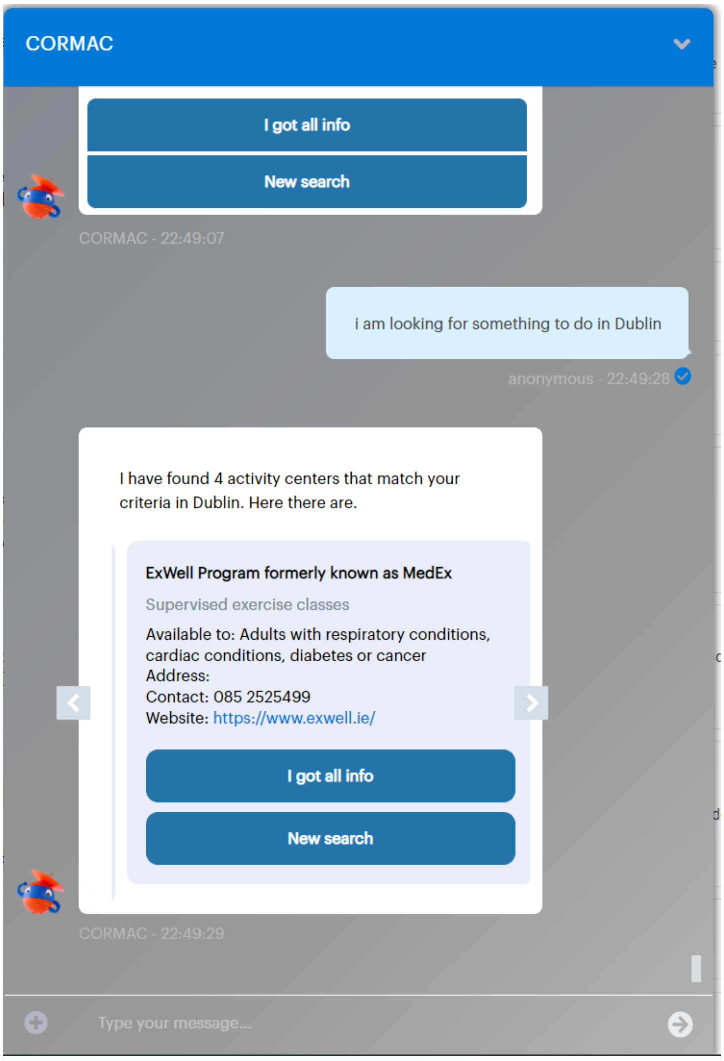
The user has options to skip each of the criteria, by using special keywords:

- "nationwide" – to bypass the location filter
- "all groups" – to bypass the target group filter
- "all sports" – to bypass the service type filter

4.6 Displaying Results

Once all the search criteria are identified by CORMAC, the results are displayed in a carousel of cards, each card being dedicated to one centre (cf. Figure 47).

Figure 47: CORMAC displays results



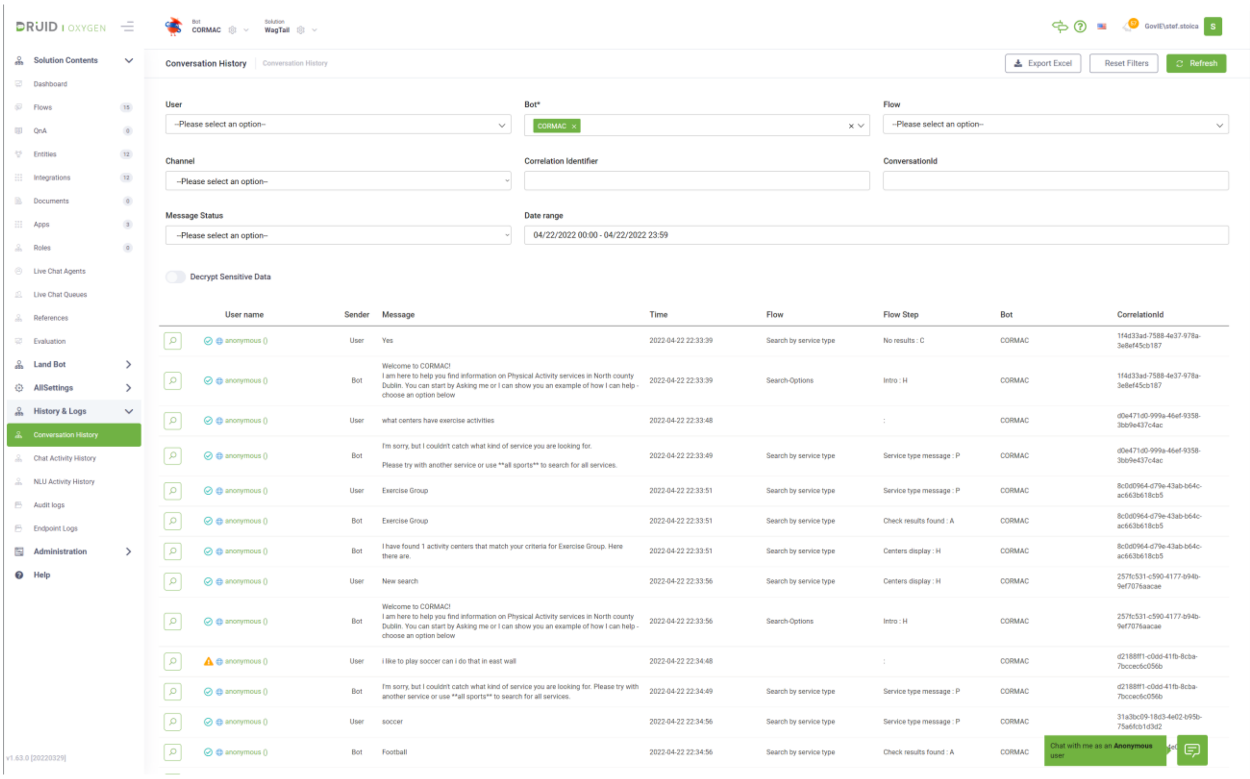
The user can scroll left/right through the list of centres, using the left/right arrows. If the user is satisfied with their results, he/she can click the **I got all info** button and the conversation will close. If the user wants to perform a new search, he/she can click on the **New search** button and all the search criteria will be reset and a new search process will commence.

4.7 Reports and Conversation Analysis

4.7.1 Conversation History

The platform provides the possibility for a privileged user to see the entire conversation history that users had with CORMAC (cf. Figure 48).

Figure 48: CORMAC's Conversation History

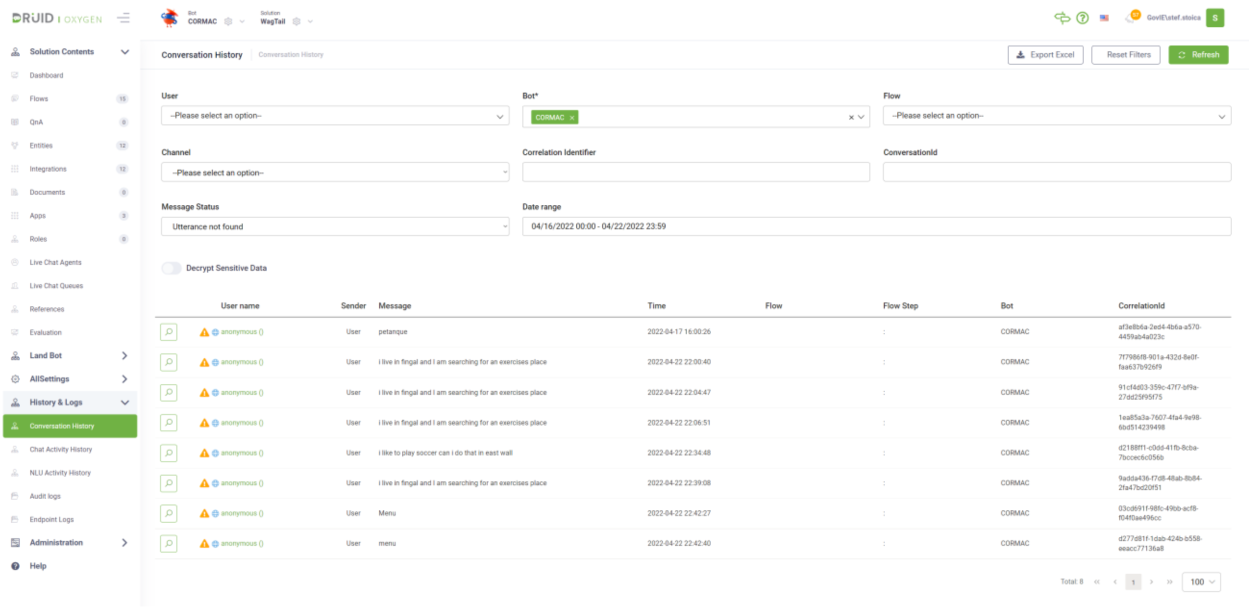


This is helpful in order to identify user behaviour and decide if there are modifications required in the conversational flows.

4.7.2 Intents Not Recognised

The platform offers the possibility to see all the intents that CORMAC has not been able to match to any of the existing flows or training phrases that have been configured.

Figure 49: CORMAC's data for intents not recognised

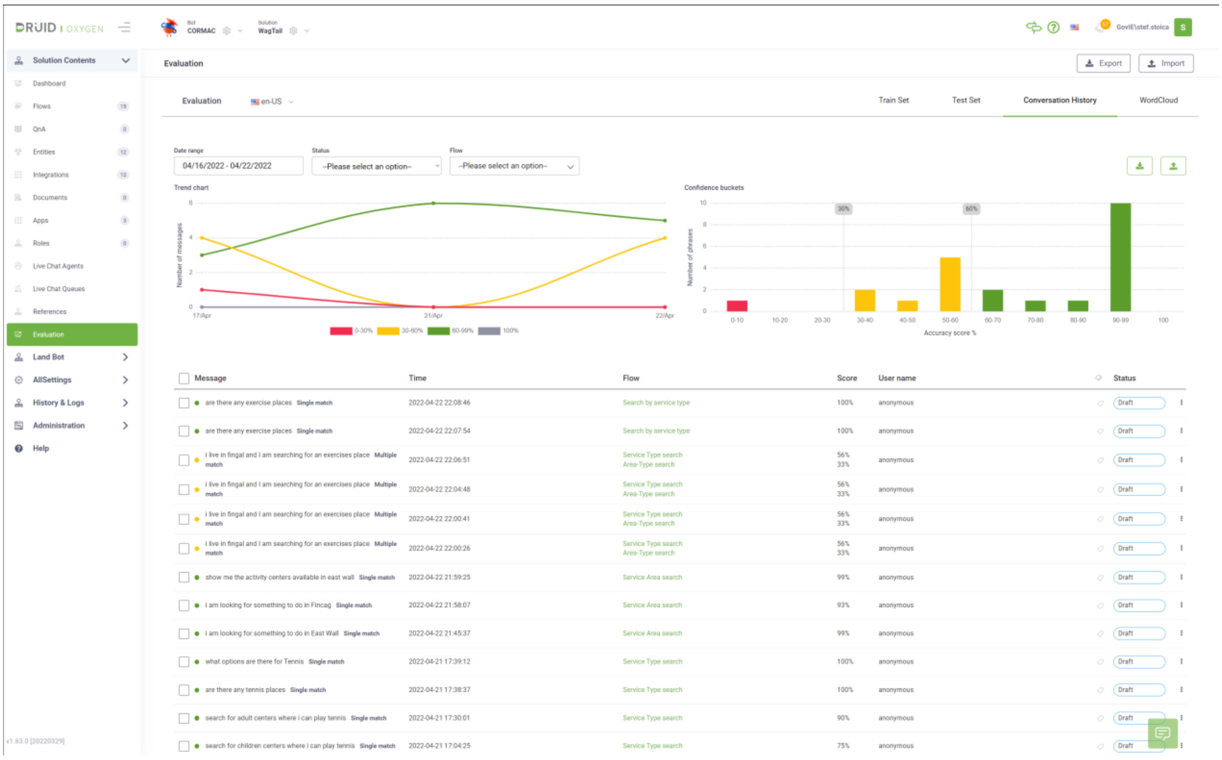


This option is helpful because CORMAC's administrators can easily identify if there are new training phrases that need to be added to the chatbot or if there are new conversational flows that need to be created to handle subjects that are of interest to users.

4.7.3 Conversation Evaluation

The platform offers an Evaluation Tool, which is capable of evaluating how well the chatbot behaves in understanding user intents. The scores are split into accuracy buckets, everything over 60% accuracy being considered correctly identified (this threshold is editable). Everything below 30% accuracy is considered not identified (this threshold is editable). Intents classified between 30 to 60% might be multiple matches (CORMAC matches more than one flow to the user's intent) or can show that there are user intents that are close to an existing flow, but not close enough -> usually this means that an update on the training phrases is required. This tool also allows the CORMAC administrator to add user intents directly as training phrases to any of the existing flows or new flows (cf. Figure 50).

Figure 50: CORMAC Administrator privileges



4.7.4 Dashboard

The platform also offers a monitoring dashboard, where key performance indicators (KPIs) relating to chatbot usage can be monitored (cf. Figures 51-53).

Figure 51: CORMAC's Dashboard (A)

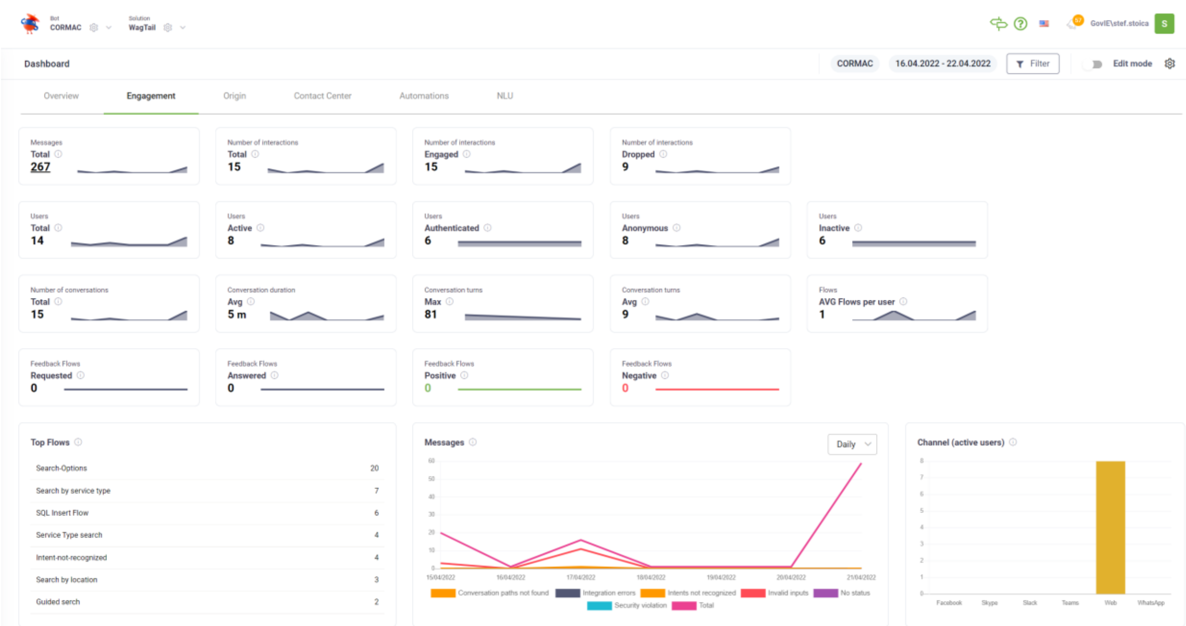


Figure 52: CORMAC's Dashboard (B)

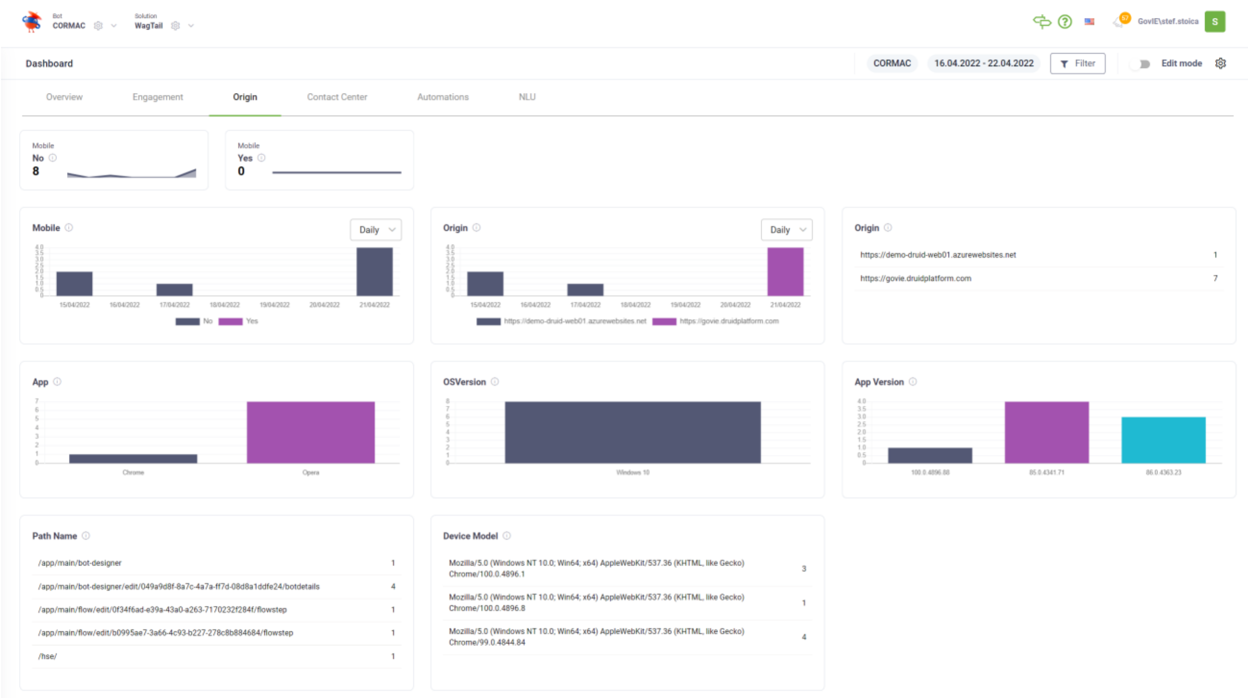
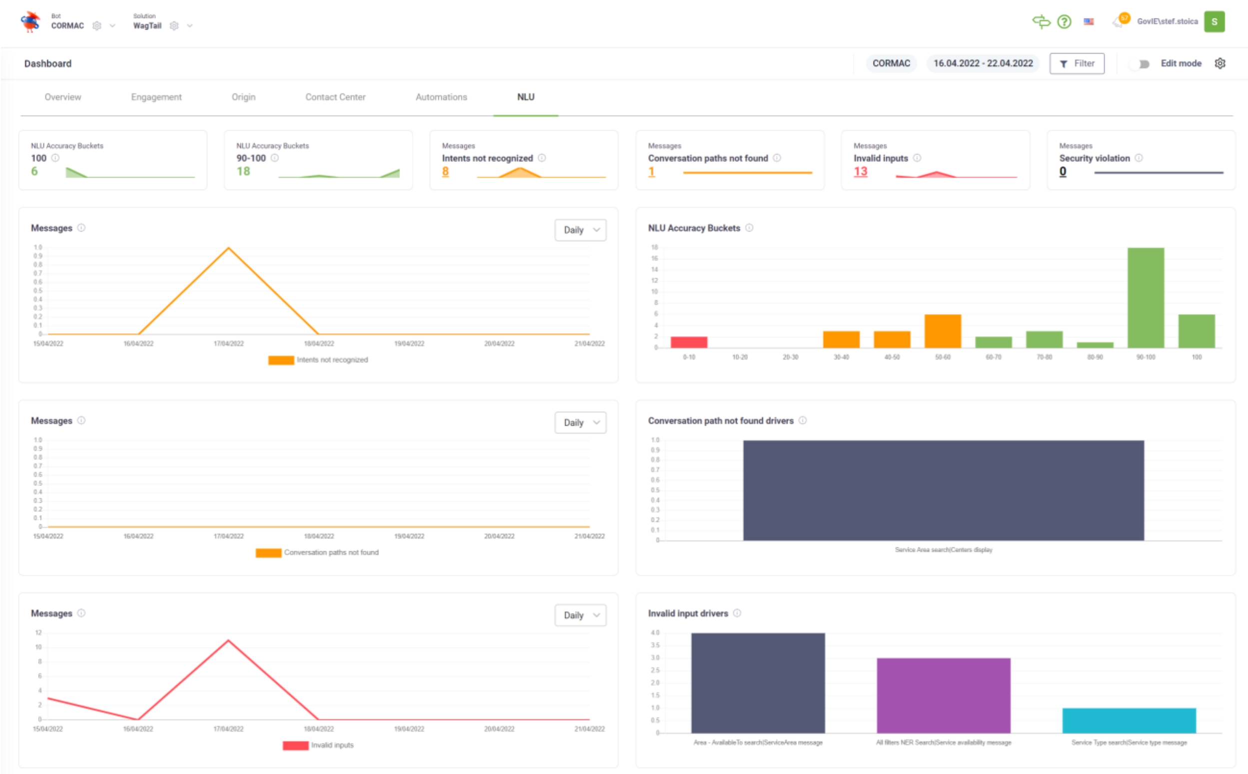


Figure 53: CORMAC's Dashboard (C)



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Appendices

Appendix 1: Key Stakeholders

NAME	ORGANISATION	DEPARTMENT	TITLE	PROJECT ROLE
Angela Walsh	HSE	Mental Health Services	Head of Mental Health Services	Sponsor
Project Team	University of Limerick	MSc Students, Digital Health Transformation	MSc Students	Project Management
Annette McElligott	University of Limerick	Department of Computer Science	Lecturer	Project Assurance
Clinicians (end-users)	HSE	Health & Wellbeing	Clinicians	
Kevin Kelly Emily Feneran	OoCIO	RPA Centre of Excellence [eHealth and disruptive technology (HSE)]	RPA Lead	Oversight of RPA development
John Parker	HSE	CHO DNCC ICT	ICT Manager	Oversight for CHO DNCC digital systems
Adrian Gorgan	UiPath	RPA delivery for Public Sector	Various (RPA Development Team)	Alignment of agreements, processes and work practices with project objectives
Adrian Sweeney	HSE	Digital Communications Team	DevOps Team Lead	Support integration with digital communications architecture
Louise Cooney	HSE	Digital Communications Team	DevOps Team	Support integration with digital communications architecture

Appendix 2: Original Requirements

REQUIREMENTS	DESCRIPTION	IMPACT TO STAKEHOLDERS
1. Functional Requirement: The chatbot must be able to understand complex dialogues. 1.1. Interact with unstructured questions. 1.2. Identify incomplete language and request clarification appropriately. 1.3. Use AI to analyse requests and deliver health service information to users.	The system must be able to understand natural language and process requests in English. **Deliverables:** 1. A prototype RPA enabled chatbot that meets all functional requirements. 2. Prototype datastore and data dictionary that are compliant with the National Adult Literacy Agency (NALA) guidance. 3. A performance testing tool that can verify information 4. Data is compliant with NALA guidance, enabling the prototype chatbot to deliver information in a format that is compliant with the National Adult Literacy Agency (NALA) guidance.	This will allow the patient, public and clinical users to engage with the chatbot in a natural and seamless way. This will improve ease of use and access to information in a timely manner.
2. Functional Requirement: The system must support flexible data connections to allow integration and scalability of increasing volumes of information. 2.1. Integrate new information quickly and easily using AI. 2.2. Leverage new information and requests from users to build new data connections using AI. 2.3. The system will use automation to detect and report on incomplete and inaccurate information in the data store.	The user health data must be structured and modelled, which in turn can help to generate new knowledge. Moreover, the integration of new data from either internal organisational sources or external data sources will be embedded in the system. The system will capture, read and process large amounts of data to gain insights from relevant sources and to quickly solve customer problems. **Deliverables:** 5. The Project team will deliver a process and associated service information update templates.	The system will be able to develop its capabilities and improve its performance with increased interactions with customers. The complexity of queries will help improve the future performance of the system. The system performance in relation to identifying and reporting inaccurate information will be testable.
3. Functional Requirement: The system must be accessible to users across a range of digital platforms/channels. 3.1. System must function on a website. 3.2. The system must function across social media platforms. 3.3 The system has the capability to function as an app.	For the system to be able to reach a sufficient number of users the system must reside on the appropriate range of media channels to offer maximum opportunity for engagement. **Deliverable:** 6. A user centred workshop will be carried out to assess an accurate picture of user preferences in relation to equity of access.	Stakeholders can access the system on the social media platforms of their choice. Clinicians offer multiple pathways to users to access information. Stakeholders can be assured that information about services has increased visibility. Offers the opportunity for organic user to user dissemination and sharing of the system existence (outside of interactions with healthcare workers).
4. Functional Requirement: The system retrieves information accurately and with sufficient speed from the defined data store. 4.1 Prototype must be 100% accurate when tested against discrete/defined dataset. 4.2 No response from the system should be over 2 seconds.	**Deliverable:** 7. Develop test and deliver a system performance protocol that will be used to run regular performance testing on the system's performance in relation to the following metrics: • Service availability • Service contact details • Service suitability	An agreed performance testing protocol will allow users and stakeholders to have access to performance data that will indicate the quality of the system over time allowing comparative analysis of performance as the system develops in scale and complexity.
5.Functional Requirement: The system will incorporate a	**Deliverable:** 8. A website wireframe to	The website will provide an organisational host for the chatbot and enable

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supporting website. 5.1 The website will host the chatbot. 5.2 The website will be compatible with existing HSE architecture	support the following functionality: • Upload of new services to the datastore • Change of Service Information on datastore • Remove service information from datastore	interactions with the datastore.
6. Functional requirement: Security: The system must be compliant with applicable HSE security requirements and GDPR. 6.1 Cloud service security 6.2 HSE IT and security policies 6.3 The system must pass the HSE DPIA	**Deliverable:** 9. Delivery of a completed DPIA form to nominated Data Protection Officer for approval Engage with Vendors to complete Cloud Security assessment form in conjunction with HSE Technical office. 10. Run workshops to collate user concerns regarding data usage and analysis and communicate to users the type of data to be collected and the purpose of data usage.	This will ensure the development of the system prototype will be informed by potential future users. This will be the first stage of risk management whereby concerns and potential issues are identified in relation to the use of AI as part of the system.
7. Functional Requirement The prospective system will be developed in line with the IEEE Standard 7010. 7.1 The system will be developed with respect to international ethical considerations. 7.2 The potential impact of the	**Deliverable:** 11. A quality control checklist based on the IEEE standard 7010. The checklist will be used by stakeholders within the HSE to communicate and measure adherence to recommended practice.	The development of the system in line with European standards will provide guidance on the best approach to understanding, measuring and managing the direct and indirect and intended/ unintended impacts of AI and automation on the well-being of users interacting with the system.

7.3 In line with the IEEE standard 7010 a "How To" guide to be developed outlining the implantation of RPA enabled Chatbots in the HSE.	place within the HSE in relation to implementing AI and RPA in the health service 13. Produce a "How To" guide.	
8 Functional Requirement: *(desirable)* The system should be able to deliver data relating to information requests and interactions with clients/users and the platforms use to access same. 8.1 Report the number of users accessing the system. 8.2 Report the most common search requests. 8.3 Report incomplete/unresolved queries or interactions with users.	**Deliverable:** 14. A defined set of analytics metrics. Metrics will cover the following domains: • User access • Usage patterns • System performance • System accuracy • System speed	Standardized reporting of system performance will allow for communication and engagement with a range of stakeholders to assess the utility and potential scalability of the system in the HSE.
9. User Requirement: The user will be able to interact with the system in a way that is intuitive and easy to follow. 9.1 Allow intuitive engagement to support user needs being met. 9.2 Produce intelligible answers in compliance with NALA guidelines. 9.3 Consistent performance of system during interactions	**Deliverables:** 15. The project team will deliver user-centred workshops that will assess the usability of the system using a validated measurement tool for digital systems, the System Usability Scale. 16. The project team will produce an assessment tool to assess system response against NALA guidelines.	This will support iterative refinement of the system that can be implemented in a scheduled manner. This will also allow for stakeholders to engage in the prototype development and establish a process for continued user-centred design of the system going forward.

9.4 Users will require no prior knowledge to engage with the system.		
10. User Requirement: The information relating to each service in the datastore will contain the minimum criteria. 10.1 Cost for user to attend 10.2 Approved by HSE Health and Wellbeing 10.3 Location of Service 10.4 Service Provider 10.5 Type of service	**Deliverable:** 17. An agreed quality checklist will be produced and agreed with the HSE Health and Well-Being Department.	This will aid trust from users in the information stored on the system.

Appendix 3: Tree Testing Data

First Click Data

1	Find the CHO Dublin North City & County MECC Resource	Visited first	Visited during
	Health Services	67%	78%
	Health A-Z	11%	33%
	Staff and Careers	22%	33%
	About Us		
	Search		22%
2	Find a webpage/pdf where you can find information on Physical Activities in North Dublin	Visited first	Visited during
	Health Services	33%	78%
	Health A-Z	44%	44%
	Staff and Careers	11%	11%
	About Us		
	Search	11%	22%

Destinations

	1 Find the CHO Dublin North City & County MECC Resource
1	> Health Services < HSE.ie > Health A-Z > M < Health A-Z < HSE.ie > Staff and Careers > Benefits and Services < HSE.ie > Health Services > Publications and Reports < Health Services > Publications and Reports
2	> Health Services > Find Your Local Health Services > All Health Services < HSE.ie > Health Services > All Services < HSE.ie > Health Services < HSE.ie > Health Services > Find Services Near Me < HSE.ie > Health A-Z > H < HSE.ie > Search > MECC > Resourc
3	> Staff and Careers > Staff News
4	> Health Services > Find Services Near Me > All Health Services > Community Intervention Teams
5	> Health Services > All Services > GPs and Family Doctors
6	> Health A-Z > M < Health A-Z < HSE.ie > Health Services > All Services > Primary Care > Community Funded Schemes
7	
8	> Staff and Careers > Staff resources
9	> Health Services > Publications and Reports
10	
11	> Health Services > All Services < HSE.ie > Search > MECC Dublin > MECC Lifestyle Behaviour Services and Resources Directory DNCC
	2 Find a webpage/pdf where you can find information on Physical Activities in North Dublin
1	> Staff and Careers < HSE.ie > Health Services > Find Services Near Me > All Health Services > Public Health
2	> Health A-Z > E > Exercising indoors < HSE.ie > Health Services > Find Your Local Health Services < HSE.ie > Search > Physical Activity Dublin > Healthy Ireland
3	> Search > Physical Activity Dublin > Fitness for your lifestyle > Fit4Life running programme
4	> Health Services > Find Services Near Me > All Health Services < Find Services Near Me > Map View < Health Services > All Services > Local Health Offices > Dublin North > Health Centres
5	> Health A-Z > A < Health A-Z > M < HSE.ie > Health Services > You and your Health Service < Health Services > You and your Health Service
6	> Health A-Z < HSE.ie > Health Services > Find Your Local Health Services > All Health Services < Health Services > All Services > Public Health
7	
8	> Health Services > Find Services Near Me > Map View
9	> Health Services > Find Services Near Me > All Health Services < Find Services Near Me > Map View
10	
11	> Health A-Z > F < Health A-Z > E > Exercising indoors < Health A-Z > P < Health A-Z > G < Health A-Z > E > Exercising indoors
	Color key:
Direct success:	Green
Indirect success:	Light Green
Direct failure:	Red
Indirect failure:	Orange
Direct skip:	Gray
Indirect skip:	Light Gray

Sample of Destinations (marked in red)

HSE Physical Activity								
Surveys started	11							
Surveys completed	9	82%						
Task						1	2	
						Find the CHO Dublin North City & County MECC Resource	Find a webpage/pdf where you can find information on Physical Activities in	Average
Total successes						1	0	0.5
Total success %						**11%**	**0%**	**6%**
HSE.ie								
	Health Services							
		COVID-19 vaccination information						
		Find Services Near Me						
			Map View				2	
			All Health Services					
				Benefits and Schemes				
					Medical cards			
					Fari Deal Scheme			
					Northern Ireland Planned Healthcare Scheme			
					Blind welfare allowance			
					European Health Insurance Card (EHIC)			
					Drugs Payment Scheme			
					Treatment Abroad Scheme			
					Medical Cannabis Reimbursement Scheme			
					GP visit cards			
					Cross Border Directive			
					Long-Term Illness Scheme			
					National Lottery grants			
				Environmental Health				
					Prepare for Brexit			

Task Results

Task 1: Find the CHO Dublin North City & County MECC Resource		Task 2: Find a webpage/pdf where you can find info on Physical Activities in North Dublin	
Result	Time taken (s)	Result	Time taken (s)
Indirect failure	73.05	Indirect failure	22.87
Indirect failure	131.11	Indirect failure	96.73
Direct failure	19.81	Direct failure	47.5
Direct failure	26.9	Indirect failure	72.57
Direct failure	43.04	Indirect failure	56
Indirect failure	49.93	Indirect failure	52.01
Abandoned		Abandoned	
Direct failure	33.86	Direct failure	9.62
Direct failure	7.66	Indirect failure	12.39
Abandoned		Abandoned	
Indirect success	51.09	Indirect failure	69.95

Appendix 4: Focus Group Data

Focus Group Analysis

Introduction

A focus group was conducted on Feb 2nd, 2022, to gather qualitative data on the "As Is" situation i.e. the process by which healthcare workers currently access information on local healthy living resources. The project group wanted to ascertain the healthcare workers' perceptions of the process and ideas for improvements or changes. This is to ensure that the pilot chatbot and database are designed with the end user in mind and to incorporate their thoughts on the chatbot design.

Structure of Focus Group

The focus group was carried out online using MS Teams. Present at the focus group were a facilitator, 2 note-takers and seven physiotherapists working in primary care in the North Dublin, CHO DNCC area. Each of the physiotherapists consented to taking part and consented to a temporary recording of the session on MS Teams. It was explained to those taking part that the recording would be deleted in May 2022 and was being taken for the purpose of transcribing their feedback. The focus group commenced with a brief overview of the "Connecting Communities" project.

A list of questions was circulated to participants in advance and then used to guide the session. These questions are detailed below and were devised by the project team in advance of the session. The focus group ran for approximately one hour on Feb 2nd, 2022

Focus Group Questions

How do you currently look up potential classes/groups for your patients?
How much time does this take?
How do you ensure there are high quality/legitimate resources?
How would you direct your patients to these resources?
What would encourage you to use the MECC resources more?
What do you think we should include to make the MECC resources easier for you to use?

Profile of Focus Group Attendees

All participants were physiotherapists employed in the CHO DNCC area who work fulltime in primary care. Six of the attendees are employed as senior physiotherapists with an average of 10 years plus experience, only one attendee was a basic grade physiotherapist with three years' service in the HSE. All attendees have experience of recommending local physical activity resources to their physiotherapy clients.

This group was selected as project team member (Lise-Ann O'Neill) is employed in this physiotherapy department and was granted permission by her line manager to conduct this focus group as part of a service improvement initiative.

Major Themes Identified

There was 5 main topics of discussion in the focus group. These were

1) Making Every Contact Count or MECC booklet

2) How physiotherapists are currently accessing information on physical activity resources in the local area

3) Physiotherapists opinions on how they would like to receive this information

4) Reflections on the importance of recommending quality resources/risk of reputational damage if the resources are poor

5) Physiotherapists ideas on where the project could go in the future.

Topic 1: Making Every Contact Count or MECC booklet

The HSE Health & Wellbeing Dept has put together a paper-based resource of local healthy living resources in the Dublin North City and County area of CHO 9. This booklet is also available in pdf format online. It is called "Making Every Contact Count" or MECC for short. This is based on a HSE approved brief intervention approach to supporting the public in making healthier lifestyle choices. The MECC framework is a significant feature of HSE policies such as the HSE Overweight and Obesity program. There is online training available to HSE employees in using the MECC approach.

Despite the importance of MECC to the HSE's health promotion goals and the amount of work put into assembling and maintaining this booklet, it would appear awareness of its existence among healthcare workers could be improved. When asked "have any of you come across the MECC booklet before?" responses ranged from

"It looks vaguely familiar"

"I haven't come across this"

"Not the booklets but I have done the course"

"When you first said MECC, I didn't know what you meant to be honest"

"If the booklet is out of date, it's not much use"

Topic 2: How physiotherapists are currently accessing information on physical activity resources in the local area

For this question, all participants stated they looked online to find information on physical activity resources for their clients or spoke to fellow healthcare professionals.

"a google search"

"ask colleagues"

"I prefer online"

Some physiotherapists reported spending significant amounts of time contacting local resource providers by phone or email and described their frustration at same. One physiotherapist reported having leaflets dropped into her health centre by a service provider.

"I'll have to ring Fingal, I'll have to ring Siel Bleu, Men's Sheds... that's going to be a bit of work!"

"It did take a lot of work"

Barriers to accessing this information were also discussed such as issues around reliability of resources and if they are potentially out of date.

"If you Google..... it's not up to date. So, I probably wouldn't trust the information on the internet, I'd still have to ring. Then since Covid obviously, a lot of things have changed. So even if it was online before, it wouldn't be trustworthy."

"They (resources) are often not updated"

"Things seem to chop and change a lot"

Physiotherapists were very familiar with the Quit.ie website for smoking cessation and on advising patients to link in with their GPs for more support on same.

Topic 3: Physiotherapists opinions on how they would like to receive this information

The group was then asked how they would like to receive this information and what would be the easiest format i.e., online, an app, current existing booklet.

Some were keen on the idea of a booklet

"A booklet is good if appropriate for the area"

But others had concerns around how accurate the information contained in a booklet would be. There were also concerns about the environmental impact of printing these booklets.

"If the booklet is out of date, it's not much use"

"For something like smoking cessation where the contact information doesn't change too much or they're directed to a phone number that's manned or a website, that's one thing.

But if its information that's changing all the time, it becomes out of date very quickly, it's not always useful to have a handout"

"Save the planet!"

"You can be sure that the only one (booklet) you can find is the ones that's out of date"

"These paper leaflets, they develop wings and fly away sometimes"

Most physiotherapists expressed their preference for the information to be available online

"Online would be very handy that way"

"Something like this (online) would be extremely useful with an up-to-date package"

"So, to have something real time that is accurate and up to date would be great, saves so much time"

"Maybe notifications…. monthly notifications about all the programs that are there so its fresh in your mind"

This led to a discussion around Chatbots-. Some physiotherapists felt use of machine learning would make the process more reliable and others described experiences (both positive and negative) that they had had with other chatbots in the past.

"You know, in updating information in real life and things like that…with machine learning, its way more accurate. You know human errors can be eliminated that way….so I think it could be a good idea"

"Input this, input that and then the answer pops up? I think that would be a great idea"

"The HSE library have the LLAMA and it is very helpful, handy"

"The only one I've used is the Ryanair one….it was repetitive, left me waiting a long time and I had to keep putting in what my query was"

"They seem more and more like they're popping up nearly on everyone's website now"

"Sometimes they are frustrating"

Topic 4: Reflections on the importance of recommending quality resources

Physiotherapists discussed the risks in recommending resources online and their concerns about the quality of those recommendations. They highlighted that they are in a trusted position and are careful with their recommendations, recognising a reputational risk if they were to suggest a poor resource to one of their clients.

"I probably wouldn't trust the information on the Internet. I'd have to then still ring and since Covid obviously, you know a lot of things have changed. So even if it was online before, it wouldn't be trustworthy because they are not often updated"

"As health professionals, we have to be careful where we are recommending people go to"

"If it comes from us, there's a certain level of trust that the person thinks that it has been vetted maybe by the HSE. So, you do have to be careful around what you are recommending…maybe that's we are a little cautious about what we do recommend"

They also highlighted that if other clients have attended a service and given good feedback, they are more likely to recommend it.

"I knew from reviews that it was really good"

"Word of mouth mostly" (when asked what would encourage them to recommend a resource to a client)

<u>Topic 5: Physiotherapists' ideas on where the project could go in the future</u>

During the session, physiotherapists were asked what they would like to see in a future online portal of healthy living resources. They suggested including the price of resources online and ensuring that resources could be easily printed or that the portal could be accessed via an app for younger clients.

"What would be really nice is if you have something and it kind of selects the three classes and printed them off for them…that you were generating a leaflet"

"One thing that would be useful as well, maybe with the website would be that it would be printer friendly, so if there was, you know, some information that you did want to print out and hand over to a client that it would….maybe for older adults, if they weren't too good on being directed to the Internet, you could still print something out and give it to them"

"It would be helpful if they put their prices on…. I'd like to avoid a situation where the person goes and said the Physio recommended it and I go there and now I'm out of pocket"

When discussing what would make it easier for clients to access the information without the guidance of a healthcare professional, there was positive feedback on the use of Chatbots. The use of an app was also suggested, with the functionality that alerts could be set for activities the client was interested in. They also felt that people would trust information coming from the HSE

"HSE being a reputable organisation so definitely people will trust that"

And that a Chatbot would be useful but expressed their preferences around its usability

"a chatbot can help"

"Just make sure that it doesn't take over the whole page and you minimise it and then it jumps up again!"

They were keen that the information could be accessible online or on an app. They highlighted the need for the HSE to promote such a portal in the future.

"An advertising campaign from the HSE to get the information out there"

"What about an app? You know that it was not just a website but an app and then you can download the app. You can put your details in so only stuff that comes up in your area comes up and it can send you notifications…. that if a class is starting in your area and you know, if you're interested you can log into the app and find more information on it"

"The youngsters would like an app or a website (for younger adults)"

They wanted to know who would take ownership of such a website/portal and had other concerns in relation to what a future website would perform like how often it updates or how resources could be printed off it for clients

"Who feeds into this thing? Say for example a class is cancelled suddenly, is there somebody who updates it and takes it off the site?"

"Things seem to chop and change a lot"

"It will require a lot of coordination just to be sure that everybody who has the programs is listed on the platform…. they would need to be checked on…three monthly or whatever. it creates a kind of rapport with them and just say look, if anything is taking place, we give us a buzz so that we can update the whole thing."

"You could set up a tablet with an easy icon for them (older adults)"

"We can do the email campaign and we can do the text message campaign"

Appendix 5: User Acceptance Testing for CORMAC

The System Usability Scale[8] was selected to gather insights on usability as it is a widely used testing tool for user acceptance testing (UAT). The SUS features ten statements, all of which are marked on a Likert Scale. As there is no recognised standard for chatbot evaluation, the project team created a listed of open-ended questions specific to the CORMAC chatbot, which was named the "CORMAC Chatbot Usability Questionnaire", or CCUQ.

User acceptance testing (UAT) for the CORMAC chatbot was carried out to gather information on usability. This information was collected using an online survey system from users who opted in to UAT of the CORMAC chatbot. Users completed an informed consent form and their feedback from the survey was collected anonymously.

There were 36 responses, of which 8 were partially completed and 28 fully completed. A mix of clinicians, HSE Health and Wellbeing staff and the general public were contacted to undertake the UAT.

Results broadly indicate that CORMAC in its current form was easy to use (89%, cf. Q2), and the guided search function clearly explained (76%, cf. Q4). Positivity in the return of results was lower, with 60% of people indicating that CORMAC had provided the information they had sought. Some comments indicate that searches were beyond the scope of what was contained within the database developed from the MECC Booklet, for example searches related to the GAA, ("*I typed in GAA as an activity and it gave me Tai Chi and walking*") , resources for the Midlands, ("Midlands East region had no options for activities …").

96% of respondents believed that using a CORMAC was easier to use than a paper-based directory, and there was broad agreement that such a chatbot should be used within the context of healthcare information (21 of 24 responses, or 87.5%).

A breakdown of all responses is provided.

Question 1

1. Please indicate how strongly you agree with the below statements

Answer Choices	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Response Total
I think that I would like to use this system frequently	14.29% 4	50.00% 14	21.43% 6	14.29% 4	0.00% 0	28

[8] Brooke, J. (1996). *SUS- a quick and dirty usability scale.* Available: https://web.archive.org/web/20190713230459id_/http://hci.liacs.nl:80/files/SUS-questionaire.pdf. [Accessed 11 April 2022.]

1. Please indicate how strongly you agree with the below statements						
I found the system unnecessarily complex	0.00% 0	14.29% 4	21.43% 6	53.57% 15	10.71% 3	28
I thought the system was easy to use	7.14% 2	60.71% 17	17.86% 5	14.29% 4	0.00% 0	28
I think that I would need support of a technical person to be able to use this system	0.00% 0	14.29% 4	3.57% 1	50.00% 14	32.14% 9	28
I found the various functions in this system were well integrated	7.14% 2	53.57% 15	28.57% 8	10.71% 3	0.00% 0	28
I thought there was too much inconsistencies in this system	7.14% 2	28.57% 8	35.71% 10	28.57% 8	0.00% 0	28
I would imagine that most people would learn to use this system very quickly	21.43% 6	57.14% 16	14.29% 4	7.14% 2	0.00% 0	28
I found the system very cumbersome to use	0.00% 0	17.86% 5	25.00% 7	46.43% 13	10.71% 3	28
I felt very confident using the system	0.00% 0	60.71% 17	25.00% 7	14.29% 4	0.00% 0	28
I needed to learn a lot of things before I could get going with this system	0.00% 0	10.71% 3	10.71% 3	57.14% 16	21.43% 6	28
					answered	28
					skipped	0

Q1.1: I think that I would like to use this system frequently: 64.29% stated that they strongly agreed or agreed with this statement. 14.29% disagreed, with 21.43% neither disagreeing nor agreeing.

Q1.2: I found the system unnecessarily complex: 64.28% either disagreed or strongly disagreed with this statement. 14.29 agreed, with a further 21.43% neither disagreeing nor agreeing

Q1.3 I thought the system was easy to use: 67.85% agreed or strongly agreed to this question. However, a stand-alone question related to the ease of use of the CORMAC noted an 89% positive rating (cf. Q2).

Q1.4: I think that I would need support of a technical person to be able to use this system: 14.29 agreed with this statement, with 3.57 neither agreeing nor disagreeing. A majority either disagreed (50%) or strongly disagreed (32.14%).

Q1.5: I found the various functions in this system were well integrated: over 60% agreed or strongly agreed with this statement. Nearly 11% disagreed.

Q1.6: I thought there were too many inconsistencies in this system: Nearly 36% agreed or strongly agreed with this statement, with the same number of responses neither agreeing or disagreeing. 28.57% disagreed.

Q1.7: I would imagine that most people would learn to use this system very quickly: 78.57% agreed or strongly agreed with this statement. 14.29% were neutral, and 7.14% disagreed.

Q1.8: I found the system very cumbersome to use: 5 people agreed with this statement, a quarter were neutral and 57.14% disagreed or strongly disagreed.

Q1.9: I felt very confident using the system: 60.71% agreed with this statement and 14.29% disagreed. A quarter of respondents were neutral.

Q1.10: I needed to learn a lot of things before I could get going with this system: A majority (78.57%) either disagreed or strongly disagreed with this statement. 10.71% were either neutral or agreed.

A further view of these results is outlined here.

I think that I would like to use this system frequently

Answer Choices	Responses	
Strongly agree	14.29%	4
Agree	50.00%	14
Neither agree nor disagree	21.43%	6
Disagree	14.29%	4
Strongly disagree	0.00%	0

I found the system unnecessarily complex

Answer Choices	Responses	
Strongly agree	0.00%	0
Agree	14.29%	4
Neither agree nor disagree	21.43%	6
Disagree	53.57%	15
Strongly disagree	10.71%	3

I thought the system was easy to use

Answer Choices	Responses	
Strongly agree	7.14%	2
Agree	60.71%	17
Neither agree nor disagree	17.86%	5
Disagree	14.29%	4
Strongly disagree	0.00%	0

I think that I would need support of a technical persone to be able to use this system

Answer Choices	Responses	
Strongly agree	0.00%	0
Agree	14.29%	4
Neither agree nor disagree	3.57%	1
Disagree	50.00%	14
Strongly disagree	32.14%	9

I found the various functions in this system were well integarated

Answer Choices	Responses	
Strongly agree	7.14%	2
Agree	53.57%	15
Neither agree nor disagree	28.57%	8
Disagree	10.71%	3
Strongly disagree	0.00%	0

I thought there was too much inconsistencies in this system

Answer Choices	Responses	
Strongly agree	7.14%	2
Agree	28.57%	8
Neither agree nor disagree	35.71%	10
Disagree	28.57%	8
Strongly disagree	0.00%	0

I would imagine that most people would learn to use this system very quickly

Answer Choices	Responses		
Strongly agree		21.43%	6
Agree		57.14%	16
Neither agree nor disagree		14.29%	4
Disagree		7.14%	2
Strongly disagree		0.00%	0

I found the system very cumbersome to use

Answer Choices	Responses		
Strongly agree		0.00%	0
Agree		17.86%	5
Neither agree nor disagree		25.00%	7
Disagree		46.43%	13
Strongly disagree		10.71%	3

I felt very confident using the system

Answer Choices	Responses		
Strongly agree		0.00%	0
Agree		60.71%	17
Neither agree nor disagree		25.00%	7
Disagree		14.29%	4
Strongly disagree		0.00%	0

I needed to learn a lot of things before I could get going with this system

Answer Choices	Responses	
Strongly agree	0.00%	0
Agree	10.71%	3
Neither agree nor disagree	10.71%	3
Disagree	57.14%	16
Strongly disagree	21.43%	6

Question 2: Did you find this chatbot easy to use?

A majority responded yes to this question: 89.29%. Comments in the feedback included:

"The guided 'how to use' was very helpful and the follow up questions to refine my search was also useful very responsive to the information I entered."

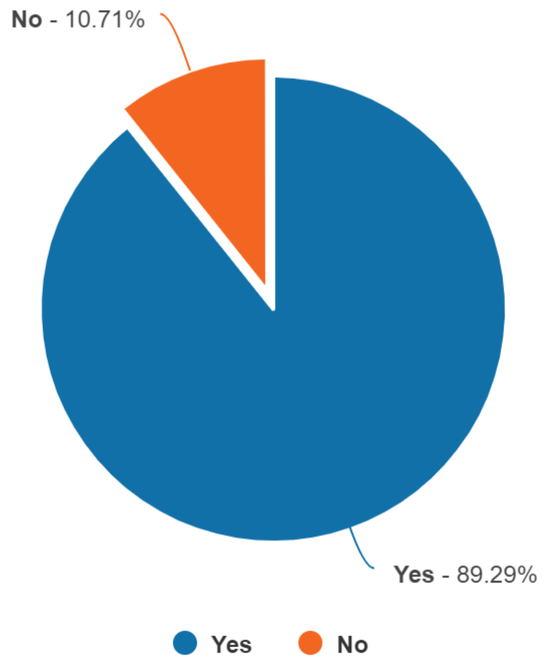
"Very straightforward. I think once you've looked for a couple of things, used it a few times you would easily get the hand of how it works best etc."

Feedback on how to make the chatbot more user friendly was also returned in the comments:

"Use buttons for the options not users typing in."

"I could not find where to type in my question initially as the writing was too faint... but once I found that it was easy to use."

Did you find this chatbot easy to use?



2. Did you find this chatbot easy to use?								
Answer Choices							**Response Percent**	**Response Total**
1	Yes						89.29%	25
2	No						10.71%	3
Analysis	Minimum:	1.00	Mean:	1.11	Std. Deviation:	0.31	answered	28
	Maximum:	2.00	Variance:	0.10	Std. Error:	0.06	skipped	0
	Satisfaction Rate:	10.71						

Questions 3 and 4

Of those that knew that they undertook the guided search option (89.29%), 76% noted that this was explained well by CORMAC.

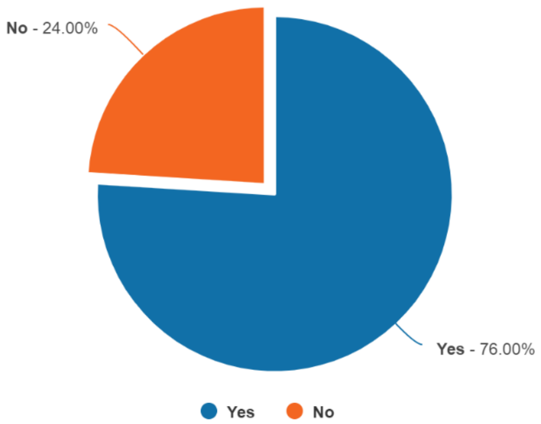
"Speaking for someone who IT is not a strong point, I found it very easy to follow the instructions. Then to have a very clear example to follow was really helpful."

Others wanted some more detail in this option:

"I think this could have been more detailed, but I know it's only at prototype stage but definitely think it should be kept and further developed."

3. Did you use the guided search option?				
Answer Choices			**Response Percent**	**Response Total**
1	Yes		89.29%	25
2	No		3.57%	1
3	Unsure		7.14%	2
			answered	28
			skipped	0

Do you think the chatbot explained how to use the guided search option clearly?



4. Do you think the chatbot explained how to use the guided search option clearly?				
Answer Choices			Response Percent	Response Total
1	Yes		76.00%	19
2	No		24.00%	6
			answered	25

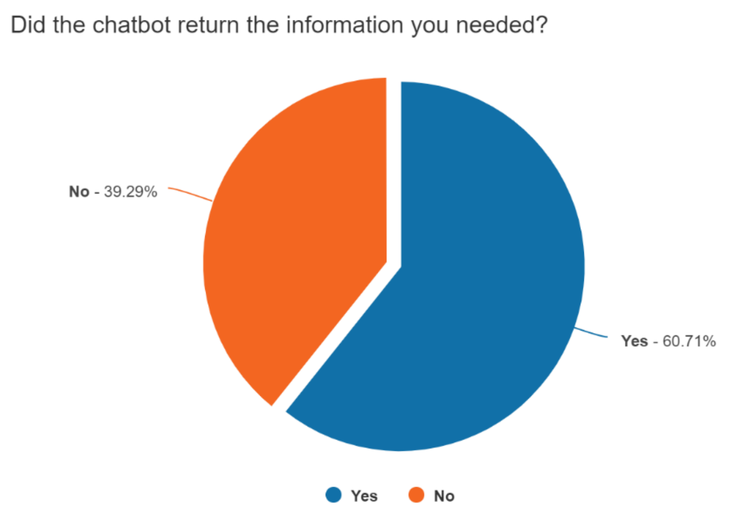
Question 5

Over 60% noted that the CORMAC returned the information that they had sought, with some stating that information had not been returned or CORMAC not being able to understand requested information.

"I had no hits when searching for football for 30-40 year Olds (sic) nationwide. I was able to retrieve 3 results when searching across all groups"

Some noted that it was easier to get results via the guided search option:

"Yes, but only through the guided search." While others appeared to have no difficulty: *"I tried three examples and got the information required. Walking - it came back with 4 groups. Dancing - it came back with no groups. Tennis for 5-17 it came back with several groups"*



5. Did the chatbot return the information you needed?			
Answer Choices		**Response Percent**	**Response Total**
1	Yes	60.71%	17
2	No	39.29%	11
		answered	28
		skipped	0

Question 6

This was an open-ended question, with 21 of 24 responses clearly indicating that they felt a chatbot would be appropriate for use in healthcare and HSE Health and Wellbeing. 1 person had indicated a concern of how older people would use such a system, another wrote no comment and third indicated the need for more staff. Four people skipped this question.

6. Do you think this system i.e., a chatbot that accesses a database of physical activity resources, would be appropriate for use in Irish Healthcare/HSE Health & Wellbeing?	
1	Yes. Once it was accompanied by an information session on how to use and the benefits of using it. And explaining was a 'Chatbo't is.
2	yes
3	Yes I think it would be very useful and beneficial to people wanting to search for HSE approved activity who are trying to become more active. It also saves HSE staff's time by not having to deal with questions that the chatbox can deal with
4	Yes
5	Not sure to be honest. Sceptical of older users being comfortable with it
6	Just hire staff
7	Yes, I'm sure it could work very well.
8	Yes definitely a need in the HSE, and also wider community ie Social Prescribers. The HSE website is so vast that something like this is useful to direct people to the right place but also a resource that can be updated regularly. People are also less likely to spent long periods of time searching online so this helps them find the information quicker.
9	Yes it is very hard to find information on the HSE website about what resources/services are being provided locally. This would make the information more accessible to people.

6. Do you think this system i.e., a chatbot that accesses a database of physical activity resources, would be appropriate for use in Irish Healthcare/HSE Health & Wellbeing?	
10	Yes absolutely. Brilliant to find outwith a click of a button, professional, registered and trustworthy activities available in each region of Ireland.
11	Yes, definitely. This service is really needed
12	Yes
13	Yes. Definately. Great idea
14	Yes
15	I think it is an excellent idea as it is user friendly and a great way to cut down on unnecessary papers and leaflets that probably wouldn't get as much attention from the general public.
16	YES I THINK IT WOULD BE BRILLIANT
17	Yes but might work better if supported by another system of mecc resources.
18	Yes, it's time for this but would require a lot of planning, branding, training and marketing and promotion.
19	Yes, community centres that have gyms and pools should be easy to create databases on and GAA and FAI should be able to perceive the benefits for public and themselves
20	Yes, great idea - would be great if it worked as an app too.
21	Yes, if it A) allows for basic search terms as well as full-sentence input and B) returns relevant information
22	Yes, more information the better
23	No comment
24	Yes , I think it would be great to have a list of activities all in the one place. Makes it easy for people to find

Question 7

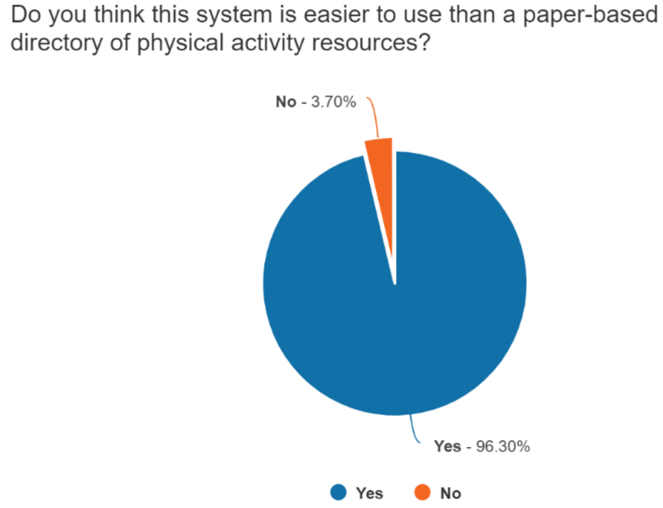
The vast majority agreed that CORMAC is easier to use than a paper-based directory (96.3%). Concerns raised about the data in a paper-based directory potentially being out of date, and potential of being able to update this system were noted in comments to the question:

"By being able to use the chatbot and search certain activities it saves time instead of going through every page on a paper-based directory for the specific activity. Also, the paper-based directory could be out of date. An online system would be easier to keep up to date"

Others noted that it would save time and more beneficial to the environment:

"In today's age of googling, everyone wants all of the answers in one place, so I think this is a great starting point to find out what people need as opposed to going through many leaflets. It would be a quicker and more efficient way of gaining information."

“Better for the environment without fliers being distributed everywhere”



7. Do you think this system is easier to use than a paper-based directory of physical activity resources?				
Answer Choices			**Response Percent**	**Response Total**
1	Yes		96.30%	26
2	No		3.70%	1

Question 8

Self-perceived tech savviness information was gathered from those who participated in the testing. This is “the measure of use of and familiarity with digital technology”.

75% noted that they strongly agreed or agreed to being tech savvy.

Over 57% stated that they agreed with the statement People often ask me for help when troubleshooting technical problems.

25% agreed or strongly agreed with ‘I'm usually the first of my friends and family to try a new type of technology’. 25% were neutral ad 50% disagreed or strongly disagreed with this statement.

8. Please rate your level of agreement with the following statements:						
Answer Choices	**Strongly agree**	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**	**Response Total**
I am 'tech savvy'	25.00% 7	50.00% 14	17.86% 5	0.00% 0	7.14% 2	28
People often ask me for help when troubleshooting technical problems	10.71% 3	46.43% 13	14.29% 4	25.00% 7	3.57% 1	28
I'm usually the first of my friends and family to try a new type of technology	10.71% 3	14.29% 4	25.00% 7	39.29% 11	10.71% 3	28
					answered	28
					skipped	0

Please rate your level of agreement with the following statements: