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D2.2 Requirements and Use Cases

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Abstract	The deliverable D2.2 "Requirements and Use Cases" outlines the foundational strategies and methodologies employed to gather, analyze, and establish user requirements and use cases relevant to addressing childhood and adolescent obesity through innovative digital solutions. This document details the processes involved in persona creation, the identification of stakeholders, and the subsequent elicitation of precise user requirements to tailor the development of the BIO-STREAMS platform effectively. Key aspects include the adoption of a mixed-method approach for persona development, comprehensive stakeholder engagement through workshops, and iterative refinement of personas based on extensive qualitative and quantitative evaluations. The results are integrated into a series of user stories and scenarios that aim to optimize the platform's design and functionality, ensuring it meets the diverse needs of users including healthcare professionals, educators, and policymakers involved in combating childhood obesity. This systematic approach underpins the project's goal to foster an inclusive, evidence-based digital environment that supports effective obesity management strategies across Europe.
Keywords	user requirements, use cases, personas, value sensitive design

DOCUMENT REVISION HISTORY

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1.0	17.01.2024	Initial draft of the deliverable	Izidor Mlakar
2.0	22.02.2024	Added content on Personas and The validation	Ana Dimič, Urška Smrke
2.1	18.03.2024	Added content on the requirements elicitation process	Ana Dimič, Izidor Mlakar
2.2	17.04.2024	Added the analysis and of the expert survey and user-stories	Izidor Mlakar, Ana Dimič, Urška Smrke
2.3	19.04.2024	Final draft of the deliverable, ready for internal review	Izidor Mlakar
3.0	26.4.2024	Implementation of changes from the internal review	Ana Dimič, Izidor Mlakar, Urška Smrke
4.0	12.03.2025	Implementation of changes as requested by the external reviewers: • "Data validation processes and broader inclusion of diverse stakeholder perspectives" - The mythology and evaluation processes carried out to evaluate the personas have been refined to provide more detail. • "Additionally, clearer links between	Ana Dimič, Izidor Mlakar, Urška Smrke

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		the identified user requirements and the platform's technical specifications would improve coherence" – Section 4.2 was refined, to provide a brief summary related to link between user and technical requirements. A subsection 4.3 was introduced that maps all technical requirements with relevant user requirements from where they originate.	

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SEN	*Sensitive, limited under the conditions of the Grant Agreement*	
Classified R-UE/ EU-R	*EU RESTRICTED under the Commission Decision No2015/ 444*	
Classified C-UE/ EU-C	*EU CONFIDENTIAL under the Commission Decision No2015/ 444*	
Classified S-UE/ EU-S	*EU SECRET under the Commission Decision No2015/ 444*	

EXECUTIVE SUMMARY

Deliverable D2.2 "Requirements and Use Cases" represents and initial description BIO-STREAMS project, dedicated to developing a comprehensive digital platform aimed at preventing and managing childhood and adolescent obesity, from a user-perspective. This document provides a detailed account of the methodologies and strategies implemented to accurately identify and analyze initial set of user needs and to create an initial set of effective use cases tailored to these requirements.

The process began with the creation of detailed personas representing the platform's diverse user base, including healthcare professionals, educators, and policymakers. These personas

were developed using a mixed-method approach that integrates both qualitative and quantitative data. This approach ensured a deep understanding of the complex needs and challenges faced by users in combating obesity.

Internal stakeholder engagement was another pivotal aspect of the process. It involved a series of workshops designed to gather direct input from experts from or near to Bio-Streams consortium. This hands-on engagement facilitated the collection of valuable insights, which were essential for refining the personas and aligning the platform's development with real-world requirements. External experts were also engaged to evaluate the final set of personas and their relevance.

The culmination of this process led to the crafting of specific set of user-questions, user stories and scenarios, reflecting the daily challenges and interactions users face. These stories and scenarios are instrumental in guiding the design and functionality of the BIO-STREAMS platform, in the next steps of user-centric and value-sensitive approach, to be carried out with real-world stakeholders, under the umbrella of BIO-STREAMS Living Labs, to be deployed in WP6.

Overall, Deliverable D2.2 establishes a solid foundation for the ongoing user-centered development of the BIO-STREAMS project through continuous engagement with stakeholders. By focusing on user-centered design and stakeholder involvement, the project upholds its commitment to creating an inclusive, evidence-based digital environment by including relevant end user in early stages of conceptualization, design and development.

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Abbreviations

EQF	**European Qualifications Framework**
EU	**European Union**
GA	**Grant Agreement**
HCI	**Human-Computer Interaction**
ICC	**Intraclass Correlation Coefficient**
IP	**Internet Protocol**
KPI	**Key Performance Indicator**
M	**Month**
ML	**Machine Learning**
NGO	**Non-governmental Organization**
SME	**Small and Medium-sized Enterprise**
TCP	**Transmission Control Protocol**
WP	**Work Package**

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1 Introduction

The BIO-STREAMS, here referred to as the '**Project**,' is a multi-disciplinary EU project, primarily focusing on addressing childhood and adolescent obesity. The Project's objectives, components, and deliverables are manifold. To begin with, it aims to develop and implement three key elements:

- EU-wide Childhood/Adolescence Obesity Biobank, designed to facilitate data sharing across the EU for research and innovation purposes;
- Accessible Obesity Platform, utilizing the resources of the Biobank to offer various services, including applications; and
- EU Community Network dedicated to Childhood/Adolescence Obesity.

The Project spans across four years, from May 2023 (M1) to April 2027 (M48).

Childhood obesity is a pressing public health issue that poses serious health risks to millions of children and adolescents across Europe and globally. The complex etiology of obesity, involving interplay between genetic, environmental, and lifestyle factors, requires multifaceted interventions. In response to this challenge, the BIO-STREAMS project was initiated to develop a digital platform designed to support the prevention and management of obesity among young populations. This platform aims to integrate the latest research and evidence-based practices into tools that are both practical and accessible for healthcare providers, educators, policymakers, and families.

The deliverable D2.2 "Requirements and Use Cases" represents a foundational component of the BIO-STREAMS project. It focuses on the meticulous process of gathering and defining user requirements and developing comprehensive use cases that will guide the subsequent design and development phases of the digital platform. The ultimate goal of this deliverable is to ensure that the platform not only meets the technical specifications necessary for effective functionality but also addresses the real-world needs and challenges faced by its users.

To achieve this, the project employs a robust mixed-methods approach that combines quantitative data analysis, qualitative interviews, and participatory workshops. This approach allows for a thorough understanding of the diverse needs of various stakeholders involved in obesity management, including direct insights from those on the front lines of healthcare and education, as well as input from those who shape policies and community programs.

The structure of this document follows a logical progression, beginning with the methodology used to identify and engage stakeholders, followed by the processes employed to elicit, analyze, and refine user requirements. Subsequent sections detail the development of use cases that translate these requirements into practical scenarios, illustrating how the BIO-STREAMS platform can be utilized effectively in various settings.

In conclusion, the introduction frames the deliverable as a crucial step in ensuring the success and impact of the BIO-STREAMS project. By grounding the development of the digital platform in a deep understanding of user needs and industry best practices, this work lays a solid foundation for creating a tool that is both impactful and sustainable in its fight against childhood obesity.

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1.1 Scope of Project

The scope of the Project's is detailed within the GA and Horizon Europe Proposal ('**Proposal**').[1] This section offers a concise overview, emphasizing the Project's most pertinent aspects for this Report.

As mentioned earlier, BIO-STREAMS is a diverse project aimed at addressing childhood and adolescent obesity through the utilization of data and technology. The Proposal includes a visual representation of the BIO-STREAMS 'Ecosystem,' summarizing its various elements.[2]

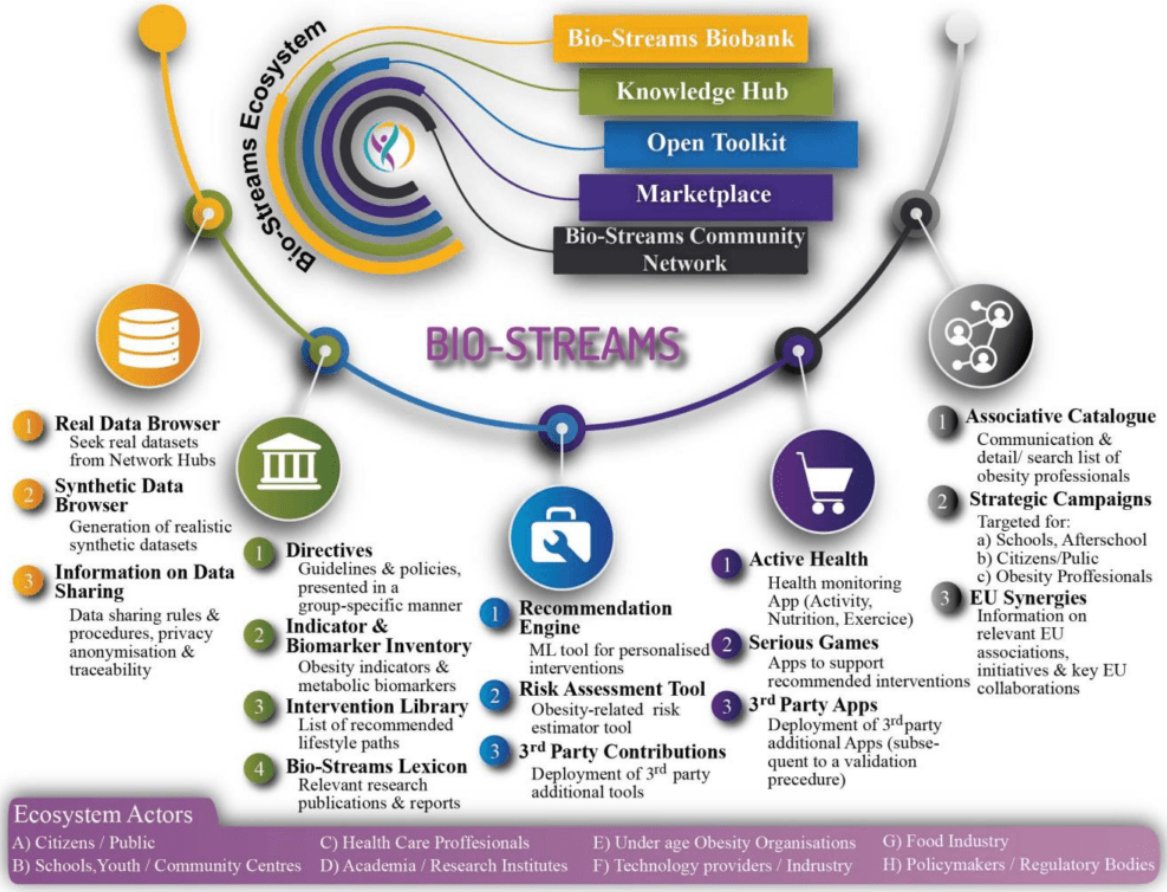

Figure 1: A visual representation of Bio-Streams Ecosystem

[1] *Proposal for Horizon Europe Work Programme 2021 – 2022 / Health HORIZON-HLTH-2022-STAYHLTH-01-05-two-stage - Prevention of obesity throughout the life course Multi-Pillar Framework for children Anti-Obesity Behaviour building on an EU Biobank, Micro-Moments and Mobile Recommendation Systems. Ref. Ares (2022) 6184745 - 07/09/2022.*

[2] *Proposal, 7.*

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The BIO-STREAMS 'Ecosystem' incorporates five main components, supported by the necessary backbone services & packages',[3] which are presented in the following table:[4]

Table 1: Bio-Streams main backbone services and packages

Service/Package	Short Description
Bio-Streams Node Bundle (BNB)	It includes hardware & software resources, installed at every *Bio-Streams* member site to create a Data Hub. All Hubs formulate a Hub Network constituting the *Bio-Streams* Biobank.
Synthetic Data Generator (SDG)	Service for on-demand creation of synthetic datasets based on knowledge extracted from real data in the *Bio-Streams* Biobank.
Data Handler	Service for dataset cataloguing, browsing, requesting, sharing & tracking. Operation will be governed by the *Bio-Streams* regulatory framework and Data Management Plan.
Security Assurance Framework (SAF)	SAF will ensure secure and privacy-preserving operation of all *Bio-Streams* components and services, dynamically operating both synchronously and asynchronously.
ML tools	Federated ML supporting knowledge representation & extraction (e.g. SDG), risk assessment and pathway recommendation.

Structurally, the Project is organised into five 'Phases', which are summarized from the Proposal[5] as follows:

1. Build knowledge foundation for the design, development and implementation of BIO-STREAMS;
2. Build BIO-STREAMS Biobank;
3. BIO-STREAMS Solution Integration;
4. BIO-STREAMS Community Network; and
5. Pilot-based Evaluation & Efficacy Validation.

While each Phase holds significance for the Project's overarching goals, the Biobank stands as a cornerstone, essential for advancing other Phases or components within the BIO-STREAMS Ecosystem. The Project entails gathering and examination of physical biological samples. However, it is the digitized data that will primarily drive the Project toward its objectives, encompassing metadata extracted from biological material.[6] Therefore, the BIO-STREAMS Biobank is best conceptualized as a virtual biobank, serving as an 'EU-wide data-sharing centre'[7] for childhood/adolescent obesity, housing various data types such as demographic, behavioral, clinical, genetic/epigenetic, and cost data.[8] The critical role of the BIO-STREAMS Biobank within the Project is depicted in the accompanying graphic:[9]

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[3] *Proposal, 6.*

[4] *Proposal, 7.*

[5] *Proposal, 7-18.*

[6] *Proposal, 12. Note that the GDPR distinguishes biological material from data that is derived from it (at recital 33).*

[7] *Proposal, 2.*

[8] *Ibid.*

[9] *Proposal, 12.*

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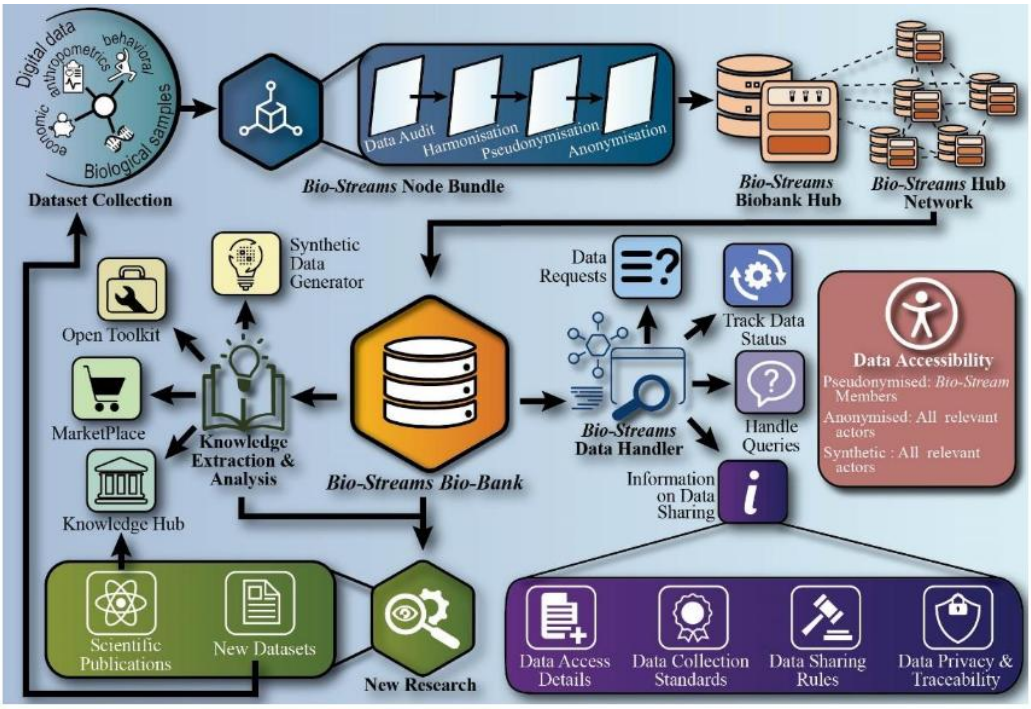

Figure 2: Process of collecting, storing, analysing, and sharing Project data

The graphic above illustrates the process of collecting, storing, analysing, and sharing Project data in connection with the BIO-STREAMS Biobank.

1.2 Scope of Report

This deliverable is designed to systematically capture and define the necessary requirements and detailed use cases that will inform the design and functionality of the digital solution. The main aspects covered by the deliverable are:

- Stakeholder Identification: Identifying a diverse range of stakeholders involved in childhood obesity management, including healthcare professionals, educators, policy makers, and families. This ensures that the platform caters to the needs and expectations of all relevant users.
- Requirements Elicitation: Conducting in-depth analyses and interactions with stakeholders to gather comprehensive information on their needs, preferences, and the challenges they face in managing or preventing obesity in children and adolescents.
- Requirements Analysis: Analyzing the collected data to distil and prioritize user requirements. This involves sorting through various inputs to identify common themes and unique needs that the platform must address.
- Use Case Development: Translating the refined user requirements into detailed use cases that describe specific scenarios in which the digital platform will be used. These use cases help visualize how the platform functions in real-world applications and serve as a guide for developers.
- Validation and Refinement: Iteratively reviewing the requirements and use cases with stakeholders to validate their accuracy and relevance. This process will be carried out under umbrella of Living Labs, carried out under WP6. The process ensures that the

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platform development is aligned with user needs and expectations, increasing its usability and effectiveness.

1.3 Actors

The Project involves and impacts a variety of actors. This section maps out the primary stakeholders relevant to this Report.

1.3.1 Project Partners

The Project connects 30 project partners ('**Partners**') from all over EU, including:

- 12 Small-Medium Enterprises ('**SMEs**');
- 7 Clinical Partners;
- 5 School Pilot Partners;
- 2 Academic Partners;
- 3 Industry Partners; and
- 1 Non-Governmental Organisation ('**NGO**').

Informally within the Project, particularly in meetings among the Partners, there is a common practice of identifying 'Technical Partners.' These partners primarily handle technical aspects of the Project, such as developing machine learning ('**ML**') models or ensuring data security. In this Report, the term 'Technical Partners' is used to specifically denote those partners primarily focused on technical aspects, most of which are small and medium-sized enterprises (SMEs).

1.3.2 Other Actors

Numerous other stakeholders are involved in the BIO-STREAMS Project. These groups of individuals may be categorized differently depending on the context. For instance, a study participant could also be regarded as a 'patient' under various legal or ethical frameworks.

The Proposal organizes the various actors pertinent to the Project's main components in the previously shown Ecosystem graphic.[10] These are:

1. Citizens / Public
2. Schools, Youth / Community Centres
3. Healthcare Professionals
4. Academia / Research Institutes

[10] *Proposal, 7.*

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5. Underage Obesity Organisations
6. Technology providers / Industry
7. Food Industry
8. Policymakers / Regulatory Bodies.

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2 Value sensitive design and stakeholder engagement

In this section, the timeline and overall methodology of User requirements and Use cases definition is presented. The objective was to collect information and align the vision from relevant stakeholders to identify needs within the relevant obesity-related domains and translate this information into the final version of use cases and KPIs (outcomes) for the studies. Methodology from project H2020 HosmartAI (ref.: 101016834) has been adopted for this goal.

2.1 Task timeline

Figure 3: Task 2.3 timeline

In the first step, the goal was to define the user Persona questions and a strategy to implement them. This was done in close collaboration with HUA, NKUA and other educational and clinical sites. Also, pilot sites have been specified with the type of interventions to be carried out and best practices. Access to stakeholders and the definition of engagement and recruitment strategies has been provided with the help of clinical, education sites EASO and NUCLIO. Meanwhile, surveys and online meetings with partners have been conducted and later also workshops. A literature review conducted by all partners provided insights for the requirements targeting Personas. Based on the input from partners, initial version of user Personas have been drafted, including their background information, goals, motivations, needs, and benefits that they could receive from BIO-STREAMS digital solutions.

The goal of the second step was to collect user requirements. Based on the user Persona profiles formed in the previous step, user requirements have been specified by the UM team and extended by the thematic analysis of the initial survey among expert stakeholders in BIO-STREAS. Considering this, user stories have been prepared by the to describe the user scenarios.

The third step is yet to be carried out in the following 12 months. User requirements and user stories defined in phase two will be further refined through stakeholder workshops.

2.2 Task methodology

Participatory design is an overarching methodology that has been used throughout the first and the second step in this task. It is reported to be an effective method of obtaining user requirements, being based on the active involvement of stakeholders in the design process, where stakeholders become proactive agents in the product development process (Halskov et al., 2015).

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As the profiles of professional stakeholders (clinicians, data scientists, …) relevant to the design process are to a large extent represented in our consortium, the activities aimed at defining user requirements have included the partners themselves.

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3 Identification of stakeholders and Persona research

A Persona-development approach has been adopted to define use cases and user requirements for Task 2.3. This approach is being increasingly used in the Human-Computer Interaction (HCI) field to define characteristics of people who are likely to use a device or an online service (Acuña et al., 2012). Their advantage is also to help designers focus on the relevant user segments and providing a shared ground for communication (Pruitt & Grudin, 2003).

In the literature, three Persona creation methods can be found: qualitative, quantitative (data-driven) and mixed method (see Jansen et al., 2022 for an overview), where each one has its own advantages and limitations. For creating Personas in the BIO-STREAMS project, we have decided to use a mixed-method approach, as it is advocated by experts in the field (Salminen, Guan et al., 2020) due to its ability to produce comprehensive and complete Personas, combining the benefits of both alternative approaches.

3.1 Persona Creation

3.1.1 Persona creation methodology

For the first step of Persona development, i.e., Persona creation, a qualitative approach has been adopted. Partners have provided answers to open-ended questions in the initial questionnaire, which have been then synthesized. In the second iteration, key persona characteristics that emerged from the synthesis have been mapped to a shorter list of Personas. Based on these, more elaborate descriptions and the first versions of Personas have been formed.

3.1.2 Initial questionnaire to define Personas

Initial content has been obtained by distributing a questionnaire among BIO-STREAMS partners to serve as a starting point for Persona creation. Based on their insights, the aim was 1) to determine who the key end-users of BIO-STREAMS platform will be and 2) to determine their background information (age range, level of education), motivations, needs, goals that the user would want to accomplish with the BIO-STREAMS solution, digital solutions the user will seek in BIO-STREAMS solution, and benefits that they would gain from using it (see Appendix A for specific questions).

We have consulted existing literature on Persona development to determine the content of the questionnaire. According to Pruitt and Adlin (2010), different types of information is relevant in different contexts, thus developers need to decide based on their expertise and knowledge on their environment, what kind of information will prove most relevant in their specific case. Tu and colleagues (2010), for example, included questions on users' goals and motivations, Ferreira and colleagues (2018) propose including needs, among other characteristics, and multiple developers include background information (Baxter et al., 2015; Ferreira et al., 2018; Pruitt & Adlin, 2010, etc.). In addition to goals, needs, motivation and background information, we have decided to add a topic on digital solutions to be sought by a BIO-STREAMS platform user and expected benefits of the platform.

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After the partners' contributions have been delivered, their inputs were analysed and synthesized. The outcome of this step were 19 different Personas with basic characteristics defined. These characteristics followed five main topics of the questionnaire: user's background info, motivations, needs, goals the user would want to accomplish with the BIO-STREAMS solution, digital solutions the user will seek in BIO-STREAMS solution, and benefits that they would gain from using it.

3.1.3 Persona voting and characteristics mapping exercise

To create comprehensive Persona descriptions, a live workshop with all partners has been organized during the BIO-STREAMS plenary meeting on 9th and 10th of November 2023. The workshop included two exercises, the first one being a voting exercise on Personas, where the aim was to reduce the number of Personas that emerged from the previous step. Parent and child Persona have been chosen by default and then, partners were instructed to vote for three Personas from the clinical environment and three from school environment. The second exercise was held in the Miro app, where partners were asked to map the key characteristics, defined in the previous step, with the Personas on the board. After synthesizing the insights from these two activities, the outcome of this step was a shortened list of 12 Personas with comprehensive definitions of Personas' distinguishable characteristics.

3.1.4 Persona list refinement and descriptions creation

Following the live workshop with partners and the synthesis of their contributions, discussions have been held on bi-weekly T2.3 meetings to further shorten the Persona list. Based on the observation that several developed Personas were very similar to each other and on the need to keep the Personas list manageable quantity-wise, it has been decided on the BIO-STREAMS consortium level that some Personas would better be combined (e.g. all healthcare specialist Personas have been merged into Doctor). Next, initial descriptions for each Persona section (background info, motivations, needs, goals, digital solutions sought, and benefits) have been created based on the inputs from Step 1 and Step 2 and presented in a chosen template (see Chapter 3.3). Profile photos for each Persona have been chosen from a site offering free pictures (www.freepik.com).

3.1.5 Final list of identified Personas

The final list constitutes of eight Personas that have been assessed to be relevant for accomplishing for BIO-STREAMS project goals: Child, Parent, Teacher, Principal, Doctor, Dietitian, Biomedical Data Scientist, and Policy maker.

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3.2 Persona Validation

3.2.1 Validation with internal stakeholders

3.2.1.1 Persona validation methodology

For Persona validation with internal stakeholders, we have adopted a predominantly quantitative approach in combination with a qualitative analysis of respondents' textual comments on the Personas (hence, a mixed-method approach).

Procedure

For quantitative validation, an online survey was distributed among all consortium members via an online survey tool (www.1ka.si), receiving responses from 9th to 29th of January 2024. Before evaluating the Personas, participants were informed about the study, the anonymous and voluntary nature of their participation, and their right to terminate the study at any time. Specifically, participants were shown each Persona on screen presented in a form similar to the form of final Personas (see Chapter 3.3). To quantitatively evaluate various aspects of each Persona, participants were asked to respond to a validated questionnaire, integrated into the online survey tool (Salminen, Santos et al., 2020). With each Persona presentation, participants received instructions: "Please, review the persona information carefully in the light of the BIO-STREAMS – imagine that the presented Persona is an end user of the products developed in this project. Keeping this in mind, please provide your honest opinion regarding the Persona profile on a 7-point scale."

Materials

Persona Perception Scale (Salminen, Santos et al., 2020) has been previously used elsewhere for the same purposes (Tan et al., 2021). It consists of 27 items on a scale from 1 to 7 (1 - strongly disagree; 2 – disagree, 3 – somewhat disagree, 4 – nor agree nor disagree, 5 – somewhat agree, 6 – agree, 7 - strongly agree) and some statements have been slightly adapted to fit into the BIO-STREAM context. Items refer to different aspects of Persona perception, namely (example items shown in parentheses), Persona Consistency (example item: "*The picture of the persona matches other information shown in the persona profile*."), Completeness ("*The persona profile is not missing vital information*."), Willingness to use *("We would make use of this persona in our task of developing BIO-STREAMS outputs.*"), Credibility ("*The persona seems like a real person*."), Clarity *("The information about the persona is well presented*."), Similarity ("*This persona feels similar to me.")*, Likability *("I find this persona likable.*") and Empathy *("I feel like I understand this persona.*").

Additionally, after participants rated persona quantitatively, there was space to enter any textual comments they might have had regarding the quality of Personas. These comments were later qualitatively analysed, results of which we present at the end of next section.

The survey also included several demographic questions (role of participant's institution in BIO-STREAMS, field of work, frequency of contact with children, education level, field of study, years of work experience, and gender), report on which we include in the next chapter.

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3.2.1.2 Persona validation results

In this section, we present the participants' characteristics and the results of Persona validation process. First, we present general information on the online survey response metrics in Table 2, second, sample characteristics are presented in Table 3, third, we report results on Persona quantitative evaluation in the form of means and standard deviations in Table 4, and fifth, we present the estimations of inter-rater reliability of Persona evaluations in Table 5.

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Participants

In Table 2 below, general metrics of survey responses are recorded. It is evident that 31 complete responses of consortium members have been received.

Table 2: Number of responses received in the online validation survey

Metric	Frequency
Complete	31
Partially complete	24
Total valid	*55*
Entered first page	5
Entered intro	58
Total invalid	84
Total surveyed	118
All units in database	118

Note. The final analyses were conducted on a sample of 34 raters.

In Table 3 (on next page), we present the demographic characteristics of respondents to the survey. We have received twice as many responses from female participants than from male, which points to a slight underrepresentation of male participants in the sample. Regarding the participants' working field, more than half work in healthcare, around one quarter in research and smaller proportions in education, technology and government. Highest education level reached by a bit less than a half of participants is a Doctoral degree, around one third a Master's degree and smaller proportion of participants reached Bachelor's degree and secondary education. Regarding field of study, around one quarter of the participants have educational background in medicine, around 15% in dietetics or nutrition and economics, and smaller proportion in other fields of study (see Table 3). Lastly, participants have also reported the role of their institution in the project. Most represented were clinical and academic partners (each around one third of the sample) and the rest were represented by smaller percentages (see Table 3 for specific percentages and project partner roles.

Based on the results, we estimate that we have managed to reach a representative sample of respondents, as regards field of work, education level, field of study, and role of participant's institution in the project.

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Table 3: Demographic data of online validation survey participants

		Count	Percent
Gender	Female	20	58.82
	Male	10	29.41
	Missing value	*4*	*11.76*
Field of work*	Healthcare	19	55.88
	Research	9	26.47
	Education	5	14.71
	Technology	5	14.71
	Government	4	11.76
Education level	Doctoral degree	15	44.12
	Master's degree	11	32.35
	Bachelor's degree	3	8.82
	Higher secondary	1	2.94
	Missing value	*4*	*11.76*
Field of study	Medicine	8	23.53
	Dietetics/Nutrition	5	14.71
	Economics	4	11.76
	Nursing	2	5.88
	Education and leadership	2	5.88
	Psychology	2	5.88
	Physiotherapy	2	5.88
	Teaching	1	2.94
	Engineering	1	2.94
	Political science	1	2.94
	Anthropology	1	2.94
	Missing value	*5*	*14.71*
Role in project*	Clinical pilot	12	35.29
	Academia	11	32.35
	School pilot	4	11.76
	Industry	4	11.76
	SME	4	11.76
	NGO	2	5.88
	Other	2	5.88

Note. * - participants were able to select multiple answers, percentages for these two demographic characteristics were calculated based on total sample size (N = 34).

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Persona validation results

In Table 4 (on next page), basic statistics (means and standard deviations) for each Persona and scale dimension pair are presented. All Personas were, on average, assessed above 5 (on a 7-point scale), which we interpreted as satisfactory. Moreover, the highest rated dimension across all Personas was Clarity and the lowest was Similarity. Similarity rated in Child Persona had the lowest score overall, which is reasonable since the raters were adults. Looking at the summary scores for Personas, the Doctor Persona had the highest rating and the lowest, once more, the Child Persona. Since relatively many respondents were doctors (see Table 3), perhaps higher scores indicate that the Personas raters find the most similar to themselves, are rated higher. This is additionally supported by the fact that the Child persona has the lowest rating.

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Table 4: Means and standard deviations across Persona Perception Scale dimensions and Personas

	Consistency *M (SD)*	**Completeness *M (SD)***	**Willingness to use *M (SD)***	**Credibility *M (SD)***	**Clarity *M (SD)***	**Similarity *M (SD)***	**Likability *M (SD)***	**Empathy *M (SD)***	**Overall results for persona *M (SD)***
Child	5.51 (0.85)	5.44 (0.96)	5.72 (1.00)	5.52 (0.70)	6.00 (0.60)	4.26 (1.15)	5.11 (0.84)	5.15 (0.80)	5.34 (0.52)
Parent	5.71 (0.76)	5.67 (0.92)	5.73 (1.09)	5.87 (0.57)	6.11 (0.55)	5.38 (0.87)	5.66 (0.79)	5.46 (0.71)	5.70 (0.23)
Teacher	5.82 (0.73)	5.85 (0.67)	5.84 (1.08)	5.73 (0.76)	6.06 (0.56)	5.48 (0.89)	5.65 (0.74)	5.57 (0.69)	5.75 (0.18)
Principal	5.84 (0.72)	5.86 (0.78)	5.71 (1.08)	5.64 (0.75)	5.98 (0.73)	5.14 (1.07)	5.44 (0.91)	5.24 (0.99)	5.61 (0.30)
Doctor	5.98 (0.76)	6.06 (0.67)	5.99 (1.13)	6.03 (0.76)	6.26 (0.64)	5.53 (1.25)	5.84 (0.87)	5.63 (0.98)	5.92 (0.24)
Dietitian	5.83 (0.79)	5.82 (0.97)	5.93 (1.04)	5.78 (0.83)	6.02 (0.90)	5.50 (1.07)	5.61 (0.85)	5.56 (0.95)	5.76 (0.18)
Data Scientist	6.08 (0.58)	5.96 (0.67)	5.94 (1.13)	5.96 (0.56)	6.19 (0.55)	5.36 (1.13)	5.73 (0.77)	5.52 (0.99)	5.84 (0.28)
Policy maker	6.01 (0.65)	5.88 (0.71)	5.83 (1.07)	5.77 (0.68)	6.10 (0.63)	5.21 (1.18)	5.34 (0.97)	5.37 (0.93)	5.69 (0.34)
Overall results for dimension *M (SD)*	5.85 (0.18)	5.82 (0.19)	5.84 (0.11)	5.79 (0.17)	6.09 (0.10)	5.23 (0.42)	5.55 (0.24)	5.44 (0.17)	

Note. In the columns, different personas within each dimension are compared and in the rows, dimensions within each persona are compared. Consistency: measures how consistent the different information in the persona profile is; Completeness: measures how well the persona captures essential information about the users it describes. Willingness to use: measures how willing the respondent is to learn more about the persona; Credibility: measures how credible (realistic, authentic) the persona appears; Clarity: measures how clearly the persona information is presented; Similarity: measures how similar the respondent feels the persona is to him or her; Likability: measures how likable the respondent perceives the persona to be; Empathy: measures how well the respondent empathizes with the persona. *M* – mean, *SD* – standard deviation

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Overall inter-rater reliability (on the level of items) was good, ICC(2,33) = 0.81, 95 % CI (0.76, 0.84).

In Table 5: Intraclass correlation coefficients and 95% confidence intervals for Persona Perception Scale dimensions, we are presenting the ICCs that were utilized to measure interrater agreement. However, as can be seen from the 95% confidence intervals, the ICC estimates are not reliable due to some missing data and low variability in some cases of data. Thus, the ICCs should be interpreted with caution. We have highlighted in bold some estimates that nevertheless show good reliability (above 0.75), following the guidelines from Koo and Li (2016). The following table presents ICCs for each evaluated dimension across all Personas, informing on consistency of raters in their evaluations within each dimension. However, as mentioned, confidence intervals are wide and therefore the estimates are not reliable.

Table 5: Intraclass correlation coefficients and 95% confidence intervals for Persona Perception Scale dimensions

Consistency ICC [95% CI]	**Completeness ICC [95% CI]**	**Willingness to use ICC [95% CI]**	**Credibility ICC [95% CI]**	**Clarity ICC [95% CI]**	**Similarity ICC [95% CI]**	**Likability ICC [95% CI]**	**Empathy ICC [95% CI]**
0.585 [0.271, 0.880]	0.502 [0.129, 0.850]	0.107 [-0.065, 0.529]	0.499 [0.132, 0.850]	0.083 [-0.363, 0.674]	**0.810 [0.609, 0.950]**	0.687 [0.406, 0.910]	0.370 [-0.041, 0.802]

Notes. In this analysis, all missing values were excluded. Results were computed for all Personas combined. ICC – Intraclass correlation coefficient, CI – confidence interval

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Qualitative methodology

Procedure

Data for qualitative evaluation of the Personas was collected through text boxes that were provided in the online survey after the quantitative evaluation for each Persona. Participants were encouraged to leave their comments by an instruction: “You can add any additional comments or observations regarding the CHILD Persona here:” followed by a text entry box.

Some qualitative feedback on Personas has also been collected in parallel to the online survey through other project activities, e.g. internal workshops.

Qualitative data analysis

We used a simple text analysis to summarize the results on Persona qualitative evaluation. Greater emphasis was out on the comments that have emerged multiple times. In the section below, you will find a summary of participant feedback on each Persona. At the beginning of each summary, more important feedback is presented that has emerged from multiple comments, followed by less important comments that have been noted only by one or two participants.

Qualitative results

On average, eight out of 31 respondents have provided textual comments in addition to quantitatively evaluating the Personas.

Child Persona

Participants reported that background information on the Persona’s family and home situation was somewhat insufficient. Additionally, it has been emphasized several times that the Persona’s classification as overweight or obese should be made more explicit. It has also been noted that the importance of parent surveillance over the use of technology, such as smartphones and tablets, should be added to the Persona. Furthermore, suggestions for rephrasing specific sentences have been provided.

Parent Persona

Similar as in Child Persona, comments implied that background information was lacking (marital status of the parent, fulltime parent, employed or not, time available, whether he is a parent of a child with obesity…). Furthermore, suggestions for rephrasing specific sentences have been provided.

Teacher Persona

It has been highlighted several times that many responsibilities mentioned in the persona fall out of the scope of work of a teacher (e.g. her job is not to assess and plan tailored interventions). It was noted that the fact that some teachers might not be willing to participate in such extra-curricular activities and might find them as a burden should be added. Again, background information was missing (i.e., whether the teacher has any specific roles or responsibilities in the school). Furthermore, suggestions for rephrasing specific sentences have been provided.

Principal Persona

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Participants have reported that the fact that graphical presentation of research data should be presented to the principal in a simple and understandable way should be added to the Persona. Additionally, comments also highlighted that some activities and digital solutions mentioned in the descriptions are more relevant for a Teacher Persona or a Doctor Persona when it comes to planning obesity prevention. Again, it was reported that background information was missing and suggestions for rephrasing specific sentences were provided.

Doctor Persona

Some comments mentioned the fact that it should be decided whether the doctor Persona is about the doctor that is mostly doing research or a doctor that is working in clinical practice. Furthermore, suggestions for rephrasing specific sentences have been provided.

Dietitian Persona

It has been mentioned several times that the goal/motivation regarding performing research should be put after assisting children with weight management. Furthermore, suggestions for rephrasing specific sentences have been provided.

Biomedical Data Scientist Persona

Some comments implied minor revisions in Persona's motivations, goals and needs (whether improving quality of life of children is a relevant goal, etc.).

Policy maker Persona

Several comments have implied that background information is missing, such as what kind of policy maker is presented by the persona (national, international, regional, local, organizational) and from which field. Participants also commented that cost effectiveness data could be added and also that educational modules for children fall out of scope for this Persona.

Feedback presented here has been integrated into Persona presentations. The final Personas are presented in Chapter 3.3.

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3.2.2 Validation with external stakeholders

3.2.2.1 Persona validation methodology

Additionally, some of the Personas were evaluated in the parallel study with raters outside the consortium. This study was conducted by University of Maribor team two contexts, i.e., clinical and educational, where participants employed in each of the contexts were evaluating Doctor – Paediatrician, Dietitian and Patient Personas, and Student, Teacher and Principal Personas, respectively. Similarly to the evaluations of Personas within consortium, Persona Perception Scale (Salminen, Santos et al., 2020) was used. However, we omitted the Similarity and Willingness to use subscales since we did not expect participants to feel particularly similar to our Personas, nor were they expected to provide information on whether they would use Personas in their work for BIO-STREAMS, as they were not part of the project.

3.2.2.2 Persona validation results

Methods

Participants

In the clinical context, 63 participants responded to the online survey. Most of the participants (55.56%) were female and had on average 9.24 (SD = 9.06) years of work experience. The sample consisted mostly of nurses (25.40%) and doctors (20.63%), with mostly medical (39.68%) and nursing (23.81%) studies background, obtaining bachelor's degree or equivalent (41.27%) Most of the participants were employed in the primary health care (49.21%), and mostly resided in the United Kingdom (26.98%).

In the educational context, 64 participants responded to the online survey. Most of the participants were female (60.94%) and had on average 11.09 (SD = 10.31) years of work experience. The sample consisted mostly of teachers (50.00), and most of the participants had an educational background in teaching a specific subject (39.06%), with most of them obtaining master's degree or equivalent (43.75%). Most of the participants were employed in higher education (40.63%), and mostly resided in the United Kingdom (25.94%).

Detailed description of both samples is available in the Appendix C.

Materials

Participants were presented three Personas in each context: Child patient, Doctor (Pediatrician), and Dietitian in the clinical context, and Student, Teacher, and Principal in the educational context. Participants in both contexts evaluated a set of three personas via Persona Perception Scale (Salminen et al., 2020), which consists of eight subscales of which six were used: Credibility (3 items; e.g., *The Persona seems like a real person*.), Consistency (4 items; e.g., *The Persona information seems consistent*.), Completeness (4 items; e.g., *The Persona profile is not missing vital information*.), Clarity (3 items; e.g., *The information in the persona profile is easy to understand.*), Empathy (3 items; e.g., *I feel like I understand this Persona.*), and Likability (4 items; e.g., *I could be friends with this Persona*). Most subscales showed acceptable to great internal consistency. The scale consisted of 20 items, to which participants responded on a 7-point scale (1 – *strongly disagree*, 7 – *strongly agree*). We presented slight modifications to the questionnaire, i.e., in one item in the Completeness subscale (i.e., The Persona profile is detailed enough to make decisions about the consumers it describes), the word "consumers" was replaced with the word "people" to align better with the study, and we omitted one item from the Consistency subscale as it referred to parts of description of Persona that we did not use. In this study present study, the Consistency and

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Credibility subscales included items referencing a picture of the Persona. However, these items were not relevant for the Persona descriptions developed using LLMs, as they did not include images. Consequently, these items were omitted from the analysis. Additionally, participants were required to complete four attention checks distributed throughout the questionnaires. These checks were presented as specific instructions, such as selecting 'Not applicable' as a response (Maniaci & Rogge, 2014). Additionally, participants responded to a set of questions on their socio-demographic characteristics.

Procedure

Participants were recruited via Prolific (www.prolific.com/) panel which redirected them to the survey set up at 1ka (https://1ka.arnes.si/) in February 2024. The following eligibility criteria were applied: 1) had to be of 18 years old or more, 2) reside in Europe, 3) have good knowledge of English, 4) employment in the medical sector or education and training sector (for clinical or educational context, respectively).

Before evaluating the Personas, participants were informed about the study, the anonymous and voluntary nature of their participation, and their right to terminate the study at any time. Those who consented to participate, were presented with three Personas in a random order and Persona Perception Scale for their evaluation. After evaluating the Personas, they responded to the socio-demographic questions. After completing the questionnaires, they were rewarded 6.5£ for their participation. Ethical approval was not required for this study following the institutional guidelines.

Results

First, we evaluated the inter-rater reliability in both contexts, which proved to be excellent (Koo & Li, 2016) in clinical, ICC(2, 63) = .92, 95% CI [.90, .93], and educational context, ICC(2, 64) = .92, 95% CI [.91, .94].

Second, we calculated the average scores and standard deviations for each Persona and each subscale of the Persona Perception Scale.

In the educational context, the evaluations on all perception dimensions for all Personas were above 4.1 (on a 7-point scale), presenting favourable evaluations on all dimensions. The most favourably evaluated was the Teacher Persona, with evaluations from an average 4.7 (SD = 1.22) on Empathy subscale to 5.77 (SD = 0.82) on Consistency subscale. The second best evaluated was the Principal Persona, with evaluations from an average 4.42 (SD = 1.32) on the Empathy subscale to 5.75 (SD = 0.81) on Consistency subscale. Least favourable, but still very positively evaluated was the Student Persona, with evaluations from an average 4.17 (SD = 1.38) on Likability subscale to 5.67 (SD = 1.07) on Clarity subscale. In general for educational context, the Personas scored the highest on the Consistency subscale (average for all three Personas (M) = 5.65, SD = 0.20), followed by Clarity subscale (M = 5.48, SD = 0.40), Completeness subscale (M = 5.36, SD = 0.09), Credibility subscale (M = 5.29, SD = 0.37), Likability subscale (M = 4.53, SD = 0.36), and Empathy perception subscale (M = 4.43, SD = 0.26).

In the clinical context, the evaluations on all perception dimensions for all Personas were above 4.5 (on a 7-point scale), again presenting favourable evaluations on all dimensions. The most favourably evaluated was the Paediatrician Persona with evaluations from an average 5.03 (SD = 1.16) on Empathy subscale to 5.96 (SD = 1.02) on Clarity subscale. The second best evaluated was the Patient Persona with evaluations from an average 4.50 (SD = 1.37) on Likability subscale to 5.87 (SD = 0.86) on Clarity subscale. Least favourably, but again still very positively evaluated was the Dietitian Persona with an average 4.51 (SD = 1.33) on Empathy subscale to 5.84 (SD = 0.91) on Clarity subscale. In general for the clinical context,

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the Personas scored the highest on the Clarity subscale (average for all three Personas (M) = 5.89, SD = 0.06), followed by the Consistency subscale (M = 5.65, SD = 0.19), Completeness subscale (M = 5.57, SD = 0.22), Credibility subscale (M = 5.29, SD = 0.38), Likability subscale (M = 4.97, SD = 0.51), and Empathy subscale (M = 4.70, SD = 0.29).

Average scores for all Personas on all perception dimensions are available in the Appendix C.

To summarize, all evaluated of Personas were evaluated positively by participants outside of the BIO-STREAMS consortium.

3.3 Final Persona Refinement and Persona Descriptions

Based on the concrete textual comments provided by participants through the Persona evaluation survey, minor revisions of Personas have been made. More specifically, we have added background information on several Personas and redefined some responsibilities that have been reported to fall out of scope of these Personas. On the next pages, final Persona descriptions can be found.

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Background info

Name: Jane
Age: 9 years
Role: child with excess weight

Jane lives with her sister and parents in a suburban house. She plays tennis on a weekly basis for one hour and enjoys regular sports class twice a week in school. Every day after school, her mom prepares a pre-cooked meal for the family.

What are her goals?

Children do not fully grasp the idea of goals yet at that age. Her goal is **to have fun**, **interact with peers**, and to **have peer and parent approval**. However, when they become teenagers, they begin forming ambitions for themselves. One ambition related to obesity prevention is **to have a healthy relationship with her own body** and another is **to reduce sedentary behavior**.

What are her needs?

Jane's needs are to **receive knowledge on a healthy lifestyle** and to **get engaging information** and, most importantly, to **receive enough encouragement** from her parents, peers, and teachers. Her need is also to **reduce sedentary behavior** and, when she is older, **to take charge of her own weight management**.

More specifically:

- Fun and Engaging Learning: Jane needs a platform that turns learning about nutrition and exercise into a fun and interactive experience. For instance, interactive games that teach her about healthy food choices and the importance of physical activity.
- Peer and Parent Approval: Jane seeks approval from her friends and family. The platform should have features that allow her to share achievements with peers and receive positive feedback from both friends and parents.
- Encouragement and Positive Reinforcement: Jane requires regular encouragement to stay motivated. Personalized messages, virtual rewards, and a system that acknowledges her progress can be crucial in keeping her engaged.
- Knowledge of a Healthy Lifestyle: Jane needs easily digestible information about healthy eating habits and the benefits of an active lifestyle. Animated videos or infographics that break down these concepts in a child-friendly manner would be ideal.
- Taking Charge of Health: Jane wants to feel in control of her health journey. The platform should provide her with tools, like setting personal goals or creating a virtual avatar, to empower her to make positive choices.

What can Jane benefit from BIO-STREAMS?

Jane is looking **to have fun with activities** she engages in. By using BIO-STREAMS, she will benefit by **indirectly changing her lifestyle habits** and **improving her self-esteem**. The solution will offer her **guidance on weight management**. This guidance will focus on promoting the principles of a healthy lifestyle and not weight loss per se, therefore the stigma around overweight/obesity will be smaller, which will cause lesser pressure on her.

What is her motivation?

Jane is motivated by her **well-being and happiness**, which resonates with mental health in people her age. She is highly motivated by **peers' opinion and approval.** Sometimes, she **is a victim of bullying at her school, which also impacts her self-esteem in a negative way**. She **enjoys physical activity** which also helps her with **health issues prevention**. She does not bother herself with health issues; however, her parents do, and she seeks their approval. Lastly, she is also motivated by competing with her peers.

What digital functions does she seek?

Jane benefits from different functions in her digital devices. She likes to **connect with her peers** and **engage in interactive activities**. She **likes to play electronic games or use apps with gamified elements.** However, her smartphone and/or tablet use should not be without the parents' surveillance. When Jane becomes a teenager, she will benefit from **personalized recommendations in the app** and **an individualized nutrition plan**.

More specifically, examples of digital solutions sought are:

- Interactive Mobile Apps: An app that she can access on her tablet or her smartphone, incorporating gamified elements and interactive features to make it enjoyable for her.
- Virtual Rewards System: A system that rewards her with virtual badges, stars, or other symbols of achievement for completing daily exercises or making healthy food choices.
- Family-Friendly Challenges: Challenges that involve the whole family, fostering a supportive environment for Jane and encouraging healthy habits for everyone.
- Progress Tracking and Visualization: A feature that allows Jane and her parents to track her progress visually, providing a sense of accomplishment and motivation for continued engagement.
- Parent-Child Interaction Tools: Features that facilitate communication between Jane, her parents, and potentially her teachers, fostering a collaborative effort in her weight management journey.

Figure 4: Child Persona description

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Background info

Name: Peter
Age: 35 years
Role: parent

Peter lives in an apartment in a middle-class neighborhood with his partner and a child who is overweight. He and his partner have a full-time job, all family members have their own activities in the afternoons. They spend time together in the weekends.

What are Peter's goals?

With BIO-STREAMS solution, Peter wants to **educate himself and achieve a better understanding** of obesity. He also strives to use it for **habit and behavior change** for his family, where **feedback on child's progress, health, and lifestyle habits** will help him. The goal for himself and his family is to generally **follow a healthy lifestyle.**
In the longer term, he aims for his child to **eat healthily, maintain a healthy weight, have optimal quality of life, mental health**, and **engage in less sedentary behavior**. All of this will lead to a smaller chance of comorbidities to obesity.

What are his needs?

Peter's needs are to be **educated, to have access to valid, comprehensible,** and **up-to-date information** on healthy lifestyle and nutrition and to know **how to help his child with weight management**. He needs lots of encouragement and empowerment from other actors.

More specifically:

- Education and Understanding: Peter needs access to valid, comprehensible, and up-to-date information about childhood obesity. He seeks resources that help him understand the factors contributing to his child's weight and the importance of healthy habits.
- Feedback on Child's Progress: Regular feedback on his child's progress is crucial for Peter. This includes updates on weight changes, nutritional improvements, and overall health.
- Healthy Lifestyle Guidance: Peter requires guidance on incorporating a healthy lifestyle into his family's daily routine, including exercise routines, meal planning, and stress management.
- Monitoring Effectiveness: The ability to monitor the effectiveness of activities and interventions is vital. Peter wants measurable data on how lifestyle changes impact his child's health.
- Digital Connection with Health Professionals: Peter seeks a platform that allows him to digitally connect with health professionals, such as nutritionists and pediatricians, for expert guidance and support.
- Long-Term Health Impact: Peter needs to create lasting positive changes that will impact his child's health in the long term, reducing the risk of obesity-related health issues.

What can Peter benefit from BIO-STREAMS?

Peter will be most thankful for **healthy meal preparation suggestions** and **guidance on a healthy lifestyle**. Like **following feedback on child's health status**, he is interested in **monitoring how effective the activities and interventions** that he is participating in are. He likes to **receive feedback, which helps him with changing his own habits**. He will be able to **digitally connect with health professionals** and receive daily support. He will also receive strategies to empower and support his child.

What is his motivation?

As **understanding obesity** is his goal, it also motivates him to use BIO-STREAMS. Most importantly, Peter's **child's mental health** (self-esteem, depression, long-term happiness) is the greatest motivator for him. Generally, he cares for **safeguarding his child's health**. Bad results from doctor's examination might motivate Peter to use BIO-STREAMS and make changes. Also, good motivation is **setting a good example** with living a healthy lifestyle himself.

What digital functions does he seek?

Peter is interested in **monitoring his and his family's progress and results**. He also expects to have **access to valid information digitally**, including **guidelines on obesity prevention**, and to receive personalized recommendations.

More specifically, examples of digital solutions sought are:

- Educational Apps and Resources: Apps and resources providing educational content on childhood obesity, healthy eating, and lifestyle choices.
- Health Monitoring Apps: Apps that track the child's weight, nutritional intake, and physical activity, providing real-time data and trends.
- Lifestyle Planning Platforms: Platforms offering healthy meal preparation ideas, recipes, and grocery shopping assistance tailored to the family's preferences. Regular feedback on his child's progress and personalized recommendations based on the family's needs enhance Peter's ability to implement effective changes. Tools to enable data-driven decision-making and adjustments to the family's lifestyle plan.
- Telehealth Services: Access to telehealth services for virtual consultations with nutritionists, pediatricians, and other healthcare professionals.
- Community Support Platforms: Online communities or forums where Peter can connect with other parents facing similar challenges, sharing experiences and insights.

Figure 5: Parent Persona description

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Background info

Name: Vilma
Age: 51
Role: teacher

Vilma teaches English in elementary school in her hometown. She is actively engaged in extra activities outside of classroom, as an example, she is leading the Healthy Lifestyle workshop that takes place weekly after class and welcomes children aged 11 to 15.

What are her goals?

Vilma's goals are to **learn strategies not only to empower children** but also **to empower and educate parents**. She aims to obtain skills to **communicate information regarding children's healthy lifestyle to parents**. She wants to get in touch with **strategies on how to promote healthy living among children**, to foster critical thinking and prepare them for their future.

What are her needs?

Vilma's needs are **to get skills to make changes, to have autonomy and freedom to enhance learning with technology**. It is crucial that she has **support from the school board**, but she also needs professional development for innovation and inclusion.

More specifically:

- Educational Resources: Vilma needs comprehensive and engaging educational materials that cover the spectrum of promoting healthy habits and preventing obesity. This includes information about nutrition, physical activity, and overall well-being. For example, a virtual lab offering interactive simulations where students can explore the impact of different diets on the body and learn about the nutritional value of various foods.
- Collaborative Platforms: To promote collaboration between students, parents, and fellow teachers, Vilma needs a platform that facilitates communication and resource sharing. For example, a digital space where she can organize and share lesson plans, healthy recipes, and success stories, fostering a sense of community around health and well-being.
- Training and Skill Development: Vilma needs a dedicated section of the platform that offers professional development courses. These courses could cover topics such as incorporating physical activity into the curriculum, organizing nutrition-focused events, and how to be a role model of the desired healthy behaviors.

What can Vilma benefit from BIO-STREAMS?

She will have access to **evidence-based material on preventing obesity** that she will be able to **include in lesson plans**. AI-based platform will help her **identify and meet individual needs of learners**. Also, she will receive **support to organize classrooms in an innovative and collaborative design**.

What is her motivation?

Vilma's greatest motivation is to **maintain positive classroom dynamics, promote health education,** and **educate children about health and well-being**. Also, her motivation is to be recognized for her efforts.

What digital functions does she seek?

In a digital solution, she seeks resources on **how to promote healthy habits, to be in touch with updated best practices, to have access to virtual labs and simulations,** and **collaboration platforms**.

More specifically, examples of digital solutions sought are:

- Gamified Learning Platforms: A gamified app that teaches children about healthy food choices and the importance of regular physical activity through interactive games. This could include challenges, quizzes, and rewards to keep students engaged.
- Gamification for Physical Activity: Integrating gamification elements into the platform to encourage physical activity among students. This could include challenges, competitions, and rewards for achieving fitness milestones. Mick can use this feature to motivate students and make physical activities more enjoyable.
- Nutrition Tracking Apps: An app that allows students and parents to track their daily food intake and physical activity. Vilma can encourage the use of Nutrition Tracking apps and incorporate them in class for education.
- Virtual Cooking Classes: Virtual cooking classes that Vilma can conduct or recommend. These classes could demonstrate how to prepare nutritious meals, involving both students and parents in the learning process.
- Digital Health Journals: A digital platform where students can maintain health journals, recording their daily activities, meals, and emotions. Vilma can encourage the use of Digital Health Journals and incorporate them in class for education.
- Online Workshops and Webinars: Collaborating with health experts to conduct online workshops or webinars on topics related to nutrition, mental health, and physical well-being. This provides Vilma and her students with access to the latest information and expert insights.
- Virtual Field Trips to Health Facilities: Organizing virtual field trips to local health facilities or farms through immersive technologies. This allows students to understand the source of their food and learn about healthy living practices in a virtual environment.
- Peer-to-Peer Support Platforms: Implementing a digital platform where students can share their personal successes and challenges in adopting a healthier lifestyle. This promotes a sense of community and peer support, reinforcing positive behaviors.
- Effort Recognition: A communication channel or a platform where the principal, other teachers, parents, and children can give her recognition for her efforts. For example, in the form of badges, 'Thank you' messages or comments, etc.
- Augmented Reality (AR) Experiences: Integrating AR experiences in health education lessons, where students can use mobile devices to explore virtual 3D models of the human body or visualize the nutritional content of different foods.
- Parent-Teacher Health Forums: Establishing online forums or discussion boards specifically focused on health and well-being. Vilma can use these forums to share resources, answer questions, and foster a collaborative approach with parents.

Figure 6: Teacher Persona description

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<table>
<tr><td rowspan="2">  </td><td>Background info</td><td>What are his needs?</td></tr>
<tr><td>Name: Simon
Age: 32
Role: biomedical data scientist
What are his goals?
Simon’s goal is to connect to researchers and health professionals and to contribute to improving the quality of life of children. Regarding his work, his goal is to generate data-driven insights.</td><td>Simon needs data on physical activity and meal frequency. Also, he needs clearly defined criteria for obesity classification.

More specifically:
• Connectivity: Simon seeks a platform that facilitates seamless communication and collaboration with fellow researchers and health professionals. He aims to build a network that fosters the exchange of ideas, research findings, and best practices in the realm of obesity prevention.
• Research Support: As a data scientist, Simon requires access to a vast pool of real-world data, including information on physical activity, dietary patterns, comorbidities risk, and clearly defined criteria for obesity classification. Having robust research support is crucial for the development of predictive models that can enhance the effectiveness of obesity prevention strategies.
• Behavioral Insights: Understanding the behavior of children with obesity is a key focus for Simon. He needs access to comprehensive data on the lifestyle, habits, and environmental factors influencing obesity in children. Insights into these aspects will inform targeted interventions and personalized treatment plans.
• Data Visualization Capabilities: To communicate findings effectively, Simon values platforms with strong data visualization capabilities. Being able to convey complex data in an accessible manner is vital for collaboration with both researchers and health professionals.</td></tr>
<tr><td>What can Simon benefit from BIO-STREAMS?</td><td colspan="2">What digital functions does he seek?</td></tr>
<tr><td>Simon’s benefits are mostly linked to data access. From BIO-STREAMS, he can benefit from the availability and analytics of real-world data.
What is his motivation?
Simon is motivated by performing research and creating predictive models from data. In this case, predictive models are aimed at early obesity and overweight intervention.</td><td colspan="2">Simon seeks access to data on the behavior of children with obesity and access to demographic, clinical and genetic data. He also expects to have data visualization capabilities in BIO-STREAMS tools and access to data reprocessing. He also aims to be able to connect to researchers and professionals via the platform.

More specifically, examples of digital solutions sought are:
• Machine Learning Algorithms: Advanced algorithms that can process and analyze large datasets, extracting patterns and trends related to obesity and overweight.
• Mobile Applications: Tools that collect real-time data on physical activity and meal frequency directly from individuals, especially children, to supplement clinical and genetic data.
• Cloud-Based Platforms: Platforms that leverage cloud computing for scalable storage and processing of vast amounts of biomedical data.
• Secure Data Sharing: Solutions that prioritize security and privacy while allowing for the secure sharing of datasets among authorized professionals and researchers.
• Data Integration: A platform that allows seamless integration of diverse datasets, including clinical, genetic, and behavioral data, empowering him to create comprehensive models and insights.
• Collaboration Tools: Features that facilitate collaboration, such as discussion forums, webinars, and collaborative project spaces, to connect with researchers and professionals in the field.
• Advanced Analytics: Robust analytics tools for creating predictive models based on real-world data, enabling Simon to derive actionable insights for obesity prevention.
• Customization: The ability to define and customize criteria for obesity classification based on evolving research and emerging patterns.
• Visualization Tools: Advanced data visualization tools for presenting findings in an accessible manner to both scientific and non-scientific audiences.</td></tr>
</table>

Figure 7: Biomedical Data Scientist Persona description

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<table>
<tr>
<td rowspan="2">  </td>
<td>Background info
Name: Amanda
Age: 44
Role: dietitian
What are her goals?
Amanda's goals are to learn and use better diagnostic and preventive approaches and strategies to implement successful dietary interventions and to empower children and parents. She aims to know how to support behavior change and to be able to monitor the effectiveness of interventions for childhood obesity prevention both at the clinical setting and the community. She wants to obtain skills to communicate info to children and parents.</td>
<td>What are her needs?
Amanda needs to be aware of the latest guidelines and research. She needs real world data on dietary patterns. She needs resources and tools that help her engage families.

More specifically:
• Educational Modules: Amanda requires in-depth training on evidence-based diagnostic approaches for assessing childhood obesity. These modules should cover a range of topics, including the identification of risk factors, measurement techniques for assessing body composition and metabolic health, and the interpretation of results to inform personalized interventions. By receiving thorough training in these diagnostic approaches, Amanda can enhance her ability to accurately assess and address childhood obesity.
• Literature Access: Access to the latest research papers and evidence-based studies on childhood obesity is crucial for staying informed about emerging trends, best practices, and advancements in the field. Amanda requires access to a wide range of academic journals, publications, and databases where she can find relevant literature to inform her decision-making process and stay updated on current research findings.
• Monitoring Tools: Real-time feedback on a child's health status and the effectiveness of interventions is essential for tracking progress, identifying areas for improvement, and optimizing outcomes in the management of childhood obesity. Amanda needs access to monitoring tools that enable continuous assessment of key health indicators and behavioral changes over time.
• Community and Collaboration: A space for collaborative discussions and sharing insights with peers is invaluable for enhancing professional development, exchanging insights, and fostering a supportive network of professionals dedicated to addressing childhood obesity. Amanda would benefit from a platform or forum where she can engage with other healthcare providers, educators, researchers, and community stakeholders to exchange ideas, discuss challenges, share success stories, and collaborate on interdisciplinary approaches to prevention and treatment of obesity.
• Guideline Updates: Timely updates on the latest guidelines and research in the field of childhood obesity. Staying informed about the latest guidelines and research in the field of childhood obesity is essential for maintaining evidence-based practice and ensuring quality care delivery.</td>
</tr>
<tr>
<td>What can Amanda benefit from BIO-STREAMS?
Via BIO-STREAMS, she will be able to access literature, valid evidence, and evidence-based work on childhood obesity. She will be able to see the feedback on a child's health status and have an increased knowledge on obesity, guidelines on prevention of obesity and guidelines on how to engage community.
What is her motivation?
Amanda is motivated by assisting children with weight management. She is also motivated by performing research and being up to date with the latest research on obesity.</td>
<td>What digital functions does she seek?
In BIO-STREAMS, she is looking for a tool that will support her in assisting children with weight management, that summarizes previous research and provides access to literature. She also seeks to have an AI-based assistant.

More specifically, examples of digital solutions sought are:
• Educational Modules: An interactive online platform offering modules such as "Effective Communication Strategies for Pediatric Nutrition." Video demonstrations of successful interactions with children and parents, for example, to teach parents the consequences of buying unhealthy snacks. Quizzes to reinforce learning on behavior change techniques. Virtual case studies simulating real-world scenarios in pediatric nutrition counseling.
• Literature Access: A digital platform that offers a curated library of journals, allowing Amanda to search and filter information based on specific criteria like age group, intervention type, or outcome measures. Advanced search functionality for specific topics, age groups, or intervention types. Access to full-text articles, ensuring Amanda can delve into the details of relevant studies. Regular updates on new publications related to childhood obesity prevention, treatment, and guidelines for weight management. The latter are highly valued by a dietitian like Amanda as a helpful guidance for dietary practice.
• Monitoring Tools: A mobile app that allows parents to input daily food logs and activity levels for their child, with Amanda receiving summarized data, trends, and personalized suggestions for adjustment. Parent-friendly interface for inputting daily dietary and activity information. Automated data analysis providing trends and patterns. Customizable alerts for Amanda to address any concerning changes promptly.
• Community and Collaboration: An online forum or discussion board where Amanda, specializing in pediatric nutrition can share case studies, seek advice, and engage in discussions about the latest trends and challenges in childhood obesity prevention. Discussion forums organized by specific topics, such as effective interventions or challenging cases. Webinars and virtual events for shared learning experiences. Private messaging for one-on-one collaboration with peers.
• Guideline Updates: A service that sends regular email updates and notifications to Amanda whenever there are updates to guidelines, ensuring she stays informed and can adapt her practice accordingly. Customizable preferences for the types of updates (e.g., guidelines, research, news). Push notifications on the platform or through email, ensuring timely awareness. A centralized dashboard summarizing recent changes and highlighting critical updates.
• Tools for Personalized Recommendations and Risk Assessment: An online tool to suggest personalized interventions for her patients and to provide risk assessment scores for obesity onset or progress based on patients genetic and family health data.</td>
</tr>
</table>

Figure 8: Dietitian Persona description

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<table>
<tr><td rowspan="2">  </td><td>Background info</td><td>What are her needs?</td></tr>
<tr><td>Name: Esther
Age: 34
Role: doctor
What are her goals?
Esther’s goal is to learn and use better diagnostic and therapeutic approaches for obesity prevention and management, to use an individualized approach and to monitor children’s progress. She also aims to know how to motivate behavioral change.</td><td>Esther’s needs are to know and have access to valid info about metabolic and hedonic drives in control of appetite and scientific evidence on obesity development. She needs info on current trends in healthy lifestyle and nutrition and data on cost-effectiveness of interventions. She would also find better practices for communication with parents and children useful.

More specifically:
• Access to Best Practices and Interventions: Esther requires a platform that provides her with up-to-date, evidence-based guidelines and interventions for obesity prevention. She seeks a resource that combines the latest scientific findings and translates them into actionable strategies. Esther requires real-time information on evolving trends in healthy lifestyles and nutrition and tools to effectively prevent and manage comorbidities associated with obesity, such as diabetes and cardiovascular issues.
• Tools for Monitoring Effectiveness: Esther is focused on interventions that are sustainable over the long term, ensuring that positive outcomes persist beyond short-term changes. She needs tools that enable her to monitor the progress of her young patients thoroughly. Real-time tracking of lifestyle changes, nutritional habits, and physical activities is crucial for assessing the effectiveness of interventions. Esther seeks tools that address both the physical and mental well-being of her patients, recognizing the interconnected nature of these aspects.
• Data Visualization Capabilities: To make informed decisions, Esther requires a platform with robust data visualization capabilities. Clear, interpretable visualizations aid in identifying trends, patterns, and areas requiring immediate attention. Understanding the intricate factors contributing to obesity, including metabolic and hedonic drives is crucial for Esther.
• Data on Cost-Effectiveness of Interventions: Esther is interested in understanding the cost-effectiveness of various interventions to guide decision-making.</td></tr>
<tr><td>What can Esther benefit from BIO-STREAMS?
Via BIO-STREAMS, Esther will have access to practices and interventions and tools for monitoring their effectiveness. Most importantly, she will have access to valid evidence and evidence-based work. She will benefit from increased knowledge on obesity and from connecting with professionals and parents.
What is her motivation?
Esther’s greatest motivation is health issues, obesity, and its comorbidities prevention. She is motivated by a clear indication of what intervention is needed and aims for early intervention. She likes to manage obesity holistically and long term. She cares about supporting children’s physical and mental health and physical growth. In addition, she is highly motivated by conducting research and contributing to science.</td><td colspan="2">What digital functions does she seek?
In digital functions of BIO-STREAMS, Esther will seek an option for personalized recommendations, risk assessment, and data visualization capabilities. She will seek guidelines on prevention of obesity and electronic media to communicate with children.

More specifically, examples of digital solutions sought are:
• Evidence-Based Content Repository: A digital library compiling the latest scientific evidence, guidelines, and best practices in childhood obesity prevention. Implementation of machine learning algorithms that analyze individual patient data to provide personalized recommendations. For example, the platform could use AI to suggest tailored dietary plans or activity regimens based on a child's unique characteristics and responses. A comprehensive data analytics dashboard will be useful to Esther to visualize and analyze trends in her patient population. This could include graphical representations of BMI changes, activity levels, and other relevant metrics.
• Integrated Monitoring Tools: A comprehensive system integrating wearables, mobile apps, and other devices for real-time monitoring of patients' lifestyle changes. Integration with wearable devices (e.g., fitness trackers, smartwatches) to collect real-time data on a child's physical activity, sleep patterns, and vital signs. The platform should seamlessly sync with these devices, providing Esther with objective data for analysis. A telehealth feature would allow Esther to conduct virtual consultations and remotely monitor her patients' progress. This could include video calls, secure messaging, and a dashboard summarizing key health metrics. This would allow seamless integration with popular nutrition tracking apps, allowing parents to log and monitor their child's dietary intake. The platform could analyze this data to provide dietary recommendations aligned with obesity prevention goals.
• Collaborative Research Platform: A secure platform that facilitates collaboration with fellow clinicians, researchers, and experts to collectively advance the understanding and treatment of childhood obesity. A collaborative research dashboard where Esther can connect with other clinicians and researchers, share insights, and participate in ongoing studies. The platform could facilitate discussions, document sharing, and collaborative data analysis.
• Literature Access: A digital platform that offers a curated library of journals, allowing Esther to search and filter information based on specific criteria like age group, intervention type, or outcome measures. Advanced search functionality for specific topics, age groups, or intervention types. Access to full-text articles, ensuring Esther can delve into the details of relevant studies. Regular updates on new publications related to childhood obesity prevention.</td></tr>
</table>

Figure 9: Doctor Persona description

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<table>
<tr><td rowspan="2">  </td><td>Background info</td><td>What are his needs?</td></tr>
<tr><td>Name: Boris
Age: 40
Role: policy maker

Boris works as a policy maker in a governmental institution in a medium-sized European country. His responsibilities include developing and revising policies in the field of lower education.

What are his goals?

Boris's goals are to learn or develop better strategies to educate and empower children regarding weight management and healthy lifestyle and to successfully implement such strategies in the form of community programs. They also aim for standardized data collection.</td><td>He needs to be up to date with policies on health promotion and aware of the latest research. He also needs clear information and data on the effectiveness of various interventions for managing and preventing obesity.

More specifically:
• Comprehensive Data on Effectiveness: Boris needs access to a platform that aggregates and analyzes data on various obesity interventions. For instance, the platform could showcase a comparative analysis of school-based nutrition programs, community fitness initiatives, and policy-driven changes in school lunch programs. This would aid Boris in identifying evidence-based interventions that have proven effective in different contexts.
• Access to Valid Evidence and Real-World Data: The platform should provide access to validated and up-to-date research studies, clinical trials, and real-world data. For instance, it could feature a repository of peer-reviewed articles on the impact of lifestyle changes on childhood obesity, along with data from ongoing community programs. This ensures that policy decisions are informed by the latest scientific evidence and practical insights.
• Information on National Obesity Prevalence: The platform should feature a dynamic dashboard that visually represents national obesity prevalence. This could include maps, trend graphs, and demographic breakdowns to help Boris identify regions or demographics with higher prevalence rates. For instance, Boris could use the platform to quickly spot areas where targeted interventions are needed.
• Effective Community Programs: Boris seeks a platform that not only provides information on community programs but also offers tools for program design and evaluation. For instance, the platform could include case studies of successful community initiatives with detailed implementation plans, measurable outcomes, and lessons learned. This would empower Boris to adapt and replicate successful models.
• Regular Updates on Latest Research and Policies: The platform should have a dedicated section that provides real-time updates on the latest research findings and policy changes related to obesity prevention. For instance, it could push notifications or newsletters summarizing recent studies on the impact of a specific dietary intervention or changes in national policies affecting school-based physical education.
• Cost-Effectiveness Data: Useful information for Boris would also be actual intervention implementation costs and time, specific for the relevant country. This will help Boris to choose or plan interventions with most desirable outcomes relative to the costs required for such intervention implementation.</td></tr>
<tr><td>What can he benefit from BIO-STREAMS?

Via BIO-STREAMS, Boris will have access to valid evidence and comprehensive real-world data. He will more easily achieve to be up to date with new policies. BIO-STREAMS will also give him a broader social context for addressing obesity.

What is his motivation?

Boris is motivated by the high prevalence of obesity on the national level and prevention of obesity. He is also motivated by addressing obesity holistically and the rise in public health costs.</td><td colspan="2">What digital functions does he seek?

Boris looks in BIO-STREAMS solution for standardized data collection, updated best practices, analysis of new data, and access to demographic, clinical, genetic data, and latest research findings.

More specifically, examples of digital solutions sought are:
• Data Analytics Tools: Boris would benefit from a platform that offers advanced data analytics tools. This could include predictive modeling to forecast future trends in obesity prevalence based on current data. For instance, a tool that uses machine learning algorithms to analyze demographic, clinical, and genetic data, providing actionable insights to tailor interventions for specific populations.
• Evidence Aggregation Platform: An evidence aggregation platform could compile research studies, clinical trials, and real-world data into a user-friendly interface. For instance, a dashboard that categorizes evidence based on intervention type (e.g., school programs, community initiatives, policy changes) with summaries of key findings. This allows Boris to quickly access relevant information for evidence-based decision-making.
• Community Engagement Features: To facilitate community engagement, the platform could offer features such as discussion forums, webinars, and virtual town hall meetings. For instance, a webinar series where experts share insights on successful community programs, and policymakers can interact with community leaders to exchange ideas and best practices. This fosters collaboration and knowledge sharing. Also, engaging with principal and teachers can help him have a realistic view of how the schools progress with the interventions and better evaluate their effectiveness.
• Digital Health Technologies Integration: Integrating digital health technologies like wearables and mobile health apps can provide real-time health data from individuals. For instance, a platform that integrates data from fitness trackers and health apps to monitor the impact of policy changes or community programs on individuals' physical activity levels and overall health. This allows for continuous monitoring and adjustment of interventions.
• Program Design and Evaluation Tools: The platform could include tools for designing, implementing, and evaluating community programs. For instance, a feature that guides Boris through the step-by-step process of creating a program, offering templates for program goals, timelines, and evaluation metrics. The tool could also provide automated surveys and feedback mechanisms for ongoing program assessment.
• Policy Update Notifications: A feature that delivers real-time notifications on policy updates and changes related to obesity prevention. For instance, an alert system that notifies Boris when there are amendments to national guidelines for school nutrition programs or when new policies are implemented at the community level. This ensures that Boris stays informed and can adapt strategies accordingly.</td></tr>
</table>

Figure 10: Policy maker Persona description

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<table>
<tr><td rowspan="2">  </td><td>Background info</td><td>What are his needs?</td></tr>
<tr><td>Name: Mick
Age: 60
Role: principal

Mick is a principal of a public elementary school who is very motivated and frequently undertakes new projects.

What are his goals?
Mick’s goal is to obtain skills for making changes, to raise awareness among parents, teachers, and students. His goal is also to connect and construct relevant ecosystems in and around the school. He oversees establishing collaborations with medical, social and youth care organizations.</td><td>What he needs are resources for community-based interventions. To prepare such interventions or to decide which are meaningful, he needs access to valid evidence on their effectiveness. He needs to be up to date with national regulations and policies to tailor interventions to them. He also needs knowledge of how to motivate and engage teachers and show recognition to them.

More specifically:
• Research-Based Data Access: Mick requires a platform that gives him access to a repository of studies, surveys, and evidence-based practices related to obesity prevention in schools. This could include data on successful interventions implemented in similar educational settings, allowing him to make informed decisions based on proven methodologies. However, data presented to the principal must be in a simple language (excluding terms characteristic for researchers etc.)
• Community-Based Interventions: The platform should offer a toolkit that includes resources for organizing community-based events such as health fairs, workshops, and fitness challenges. This toolkit could provide step-by-step guides, promotional materials, and communication templates to streamline the planning process for Mick and his team.
• Community Engagement Tools: A communication module within the platform could include features like automated newsletters, discussion forums, and a notification system for important updates. This helps Mick keep parents and teachers informed, engaged, and actively participating in the school's obesity prevention initiatives.
• Data-Driven Insights: The platform can integrate data analytics tools that generate reports on the impact of interventions over time. For instance, Mick could track changes in student health metrics, participation rates in physical activities, and the adoption of healthier eating habits. These insights enable him to assess the effectiveness of ongoing initiatives and make data-driven adjustments.
• Policy Compliance and Alignment: Mick needs a feature that provides regular updates on national and local policies related to school health and nutrition. This could include a dashboard highlighting any policy changes, ensuring that the school's obesity prevention program remains aligned with regulatory standards and best practices.
• Training and Skill Development: A dedicated section of the platform offers professional development courses specifically designed for teachers and staff. These courses could cover topics such as incorporating physical activity into the curriculum, organizing nutrition-focused events, and integrating health education seamlessly into different subjects.
• Collaboration with Health Professionals: The platform could facilitate direct communication channels with local health professionals, dietitians, and fitness experts. This enables Mick to seek advice, invite guest speakers for school events, and ensure that the school's obesity prevention strategies are in line with the latest health recommendations.</td></tr>
<tr><td>What can Mick benefit from BIO-STREAMS?
Mick will have access to research-based data to tailor interventions specific to school needs. He will benefit from community engagement that will be enhanced by BIO-STREAMS.

What is his motivation?
His motivation is to be responsible for the school’s vision, to make changes and to care for community well-being. He is also motivated by obesity prevention and safeguarding children’s health.</td><td colspan="2">What digital functions does he seek?
In BIO-STREAMS, Mick seeks data-driven insights and information on intervention effectiveness, a guide on how to engage community, and updated best practices.

More specifically, examples of digital solutions sought are:
• Virtual Workshops and Webinars: An interactive virtual workshop feature within the platform that hosts expert-led sessions on topics like healthy cooking, creating home exercise routines, and understanding nutritional labels. This allows Mick to extend the reach of obesity prevention education beyond the school premises and engage parents and teachers in a virtual learning environment.
• E-Learning Modules for Teachers: A dedicated section offering e-learning modules on obesity prevention strategies tailored for teachers. These modules could cover integrating health education into various subjects, classroom activities promoting physical activity, and fostering a culture of healthy living. This empowers teachers to actively contribute to obesity prevention efforts.
• Social Media Integration: The platform could have features that allow easy sharing of success stories, upcoming events, and educational content on popular social media platforms. Mick can leverage this to amplify the reach of the school's obesity prevention initiatives and foster a sense of community support.
• Parent-Teacher Communication Hub: A centralized communication hub within the platform that enables direct and secure communication between parents and teachers. Mick can use this to share updates on obesity prevention initiatives, distribute informative materials, and gather feedback from parents, creating a collaborative approach to health education.
• Remote Health Monitoring Devices: Integration with wearable health monitoring devices that students can use to track their physical activity and sleep patterns. The platform can aggregate this data, providing real-time insights for both students and teachers. Mick can use this feature to encourage healthy behaviors and identify areas for targeted interventions. A platform that could facilitate direct communication channels with local health professionals, dietitians, and fitness experts. This enables Mick to seek advice, invite guest speakers for school events, and ensure that the school's obesity prevention strategies are in line with the latest health recommendations.
• Tailored Intervention Planning Tool: A tool that provides regular updates on national and local policies related to school health and nutrition. This could include a dashboard highlighting any policy changes, ensuring that the school's obesity prevention program remains aligned with regulatory standards and best practices.</td></tr>
</table>

Figure 11: Principal Persona description

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4 Identification of key questions to elicit user requirements

4.1 Key questions definition process

Internal co-creation workshops were conducted to define a tailored list of relevant questions for each persona, facilitating the precise elicitation of user requirements essential for the targeted development of the BIO-STREAMS platform. Based on the thorough understanding of the Persona profile (e.g. demographics, role, goals, challenges, needs, and specific behaviours) we defined the key areas where more information is needed. For final list and definition of Personas consult section 3.2.3. With the key areas identified, we started to formulate specific questions, focusing on primary objectives we wish to achieve with the BIO-STREAMS solution, challenges Personas might be faced when using the solution, technologies to be offered and expectations. We ensured that the questions are open-ended to encourage detailed responses rather than simple yes/no answers.

The questions have been furthered refined with BIO-STREAMS partners in two rounds in M10 (February 2024) of brainstorming and improving the questions. Since the question list was too long for feasible implementation in stakeholder co-creation workshops and since not all questions are equally crucial, we prioritize questions based on how directly they impact the design and functionality of the solution. To this end a voting process was carried out on most relevant question and a list of questions for each stakeholder group has been finalized by the end of M11 (March 2024).

4.1.1 Child Persona (Clinical version)

Adolescents

Healthy eating

B1 What is healthy lifestyle to you?
B2 Are there specific topics related to health that you are curious about?
B3 What do you think is important to know about healthy lifestyle?
B4 Through which channels/devices do you prefer to learn about healthy eating habits and physical activity?
B5 How are healthy habits promoted at home?

Healthy lifestyle literacy

D2 Can you think of any health goals you might want to set for yourself?

Healthy lifestyle (general) and motivation

A1 What kind of activities do you find fun?
A1.3 What do you think makes these activities enjoyable for you?
A2 Can you tell me about a game or activity you enjoy on your devices (phone, tablet, computer)?

Trust in interventions and in guidance (adherence)

E2 What kind of app features do you find most interesting or enjoyable?

Physical activity and sedentary behavior

C2 What kind of features would you like to see on the platform?
C5 What kind of progress tracking tools would you find helpful?

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The platform

F1 What kind of personalized recommendations would be helpful for you in the app? (e.g. healthy recipes, recommended fruit intake, recommended sport activities)

F2 Are there specific aspects of nutrition or physical activity you would like guidance on?

Younger children

Healthy eating

B1 What is healthy lifestyle to you?

B2 Are there specific topics related to health that you are curious about?

B4 Where do you like to learn about healthy food and sport activities?

B5 What healthy things do you do at home?

Healthy lifestyle literacy

D2 Do you want or wish for anything regarding being healthy?

Healthy lifestyle (general) and motivation

A1 What kind of activities do you find fun?

A1.3 What do you think makes these activities enjoyable for you?

A2 Can you tell me about a game or activity you enjoy on your phone, tablet, computer?

4.1.2 Parent Persona (Clinical version)

Awareness and Engagement

A1 What are your concerns about childhood obesity and its impact on your child's health and well-being?

A2 Which goals do you have for your child regarding health and wellness?

A3 How do you help your child to achieve healthy eating habits and increased physical activity?

A4 How do you currently stay informed about your child's health and wellness, particularly regarding obesity or weight-related issues? (only for older children)

Digital Platform and Communication

B1 How comfortable are you with using technology to monitor and track your child's health-related behaviors?

B2 What resources or tools (if any) have you used in the past to address your child's health regarding eating habits and physical activity?

B3 How would you prefer to access a digital platform for managing your child's health or eating habits (mobile app, web-based, both)?

B4 What type of features would you find most helpful in a digital platform for childhood obesity prevention or treatment (personalized goals and tracking, educational resources, meal planning tools, behavior modification tips, social support)?

B7 What privacy concerns do you have about using a digital platform to manage your child's eating habits?

B8 How would you feel about sharing your child's data with healthcare providers or professionals?

Tools and Features

C2 How would you like to track your child's health including lifestyle habits (daily logs, weekly or monthly summaries, automated data collection)? Are there specific metrics you want to track, such as weight, physical activity, or dietary habits?

C3 What types of educational resources would be most helpful to you (articles, videos, interactive games, expert advice)?

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C4 What meal planning tools would be most useful to you (recipe recommendations, shopping lists, personalized meal plans)?
C5 What behavior modification tips would you find helpful (tips for increasing physical activity, reducing screen time, making healthier food choices)?
C6 How would you like to connect with other parents or caregivers who are also dealing with childhood obesity (discussion forums, private messaging, support groups)?

4.1.3 Doctor Persona

Best Practices and Interventions

A1 What are your goals in using a digital platform to treat children with overweight/obesity?
A2 What are your biggest challenges in treating children with overweight/obesity?
A3 What are the most important features that you would want in a digital platform for treating children with overweight/obesity?
A4 How important is it for you to have real-time information on evolving trends in healthy lifestyles and nutrition?

Tools for Monitoring and Interventions

C1 How do you currently monitor the progress of your patients who have overweight or obesity?
C2 What types of data do you collect to monitor progress?
C3.1 Which data visualization/graphical representation tools/programs would be useful to apply to your organization's dataset?
C5 What specific tools or features do you need to monitor the long-term effectiveness of interventions in your young patients?
C6 How important is real-time tracking of lifestyle changes, nutritional habits, and physical activities for assessing intervention outcomes?
C10 What specific features do you think would encourage active parental participation in their child's obesity prevention journey through a mobile app?

Assistance for patients

E2 What type of personalized health assessments would be most useful for your patients?

Access to Best Practices and Interventions

B1 What are your current sources of information on best practices and interventions for childhood obesity prevention?
B2.1 What types of evidence-based guidelines and interventions would you find most useful?

Stigma Reduction

F1 What are some of the biggest challenges in addressing stigma related to obesity?
A5 In terms of communication with parents and children, what practices do you believe would be most effective in reducing stigma associated with childhood obesity?

4.1.4 Dietitian Persona

Educational Resources

A1 What are the specific topics in evidence-based diagnostic/prevention/management approaches for management of childhood obesity that you would like to learn more about?

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A2 What kind of format would you prefer for these educational modules (e.g., videos, case studies, quizzes)?
A3 What features would make these educational modules more engaging and effective for you?

Literature Access

B1 What are the specific types of research papers on childhood obesity that you would like to have access to?

Guideline Updates

C1 What types of guidelines or research updates would you like to receive notifications about?

Tools

D1 What types of data do you think are relevant to collect from parents about their child's food intake and activity levels?
D2 What specific health metrics or parameters would you like to monitor in real-time for children undergoing weight management interventions?
D3 How would you like to display this data to parents in a clear and understandable way?
D4 What personalized feedback or suggestions would you like to be able to provide to parents based on the data collected?
D6 What specific tasks or support do you expect from an AI-based assistant in the context of childhood obesity management?
D7 Are there particular functionalities or features you would like the AI assistant to have in helping you access literature and providing assistance in your work?

Stigma reduction

H1 What are some of the biggest challenges in addressing stigma related to obesity?
H2 How can a digital platform be used to reduce stigma related to obesity?

Collaboration on the Platform

E3 How do you envision engaging with other dietitians who specialize in pediatric nutrition or other professionals in a collaborative space?

Assistance for patients

F2 What type of personalized health assessments would be most useful for your patients?

4.1.5 Policy Maker in Healthcare Persona

Data Analytics Tools and Comprehensive Data on Effectiveness

A1 What specific types of analysis for interventions would you find most valuable for comparing and analyzing various obesity interventions?
A2 What specific types of data and analytics would you find most valuable for comparing and analyzing various obesity interventions?
A3 Are there particular metrics or key performance indicators you prioritize when evaluating the effectiveness of interventions?
A4 How comfortable are you with incorporating machine learning algorithms into the analysis for predictive modeling?
A5 What specific functionalities would you expect from tools guiding the design, implementation, and evaluation of community programs?
A6.1 Is there any peculiar element for policy makers that should emerge from the model (i.e. related to the sustainability of the program; the efficiency in resources allocation; the relevant point of view assumed, i.e. that of the NHS or that of society)?

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Access to Valid Evidence and Real-World Data

B1 How relevant is real-world data in your decision-making process?

B2 Are there specific sources or types of real-world data that you consider most relevant?

B3 What is the relevant time horizon used to decide whether to implement or not a childhood obesity curative or preventive program (i.e. short, medium, long; < 1 year; 1-3 years, up to 5 years; up to 15 years, long life)?

Strategies to Educate and Empower Children and their environment

C3 What tools or features do you envision for designing and evaluating community programs to be incorporated in the tool?

C4 Input from which stakeholders would you appreciate in order to develop a policy?

C5 What specific information would be critical for program success?

Regular Updates on Latest Research and Policies

D3 What criteria would be essential for categorizing evidence based on intervention types, and how would you prefer the presentation of key findings?

D4 Are there specific features or filters you would like to have in the evidence aggregation platform?

D5 Are there particular policy domains or areas of focus you want the alert system to prioritize?

4.1.6 Biomedical Data Scientist Persona

General

A2 How would you envision the platform facilitating collaboration and knowledge exchange among a network of obesity prevention experts?

A1 (for focus groups to complement A2 if necessary): What specific features or functionalities would you like to see in the platform to enhance connectivity with other researchers and health professionals?

A3 What mechanisms would you like to see implemented to promote open communication and the sharing of ideas and best practices?

A4 How would you prefer to collect real-time data from children? Are there specific functionalities you envision in a mobile application?

Research Support

B2 What features would make the platform effective in supporting your research on developing predictive models for early obesity intervention?

B1 How would you like the platform to streamline access to real-world data on physical activity, meal frequency, and obesity classification criteria?

B3 How would you like the platform to help you identify and incorporate relevant data sources from various disciplines, such as behavioral sciences, nutrition, and healthcare?

Behavioral Insights

C2 What specific data points would be most valuable in understanding the behavioral patterns of children with obesity?

C3 Are there specific environmental factors or lifestyle aspects you are particularly interested in?

Tools & Capabilities

D1 What level of detail and interactivity would you like to see in the platform's data visualization tools?

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D2 How would you like the platform to help you analyse and interpret this data to identify patterns and trends that can inform targeted interventions?
D3 How would you like the platform to help you generate visually appealing and informative visualizations that are suitable for both scientific and non-scientific audiences?
D4 What specific features would make the platform's data visualization tools effective in communicating your findings to researchers, health professionals, and the general public?
D6 Can you describe the level of complexity and accuracy do you expect from predictive models in the context of early obesity intervention?
D5 Can you provide examples of the types of patterns and trends you hope to extract using machine learning algorithms?

4.1.7 Child Persona (School version)

Adolescent

Healthy lifestyle (general) and motivation
A1 What kinds of active and enjoyable activities do you like that can also help with your health?
A2 What is healthy lifestyle to you?

Physical activity and sedentary behavior
C1 Do you like physical activity? If yes, what do you like to do to be physically active? If not, what do you think prevents you from being physically active?
C1.2 Why do you like these activities?
C1.3 What physical activities do you most like to do in school with your classmates/peers?
C1.4 What do you like in these activities?
C1.5 Outside of school (on weekends and free time): do any of the things you do involve sitting? What kind of activities involve more moving and activity?

Healthy lifestyle literacy
D1 What would you like to learn about healthy lifestyle?
D2 Where/how would you like to learn about this? In what format do you prefer to receive information on healthy eating and physical activity (videos, games, stories)?
D2.1 Would you prefer in-person-learning? Or through engaging activities?
D2.2 Would you like to learn digitally? On which device?

Healthy eating
B3 Do you eat snacks or sweets? Why?
B4 Can you think of any healthy snacks that you like?
B2 How much fruit and vegetables do you eat per day?

Trust in interventions and in guidance (adherence)
E1 Have you ever participated in some sort of healthy programs before in your school?

Younger children

Healthy lifestyle (general) and motivation
A2 What is healthy lifestyle to you?
A1 What kinds of sport activities do you like that can also help with your health?

Physical activity and sedentary behavior
C1 Do you like sport activities? If yes, what kind of activities?

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C1.2 Why do you like these activities? Why do you not like them?
C1.3 What physical activities do you most like to do in school with your classmates/peers?
C1.4 What do you like in these activities?
C1.5 Outside of school (on weekends and free time): do you do anything while sitting? What kind of activities do you do that involve more moving and activity?

Healthy lifestyle literacy
D1 What would you like to learn about healthy food and sport activities?
D2 Where/how would you like to learn about this (videos, games, stories)?
D2.1 Would you like to learn in-person?
D2.2 Would you like to learn on phone or computer? On which device would be better?

Healthy eating
B2 How much fruit and vegetables do you eat per day?
B3 Do you eat snacks or sweets? Why do you eat them? Do you take a sweet or a snack by yourself or does somebody give it to you?
B4 Can you think of any healthy snacks that you like?

4.1.8 Parent Persona (School version)

Supporting Healthy Habits
A1 What is healthy eating in your opinion?
A2 Do you set family goals related to physical activity and healthy eating? How can you involve your child in setting and achieving these goals?
A2.1 Are there activities that promote both fun and a healthy lifestyle that you can do together?
A2.2 Does your child enjoy any types of physical activities? How can you support and encourage these activities?
A2.3 Are there specific nutritious foods or meals your child enjoys? How can you involve them in making healthier food choices and preparing meals together?
A2.4 How do you currently encourage your child to adopt healthy habits, including making healthy food choices, reducing sedentary behaviour and improving sleep?
A2.5 How do you model healthy lifestyle behaviors for your child? What practices can you implement to showcase the importance of a balanced diet and physical activity?
A2.6 In what ways can you provide information and guidance on nutrition to instill healthy eating habits in your child?

Activities
B1 Do you see any obstacles that hinder you to support healthy eating in your family?
B2 Would you try some of the new home parenting lifestyle tips that will be shared regularly with your families?
B4 How would you be more likely to engage in interactive discussions and activities regarding healthy lifestyle?
B5 How do you feel about using a food diary?

Providing Information and Positive Reinforcement
D1 What information do you feel is important for you to receive regarding your child's nutrition and preventing overweight and obesity?
D2 How often do you think positive reinforcement and encouragement can be beneficial for your child's health journey, and in what form (e.g., resources, tips, progress updates)?

Addressing Bullying and Building Confidence

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C1 Have you discussed experiences of bullying or negative comments with your child? How can you provide emotional support to boost their confidence?

C2 How can you contribute to creating a positive home environment that counters negative influences related to body weight and encourages healthy eating habits?

4.1.9 Teacher Persona

Educational Resources

A1 Is nutrition and healthy lifestyle in general a topic of conversation in our school?
A1.1 Do you have specific modules or time or resources devoted to teaching about nutrition, physical activity or healthy lifestyle in your school?
A1.2 If yes, what are some of the main challenges you face in teaching your students about healthy habits and preventing obesity?
A2 What type of educational resources would be most helpful for your students?
A3 How can the digital platform be designed to engage the students?
A4 What type of interactive simulations would be most effective in teaching students about nutrition and physical activity?
A5 What type of lesson plans and healthy recipes would be most helpful for you?
A6 How can the digital platform be used to promote collaboration between students, parents, and fellow teachers?

Collaboration on Platform

D1 What kind of features should the digital platform have to promote communication and resource sharing between students, parents, and teachers?
D2 What kind of features should the digital platform offer to share success stories and encourage positive behaviors?
D3 How can the online parent-teacher discussion boards, specifically focused on health and well-being, be structured?
D4 What resources and information should a teacher share with parents through these forums?
D5 What topics are relevant for online workshops and webinars in health education?

Intervention

B2 What type of interventions would be most effective in helping students adopt healthier habits?

Digital Tools and Solutions

C3 Do you know augmented reality? Could AR experiences be integrated into health education lessons to enhance learning?

4.1.10 Principal Persona

Collaboration with stakeholders

A1 In what way do you prefer to be approached by external parties offering collaboration?
A1.1 Do you have a suggestion of how most effective recruitment of schools should look like?
A1.2 What could be the barriers for such engagement?
A2 To what extent could the school participate in the project? For how long? Do you think teaching and non-teaching staff can be engaged? What about parents and local community?

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A3 What information and support from the project would you need to start such discussion, with the teachers to include small activities to the curriculum that would have a beneficiary impact on children's healthy habits in school?

Past experience and improvement

D1 Have you previously organized community-based events related to health and wellness in your school? If yes, what challenges did you face, and what resources were or would have been helpful?

D5 What technology infrastructure is available in the school to support the implementation of the virtual learning tools and platform? Do you have a good internet connection? Do you have wireless access that the platform could use?

D6.2 What kind support would you or your team need to introduce our solution into the school?

Collaboration on platform

E2 How do you currently communicate with parents, teachers, and students regarding health initiatives?

E2.1 What tools or features would enhance this communication?

E3 What features should the platform have to encourage collaboration between the school and community organizations to create a supportive ecosystem for obesity prevention?

Platform engagement

C1 What strategies can you implement to motivate and engage teachers to utilize the platform effectively and to acknowledge their contributions to obesity prevention efforts?

Intervention design and engagement

B1 Given the description of outcomes that we aim to influence with our activities and solutions, what design would be most feasible from your point of view?

B2 How open is your school's community to virtual workshops and webinars on health-related topics? If your school is not open to these initiatives, please elaborate on why not.

B3 How do you think we can improve engagement, do you have a preferred process?

4.1.11 Policy Maker in Education Persona

Data Analytics Tools and Comprehensive Data on Effectiveness

A1 What specific types of analysis for interventions would you find most valuable for comparing and analyzing various obesity interventions?

A2 What specific types of data and analytics would you find most valuable for comparing and analyzing various obesity interventions?

A3 Are there particular metrics or key performance indicators you prioritize when evaluating the effectiveness of interventions?

A4 How comfortable are you with incorporating machine learning algorithms into the analysis for predictive modeling?

A5 What specific functionalities would you expect from tools guiding the design, implementation, and evaluation of community programs?

A6.1 Is there any peculiar element for policy makers that should emerge from the model (i.e. related to the sustainability of the program; the efficiency in resources allocation; the relevant point of view assumed, i.e. that of the NHS or that of society)?

Access to Valid Evidence and Real-World Data

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B1 How relevant is real-world data in your decision-making process?
B2 Are there specific sources or types of real-world data that you consider most relevant?
B3 What is the relevant time horizon used to decide whether to implement or not a childhood obesity curative or preventive program (i.e. short, medium, long; < 1 year; 1-3 years, up to 5 years; up to 15 years, long life)?

Strategies to Educate and Empower Children and their environment
C3 What tools or features do you envision for designing and evaluating community programs to be incorporated in the tool?
C4 Input from which stakeholders would you appreciate in order to develop a policy?
C5 What specific information would be critical for program success?
Regular Updates on Latest Research and Policies
D3 What criteria would be essential for categorizing evidence based on intervention types, and how would you prefer the presentation of key findings?
D4 Are there specific features or filters you would like to have in the evidence aggregation platform?
D5 Are there particular policy domains or areas of focus you want the alert system to prioritize?

4.2 Initial set of user requirements

To elicit and initial set of users' functional and non-functional requirements we carried out an external survey, where BIO-STREAMS expert panel, was asked to answer the questions from section 4.1. Partners were asked to only answer questions for the persona, they also represent in real life. Afterwards we carried out a thematic analysis and translation into functional and non-functional requirements was carried out.

From clinical experts, we have received 3 contributions for Parent Persona (with children with obesity/overweight), 15 for Doctor, 9 for Dietitian, 2 for Policy maker in health care, and 4 for Biomedical Data Scientist. Participants providing answers as parents reported their children to be 10 years old in average for clinical context. Educational experts have provided us with 13 contributions for Parent Persona (with children without obesity/overweight), 12 for Teacher, 4 for Principal and 1 for Policy maker in education. Parents providing answers in educational context reported their children being 9 years old in average.

In this phase of the requirements elicitation, child personas, were excluded since the consortium does not involve representatives of those personas internally. The provided initial set of use-requirements for those personas was made by BIO-STREAMS expert panel and stem from on the description of the persona.

All identified user-requirements were interested into GitHub framework, to be further utilized by D2.3 and linked with technical requirements.

This section provides an initial sets of user-requirements, as defined by experts within or close to BIO-STREAMS consortium. The aim was also to test and validate the methodology before introducing it to the wider external audience. In the period between months M14-M23, depending on the ethics approvals, where required, we will further engage with external stakeholders in Living Labs (and PPI) in WP6, through which next version of user-requirements and storylines will be delivered.

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4.2.1 Parent

Based on the thematic analysis the main themes connect with parenting, healthy eating, and physical activity. A consistent theme is the importance of parental involvement and setting a good example in both eating and physical activity. Respondents also emphasize a balanced approach to diet and activities without extreme restrictions or focusing too heavily on dieting. One of the key directions should be that health-related activities enjoyable and inclusive for children to naturally encourage healthier choices. The detailed analysis is given in Appendix F: Parent in Educational Context. The following figure provides and initial set of identified user requirements and proposed mapping to a specific BIO-STREAMS component.

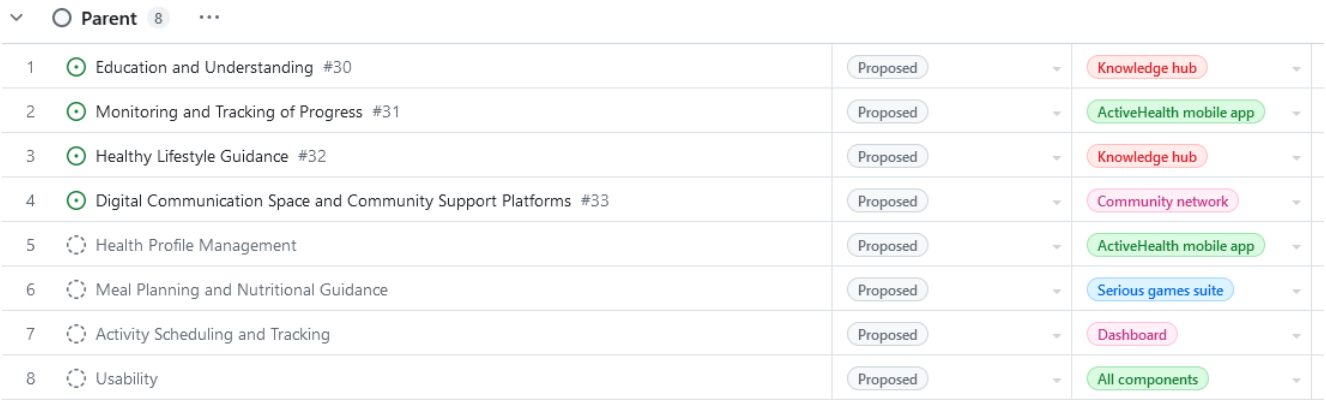

Figure 12: A proposed set of User requirements for Parent mapped to a BIO-STREAMS component

The following table provides a more detailed list of user-requirements identified through the definition of the persona and the analysis of the feedback form the internal surveys.

Table 6: Initial set of requirements for a Parent Persona

Requirement	Description
Education and Understanding	• Access to valid, comprehensible, and up-to-date information about childhood obesity, including factors contributing to weight management and the importance of healthy habits. • Educational resources that help Peter understand the impact of lifestyle choices on his child's weight and overall health. • The platform should leverage user data (age, child's weight, etc.) to offer personalized recommendations for healthy living strategies. • Content should include articles, videos, and interactive modules in language understandable for non-medical users.
Monitoring and Tracking of Progress	• The platform should integrate with popular health tracking apps to monitor the child's weight, dietary intake, sleep patterns, and physical activity levels. This allows Peter to visualize progress and understand the impact of lifestyle changes. • The platform should generate comprehensive progress reports with clear visualizations of key health metrics. This data can help Peter identify areas for improvement and adjust the family's approach. • Features for setting goals, tracking progress, and receiving reminders to stay on track with healthy habits. • Regular feedback on his child's progress, including updates on weight changes, nutritional improvements, and overall health. • Tools to monitor the effectiveness of activities and interventions, providing measurable data on how lifestyle changes impact his child's health. • Data-driven insights to understand which interventions are most effective and make informed decisions about adjustments to the family's lifestyle plan.

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Healthy Lifestyle Guidance	• Guidance on incorporating a healthy lifestyle into the family's daily routine, including exercise routines, meal planning, and stress management. • Interactive features and engaging content to facilitate learning and motivate behavior change. • Platforms offering healthy meal preparation ideas, recipes, and grocery shopping assistance tailored to the family's preferences. • Regular feedback on his child's progress and personalized recommendations based on the family's needs, family's preferences, schedules, and cultural considerations to enhance Peter's ability to implement effective changes. • Support in creating lasting positive changes that will impact his child's health in the long term, reducing the risk of obesity-related health issues. • Examples of some usefull tools: Stress management tools, Physical activity guidance, Lifestyle planning tools, tools to support maintaining healthy habits
Digital Communication Space and Community Support Platforms	• Access to digital platforms for virtual consultations with nutritionists, paediatricians, and other healthcare professionals. • Direct communication channels to ask questions, seek advice, and receive personalized recommendations from experts • Online communities or forums where Peter can connect with other parents facing similar challenges, sharing experiences and insights. • Peer support, encouragement, and practical tips from other parents can provide valuable emotional support and motivation.
Health Profile Management	• Ability for parents to create and manage health profiles for each family member, including dietary preferences, health conditions, and physical activity levels.
Meal Planning and Nutritional Guidance	• A feature to assist in meal planning that accommodates specific dietary needs and preferences, with options to include children in decision-making. • Access to a database of healthy, easy-to-prepare recipes that include nutritional information and customizable ingredients.
Activity Scheduling and Tracking	• Tools to set and track family physical activity goals and schedules, such as weekly sport or exercise sessions, integrating with existing calendar apps for reminders. • Capability to track progress over time and adjust goals accordingly.
Usability	• Intuitive and user-friendly interface suitable for both adults and children. • Accessibility features to accommodate users with different abilities.

Parents are intended to primarily interact with the ActiveHealth App and recommendation features, requiring intuitive interfaces and strong privacy protections for sensitive family health data. Thus, the Parent persona's requirements primarily focus on usability and accessibility of health management tools. Key technical requirements, defined in D2.3, are related to (a detailed list of how technical requirements are linked with user requirements is given in section 4.3):

- **User-friendly interfaces** (NFR-DASH-01, NFR-ACT-02) - Ensuring parents can easily navigate the system
- **Personalized data handling** (FR-ACT-1, FR-ACT-2) - Supporting tracking of family health metrics
- **Privacy and security measures** (NFR-ACT-04, NFR-BNB-03, NFR-IMS-05) - Protecting sensitive family health information
- **Recommendation engine components** (FR-RECENG-05, FR-RECENG-06, FR-RECENG-12) - Providing tailored family health guidance

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- **Mobile application features** (FR-ACT-5, FR-ACT-6) - Delivering accessible health tracking tools

4.2.2 Child

Due to ethics restrictions children were not directly involved in the elicitation of the first user-requirements. Children will be directly included in the refinement of requirements through co-creation in Living-Labs workshops (under WP6, M14 to M23). Based on the description of the persona we define the following sets of user requirements. The following figure provides and initial set of identified user requirements and proposed mapping to a specific BIO-STREAMS component.

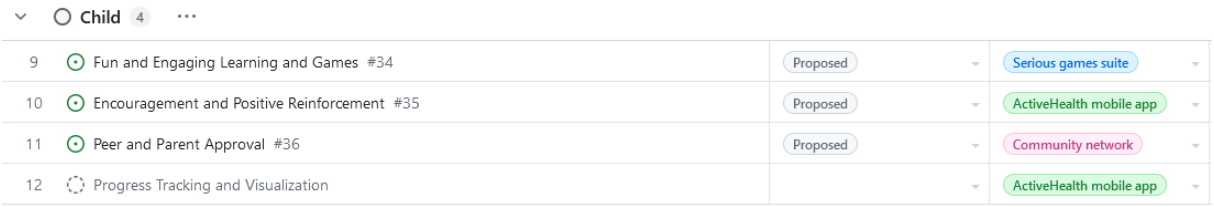

Figure 13: A proposed set of User requirements for Child mapped to a BIO-STREAMS component

The following table provides a more detailed list of user-requirements identified through the definition of the persona and the analysis of the feedback form the internal surveys.

Table 7: Initial set of requirements for a Child Persona

Requirement	Description
Fun and Engaging Learning and Games	• Interactive mobile apps or games that turn learning about nutrition and exercise into a fun and interactive experience for children aged 9 to 18. • Gamified elements, such as quizzes, challenges, and virtual rewards, to keep Jane engaged and motivated to learn about healthy lifestyle habits. • The app should offer content tailored to different age groups within the 9-18 range. Younger users might benefit from animated videos and simpler games, while teenagers could access more in-depth information and interactive quizzes. • The platform could offer family-based challenges that encourage healthy habits for the entire household. This fosters a supportive environment for Jane and promotes active participation from parents. • Communication features that facilitate interaction between Jane, her parents, and potentially her teachers, allowing them to provide support, encouragement, and guidance throughout her health journey. • Parental supervision and monitoring tools that ensure Jane's smartphone and tablet use is safe, age-appropriate, and aligned with her parents' preferences and values. • Engaging content that appeals to children of different ages and interests, with gamified elements to make learning about health and wellness enjoyable. • Tools that empower Jane to take charge of her health journey, such as setting personal goals, tracking

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	progress, and creating a virtual avatar to represent her in the app. • Features that allow Jane to personalize her experience, customize her goals, and tailor her nutrition and exercise plans to her preferences and needs.
Encouragement and Positive Reinforcement	• Personalized messages and virtual rewards, such as badges or stars, to acknowledge Jane's progress and achievements. • A virtual rewards system that incentivizes healthy behaviors and provides positive reinforcement to keep Jane motivated. • Progress tracking and visualization: The app should allow Jane and her parents to track progress visually using charts, graphs, or avatars. Seeing improvements can be motivating and encourage continued engagement..
Peer and Parent Approval	• Social Sharing Features: The BIO-STREAMS solution should include features that allow Jane to share her achievements and milestones with her peers and parents. This could be through a social feed within the app or integration with popular social media platforms, tailored to ensure privacy and safety for children. • Feedback System: Incorporate a real-time feedback system where Jane can receive immediate positive reinforcement from her parents and peers after completing activities or achieving goals. This could include likes, cheers, or custom messages.
Progress Tracking and Visualization	• Visual Progress Indicators: Provide easy-to-understand dashboards that Jane and her parents can use to track her progress. These could include graphical representations of her dietary habits, physical activity, and overall health improvements. • Goal Setting Tools: Include features that help Jane set realistic and achievable goals related to her health and wellness. These goals should be adjustable based on her progress and feedback from the app.

Children will primarily interact with the Serious Games Suite and Active Health App components. The main requirements relate to highly engaging interfaces with strong privacy protections and performance optimization for smooth gameplay. Key technical requirements, defined in D2.3, are related to (a detailed list of how technical requirements are linked with user requirements is given in section 4.3):

- **Game-based learning components** (FR-SGS-01, FR-SGS-02, FR-SGS-07, FR-SGS-08) - Supporting fun, educational experiences
- **Progress tracking visualization** (FR-ACT-2, FR-ACT-6) - Providing motivating feedback
- **Mobile interface design** (NFR-SGS-02, FR-SGS-06, NFR-SGS-07) - Ensuring responsive, engaging user experience
- **Micro-moment features** (FR-ACT-5) - Delivering timely encouragement
- **Privacy protections** (NFR-SGS-01, NFR-ACT-01) - Safeguarding children's data and interactions

4.2.3 Teacher

There is a strong emphasis on integrating nutrition and healthy lifestyle education into school curricula through engaging, practical activities and resources. Challenges include external

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influences such as advertising and the home environment. Teachers advocate for digital platforms that are interactive, visually appealing, and supportive of real-world application. Effective communication between schools and families, alongside hands-on learning experiences, is crucial for instilling lasting healthy habits in students. The following figure provides and initial set of identified user requirements and proposed mapping to a specific BIO-STREAMS component.

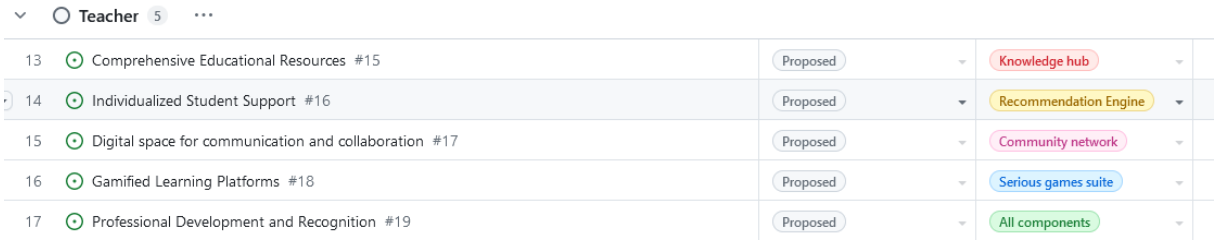

Figure 14: A proposed set of User requirements for Teacher mapped to a BIO-STREAMS component

The following table provides a more detailed list of user-requirements identified through the definition of the persona and the analysis of the feedback form the internal surveys.

Table 8: Initial set of requirements for a Teacher

Requirement	Description
Comprehensive Educational Resources	• Access to a wide range of educational materials covering topics such as nutrition, physical activity, mental well-being, and obesity prevention, tailored proper age range. • Engaging content formats including videos, interactive modules, games, stories, and quizzes to capture students' interest and facilitate learning. • Integration of real-life examples and case studies to illustrate the importance of healthy habits and promote critical thinking. • Resources should be available in multiple languages to cater to diverse student populations. • The platform should offer interactive tools like virtual labs, simulations, and gamified elements to make learning fun and engaging for students.
Individualized Student Support	• The platform should offer tools to conduct informal health assessments of workshop participants. This could be through questionnaires or surveys. • Teacher should be able to leverage the platform to create personalized recommendations and customizable plans based on each student's unique requirements, preferences, and challenges, with regular progress tracking features.
Digital space for communication and collaboration	• Digital space for communication and collaboration between students, parents, teachers, and health professionals, fostering a sense of community and shared responsibility for promoting health. • Features such as discussion forums, chat rooms, and resource sharing capabilities to facilitate communication, idea exchange, and peer support. • The platform could offer features to manage workshop schedules, register participants, and share materials and resources easily. • Integration with school management systems to ensure seamless coordination and alignment of health promotion initiatives with the broader educational curriculum.

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	• Secure forums or chat functionalities for parents to engage with Vilma, ask questions, and receive updates on their child's progress. • Peer support platform: A dedicated space for students to share their experiences, challenges, and successes in adopting healthy habits, fostering a sense of community and peer motivation. • Parent-Teacher health forums: An online forum specifically focused on health and well-being where Vilma can share resources, answer questions, and build a collaborative approach with parents.
Gamified Learning Platforms	• Interactive and gamified apps that teach children about healthy food choices, importance of regular physical activity, and other health-related topics through engaging games, challenges, quizzes, and rewards. • Integration of gamification elements into the platform to incentivize participation, motivate behavior change, and sustain interest in healthy lifestyle habits among students. • Interactive sessions that promote hands-on learning, culinary skills development, and exploration of healthy recipes suitable for children and families. • Example: Virtual cooking classes led by Vilma or guest instructors to demonstrate how to prepare nutritious meals, involving both students and parents in the learning process. • Virtual field trips: The platform could offer immersive virtual tours of health facilities or farms to give students a virtual learning experience.
Professional Development and Recognition	• Dedicated section offering professional development courses and resources for teachers focused on promoting healthy habits, incorporating physical activity into the curriculum, organizing nutrition-focused events, and being role models for healthy behaviors. • Online training courses: The platform should offer Vilma access to online courses and webinars on promoting healthy habits, incorporating physical activity into lessons, and best practices in health education. • Peer-to-peer learning: A platform for Vilma to connect with other teachers running similar workshops, share experiences, and learn from each other's successes. • Interactive modules, webinars, workshops, and expert-led sessions covering best practices, innovative strategies, and evidence-based approaches to health education and promotion. • Effort Recognition: Communication channel or platform where Vilma can receive recognition and appreciation from the school community, including the principal, fellow teachers, parents, and students, for her efforts in promoting health education and fostering positive classroom dynamics. Features such as badges, 'Thank you' messages, comments, and public acknowledgments to celebrate Vilma's contributions and achievements.

Teachers are primarily intended to interact with educational resources and collaboration tools, requiring secure access to appropriate student information while maintaining privacy boundaries. Key technical requirements, defined in D2.3, are related to (a detailed list of how technical requirements are linked with user requirements is given in section 4.3):

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- **Knowledge base access** (FR-RECENG-01, FR-ACT-3) - Providing evidence-based educational materials
- **Individualized recommendation features** (FR-RECENG-04, FR-RECENG-05, FR-RECENG-06) - Supporting personalized student guidance
- **Collaboration tools** (FR-SGS-04, FR-DASH-4) - Enabling communication with parents and healthcare providers
- **Gamified educational platforms** (FR-SGS-07, FR-SGS-08) - Supporting classroom health activities
- **Role-based authorization** (NFR-IMS-06) - Controlling appropriate access to student health information

4.2.4 Principal

Principals are open to engaging with external health initiatives, particularly when approaches are credible, clearly beneficial, and well-supported. Effective communication, technical readiness, and community involvement are key to successful implementation. There is a strong preference for integrating health initiatives into existing curriculums and using digital tools to enhance stakeholder engagement. Partnerships should offer clear value, support, and recognition to schools and should leverage modern digital communication strategies to maintain engagement and ensure the sustainability of health initiatives. The following figure provides and initial set of identified user requirements and proposed mapping to a specific BIO-STREAMS component.

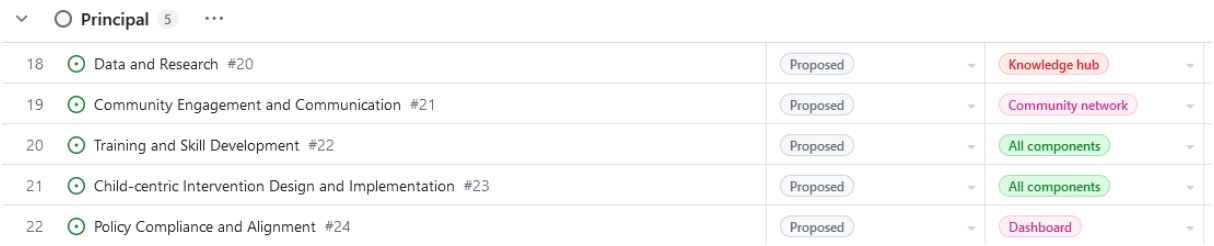

Figure 15: A proposed set of User requirements for Principal mapped to a BIO-STREAMS component

The following table provides a more detailed list of user-requirements identified through the definition of the persona and the analysis of the feedback form the internal surveys.

Table 9: Initial set of requirements for a Principal

Requirement	Description
Data and Research	• The platform should provide a curated collection of research studies, surveys, and evidence-based practices on childhood obesity prevention in schools. This data should be presented in an easy-to-understand format, avoiding complex research jargon. • The platform should offer tools to visualize data and generate reports on various health metrics, such as student weight changes, physical activity participation, and dietary habits. This allows Mick to track program effectiveness and make data-driven decisions. • Data must be organized and easily searchable, allowing Mick to quickly find relevant information to inform decision-making. • The platform should provide regular updates on national and local policies related to school health and nutrition. This ensures Mick's obesity prevention program aligns with current regulations.

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Community Engagement and Communication	• The platform should offer resources for organizing community-based events like health fairs, workshops, and fitness challenges. This could include step-by-step guides, promotional materials, and communication templates. • The platform should offer features like automated newsletters, discussion forums, and a notification system for keeping parents, teachers, and the community informed about school initiatives. • Interactive virtual workshop feature hosting expert-led sessions on healthy cooking, home exercise routines, and nutritional education. • Extend reach of obesity prevention education beyond school premises and engage parents and teachers in a virtual learning environment. • Centralized communication hub enabling direct and secure communication between parents and teachers. • Share updates on obesity prevention initiatives, distribute informative materials, and gather feedback from parents to create a collaborative approach to health education. • Features allowing easy sharing of success stories, upcoming events, and educational content on social media platforms. • Amplify reach of obesity prevention initiatives and foster a sense of community support. • Collaboration with Health Professionals: Direct communication channels with local health professionals, dietitians, and fitness experts. Ability to seek advice, invite guest speakers for school events, and ensure obesity prevention strategies align with the latest health recommendations.
Training and Skill Development	• Dedicated section offering professional development courses for teachers and staff, covering topics such as incorporating physical activity into the curriculum and organizing nutrition-focused events. • Tailored e-learning modules on obesity prevention strategies for teachers, covering integration of health education into various subjects and promoting a culture of healthy living. • Empower teachers to actively contribute to obesity prevention efforts and incorporate health education seamlessly into their teaching practices.
Child-centric Intervention Design and Implementation	• Tailored intervention planning tool: The platform should offer a tool to design and implement evidence-based interventions based on the school's specific needs and demographics. This tool could suggest appropriate interventions based on available data and best practices. • Collaboration with health professionals: The platform should facilitate communication with local health professionals, dietitians, and fitness experts. This allows Mick to seek advice, invite guest speakers for events, and ensure program alignment with health recommendations. • Virtual workshops and webinars: The platform could host interactive virtual workshops and webinars led by experts on healthy eating, creating exercise routines, and understanding nutrition labels. This extends education beyond the classroom and engages parents and teachers.
Policy Compliance and Alignment	• Feature providing regular updates on national and local policies related to school health and nutrition.

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	• Dashboard highlighting policy changes to ensure the school's obesity prevention program remains aligned with regulatory standards and best practices.

Principals will primarily interact with the Dashboard components and policy compliance features, requiring secure administrative tools with strong reporting capabilities and compliance features. Key technical requirements, defined in D2.3, are related to (a detailed list of how technical requirements are linked with user requirements is given in section 4.3):

- **Data access and management** (FR-DASH-2, FR-DASH-4, FR-DASH-5) - Supporting school-wide health data analysis
- **Authentication and security** (FR-DASH-1, FR-SMS-04) - Ensuring appropriate access to sensitive information
- **Regulatory compliance features** (NFR-SMS-01, FR-DASH-6, NFR-IMS-05) - Supporting educational and health policy alignment
- **Intervention management tools** (FR-RECENG-06, FR-DASH-4) - Enabling school-wide health initiatives
- **Communication frameworks** (FR-DASH-3) - Supporting stakeholder engagement

4.2.5 Data Scientist

Based on the thematic analysis the platform is envisioned as a highly integrated, collaborative, and user-friendly environment that supports extensive data sharing, real-time communication, and advanced data analysis capabilities. The responses highlight a strong desire for tools that facilitate easy access to and interpretation of complex data sets, with a focus on predictive modelling and real-time tracking to inform effective obesity prevention strategies. Interactive and engaging features are emphasized to ensure broad usability and accessibility, supporting a diverse range of research and practical needs in the field of obesity prevention. The following figure provides and initial set of identified user requirements and proposed mapping to a specific BIO-STREAMS component.

Figure 16: A proposed set of User requirements for Data-Scientist mapped to a BIO-STREAMS component

The following table provides a more detailed list of user-requirements identified through the definition of the persona and the analysis of the feedback form the internal surveys.

Table 10: Initial set of requirements for a Data Scientist

Requirement	Description
Data Access and Management	• Large, Real-World Datasets: The platform should provide access to a vast repository of real-world data on children, including Physical activity levels, Dietary patterns, Comorbidity risks, clearly defined obesity classification criteria (with customization options), Demographic and

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	genetic data (with secure access controls), molecular and genetic/epigenetic markers. • Cloud-Based Storage and Processing: The platform should leverage cloud computing to ensure scalable storage and efficient processing of large datasets. • Secure Data Sharing: The platform should allow secure sharing of data among authorized researchers and professionals while prioritizing user privacy. • Data Integration and Cleaning Tools: The platform should empower Simon to seamlessly integrate diverse datasets (clinical, genetic, behavioral) and provide tools for data cleaning and preprocessing. • Standardized Data Collection: The platform should encourage standardized data collection methods across studies to ensure data compatibility and facilitate future research efforts. • Data Version Control: The platform should implement data version control to track changes made to datasets and ensure reproducibility of research findings. • Ethical Frameworks: The platform should adhere to ethical frameworks for data governance and privacy, ensuring informed consent and responsible data management practices.
Data Visualization Capabilities, Analytics and Digital Functions	• The platform should provide advanced data visualization tools to create informative and clear presentations of research findings. These visualizations should be understandable by both scientific and non-scientific audiences. • Visualization tools that can convey complex data in an accessible and understandable manner, facilitating collaboration and decision-making. • Machine Learning Algorithms: Advanced algorithms for processing and analyzing large datasets, extracting patterns and trends related to childhood obesity. • Advanced Analytics: Robust analytics tools for creating predictive models based on real-world data, enabling Simon to derive actionable insights for obesity prevention. • Customization: The ability to define and customize criteria for obesity classification based on evolving research and emerging patterns. • Data Reprocessing Capabilities: The platform should allow Simon to reprocess data as needed to test different hypotheses and refine models.
Collaboration and Communication	• The platform should offer features that facilitate collaboration and communication among researchers and professionals. This could include: Discussion forums for exchanging ideas and research findings, Webinars and online events for knowledge sharing, Collaborative project spaces for joint research efforts. • Seamless communication and collaboration feature to connect with fellow researchers and health professionals. • Networking tools that facilitate the exchange of ideas, research findings, and best practices in childhood obesity prevention.
Digital Communication Space and Community Support Platforms	• Access to digital platforms for virtual consultations with nutritionists, paediatricians, and other healthcare professionals.

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	• Direct communication channels to ask questions, seek advice, and receive personalized recommendations from experts. • Online communities or forums where parent can connect with other parents facing similar challenges, sharing experiences and insights. • Peer support, encouragement, and practical tips from other parents can provide valuable emotional support and motivation.
User Profiles and Networking	• Detailed user profiles that highlight areas of expertise, research interests, and available projects. • Networking tools that facilitate connection and collaboration among researchers, healthcare professionals, and the public.
Open Communication and Knowledge Sharing	• Interactive discussion boards, webinars, and workshops to foster open exchange of ideas and best practices. • Systems to encourage and facilitate user-generated content and peer-to-peer learning.
Collaborative Tools	• Resource repositories for sharing and accessing guidelines, research publications, and datasets. • Real-time communication tools including forums, chat windows, and video conferencing capabilities. • Collaborative research areas and virtual project hubs for interdisciplinary projects.

Data Scientists are primarily intended to interact with IMS, BNB components, and the Synthetic Data Generator (i.e. center on data handling, analysis, and visualization.), requiring powerful data manipulation tools with strong security and collaboration features. Key technical requirements, defined in D2.3, are related to (a detailed list of how technical requirements are linked with user requirements is given in section 4.3):

- Data integration and management (FR-IMS-01, FR-IMS-02, FR-IMS-03, FR-IMS-04) - Providing comprehensive data access
- Data processing tools (FR-BNB-01, FR-BNB-02, FR-BNB-04, FR-BNB-05) - Supporting data cleaning and analysis
- Synthetic data generation (FR-SDG-01, FR-SDG-02, FR-SDG-03, FR-SDG-04) - Enabling privacy-preserving research
- Visualization capabilities (FR-DASH-5, FR-ACT-9, FR-ACT-10) - Supporting research insights communication
- Collaboration frameworks (FR-SGS-04, NFR-BNB-02) - Enabling research knowledge sharing

4.2.6 Dietitian

Respondents desire a highly integrated digital platform that facilitates robust data sharing, real-time communication, and advanced data analytics. Key features include user-friendly interfaces, real-time data collection tools, comprehensive data integration, and powerful visualization capabilities. The platform should support collaborative and interdisciplinary research efforts, offering detailed analytics to understand and predict obesity trends effectively. The overarching goal is to enhance the quality and impact of research in obesity prevention and management through innovative digital solutions. The following figure provides and initial set of identified user requirements and proposed mapping to a specific BIO-STREAMS component.

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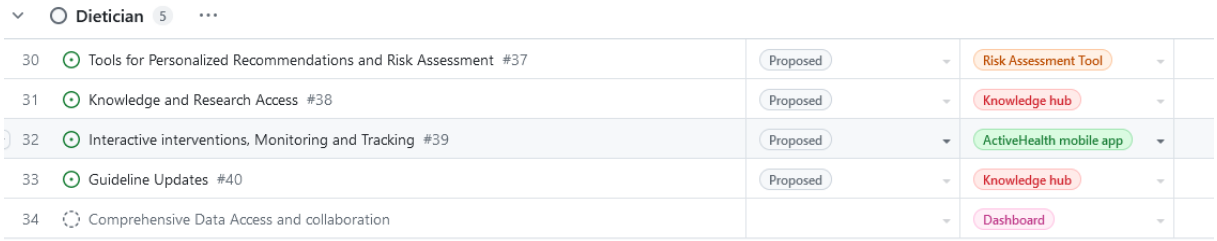

Figure 17: A proposed set of User requirements for Dietitian mapped to a BIO-STREAMS component

The following table provides a more detailed list of user-requirements identified through the definition of the persona and the analysis of the feedback form the internal surveys.

Table 11: Initial set of requirements for a Dietitian

Requirement	Description
Tools for Personalized Recommendations and Risk Assessment	• An online tool to suggest personalized interventions for Amanda's patients based on their individual characteristics, preferences, and health needs. • Risk assessment scores for obesity onset or progress based on patients' genetic and family health data, helping Amanda tailor interventions and preventive strategies accordingly. • Integration with AI-based algorithms to provide data-driven insights and recommendations for optimizing dietary interventions and promoting healthy lifestyle behaviors in children.
Knowledge and Research Access	• Educational modules: The platform should offer interactive, in-depth training modules on evidence-based diagnostic approaches for childhood obesity. This could include Identifying risk factors, Measurement techniques for body composition and metabolic health, interpreting results to inform personalized interventions, Effective communication strategies for paediatric nutrition, Case studies simulating real-world scenarios with children and parents. • An online forum or discussion board where Amanda can share case studies, seek advice, and engage in discussions with peers specializing in paediatric nutrition and childhood obesity prevention. • Webinars and virtual events for shared learning experiences and professional development opportunities. • Access to a curated library of journals and publications related to childhood obesity prevention, treatment, and guidelines for weight management. • Advanced search functionality and filters to find specific topics, age groups, or intervention types relevant to Amanda's practice. • Regular updates on new publications and research findings in the field of pediatric nutrition and obesity.
Interactive interventions, Monitoring and Tracking	• The platform should offer tools for real-time feedback on a child's health status and intervention effectiveness. This could include: A mobile app for parents to input daily food logs and activity levels, Automated data analysis to track trends and patterns, Customizable alerts for Amanda to address any concerning changes promptly. • Interactive online modules covering evidence-based diagnostic approaches for assessing childhood obesity,

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	effective communication strategies for paediatric nutrition counseling, and behavior change techniques. • Video demonstrations and virtual case studies simulating real-world scenarios in pediatric nutrition counseling to enhance Amanda's practical skills.
Guideline Updates	• Regular email updates and notifications to inform Amanda of updates to guidelines, research findings, and news related to childhood obesity prevention and treatment. • Customizable preferences for the types of updates and notifications Amanda wishes to receive, ensuring she stays informed and can adapt her practice accordingly. • A centralized dashboard summarizing recent changes and highlighting critical updates for easy access and reference.
Comprehensive Data Access and collaboration	• Access to real-world data on physical activity, dietary habits, and obesity metrics to inform dietary recommendations and interventions. • Integration with national health databases and access to up-to-date research on nutrition and obesity. • Facilities for dietitians to collaborate with other healthcare providers, such as doctors, fitness coaches, and other dietitians, to ensure a coordinated approach to patient care. • Secure messaging and data sharing capabilities to communicate effectively with other healthcare professionals involved in a patient's care.

Dietitians primarily focused on clinical assessment tools and personalized nutrition guidance, will mainly interact with the Risk Assessment Tool, Recommendation Engine, and ActiveHealth back-office features, requiring evidence-based tools with clinical performance and privacy protections. Key technical requirements, defined in D2.3, are related to (a detailed list of how technical requirements are linked with user requirements is given in section 4.3):

- **Risk assessment components** (FR-RISKA-01 through FR-RISKA-12) - Supporting nutritional risk evaluation
- **Recommendation engine features** (FR-RECENG-01 through FR-RECENG-14) - Delivering evidence-based nutrition guidance
- **Open toolkit integration** (FR-DASH-8, FR-ACT-8) - Providing specialized assessment tools
- **Knowledge management** (FR-RECENG-03) - Accessing up-to-date nutritional guidelines
- **Patient tracking tools** (FR-ACT-1, FR-ACT-2, FR-ACT-7) - Monitoring client progress

4.2.7 Clinician

Healthcare professionals seek digital platforms that offer comprehensive tools for managing childhood obesity effectively. These platforms should facilitate extensive data collection, real-time monitoring, family involvement, and communication. There is a strong need for features that support personalized care, address the psychological aspects of obesity, and combat stigma. Effective communication and evidence-based interventions are highlighted as necessary for improving treatment outcomes and engaging patients and their families in the long-term management of obesity. The following figure provides and initial set of identified user requirements and proposed mapping to a specific BIO-STREAMS component.

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	Doctor 7		
23	Access to Evidence-Based Content, Best Practices and Interventions #25	Proposed	Knowledge hub
24	Monitoring, Data Visualization and Exploration #26	Proposed	All components
25	Collaborative Research Platform #27	Proposed	Community network
26	Communication and Education #28	Proposed	Knowledge hub
27	Personalized Recommendations and Risk Assessment #29	Proposed	Risk Assessment Tool
28	Interactive Communication Tools & Patient and Family Engagement	Proposed	Dashboard
29	Customizable Treatment Plans	Proposed	Recommendation Engine

Figure 18: A proposed set of User requirements for Clinician mapped to a BIO-STREAMS component

The following table provides a more detailed list of user-requirements identified through the definition of the persona and the analysis of the feedback form the internal surveys.

Table 12: Initial set of requirements for a Clinician/Doctor

Requirement	Description
Access to Evidence-Based Content, Best Practices and Interventions	• A curated digital library compiling scientific evidence, guidelines, and best practices in childhood obesity prevention. • The platform should provide a comprehensive library of up-to-date, peer-reviewed research on childhood obesity prevention and management. This could include treatment guidelines, best practices, and information on related comorbidities like diabetes. • Incorporation of scientific findings into actionable strategies tailored for pediatric patients. • Real-time information on evolving trends in healthy lifestyles, nutrition, and effective interventions for obesity-related comorbidities like diabetes and cardiovascular issues. • Access to guidelines and best practices for childhood obesity prevention, tailored for different age groups and risk factors.
Monitoring, Data Visualization and Exploration	• Comprehensive tools enabling Esther to monitor the progress of her young patients, including lifestyle changes, nutritional habits, and physical activities. • The platform should integrate with wearable devices (e.g., fitness trackers) and mobile apps to collect real-time data on patients' physical activity, sleep patterns, and vital signs. This allows Esther to monitor their progress objectively. • The platform should offer telehealth features like video conferencing, secure messaging, and a patient health dashboard for remote consultations and progress monitoring. • Allow seamless integration with popular nutrition tracking apps to monitor dietary intake, analyze eating habits, and recommend healthier choices aligned with prevention goals. • Consideration of both physical and mental well-being, with tools for holistic assessment and monitoring. • The platform should offer robust data visualization tools to allow Esther to analyze trends in her patient population. This could include charts and graphs for BMI changes, activity levels, and other relevant metrics.
Collaborative Research Platform	• Secure platform for collaboration with fellow clinicians, researchers, and experts in childhood obesity.

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	• Collaborative research dashboard for sharing insights, participating in studies, and conducting collaborative data analysis. • Allow Esther to search and filter a curated library of relevant academic journals based on specific criteria like age group, intervention type, or outcomes. Provide access to full-text articles for in-depth research. • The platform should offer automatic notifications and updates on new research findings related to childhood obesity prevention.
Communication and Education	• Cost-effectiveness analysis tools: The platform should have tools to analyze the cost-effectiveness of different interventions, aiding Esther in making data-driven decisions. • Guidelines on prevention and communication: The platform should provide resources and recommendations for parents on how to prevent childhood obesity and effectively communicate healthy lifestyle habits to their children. • Integration of electronic media tools for effective communication with children, such as interactive educational resources and multimedia content.
Personalized Recommendations and Risk Assessment	• Implementation of machine learning algorithms to analyze individual patient data and provide personalized recommendations. • Risk assessment tools to identify children at higher risk of obesity and tailor interventions accordingly. • Consideration of both physical and mental well-being.
Interactive Communication Tools & Patient and Family Engagement	• Secure messaging and video conferencing features to facilitate communication with patients, families, and other healthcare professionals. • Collaboration tools that allow for multi-disciplinary team meetings and case discussions. Features that enable active participation of parents and children in the management plan, such as goal setting, progress tracking, and rewards systems. • Mobile app capabilities that allow patients and families to log activities, dietary intake, and receive motivational support.
Customizable Treatment Plans	• Tools to create and modify personalized treatment plans based on real-time data and evolving clinical guidelines. • Decision support systems that provide recommendations based on best practices and the latest research.

The clinicians will primarily use BIO-STREAMS in clinical decision support, patient monitoring, and collaborative care. Thus, they are foreseen to mostly interact with Dashboard, Risk Assessment Tool, and Recommendation Engine, requiring high-performance clinical tools with strong interoperability, security features, and evidence-based content. Key technical requirements, defined in D2.3, are related to (a detailed list of how technical requirements are linked with user requirements is given in section 4.3):

- **Evidence-based content access** (FR-RECENG-01, FR-DASH-1, FR-DASH-2) - Supporting clinical guidelines implementation
- **Data visualization and monitoring** (FR-BNB-01 through FR-BNB-05, FR-ACT-2) - Enabling patient progress tracking
- **Risk assessment tools** (FR-RISKA-01 through FR-RISKA-12) - Supporting clinical risk evaluation

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- **Personalized recommendation features** (FR-RECENG-04 through FR-RECENG-14) - Delivering patient-specific guidance
- **Interoperability capabilities** (NFR-IMS-03) - Ensuring seamless data exchange with clinical systems

4.2.8 Policymaker

Both policymakers in education and healthcare emphasize the critical need for evidence-based decision-making, underpinned by comprehensive data integration and advanced analytics. They advocate for rigorous analyses such as randomized clinical trials and economic evaluations to assess the effectiveness of obesity interventions. There is a strong emphasis on utilizing a wide array of data—including demographic, behavioral, health, and intervention specifics—to formulate policies that effectively address obesity challenges. Real-world data from clinical settings, public health surveys, and educational outcomes are particularly valued for crafting responsive and informed policies. Additionally, these stakeholders stress the importance of advanced analytics and predictive modeling to forecast intervention outcomes and identify at-risk populations, ensuring that initiatives are both proactive and preventive. This approach supports the creation of targeted, sustainable programs that leverage technology to facilitate communication, stakeholder engagement, and the continuous monitoring of health initiatives. The following figure provides and initial set of identified user requirements and proposed mapping to a specific BIO-STREAMS component.

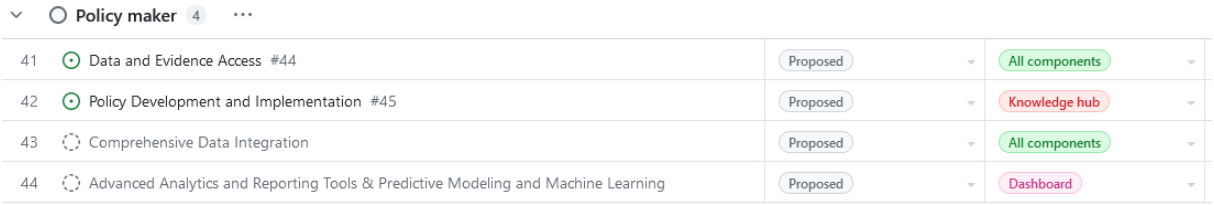

Figure 19: A proposed set of User requirements for Policymaker mapped to a BIO-STREAMS component

The following table provides a more detailed list of user-requirements identified through the definition of the persona and the analysis of the feedback form the internal surveys.

Table 13: Initial set of user requirements for Policymaker

Requirement	Description
Data and Evidence Access	• Comprehensive Data Repository: The platform should offer a central repository of: Aggregated and analyzed data on various childhood obesity prevention interventions (school-based programs, community initiatives, policy changes), Validated research studies, clinical trials, and real-world data, National obesity prevalence data with visualizations (maps, trends, demographics), Cost-effectiveness data for different interventions relevant to Boris's country. • Data Analytics Tools: The platform should offer advanced data analytics tools for:, Predictive modeling of future obesity trends based on current data, Actionable insights tailored to specific populations (demographic, clinical, and genetic data). • Evidence Aggregation Platform: The platform should provide a user-friendly interface for: Categorized evidence based on intervention types (school programs,

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	community initiatives, policy changes), Summarized key findings of research studies for quick reference. • Dynamic dashboard featuring national obesity prevalence data with visual representations like maps, trend graphs, and demographic breakdowns. • Standardized Data Collection: The platform should encourage standardized data collection methods for future research efforts. • Data Security and Privacy: The platform should adhere to ethical frameworks for data governance and privacy.
Policy Development and Implementation	• Effective Community Program Database: The platform should provide: Case studies of successful community programs with detailed plans, outcomes, and lessons learned, Tools for program design and evaluation, including templates and automated feedback mechanisms. • Community Engagement Features: The platform should facilitate community engagement through: Discussion forums for exchanging ideas and best practices, Webinars featuring experts on successful community programs, Virtual town hall meetings for policymakers and community leaders. • Digital Health Integration: The platform should integrate with digital health technologies for: Real-time health data from individuals (wearables, mobile health apps), Monitoring of intervention impact on physical activity and overall health. • Policy Update Notifications: The platform should offer real-time alerts on:Latest research findings related to obesity prevention, Policy updates and changes relevant to Boris's area. • Tools for designing, implementing, and evaluating community programs, including templates and automated surveys.
Comprehensive Data Integration	• Ability to aggregate and analyze diverse data types including demographic, anthropometric, behavioral, health, and intervention data. • Integration with real-world data sources like public health surveys, clinical data, and educational outcomes to provide a holistic view.
Advanced Analytics and Reporting Tools & Predictive Modeling and Machine Learning	• Advanced statistical analysis and meta-analysis capabilities to evaluate the effectiveness of interventions. • Real-time reporting and visualization tools that offer insights into key performance indicators such as BMI changes, quality of life improvements, and health outcomes. • Incorporate machine learning algorithms to predict the outcomes of obesity interventions and identify at-risk populations. • Tools to ensure the ethical use of predictive models, including transparency, interpretability, and fairness in algorithmic decision-making.

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The Policymaker will be mostly interested in population-level data analysis and evidence-based policy development. They will primarily interact with the Dashboard, IMS components, and reporting tools, requiring secure access to aggregated data with strong analytics capabilities and compliance features. Key technical requirements, defined in D2.3, are related to (a detailed list of how technical requirements are linked with user requirements is given in section 4.3):

- **Comprehensive data access** (FR-IMS-01 through FR-IMS-04, FR-DASH-5) - Enabling population health analysis
- **Security and privacy compliance** (NFR-SMS-01, NFR-SMS-02, NFR-IMS-05) - Ensuring regulatory alignment
- **Analytics and reporting tools** (FR-ACT-9, FR-ACT-10) - Supporting policy impact evaluation
- **Role-based authorization** (NFR-IMS-06) - Managing appropriate data access levels
- **Governance frameworks** (FR-DASH-3, FR-SMS-02) - Supporting policy implementation

4.3 Mapping of the Initial Set of User Requirements to Technical Requirements.

To understand how user-requirements were, and will be, reflected in the digital solution and services offered by BIO-STREAMS and to development priorities the technical partners have analysed each persona's requirements and created/identifying relevant technical specifications that enable/support these functionalities. In this section, we detail how each BIO-STREAMS components requirements are linked to specific user needs across the different personas. The details of the technical components are described under

4.3.1 Node Bundles (BNB) Requirements

Table 14: Initial set of user requirements mapped to the Node Bundles Technical Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from
FR-BNB-01: Data harmonisation	To assure a standardised data content and representation form	• Data Scientist - Data Access and Management; • Doctor- Monitoring, Data Visualization and Exploration
FR-BNB-02: Data curation	To identify data quality issues, including selection bias	• Data Scientist/Data Access and Management; • Doctor/Monitoring, Data Visualization and Exploration
FR-BNB-03: Data pseudonymisation	To ensure data protection by design according to GDPR	• Data Scientist/Data Access and Management;

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		• Doctor/Monitoring, Data Visualization and Exploration
FR-BNB-04: Data Integrity Validation	To ensure the accuracy and consistency of data throughout its lifecycle, including mechanisms for data validation and error checking	• Data Scientist/Data Access and Management; • Doctor/Monitoring, Data Visualization and Exploration
FR-BNB-05: Real-time Data Analytics	To provide real-time analytics and insights on the data stored within the BNB	• Data Scientist/Data Visualization Capabilities; • Doctor/Monitoring, Data Visualization and Exploration
NFR-BNB-01: Low Latency Data Access	Ensure that data retrieval and storage operations are performed with minimal delay to facilitate a responsive user experience	• Data Scientist/Data Visualization Capabilities, • Doctor/Monitoring, Data Visualization and Exploration, • Parent/Monitoring and Tracking of Progress
NFR-BNB-03: Security measures	Access to the data should be controlled by authentication and authorization mechanisms	• Parent/Health Profile Management, • Doctor/Personalized Recommendations and Risk Assessment, • Policy maker/Data and Evidence Access

*Note: FR – functional Requirements, NFR = non-functional requirements

4.3.2 Information Management System (IMS) Requirements

Table 15: Initial set of user requirements mapped to the IMS Technical Requirements

Information Management System (IMS) Requirements	Information Management System (IMS) Requirements	User Requirements From which the Technical Requirement originate from
FR-IMS-01: Data Integration	Ability to integrate and manage diverse types of data, including clinical, biological, anthropometric, demographic, behavioral, genetic, metabolic, hormonal, and cost data	• Data Scientist/Data Access and Management; • Policymaker/Data and Evidence Access
FR-IMS-02: Data cataloguing	The system must be able to request data cataloguing information from the connected federated data sources,	• Data Scientist/Data Access and Management;

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	including details such as the number of records, types of records, schemas, and other relevant metadata attributes	• Policymaker/Data and Evidence Access
FR-IMS-03: Data Collection and Formatting	Support for standardised data collection procedures to ensure data is provided in the correct format for efficient processing and integration	• Data Scientist/Data Access and Management; • Policymaker/Data and Evidence Access
FR-IMS-04: Data Sharing Information Access	IMS must have accessible information on data sharing rules, collection procedures, pseudonymisation/anonymisation techniques, etc., ensuring transparency and efficient access	• Data Scientist/Data Access and Management; • Policymaker/Data and Evidence Access
NFR-IMS-01: Security Measures	Use of advanced security measures, including encrypted communication channels and secure computation technologies, to protect data integrity and confidentiality against unauthorised access and breaches	• Data Scientist/Data Access and Management; • Policymaker/Data and Evidence Access
NFR-IMS-02: Scalability	The system must be scalable to accommodate growing data volumes and user access without degradation in performance	• Policy maker/Comprehensive Data Integration • Data Scientist/Data Access and Management • Principal/Data and Research
NFR-IMS-03: Interoperability	Capability to work seamlessly with existing and future systems, facilitating data exchange and integration within the biobanking ecosystem	• Data Scientist/Data Access and Management
NFR-IMS-04: Reliability and Availability	System reliability and availability to ensure continuous operation and access to the biobank's data for research and administrative purposes	• Doctor/Collaborative Research Platform • Dietitian/Knowledge and Research Access • Teacher/Digital space for communication and collaboration
NFR-IMS-05: Privacy Compliance	Adherence to privacy laws and regulations (e.g., GDPR) through built-in privacy protection mechanisms and compliance features	• Data Scientist/Data Access and Management

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NFR-IMS-06: Role based authorization	The system will ensure that specific data will be accessed only by specific authorized users	• Data Scientist/Data Access and Management

*Note: FR – functional Requirements, NFR = non-functional requirements

4.3.3 Risk Assessment Tool (RISKA) Requirements

Table 16: Initial set of user requirements mapped to the RISKA Technical Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from
FR-RISKA-01: Anthropometric input features	The RISKA should incorporate anthropometric factors including the Body Mass Index (BMI), Body Fat Distribution (BFD) & the Mid-Upper Arm Circumference (MUAC) in its analysis for risk level assessment	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-02: Zero cost, zero biological sampling	The RISKA must implement ML methods with no costs for screening at-risk cases and without the need for biological sampling	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-03: Input features	The RISKA's inputs must include features from the BIO-STREAMS data model as well as prognostic biomarkers	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-04: ML algorithms	The RISKA must implement a machine-learning system for the delivery of risk levels of adverse obesity-related metabolic outcomes	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-05: Age-specific stratification	The RISKA's output should provide age-specific risk stratification on obesity (potentially extending to unhealthy metabolic obesity phenotype)	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations

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FR-RISKA-06: Access	The RISKA must be accessed either through the BIO-STREAMS Platform or via the ActiveHealth App	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-07: Digitised Input	The RISKA must be based solely on digitised data, importable by either citizens (families, children) or professionals	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-08: Associative Catalogue	The RISKA could forward users to the BIO-STREAMS Associative Catalogue, which provides a direct communication channel with local specialists who can deliver sampling and analysis services	• Parent/Digital Communication Space and Community Support Platforms
FR-RISKA-09: Integration with Lexicon	The RISKA could be integrated with the meta-analytics knowledge base (BIO-STREAMS Lexicon) to provide up-to-date Risk Assessment estimation	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-10: Performance	>85% RISKA specificity	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-11: Output	The RISKA output must be a risk-based score for each individual user	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations
FR-RISKA-12: Output channel	The RISKA must send its output to the Dashboard/Active Health App	• Doctor/Personalized Recommendations and Risk Assessment • Dietitian/Tools for Personalized Recommendations

*Note: FR – functional Requirements, NFR = non-functional requirements

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4.3.4 Recommendation Engine (RECENG) Requirements

Table 17: Initial set of user requirements mapped to the RECENG Technical Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from
FR-RECENG-01: Knowledge Base	The RECENG must receive the guidelines from D2.1 -- "Knowledge on underage overweight & obesity"	• Teacher/Individualized Student Support • Doctor/Access to Evidence-Based Content; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations; • Parent/Education and Understanding
FR-RECENG-02: Understandable recommendations	The RECENG should use a simplified, comprehensible version of the guidelines to reflect the daily activities and decision process of the users	• Dietitian/Tools for Personalized Recommendations; • Parent/Education and Understanding
FR-RECENG-03: Integration with Knowledge Hub	The RECENG could be integrated with the Knowledge Hub to provide the most recent developments of gathered knowledge	• Dietitian/Knowledge and Research Access; • Dietitian/Guideline Updates
FR-RECENG-04: Rule-based system	The RECENG must implement a rule-based system for the delivery of validated recommendations	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
FR-RECENG-05: Demographic input features	The RECENG should incorporate Demographics, Lifestyle (Nutrition, Activity) & Family factors to propose pathways with minimal risk of adverse effects on behaviors in the medium to longer-term	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations; • Parent/Healthy Lifestyle Guidance
FR-RECENG-06: Tailored recommendations	The RECENG's nutrition and activity pathways must be tailored to each individual, also based on family behavior (serving as adherence predictor) toward family-wide	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Doctor/Customizable Treatment Plans;

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	behavior changes beyond conventional personalized suggestions	• Dietitian/Tools for Personalized Recommendations; • Principal/Child-centric Intervention Design; • Parent/Healthy Lifestyle Guidance
FR-RECENG-07: Smart scheduler	The RECENG could implement a smart, self-adjusting message scheduler to deliver recommendations through the ACT and maximize uptake and user engagement	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations; • Parent/Activity Scheduling and Tracking
FR-RECENG-08: Anthropometric input features	The RECENG should incorporate anthropometric factors including the Body Mass Index (BMI), Body Fat Distribution (BFD) & the Mid-Upper Arm circumference (MUAC) in its analysis for exercise/nutrition pathway suggestion	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations; • Parent/Meal Planning and Nutritional Guidance
FR-RECENG-09: Input features	The RECENG's inputs must include features from the BIO-STREAMS data model as well as prognostic biomarkers	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
FR-RECENG-10: Access	The RECENG must be accessed either through the BIO-STREAMS Platform or via the ActiveHealth App	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
FR-RECENG-11: Performance	> 0.85 Recommendation Engine MAP@K (Mean Average Precision @ K)	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
FR-RECENG-12: Output	The RECENG must provide recommendations for prevention and healthy living, following a family-centric approach based on user profile characteristics, such as age,	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations;

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	height, weight, and physical activity level	• Doctor/Customizable Treatment Plans; • Dietitian/Tools for Personalized Recommendations; • Parent/Meal Planning and Nutritional Guidance; • Parent/Healthy Lifestyle Guidance
FR-RECENG-13: Output channel	The RECENG must send its output to the Dashboard/Active Health App	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
FR-RECENG-14: Digitised Input	The RECENG must be based solely on digitised data, importable by either citizens (families, children) or professionals	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations; • Parent/Health Profile Management

*Note: FR – functional Requirements, NFR = non-functional requirements

4.3.5 Open Toolkit Requirements

Table 18: Initial set of user requirements mapped to the Open Toolkit Technical Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from
NFR-OPENT-01: Performance efficiency	The Open Toolkit must be optimised for performance, ensuring that recommendations are generated and delivered to users within a few seconds under typical load conditions	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
NFR-OPENT-02: Reliability	The Open Toolkit must consistently provide accurate and contextually relevant recommendations	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations

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NFR-OPENT-03: Availability	The Open Toolkit must achieve high uptime, to ensure high availability to users	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
NFR-OPENT-04: Data Privacy	The Open Toolkit must ensure that sensitive user data is not transferred, shared, or accessible outside of the recommendation engine's secure environment	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
NFR-OPENT-05: Maintainability and Extensibility	The Open Toolkit should be designed with modularity, clear and comprehensive documentation to facilitate effortless maintenance, straightforward updates, and efficient bug resolution processes	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
NFR-OPENT-06: Cross-Platform Compatibility	The Open Toolkit should ensure compatibility across diverse computing platforms and environments	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
NFR-OPENT-07: Explainability	The Open Toolkit should incorporate explainability features that allow users and administrators to understand the rationale behind the recommendations provided	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations

*Note: FR – functional Requirements, NFR = non-functional requirements

4.3.6 Synthetic Data Generator (SDG) Requirements

Table 19: Initial set of user requirements mapped to the Open Toolkit Technical Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from

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FR-SDG-01: Functionality	A tool for generating synthetic data that mimics real-world patterns	• Data Scientist/Data Access and Management
FR-SDG-02: Functionality	An evaluation Protocol to validate the quality and fidelity of the generated data	• Data Scientist/Data Access and Management
FR-SDG-03: Functionality	The tool shall support the generation of synthetic data for a wide range of data types	• Data Scientist/Data Access and Management
FR-SDG-04: Functionality	Users shall be able to define custom data schemas specifying the structure, format, and constraints of the generated data	• Data Scientist/Data Access and Management
NFR-SDG-01: Documentation	Document the generation process, generation algorithms and validation results	• Data Scientist/Data Access and Management
NFR-SDG-02: Security	Models, interfaces, and data will be only accessible through authentication mechanisms	• Data Scientist/Data Access and Management
NFR-SDG-03: Usability	Allow users to add requirements to the overall synthetic generation process	• Data Scientist/Data Access and Management
NFR-SDG-04: Efficiency	Select efficient models and techniques that describe the structure of the synthetic data	• Data Scientist/Data Access and Management
NFR-SDG-05: Robustness	Implement error handling mechanisms to handle unexpected situations during data generation	• Data Scientist/Data Access and Management

*Note: FR – functional Requirements, NFR = non-functional requirements

4.3.7 Dashboard (DASH) Requirements

Table 20: Initial set of user requirements mapped to the DASH Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from
FR-DASH-1: User Authentication	User authentication mechanism for secure access to the dashboard and any other components	• Principal/Training and Skill Development; • Doctor/Monitoring; • Dietitian/Tools for Personalized Recommendations;

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		• Data Scientist/User Profiles; Policy maker/Data and Evidence Access
FR-DASH-2: User Interface Design	User-friendly interfaces for accessing BIO-STREAMS components	• Principal/Policy Compliance; Doctor/Monitoring; • Dietitian/Comprehensive Data Access; • Parent/Education and Understanding
FR-DASH-3: BIO-STREAMS Board	Establishment of framework and roles for the BIO-STREAMS Board	• Principal/Community Engagement and Communication • Policy maker/Policy Development and Implementation • Data Scientist/Collaborative Tools
FR-DASH-4: Data Entry Views	Views for entering cost-related data	• Principal/Child-centric Intervention; • Principal/Policy Compliance; • Policy maker/Data and Evidence Access
FR-DASH-5: Data Handler Interface	User interface for accessing and searching data	• Data Scientist/Data Visualization; • Policy maker/Data and Evidence Access
FR-DASH-6: Audit Log Viewing	Enable transparency through viewing of data access audit logs	• Principal/Policy Compliance and Alignment • Policy maker/Data and Evidence Access • Data Scientist/Data Access and Management
FR-DASH-7: ActiveHealth Backend	Backend infrastructure development for ActiveHealth mobile app	• Doctor/Personalized Recommendations; • Dietitian/Interactive interventions
FR-DASH-8: Open Toolkit Integration	Use of the Open Toolkit UI for risk assessment and recommendations	• Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations; • Data Scientist/Data Visualization
NFR-DASH-01: User Interface	Intuitive interfaces for user-friendly interaction	• Principal/Training and Skill Development; • Doctor/Monitoring;

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		• Dietitian/Tools for Personalized Recommendations; • Parent/Education and Understanding; Parent/Usability
NFR-DASH-02: System Availability	High system availability and fault tolerance	• Doctor/Monitoring, Data Visualization and Exploration • Teacher/Digital space for communication and collaboration • Parent/Monitoring and Tracking of Progress
NFR-DASH-03: Data Confidentiality	Safeguard sensitive data and ensure confidentiality	• Principal/Training and Skill Development; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations

*Note: FR – functional Requirements, NFR = non-functional requirements

4.3.8 Active Health App (ACT) Requirements

Table 21: Initial set of user requirements mapped to the ACT Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from
FR-ACT-1: Personalized Data Handling	Enable users to input and manage personalized data	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Parent/Monitoring and Tracking; • Parent/Health Profile Management; • Dietitian/Interactive interventions
FR-ACT-2: Progress Monitoring	Monitor and track users' personalized progress	• Doctor/Monitoring; • Parent/Monitoring and Tracking; • Child/Progress Tracking; • Dietitian/Interactive interventions
FR-ACT-3: Assistive Guidance	Provide guidance with links to relevant resources	• Teacher/Comprehensive Educational Resources; • Teacher/Professional Development;

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		• Parent/Digital Communication; • Child/Encouragement; • Doctor/Interactive Communication
FR-ACT-5: Micro-moment creation	Develop logic for micro-moments. Utilize cloud messaging for notifications	• Parent/Healthy Lifestyle Guidance; • Child/Encouragement; • Child/Peer and Parent Approval
FR-ACT-6: Frontend Views	Develop frontend views of the mobile application, used by parents	• Parent/Monitoring and Tracking; • Child/Fun and Engaging Learning; • Child/Progress Tracking
FR-ACT-7: Back-office views	Develop frontend views of the back-office web application, used by health professionals	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Interactive interventions
FR-ACT-8: Open Toolkit Integration	Integrate the Open Toolkit functionalities in the back-office application	• Doctor/Personalized Recommendations; • Dietitian/Interactive interventions
FR-ACT-9: Reports/Dashboards	Reports and dashboards for viewing various metrics of usage	• Data Scientist/Data Visualization; • Policy maker/Data and Evidence Access
FR-ACT-10: Analytics Integration	Integrate analytics for tracking user participation and patterns	• Data Scientist/Data Visualization; Policy maker/Data and Evidence Access
NFR-ACT-01: Data Security	Ensure robust security measures for data protection	• Parent/Health Profile Management • Child/Peer and Parent Approval • Doctor/Interactive Communication Tools
NFR-ACT-02: User-Friendly Interface	Implement intuitive interfaces for ease of use	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Parent/Monitoring and Tracking;

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		• Child/Progress Tracking; • Dietitian/Interactive interventions; • Parent/Usability
NFR-ACT-03: System Availability	Ensure high system availability for uninterrupted service	• Parent/Monitoring and Tracking of Progress • Child/Fun and Engaging Learning • Doctor/Interactive Communication Tools
NFR-ACT-04: Data Confidentiality	Safeguard user data and ensure confidentiality	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations

*Note: FR – functional Requirements, NFR = non-functional requirements

4.3.9 Serious Games Suite (SGS) Requirements

Table 22: Initial set of user requirements mapped to the SGS Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from
FR-SGS-02: Frontend	Develop frontend views of the application, used by clients	• Child/Fun and Engaging learning • Teacher/Gamified Learning Platforms • Parent/Healthy Lifestyle Guidance
FR-SGS-04: Community Network	Integrate with Community Network/Associative Catalogue	• Data Scientist/Collaboration and Communication; • Data Scientist/Digital Communication
FR-SGS-05: Authentication Server	Setup access control	• Principal/Training and Skill Development; • Doctor/Monitoring; • Dietitian/Tools for Personalized Recommendations
FR-SGS-06: User Interface	Enable data access and search with audit logs	• Teacher/Gamified Learning Platforms • Parent/Usability
FR-SGS-07: Progress Monitoring	Monitor status of services and track users' personalized progress	• Child/Fun and Engaging Learning; • Data Scientist/Collaboration and Communication

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FR-SGS-08: Overview & Management	Manage serious games, users and functions	• Child/Fun and Engaging Learning; • Data Scientist/Open Communication
FR-SGS-09: Administration	Administer and track statistics	• Teacher/Individualized Student Support • Principal/Data and Research - Provides usage statistics for educational planning • Policy maker/Advanced Analytics and Reporting Tools - Supplies education engagement data
NFR-SGS-01: Data Security	Robust security measures for data protection	• Child/Peer and Parent Approval – • Teacher/Digital space for communication and collaboration • Parent/Health Profile Management
NFR-SGS-02: User-friendliness	Ease of use; efficient for carrying out user tasks	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Parent/Usability
NFR-SGS-03: System Reliability	Ensure the system operates consistently and reliably under normal and exceptional conditions	• Child/Fun and Engaging Learning • Teacher/Gamified Learning Platforms • Parent/Monitoring and Tracking of Progress
NFR-SGS-05: Data Confidentiality	Safeguard user data and ensure confidentiality	• Teacher/Individualized Student Support; • Doctor/Personalized Recommendations; • Dietitian/Tools for Personalized Recommendations
NFR-SGS-06: Maintainable System	Capable of being maintained cost-effectively over its expected lifetime	• Principal/Training and Skill Development • Policy maker/Policy Development and Implementation
NFR-SGS-07: System performance	Ensure the system performs its functions with minimal resource consumption	• Child/Fun and Engaging Learning • Teacher/Gamified Learning Platforms • Parent/Usability

*Note: FR – functional Requirements, NFR = non-functional requirements

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4.3.10 Security Monitoring Service (SMS) Requirements

Table 23: Initial set of user requirements mapped to the SMS Requirements

Technical Requirement	Description	User Requirements From which the Technical Requirement originate from
FR-SMS-01: Asset Cataloguing	The Asset Loader must be capable of integrating and cataloguing all organizational assets into a cyber asset model, which includes recording assets' security properties, interrelationships, and existing controls	• Policy maker/Data and Evidence Access • Principal/Policy Compliance and Alignment
FR-SMS-03: Event Monitoring and Log Management	EVEREST should continuously monitor the system for security anomalies and threats, while the Event Captors must collect, format, and forward log data for analysis	• Policy maker/Data and Evidence Access • Data Scientist/Data Access and Management • Doctor/Personalized Recommendations
FR-SMS-04: User Authentication	There should be role-based authentication and authorization of the users	• Doctor/Personalized Recommendations • Principal/Data and Research • Parent/Health Profile Management
NFR-SMS-01: Regulatory Compliance	Compliance with standards and regulations relevant to security and privacy	• Policy maker/Data and Evidence Access; • Principal/Policy Compliance and Alignment
NFR-SMS-02: Data Protection	The suite must ensure data integrity, confidentiality, and prevent unauthorized access	• Policy maker/Data and Evidence Access
NFR-SMS-03: System Monitoring	Comprehensive monitoring and logging for performance tuning and troubleshooting	• Data Scientist/Data Access and Management • Policy maker/Advanced Analytics and Reporting Tools

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5 User stories and scenarios

This section presents the initial set of user stories and scenarios developed from the comprehensive understanding of personas and user requirements identified in earlier sections. These narratives are crafted to illustrate the real-life applications of the BIO-STREAMS platform, showcasing how different stakeholders, might interact with the system to manage and prevent childhood obesity. Each user story and scenario is structured to highlight specific features and functionalities of the platform, demonstrating potential benefits and identifying areas for enhancement.

This section serves as a foundational element for the iterative development process. The user stories and scenarios described here are preliminary and will undergo further refinement through participatory design techniques in upcoming living labs (carried out under WP6 activities). These living labs will provide real-world environments where end users can interact with the prototypes, offering valuable feedback that will be used to fine-tune the platform. This iterative process ensures that the final product is not only aligned with the users' needs but also adaptable to changing requirements and new insights gained from direct user engagement.

5.1.1 Parent – Educational Context, Children at Risk of Obesity

Description of the narrative story board

Scene 1: Peter using a digital health app in a home office to input his children's health data, showing his concern and proactive approach. Scene 2: Peter and his children exploring educational resources on a tablet, which displays engaging and colorful content about healthy living. Scene 3: The family preparing a healthy meal in their modern kitchen, interacting with a recipe app on a tablet. Scene 4: Family planning weekly activities in the living room with a digital calendar app, engaging in a lively discussion. Scene 5: Peter participating in an online community forum, engaging with other parents and a healthcare professional in a virtual meeting environment.

Table 24: Outline of a user-story in non-disease related context

Scene	Description
Scene 1: Early Identification and Engagement	Setting: Peter, concerned by early signs of unhealthy habits in his children, decides to proactively engage with the BIO-STREAMS solution. User Requirement: Access to a comprehensive health profiling tool that includes risk assessment for obesity based on lifestyle and dietary habits. Action: Peter creates detailed profiles for his children, inputting initial health data and lifestyle habits. Goal: To establish a baseline and begin monitoring for signs of risk.
Scene 2: Educational Empowerment	Setting: Peter explores the educational resources within BIO-STREAMS. User Requirement: Educational apps and resources providing comprehensive information

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	on nutrition, physical activity, and the psychology of eating. Action: He learns about balanced diet importance and physical activity through interactive content, and he plans to share this knowledge with his children. Goal: To educate himself and prepare to guide his children effectively.
Scene 3: Interactive Meal Planning	Setting: Kitchen, during family meal preparation. User Requirement: A lifestyle planning platform offering healthy meal preparation ideas and recipes tailored to children's preferences. Action: Using BIO-STREAMS, Peter and his children prepare a healthy meal together, incorporating feedback from the app on nutritional balance. Goal: To involve children in meal preparation, making them active participants in their health journey.
Scene 4: Activity and Progress Tracking	Setting: Living room, during a family planning session. User Requirement: Health monitoring apps that track nutritional intake and physical activity, offering real-time data and trends. Action: The family sets weekly physical activity goals using the app, and Peter tracks their progress, adjusting activities based on app suggestions and children's feedback. Goal: To ensure the family stays active and engaged, adjusting plans to optimize health outcomes.
Scene 5: Community and Professional Support	Setting: Online, accessing a community support platform. User Requirement: Telehealth services and community forums for ongoing support and guidance. Action: Peter participates in a virtual group session with other parents and a pediatric nutritionist, discussing challenges and successes. Goal: To gain insights from the community and professionals, enhancing his strategy for family health maintenance.

5.1.2 Parent – Clinical Context, Children suffering from Obesity

Based on the information provided about Peter and his goals with the BIO-STREAMS solution and the thematic analysis we create a narrative story board as an example use case of a parent with children suffering from obesity/overweight.

Description of the narrative story board

Scene 1: Peter in his home, seriously using his computer to enroll in an obesity management program. Scene 2: Peter deeply focused on a tablet in his home office, studying educational modules on behavioral change and nutrition. Scene 3: Peter in the kitchen, preparing a healthy meal using a digital meal planning app displayed on a tablet. Scene 4: Peter in the living room,

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tracking health data on a tablet and participating in a telehealth session with a pediatrician. Scene 5: Peter engaging in an online community forum from his home office, sharing and discussing health strategies with other parents.

Table 25: Outline of a user-story in clinically relevant related context of Children Suffering from Obesity/Overweight

Scene	Description
Scene 1: Diagnosis and Immediate Action	Setting: Home, right after a pediatrician's diagnosis. User Requirement: Immediate access to an intensive intervention program through the BIO-STREAMS solution. Action: Peter signs up for an obesity management program tailored for children, starting with a comprehensive health assessment. Goal: To tackle obesity with a structured and professional-guided approach.
Scene 2: Structured Learning and Behavioural Change	Setting: Home office, using BIO-STREAMS for structured learning. User Requirement: Advanced educational modules focusing on behavioral change, nutrition, and physical health. Action: Peter goes through modules designed to help parents understand and combat childhood obesity, equipping him with strategies to support his children. Goal: To change lifestyle behaviors through educated parental guidance.
Scene 3: Customized Nutrition and Activity Plans	Setting: Kitchen and local park. User Requirement: Personalized meal planning and physical activity schedules that are adaptable based on ongoing feedback. Action: Using the app, Peter implements the suggested diet plan and daily exercise routines with his children, monitoring adherence and enjoyment. Goal: To instill healthy eating patterns and consistent physical activity among his children.
Scene 4: Monitoring and Professional Collaboration	Setting: Living room, using BIO-STREAMS for real-time monitoring. User Requirement: Real-time health monitoring tools integrated with access to health professionals. Action: Peter tracks his children's progress through the app and discusses the data with a pediatrician during a telehealth appointment, making necessary adjustments. Goal: To maintain a close watch on health improvements and adapt strategies as required by professional advice.
Scene 5: Long-term Engagement and Empowerment	Setting: Online, using community support features. User Requirement: Long-term engagement tools, including forums and progress sharing features.

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	Action: Peter shares his family's progress in an online community, receiving and giving support, and celebrating milestones. Goal: To foster a supportive environment and encourage his children through community engagement, ensuring sustained motivation and health improvements.

5.1.3 Child

Scene 1: Jane in her home, being introduced to a colorful and interactive health app on her tablet. Scene 2: Jane playing a nutrition game on her tablet in her bedroom, engaging with a virtual pet by feeding it healthy food options. Scene 3: Jane in the living room, showing her parents her achievements in the app, receiving praise, and sharing her success on a community board. Scene 4: Jane and her parents in the kitchen, setting personal health goals with the app, choosing recipes, and tracking steps. Scene 5: Jane checking her progress on the app, receiving virtual badges, and viewing her activity levels on a colourful graph

Table 26: The user-story of a Child Suffering from Obesity/Overweight

Scene	Description
Scene 1: Discovering BIO-STREAMS	Setting: Jane at home, feeling unsure about her body image after witnessing some bullying at school. User Requirement: Needs an engaging, fun way to learn about health that can boost her self-esteem. Action: Jane's parents introduce her to the BIO-STREAMS app, which has a colorful, interactive interface designed for kids. Goal: To make Jane feel comfortable and excited about learning healthy habits.
Scene 2: Engaging with Fun Learning	Setting: Jane's bedroom, using her tablet. User Requirement: Interactive games and quizzes that teach nutrition and exercise in a fun manner. Action: Jane plays a game on BIO-STREAMS that involves choosing healthy food options to feed a virtual pet, which helps her learn about balanced diets. Goal: To educate Jane about nutrition while ensuring she is having fun and feeling good about her choices.
Scene 3: Gaining Peer and Parent Approval	Setting: Living room, with Jane showing her parents a new high score on a health quiz she completed in the app. User Requirement: Social sharing features within the app that allow Jane to share achievements with her family and friends. Action: Jane's parents praise her for her score, and she shares her success on the app's community board, receiving likes and supportive comments from friends. Goal: To boost Jane's self-esteem and make her feel supported by her peers and parents.

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Scene 4: Customizing Her Health Journey	Setting: Kitchen, with Jane and her parents planning a family health challenge using BIO-STREAMS. User Requirement: Tools for setting personal health goals and tracking progress. Action: Jane sets a goal to achieve a certain number of steps each day and chooses healthy recipes to try each week with her family. Goal: To empower Jane to take charge of her health and feel in control of her body and choices.
Scene 5: Celebrating Progress and Receiving Encouragement	Setting: Online, Jane checking the app's progress tracking feature. User Requirement: Virtual rewards system and progress visualization. Action: Jane receives a virtual badge for consistently meeting her step goal and sees a positive trend in her activity levels on a colorful graph. Goal: To provide Jane with continuous motivation and positive reinforcement, encouraging her to maintain and develop healthy habits.

5.1.4 Teacher

Scene 1: Vilma in her classroom, browsing health education tools on her laptop. Scene 2: Vilma at home planning lessons on her laptop, using customizable lesson plan templates. Scene 3: Vilma teaching in her classroom with students engaged in a virtual cooking class on tablets. Scene 4: Vilma reviewing student progress analytics on her computer at school. Scene 5: Vilma showing parents how to access the BIO-STREAMS platform during a parent-teacher meeting. Scene 6: Vilma participating in a professional development webinar on her computer at school.

Table 27: The user-story of a Teacher Concerned with Health Lifestyles and Obesity/Overweight in the School

Scene	Description
Scene 1: Discovering the Platform	Setting: Vilma in her classroom, after school hours, searching for effective health education tools online. User Requirement: A comprehensive digital platform that provides interactive and curriculum-aligned health education resources. Action: Vilma discovers the BIO-STREAMS platform and explores its array of educational content and tools specifically designed for teachers. Goal: To find engaging and informative resources that can be seamlessly integrated into her daily teaching routines.
Scene 2: Planning and Customization	Setting: At home, Vilma planning her next week's lessons on her laptop. User Requirement: Customizable lesson plans and activities that can be adapted to her students' age group and learning abilities.

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	Action: Vilma uses the platform's customizable templates to prepare a series of interactive lessons on nutrition and physical activity. Goal: To prepare tailored lesson plans that are engaging and age-appropriate for her students.
Scene 3: Classroom Implementation	Setting: Vilma's classroom, with students engaged in a BIO-STREAMS interactive module. User Requirement: Real-time engagement tools that capture and maintain students' interest. Action: Vilma runs an interactive module where students participate in a virtual cooking class, learning about healthy ingredients and portion sizes. Goal: To provide students with hands-on learning experiences that enhance their understanding of healthy living.
Scene 4: Monitoring and Feedback	Setting: Vilma's desk, reviewing students' progress on her computer after class. User Requirement: Tools to monitor students' progress and gather feedback on the effectiveness of the lessons. Action: Vilma checks the analytics on BIO-STREAMS to see her students' engagement levels and quiz results from the lessons. Goal: To assess the impact of her teaching and identify areas where students might need more support or additional resources.
Scene 5: Parental Engagement	Setting: During a parent-teacher evening at school. User Requirement: Effective communication tools to involve parents in their children's health education. Action: Vilma shares access to the BIO-STREAMS platform with parents, showing them how they can support their children's learning at home. Goal: To extend health education beyond the classroom and encourage healthy habits at home.
Scene 6: Professional Development	Setting: Vilma participating in a webinar hosted on BIO-STREAMS. User Requirement: Opportunities for professional growth and learning from health education experts. Action: Vilma attends a webinar focusing on innovative strategies for teaching health education, gaining new ideas and insights. Goal: To continuously improve her teaching methods and stay updated on the latest health education trends.

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5.1.5 Principal

Scene 1: Mick in his office, reviewing obesity prevention strategies on his computer. Scene 2: Mick planning a community health fair with the school health committee, using a digital platform displayed on a large screen. Scene 3: Mick conducting a staff training session using e-learning modules on a projector, and a parallel virtual workshop for parents on his laptop. Scene 4: Mick in his office, analyzing intervention outcomes with graphs and data analytics on his computer screen. Scene 5: Mick comparing school health policies with updated national guidelines on his tablet, ensuring compliance.

Table 28: The user-story of a Principal Concerned with Health Lifestyles and Obesity/Overweight in the School

Scene	Description
Scene 1: Research and Data Access	Setting: Mick in his office early in the morning, reviewing current obesity prevention strategies. User Requirement: Needs access to a repository of studies, surveys, and evidence-based practices related to obesity prevention. Action: Mick logs into BIO-STREAMS, accessing the latest research and data on successful interventions implemented in other schools. Goal: To inform his strategy with proven methodologies and tailor interventions specific to his school's needs.
Scene 2: Planning Community-Based Interventions	Setting: Planning meeting with the school health committee. User Requirement: Toolkit for organizing community-based events such as health fairs and fitness challenges. Action: Using BIO-STREAMS, Mick downloads step-by-step guides, promotional materials, and communication templates to plan an upcoming health fair. Goal: To enhance community engagement and provide health education in an interactive setting.
Scene 3: Engaging Teachers and Parents	Setting: Staff training session and separate parent workshop. User Requirement: Professional development courses and educational modules for teachers; engaging communication tools for parents. Action: Mick coordinates a training session using BIO-STREAMS e-learning modules on integrating health education into the curriculum. Simultaneously, he initiates a virtual workshop for parents on nutritional practices. Goal: To empower teachers with knowledge and skills, and to involve parents in their children's health education.
Scene 4: Monitoring and Evaluation	Setting: Mick's office, reviewing the effectiveness of recently implemented programs. User Requirement: Data analytics tools to generate reports on student health metrics and intervention outcomes.

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	Action: Mick uses BIO-STREAMS to analyze data collected from the recent health fair and ongoing school activities, assessing improvements in student health behaviors. Goal: To evaluate the impact of interventions, making data-driven adjustments to enhance program effectiveness.
Scene 5: Policy Compliance and Updates	Setting: Administrative office, ensuring the school's programs align with national health policies. User Requirement: Regular updates on national and local health policies and regulations. Action: Mick reviews a policy update notification on BIO-STREAMS, comparing current school practices with new guidelines. Goal: To ensure all health initiatives comply with regulatory standards and incorporate the latest best practices for maximum effectiveness.

5.1.6 Data Scientist

Scene 1: Simon in his office, discovering the BIO-STREAMS platform on his computer screen. Scene 2: Simon at his workstation, integrating various data sets, with screens showing data graphs and interfaces. Scene 3: Simon engaging in an online discussion forum on BIO-STREAMS, interacting with other health professionals. Scene 4: Simon analyzing data using advanced analytics tools, surrounded by charts and data models. Scene 5: Simon preparing a data visualization presentation, making complex data easily understandable for a healthcare conference.

Table 29: The user-story of Simon, biomedical data scientist involved in obesity research

Scene	Description
Scene 1: Discovering BIO-STREAMS	Setting: Simon in his office, browsing through digital platforms that could aid his research in obesity prevention. User Requirement: Needs a platform that provides robust data access, particularly real-world data on obesity. Action: Simon discovers BIO-STREAMS and is intrigued by its promise of comprehensive data availability and advanced analytics. Goal: To find a reliable source of data that can help him develop predictive models for early intervention in obesity.
Scene 2: Engaging with the Platform	Setting: At his workstation, Simon logs into BIO-STREAMS for the first time. User Requirement: Seamless integration of diverse data sets including physical activity, meal frequency, and obesity classification. Action: He explores the platform's data repository and starts integrating various data sets to form a comprehensive database for his analysis. Goal: To consolidate and standardize data from multiple sources for cohesive analysis.

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Scene 3: Collaboration and Network Building	Setting: Using the collaboration tools on BIO-STREAMS. User Requirement: Connectivity with other researchers and health professionals to exchange ideas and findings. Action: Simon uses the platform's discussion forums and webinars to connect with peers, sharing initial findings and discussing methodologies. Goal: To build a professional network that fosters collaborative research and knowledge exchange.
Scene 4: Data Analysis and Insights Generation	Setting: Deep in research, using advanced analytics tools provided by BIO-STREAMS. User Requirement: Machine learning algorithms and data visualization capabilities to create predictive models. Action: Simon employs sophisticated algorithms to analyze the integrated data, identifying patterns and trends related to child obesity. Goal: To derive actionable insights that can inform targeted obesity prevention strategies.
Scene 5: Sharing and Visualizing Results	Setting: Preparing for a presentation at a major healthcare conference. User Requirement: Effective data visualization tools that cater to both scientific and non-scientific audiences. Action: Simon uses the platform's visualization tools to create clear, impactful presentations of his findings. Goal: To communicate complex data in an understandable format, enhancing the impact of his research and encouraging practical applications.
Scene 6: Continuous Learning and Adaptation	Setting: Back in his office, reflecting on feedback from the conference. User Requirement: Continuous access to updated data and new research tools. Action: Simon updates his models based on the latest data and feedback, continuously refining his predictive models. Goal: To maintain the relevance and accuracy of his research, adapting to new data and evolving obesity trends.

5.1.7 Dietitian

Scene 1: Amanda at her clinic, engaging with an educational module on her computer, surrounded by medical books and health posters. Scene 2: Amanda in her office, browsing through a digital library on her laptop, with articles on childhood obesity visible. Scene 3: Amanda consulting with a family in her office, reviewing data on a tablet that shows food intake and activity levels. Scene 4: Amanda participating in a virtual roundtable on her computer, actively discussing with other dietitians. Scene 5: Amanda receiving a guideline update notification on her phone, reading the update with interest in her clinic.

Table 30: The user-story of Amanda, a Dietitian involved in obesity prevention and management

Scene	Description

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Scene 1: Accessing Educational Resources	Setting: Amanda at her clinic, exploring BIO-STREAMS on her computer. User Requirement: Needs to stay updated with the latest research and educational content on childhood obesity. Action: She accesses an interactive module titled "Effective Communication Strategies for Pediatric Nutrition" and reviews video demonstrations and participates in quizzes. Goal: To enhance her diagnostic skills and learn new strategies for effectively communicating nutritional guidance to children and their parents.
Scene 2: Utilizing Literature Access	Setting: Amanda's office, where she conducts most of her research and patient planning. User Requirement: Requires access to a comprehensive digital library with the latest studies on obesity. Action: Amanda uses the platform's advanced search functionality to find and read up-to-date articles about interventions that have proven effective in similar community settings. Goal: To integrate the latest evidence-based practices into her treatment plans.
Scene 3: Monitoring Patient Progress	Setting: Monitoring progress using BIO-STREAMS while consulting with a family in her office. User Requirement: Needs real-time feedback tools to monitor the health status of children she treats. Action: Amanda reviews the data collected through the mobile app that parents use to log their children's daily food intake and activities, discussing trends and necessary adjustments in the diet plan. Goal: To provide personalized nutritional advice based on real-world data and improve the effectiveness of dietary interventions.
Scene 4: Engaging with Community and Peers	Setting: Participating in a virtual roundtable discussion with other dietitians through BIO-STREAMS. User Requirement: A platform that facilitates collaboration and community engagement among professionals. Action: Amanda shares a challenging case study, seeks advice, and discusses the latest trends and challenges in paediatric nutrition with her peers. Goal: To gain insights from peers, share experiences, and stay connected with the professional community focused on paediatric nutrition.
Scene 5: Receiving Guideline Updates	Setting: At her clinic, Amanda receives a notification on her phone from BIO-STREAMS. User Requirement: Up-to-date notifications on new guidelines and research findings. Action: She checks the latest guidelines update provided through a push notification and reviews the details on her dashboard, planning how to adjust her practice based on these updates. Goal: To ensure her practice remains aligned with the most current research and guidelines,

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	enhancing her capacity to offer the best possible care.

5.1.8 Clinician

Scene 1: Esther in her office, reviewing the latest research and guidelines on her computer. Scene 2: Esther in a consulting room with a young patient and their parents, adjusting treatment plans on a tablet that displays data from wearable devices. Scene 3: Esther conducting a video call from her office, discussing patient progress and using data visualization tools on her screen. Scene 4: Esther participating in a virtual conference with other specialists, sharing insights and data on a collaborative platform. Scene 5: Parents using a mobile app at home, interacting with modules on nutrition and exercise, while Esther reviews this data in her follow-up sessions.

Table 31: The user-story of Esther, a Doctor involved in obesity prevention and management

Scene	Description
Scene 1: Accessing Up-to-Date Research and Guidelines	Setting: Esther in her office, starting her day by updating herself on the latest research in obesity management. User Requirement: Access to the latest evidence-based guidelines and interventions for obesity prevention. Action: Esther logs into BIO-STREAMS and navigates to the Evidence-Based Content Repository where she reviews new guidelines and scientific articles. Goal: To ensure her methods are aligned with the latest scientific findings and to implement the most effective strategies for her patients.
Scene 2: Personalized Patient Care	Setting: Consulting room, where Esther meets with a young patient and their parents. User Requirement: Tools for real-time monitoring and personalized recommendations based on patient-specific data. Action: Esther uses the platform's integrated monitoring tools to review the patient's latest data collected via wearable devices and adjusts the treatment plan accordingly. Goal: To provide tailored care that addresses the unique needs of each patient, ensuring better adherence to treatment plans.
Scene 3: Virtual Consultations and Monitoring	Setting: Esther's office, where she prepares for a series of telehealth sessions. User Requirement: Telehealth features for virtual consultations and remote patient monitoring. Action: Esther conducts video calls with patients who are unable to visit her clinic in person, discussing their progress and making adjustments to their plans using the data visualization capabilities of BIO-STREAMS. Goal: To maintain continuous care and support for patients, especially those in remote locations or with mobility issues.
Scene 4: Collaborative Research and Learning	Setting: Online platform where Esther participates in a virtual conference with other specialists.

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	User Requirement: Collaborative tools for sharing research findings and best practices. Action: Esther shares her own findings and learns from peers via the collaborative research platform, engaging in discussions and sharing data-driven insights. Goal: To contribute to and benefit from collective knowledge in the field, enhancing her understanding and approaches to obesity management.
Scene 5: Engaging Parents and Children	Setting: At home, parents using the BIO-STREAMS mobile app designed to support family involvement. User Requirement: Mobile app features that facilitate parental engagement and interactive education for both parents and children. Action: Parents interact with the app's modules on nutrition and exercise, using tools like meal planning and activity logs. Esther reviews these logs during follow-ups. Goal: To empower parents and children to take an active role in managing obesity, promoting healthier lifestyle choices through education and practical tools.

5.1.9 Policymaker

Scene 1: Boris, a prevention programme manager for his community, is in his office, discovering the BIO-STREAMS platform on his computer. Scene 2: Boris analyzing obesity trends and demographic data using advanced analytics tools. Scene 3: Boris and his team drafting a community program focusing on school nutrition using BIO-STREAMS. Scene 4: Boris hosting a virtual town hall meeting with community leaders to discuss new policies. Scene 5: Boris reviewing program outcomes and community feedback on his laptop. Scene 6: Boris receiving updates on new research and policy changes, integrating this information into policy revisions.

Table 32: The user-story of Boris, a Policymaker involved in obesity prevention and management

Scene	Description
Scene 1: Discovering BIO-STREAMS	Setting: Boris at his office, browsing through various digital platforms to find effective tools for obesity prevention and management. User Requirement: Access to a platform that provides comprehensive real-world data and validated evidence to inform policy decisions. Action: Boris discovers BIO-STREAMS and is impressed by its extensive repository of peer-reviewed articles and demographic data. Goal: To utilize a reliable source of information that can help in crafting effective community health programs.
Scene 2: Data Analysis and Insights Gathering	Setting: Boris working on his computer, analyzing data provided by BIO-STREAMS. User Requirement: Advanced data analytics tools for demographic, clinical, and genetic data to tailor interventions for specific populations.

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	Action: Boris uses predictive modeling features on BIO-STREAMS to forecast obesity trends and identify at-risk populations. Goal: To develop targeted interventions based on actionable insights derived from comprehensive data analysis.
Scene 3: Strategy Development	Setting: A strategy meeting with his team at the health department. User Requirement: Tools for program design and evaluation that include templates for goals, timelines, and metrics. Action: Boris and his team use BIO-STREAMS to draft a new community program focusing on school nutrition improvements, leveraging templates and planning tools. They can estimate the clinical and economic outcomes of the program thanks to the health economic model underlying the knowledge hub based on literature evidence and available real world data. Goal: To ensure that the new initiatives are well-structured, goal-oriented, measurable and sustainable.
Scene 4: Engaging Stakeholders	Setting: Virtual town hall meeting organized through BIO-STREAMS. User Requirement: Community engagement features like forums, webinars, and virtual meetings to facilitate stakeholder involvement. Action: Boris hosts a webinar to discuss the new policies with community leaders, educators, and healthcare professionals, using the platform's interactive features. Goal: To gather feedback, generate buy-in, and refine policies based on community input.
Scene 5: Monitoring and Adjusting	Setting: Boris reviewing program outcomes and community feedback on BIO-STREAMS. User Requirement: Real-time monitoring and evaluation tools to assess the effectiveness of implemented programs. Action: Boris examines the impact of the school nutrition program using BIO-STREAMS' feedback and monitoring tools, analyzing user engagement and health outcomes. Goal: To continuously improve health programs by integrating feedback and adapting strategies to better meet the community's needs.
Scene 6: Policy Updates and Continuing Education	Setting: Boris's office, receiving updates and alerts on the latest research and policy changes. User Requirement: Regular updates on new research findings and policy changes related to obesity prevention. Action: Boris reviews a notification on BIO-STREAMS about recent changes in national dietary guidelines and decides to integrate this information into upcoming policy revisions.

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	Goal: To stay informed about the latest developments in the field and ensure that policies remain current and effective.

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Conclusions

D2.2 lays a robust foundation for the design and development of a digital platform tailored specifically to address the complex challenge of childhood and adolescent obesity. The collaborative process undertaken in this deliverable, involving a wide range of stakeholders from healthcare professionals to educators and policymakers, ensures that the resulting digital solution is not only comprehensive but also versatile and applicable in various contexts across Europe. This inclusive approach guarantees that the platform will be equipped with the necessary features to effectively engage users, facilitate management, and provide educational resources that are culturally relevant and scientifically sound.

Furthermore, the document underscores the importance of a user-centered design methodology in creating digital health solutions. By focusing on real-world applicability and user engagement, BIO-STREAMS is positioned to deliver a platform that is not only technically proficient but also highly user-friendly and accessible to its target audience. This is critical in ensuring that the platform not only meets the specified requirements but also resonates with the users, thereby enhancing the adoption rates and overall impact of the initiative.

The extensive data collection and analysis outlined in this deliverable have established a clear roadmap for the next phases of the BIO-STREAMS project. The identified requirements and use cases will further guide the technical development, ensuring that every feature and functionality built into the platform is necessary, relevant, and based on solid evidence and user feedback. This strategic alignment is crucial for the success of the project as it moves forward into the development and implementation stages.

In conclusion, the work completed in deliverable D2.2 is fundamental to the BIO-STREAMS project's vision of creating a holistic and impactful digital solution for obesity management in children and adolescents. The rigorous process of requirements gathering and use case development ensures that the final product will not only meet the theoretical needs of the community but will also be practical and effective in real-world settings. This deliverable sets the stage for the upcoming phases of the project, where these plans will be transformed into living labs. fostering a dynamic and engaging digital platform that has the potential to significantly improve health outcomes for young people across Europe. We expect further and continuous evolution of the user-requirements.

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Appendix

Appendix A: Initial questionnaire for Persona creation

GENERAL PERSPECTIVE OF BIOSTREAMS

Question 1: What is or should be the purpose of the BIO-STREAMS 's BioBank and Services that will be offered within the context of the BIO-STREAMS project?
Question 2: What are or should be the goals of the BIO-STREAMS 's BioBank and Services that will be offered within the context of BIO-STREAMS?
Question 3: What kind of services or interventions does the solution offer?

ACTOR SPECIFIC QUESTIONS

Question 1: Type of the actor (user):
Question 2: Age range or ranges applicable for such actor:
Question 3: Levels of achieved education applicable for such an actor (please use EQF):
Question 4: What is the actor motivated by, related to Childhood Obesity?
Question 5: What are the actor's needs and?
Question 6: What, in your opinion, are the goals that the actor will attempt to accomplish with the BioStreams solution?
Question 7: What is the actor looking to do with BIO-STREAMS solution, i.e., what kind of services or support should in your opinion BIO-STREAMS offer for the actor?
Question 8: What in your opinion, are the benefits the Actor will receive from the BIO-STREAMS solution?

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Appendix B: Results of (external) Persona evaluation

Table 33: Demographic characteristics of participants.

	Clinical context		Educational Context	
Numerus	63		64	
Gender				
Female	55.56%		60.94%	
Male	42.86%		37.50%	
Other/Preferred not to answer	1.59%		1.56%	
Years of professional work experience				
M (SD)	9.24 (9.06)		11.09 (10.31)	
Educational level				
Primary education or less	3.17%		1.56%	
Higher secondary education	12.70%		3.13%	
Bachelor's degree or equivalent	41.27%		40.63%	
Master's degree or equivalent	36.51%		40.75%	
Doctoral degree or equivalent	6.35%		2.13%	
Occupation				
	Nurse	25.40%	Teacher	50.00%
	Doctor	20.63%	Psychologist	4.69%
	Public health prevention manager	4.76%	Researcher	4.69%
	Psychologist	4.76%	Teaching assistant	4.69%
	Student	4.76%	Administrative worker	3.13%
	Scientific researcher/consultant	4.76%	Assistant	3.13%
	Other	34.92%	Student	3.13%
			Other	29.69%
Type of organisation				
	Primary health care	49.21%	Primary school	23.44%
	Secondary health care	23.81%	Secondary or high school	18.75%
	Tertiary health care	9.52%	Higher education	40.63%
	University	4.76%	Language school	3.13%
	Other	12.69%	Self-employed	3.13%
			Other	10.94%
Educational background				
	Medicine	39.68%	Teaching a specific subject (e.g., history)	39.06%
	Nursing	23.81%	Primary education	15.63%
	Psychology	6.35%	Psychology	9.38%
	Social work	6.35%	Social work	4.69%
	Pharmacy	4.76%	Economics	3.13%
	Other	19.05%	Engineering	3.13%
			Business management	3.13%
			Other	21.88%
Country of residence				
Italy	9.52%		14.06%	
Poland	17.46%		/	
Portugal	19.05%		9.38%	
Spain	4.76%		9.38%	
The Netherlands	4.76%		10.94%	

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United Kingdom	26.98%	25.94%
Other*	17.47%	30.30%

*Note.**Less than one participant per country.

Table 34: Means and standard deviations across dimensions and Personas in the educational and clinical context.

Educational context			**Clinical Context**		
	M (SD)			*M* (SD)	
Principal			**Dietitian**		
Empathy	4.42	(1.32)	Empathy	4.51	(1.33)
Likability	4.55	(1.38)	Credibility	4.90	(1.25)
Clarity	5.02	(1.65)	Likability	4.90	(1.18)
Completeness	5.34	(1.14)	Completeness	5.36	(1.10)
Credibility	5.41	(0.97)	Consistency	5.57	(0.91)
Consistency	5.75	(0.81)	Clarity	5.84	(0.91)
Student			**Patient**		
Likability	4.17	(1.38)	Likability	4.50	(1.37)
Empathy	4.18	(1.43)	Empathy	4.56	(1.34)
Credibility	4.88	(1.35)	Credibility	5.31	(1.21)
Completeness	5.29	(1.03)	Consistency	5.51	(1.23)
Consistency	5.42	(1.21)	Completeness	5.56	(0.91)
Clarity	5.67	(1.07)	Clarity	5.87	(0.86)
Teacher			**Paediatrician**		
Empathy	4.70	(1.22)	Empathy	5.03	(1.16)
Likability	4.88	(1.21)	Likability	5.52	(1.02)
Completeness	5.46	(1.10)	Credibility	5.66	(0.84)
Credibility	5.58	(0.94)	Completeness	5.80	(0.80)
Clarity	5.74	(0.90)	Consistency	5.87	(0.84)
Consistency	5.77	(0.82)	Clarity	5.96	(1.02)
All evaluations M (SD)	5.12	(0.54)		5.35	(0.49)

Note. Note. Overall inter-rater reliability in both contexts was excellent was excellent (Koo & Li, 2016): ,educational context: ICC(2, 64) = .92, 95% CI [.91, .94], clinical context: ICC(2, 63) = .92, 95% CI [.90, .93].

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Appendix C: Detailed thematic analysis

Parent in Educational Context

Question	Overall Analysis
Question 1: Healthy Eating Opinions	**Diverse Views:** Responses varied from eating a balanced diet with minimally processed foods, enjoying home-cooked meals, to intuitive eating without focusing excessively on diet restrictions. **Key Components:** Common mentions included vegetables, fruits, lean proteins, and hydration, emphasizing balance and moderation.
Question 2: Family Goals on Physical Activity and Healthy Eating	**Mixed Approaches:** Some families set explicit goals involving children in planning and executing healthy eating and physical activities, while others prefer a more casual approach, emphasizing leading by example. **Child Involvement:** Responses ranged from active participation in meal planning to passive involvement where children follow parental choices.
Question 3: Fun and Healthy Activities	**Outdoor and Cooking Activities:** Many suggested outdoor activities like playing sports, trekking, and swimming combined with cooking and eating together as ways to promote both fun and a healthy lifestyle. **Family Involvement:** Emphasis on involving children in fun activities that also promote health, such as participating in meal preparation.
Question 4: Children's Enjoyment of Physical Activities	**Variety of Interests:** Children enjoy a range of activities from swimming and football to less structured play. **Supportive Practices:** Parents support by prioritizing these activities, joining in, and encouraging participation in group sports.
Question 5: Nutritious Foods Children Enjoy	**Preferences:** Children have specific food likes such as fruits, vegetables, and certain preparations like smoothies or soups. **Parental Strategies:** Involvement in cooking and meal planning, focusing on making mealtime enjoyable and educational regarding nutrition.
Question 6: Encouraging Healthy Habits	**Role Modelling:** Many parents focus on demonstrating healthy habits through their actions—eating well, being active, and regulating screen time and sleep. **Direct Involvement:** Discussions about health and direct involvement in physical activities are common methods.
Question 7: Modelling Healthy Lifestyle Behaviours	**Consistency and Example:** Consistent behaviours from parents, such as maintaining a balanced diet and engaging in physical activity, are used to influence children. **Practical Implementation:** Encouraging participation in meal preparation and active family outings.

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Question 8: Guidance on Nutrition Educational	**Approach:** Utilizing conversations, educational videos, and practical involvement in food choices and cooking to instil healthy eating habits. **Resource Utilization:** Parents suggest the importance of reliable resources for making informed nutritional choices.
Question 9: Obstacles in Supporting Healthy Eating	**External Influences:** Friends, school environments, and media are seen as challenges in maintaining healthy eating habits in children. **Time and Availability:** Time constraints and the availability of healthy food options are significant barriers.
Question 10: New Parenting Lifestyle Tips	**Openness to New Ideas:** Most parents are open to trying new ideas, especially if they align with their family's needs and schedules. **Engagement Preference:** Preference for practical and engaging tips that can be easily incorporated into daily routines

Data Scientist

Question	Overall Analysis
Question 1: Platform Facilitating Collaboration	Resource repositories for sharing guidelines and research. Real-time communication tools like forums and data analytics for insights. User-friendly interfaces and virtual event organization.
Question 2: Features for Enhancing Connectivity **Direct and group messaging capabilities**	Collaborative tools like research areas and networking tools. Interactive forums and detailed user profiles to highlight expertise.
Question 3: Promoting Open Communication	Interactive boards, webinars, and workshops. Open forums and Q&A sessions for dynamic interaction. Ambassadors to empower participation and ensure inclusive, respectful sharing.
Question 4: Real-Time Data Collection from Children	Mobile app features for activity tracking and food logging. Gamification to encourage participation. Parental tools for engagement and privacy.
Question 5: Supporting Research on Predictive Models	Strong data integration and machine learning for predictive analysis. Collaborative spaces and secure data sharing. Real-time monitoring and tracking metrics
Question 6: Streamlining Access to Real-World Data	Centralization and standardization of datasets. Integration with wearable technology and health APIs. Quality assurance processes for data reliability.
Question 7: Incorporating Various Data Sources	Cross-disciplinary data catalogs and collaborative spaces. Tag-based data sorting for research relevance. Integration of behavioral, nutritional, and healthcare data.
Question 8: Valuable Data Points for Behavioral Patterns	Physical activity levels, sedentary behavior, and dietary habits. Emotional well-being and social environment impacts.

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	Family dynamics and socioeconomic background.
Question 9: Environmental Factors and Lifestyle Aspects	Access to nutritious food and physical activity spaces. Influence of marketing and built environment on lifestyle choices. Family dynamics and socioeconomic status.
Question 10: Data Visualization Tools	High-detail interactive visualizations with customizable dashboards. Real-time updates and collaborative features. Accessibility and contextual enhancements for clarity.
Q11: Analyzing and Interpreting Data	Advanced data analysis with machine learning and statistical tools. Geospatial and temporal analysis capabilities. Predictive modeling and dynamic data exploration.
Question 12: Creating Visually Appealing Visualizations	User-friendly design interfaces with adjustable templates. Interactive elements for enhanced user engagement. Export and share functionalities for wider dissemination.
Question 13: Effective Data Visualization Communication	Interactive and customizable visualization tools. Accessibility features for inclusivity. Real-time updates for the latest information access.
Question 14: Complexity and Accuracy in Predictive Models	Balance of complexity and practicality in models. High precision for identifying at-risk individuals. Validation and testing across diverse populations.
Question 15: Patterns and Trends with Machine Learning	Identifying patterns in incidence and risk factors. Forecasting trends and clustering analysis for targeted interventions. Association mining to uncover lifestyle and obesity correlations.

Dietitian

Question	Overall Analysis
Question 1: Facilitating Collaboration and Knowledge Exchange	Resource sharing, real-time discussions, user-friendly interfaces, and data analytics tools are essential. Respondents emphasized the need for platforms similar to Teams or Zoom that are augmented by AI to connect experts with common interests.
Question 2: Enhancing Connectivity	The platform should support interdisciplinary collaboration through features like collaborative research areas, detailed user profiles, and direct messaging. A user-friendly interface and notification systems for updates are crucial.
Question 3: Promoting Open Communication	Interactive discussion boards, webinars, and clear resource sharing protocols are necessary. An inclusive environment that protects users from hostility is important for open idea exchange.
Question 4: Real-Time Data Collection from Children	Mobile applications with gamification, activity tracking, and strong privacy measures are preferred for engaging children and collecting data efficiently.

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Question 5: Supporting Research on Predictive Models	Needs include strong data integration, real-time monitoring, and advanced analytics with machine learning to develop effective predictive models.
Question 6: Streamlining Access to Real-World Data	Centralization of data, integration with wearable technologies, and high-quality data retrieval systems are key.
Question 7: Incorporating Various Data Sources	A cross-disciplinary data catalog and tools for easy integration of diverse data types are needed to support comprehensive analytical approaches.
Question 8: Valuable Data Points	Detailed behavioral, environmental, and physiological data points are essential for understanding obesity patterns in children.
Question 9: Environmental Factors and Lifestyle Aspects	Access to nutritious food, physical activity opportunities, and understanding of socioeconomic impacts are important areas of focus.
Question 10: Data Visualization Tools	High-detail, interactive visualization tools that allow for custom displays and real-time data updates are necessary for effective communication of research findings.
Question 11: Analyzing and Interpreting Data	Advanced data analysis capabilities, including machine learning and statistical tools, are essential for identifying patterns and trends that inform targeted interventions.
Question 12: Generating Informative Visualizations	The platform should provide user-friendly design interfaces, customizable visualization templates, and interactive features suitable for various audiences.
Question 13: Effective Data Visualization Communication	Visualization tools should offer interactivity, customizable settings, and accessibility features to cater to a broad audience, including non-scientists.
Question 14: Complexity and Accuracy of Predictive Models	Balancing complexity and practicality in models is crucial, with a need for high precision and rigorous validation processes.
Question 15: Patterns and Trends with Machine Learning	Machine learning should facilitate the identification of detailed patterns and trends across multiple data points to guide interventions and predict future trends.

Clinician

Question	Overall Analysis
Question 1: Goals of Using Digital Platforms	Informing all stakeholders about obesity, preventing associated complications, minimizing stigma, and providing group support and empowerment. Digital platforms are seen as tools to facilitate comprehensive care, enable real-time monitoring, and extend healthcare access to remote areas.

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Question 2: Challenges in Treating Childhood Obesity	Family involvement, changing family habits, addressing cultural differences, and promoting a balanced lifestyle over perfection in body image. Stigma and the psychological sensitivity of children are significant challenges, alongside the difficulty in achieving lasting lifestyle changes.
Question 3: Desired Features in Digital Platforms	Ease of use, motivation through interactive elements like notifications and rewards, and tools for monitoring, personalized advice, and maintaining patient motivation. Platforms should support remote consultations and parent/caregiver involvement.
Question 4: Importance of Real-time Information	Real-time information on healthy lifestyles and nutrition is crucial for decision-making, adapting treatment strategies, and ensuring up-to-date care.
Question 5: Monitoring Patient Progress	Regular medical check-ups, personalized nutritional counseling, and collaboration with other healthcare professionals are standard. Digital tools are sought for better tracking and integrated care.
Question 6: Data Collection for Monitoring Progress	Collection of comprehensive data including anthropometric measures, dietary habits, physical activity, and medical parameters to monitor patient progress effectively.
Question 7: Data Visualization Tools	Preference for electronic charts and diagrams to visualize BMI changes, dietary patterns, and other health indicators over time. Tools should allow easy interpretation and tracking of patient progress.
Question 8: Long-term Effectiveness Monitoring	Digital tools that support long-term tracking of interventions, including mobile apps for ongoing health assessments and telemedicine options for continuous engagement and monitoring.
Question 9: Real-time Tracking Importance	Real-time tracking is essential for personalizing interventions, motivating patients, and monitoring immediate changes and long-term outcomes in lifestyle and nutritional habits.
Question 10: Parental Participation via Mobile Apps	Features that engage parents directly in their child's care process, including meal tracking, physical activity suggestions, and educational resources. Tools that encourage family participation and provide real-time feedback are valued.
Question 11: Personalized Health Assessments	Personalized assessments that cover a broad range of health factors including diet, exercise, psychological well-being, and medical history. Preference for tools that provide detailed insights into patient health and facilitate tailored interventions.
Question 12: Sources of Information for Best Practices	Reliance on scientific literature, guidelines from reputable health organizations, and conferences for staying informed on best practices and new research in childhood obesity prevention.

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Question 13: Evidence-Based Guidelines and Interventions	Need for guidelines supported by leading health organizations and evidence-based interventions that are comprehensive and multidisciplinary, emphasizing behavioral, nutritional, and family-centered approaches.
Question 14: Addressing Obesity Stigma	Tackling societal views on obesity, improving education to prevent bullying, promoting mental health, and using non-stigmatizing language are crucial to addressing obesity stigma effectively.
Question 15: Effective Communication with Parents and Children	Strategies that promote understanding, empathy, and support. Utilization of non-stigmatizing language, focusing on health rather than aesthetics, and building confidence and motivation through positive reinforcement.

Principal

Question	Overall Analysis
Question 1: Preferred Approach for External Collaboration	Formal channels like Department of Education or professional associations are preferred for credibility. Direct approaches through mail followed by phone calls are seen as effective. Proposals must clearly benefit students and be feasible.
Question 2: Effective Recruitment of Schools	Clear communication of the research/project's aim and benefits. National promotion and integration with existing health programs. Recognitions and support for participating schools are crucial.
Question 3: Barriers to Engagement	Lack of awareness and skepticism about the legitimacy of the initiatives. Technical difficulties and overly complex information can deter engagement. Lack of personal follow-up can diminish interest.
Question 4: School Participation in Projects	Schools are generally open to participating; duration could be up to a year. Essential to engage teaching and non-teaching staff, as well as parents and local communities.
Question 5: Information and Support Needs	Need for clear, actionable information and training that could benefit career progression. Incorporation of health topics into existing curriculum areas like Citizenship.
Question 6: Past Community-Based Health Events	Successful events typically involve integrating health into broader cultural or educational activities. Challenges include altering ingrained habits and ensuring parental support.
Question 7: Technology Infrastructure for Virtual Learning	Most schools have adequate internet and wireless infrastructure to support digital tools. Some schools face issues with outdated equipment and need better technological support.
Question 8: Support Needs for Implementing Solutions	Need for clear instructions, a dedicated helpline, and didactic materials. Support for coordinators and regular updates are important.

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Question 9: Communication with Stakeholders	Utilization of multiple channels including written notices, emails, websites, and social media. Regular updates through school newsletters and websites.
Question 10: Enhancing Communication	Integration of digital communication methods and creation of engaging content. Use of social networks and direct messaging to parents.
Question 11: Encouraging School-Community Collaboration	Platforms should be engaging, simple to use, and facilitate active participation. Identification and collaboration with relevant community organizations are essential.
Question 12: Motivating Teachers	Incentives such as gifts and social gatherings post-project are effective. Consideration of digital badges or credentials for participation.
Question 13: Design of Health Initiatives	Need for school-wide approaches and easy-to-implement routines. Platforms should offer various engagement pathways and be easy for schools to adopt.
Question 14: Openness to Virtual Workshops	Increased openness to virtual workshops post-COVID, especially if they offer CPD credits. Health-related topics are generally seen as attractive.
Question 15: Improving Engagement	Keep content concise and focused on educational value. Collaboration with recognized health education initiatives like "de gezonde school" in the Netherlands.

Teacher

Question	Overall Analysis
Question 1: Importance of Nutrition and Healthy Lifestyle in Schools	Most responses affirm that nutrition and healthy lifestyle topics are frequently discussed and integrated into school curricula. Many schools actively participate in health promotion projects and dedicate specific days to food-related activities.
Question 2: Resources and Time Allocation for Health Education	Responses vary, with some schools having dedicated modules and time slots for health education, while others integrate these topics into broader subjects like physical education and science. Challenges include lack of specific modules for nutrition and reliance on broader curriculum integration.
Question 3: Challenges in Teaching Healthy Habits	Major challenges include combating the influence of advertising, ensuring continued practice at home, and addressing the quality of food in school canteens. Teachers also note socioeconomic factors and parental habits as significant barriers to reinforcing healthy habits learned at school.
Question 4: Desired Educational Resources	Teachers express a need for practical, engaging resources such as interactive workshops, fun activities, and hands-on projects that can make learning about healthy lifestyles more relatable and effective for students.
Question 5: Designing Engaging Digital Platforms	Suggestions for digital platforms include gamification, interactive content, and visually

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	appealing, user-friendly interfaces. These elements are seen as crucial for engaging students and enhancing their learning experience.
Question 6: Effective Interactive Simulations	Preferred simulations involve practical, hands-on activities like cooking, meal planning, and physical exercises that can be gamified. Real-life applicability and direct involvement in learning processes are emphasized.
Question 7: Lesson Plans and Recipes	Main Themes: Teachers seek simple, practical lesson plans that involve families and promote real-life application of healthy eating habits. Recipes should be easy to prepare, affordable, and culturally relevant.
Question 8: Enhancing Collaboration Using Digital Platforms	Digital platforms should facilitate easier communication and resource sharing among students, parents, and teachers, potentially through forums, shared calendars, and collaborative projects.
Question 9: Features for Effective Communication and Resource Sharing	Important features include interactive and feedback-oriented tools, resource libraries, customizable user profiles, and notification systems to keep all parties informed and engaged.
Question 10: Sharing Success Stories	Platforms should allow for sharing success stories through features like progress tracking, recognition badges, and social sharing options to motivate and inspire students by showcasing real results and achievements.
Question 11: Structuring Online Parent-Teacher Discussion Boards	Boards should be structured to provide relevant, reliable information, facilitate easy and open communication, and include regular updates and feedback mechanisms.
Question 12: Resources to Share With Parents	Teachers can share a wide range of resources with parents, including nutritional guidelines, physical activity suggestions, and strategies for mental health and well-being.
Question 13: Relevant Topics for Online Workshops	Workshops should cover practical health-related topics such as nutrition, physical activity, mental health, and preventive care, with a focus on engaging, age-appropriate content.
Question 14: Effective Interventions for Healthier Habits	Effective interventions include comprehensive educational programs, community and parental involvement, practical activities like cooking and sports, and policies that support healthy school environments.
Question 15: Integrating Augmented Reality in Health Education	Augmented reality could enhance learning by providing interactive and immersive experiences, such as virtual cooking classes, anatomy education, and simulation of physical activities.

Policymaker in Healthcare context

Question	Overall Analysis
Question 1: Types of Analysis for Interventions	Emphasis on using randomized clinical trials (RCTs) and meta-analyses to evaluate intervention effectiveness. Comparative and economic analyses to understand cost-effectiveness and broader impacts.

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	Importance of assessing quality of life and epidemiological factors.
Question 2: Valuable Data and Analytics	Need for comprehensive data points that are relevant and can provide deep insights into obesity as a complex condition.
Question 3: Key Performance Indicators	Focus on weight loss, changes in BMI, body composition, and measures related to obesity complications.
Question 4: Use of Machine Learning	Recognition of the utility of machine learning in predictive modeling but also concerns about interpretability and ethical considerations.
Question 5: Functionalities for Community Program Tools	Comprehensive participant data management, event planning, communication features, monitoring and evaluation capabilities, and collaboration tools.
Question 6: Elements for Policy Makers	Emphasis on assessing social and economic impacts and the efficiency of resource allocation.
Question 7: Relevance of Real-World Data	High importance placed on real-world data for informed decision-making.
Question 8: Relevant Real-World Data Sources	Preference for clinical, social, economic, and geographical data to inform policies and interventions.
Question 9: Decision-Making Time Horizon	Advocacy for long-term approaches to childhood obesity, emphasizing chronic care.
Question 10: Tools for Community Programs	Need for tools that support task management, data collection, communication, and risk management.
Question 11: Stakeholder Input	Importance of involving citizens, experts, industry representatives, NGOs, and government bodies in policy development.
Question 12: Critical Information for Program Success	Data on obesity prevalence, child health, effective strategies, social and economic conditions, and resource availability.
Question 13: Categorizing Evidence	Criteria for evidence include intervention type, level of evidence, effect size, target group, and context; preference for clear and standardized presentation formats.
Question 14: Features for Evidence Aggregation Platform	Desired features include filtering by evidence type, searching by keywords, graphical data representations, and interactive feedback mechanisms.
Question 15: Policy Focus Alert System	Priority areas include education, healthy public policies, prevention, and interventions in education and health systems.

Policymaker in Educational context

Question	Overall Analysis
Question 1: Types of Analysis for Interventions	Emphasis on viability analysis, impact analysis on target populations, and cost-effectiveness analysis.
Question 2: Valuable Data and Analytics	Importance of demographic, anthropometric, behavioral, health, and intervention data for comprehensive analysis.
Question 3: Key Performance Indicators	Focus on changes in BMI, quality of life, and health outcomes.
Question 4: Machine Learning in Analysis	Comfort with the use of machine learning for predictive modeling, with considerations for responsible and ethical usage.

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Question 5: Community Program Tools	Need for tools for mapping community assets, detailed implementation planning, evaluation data analysis, and reporting.
Question 6: Elements for Policymakers	Importance of considering long-term impacts, replicability, and political viability of programs.
Question 7: Relevance of Real-World Data	Real-world data is crucial for making informed, equitable, and effective policy decisions.
Question 8: Relevant Real-World Data Sources	Importance of lifestyle data, cross-sectional studies, public health surveys, and demographic data.
Question 9: Decision-Making Time Horizon	Time horizons vary from under one year for curative programs to up to five years for preventive programs.
Question 10: Community Program Design and Evaluation	Need for interactive online platforms, integrated feedback mechanisms, and multilingual interfaces.
Question 11: Stakeholder Input	Input from various stakeholders is valuable for identifying resources, challenges, and gaining support for policy implementation.
Question 12: Critical Information for Program Success	Essential information includes objectives, target audience, evidence supporting interventions, resources, timeline, and evaluation mechanisms.
Question 13: Categorizing Evidence	Criteria for categorizing evidence include type of intervention, mechanism of action, target audience, level of evidence, and impact.
Question 14: Evidence Aggregation Platform Features	Desired features include filters for keywords, types of intervention, populations, health conditions, results, and sources of evidence.
Question 15: Policy Domains for Alert System	No specific domains mentioned, indicating a need for a comprehensive approach

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