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Barriers and Enablers Influencing Clinical Recommendations and Referrals for Rare Tumour Risk Syndromes: A Mixed-Methods Study Across Six European Countries

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Research Article

Keywords: Rare Tumour Risk Syndromes, Mixed-methods, Barriers and enablers, COM-B Model, decision-making

Posted Date: July 1st, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9985450/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Rare Tumour Risk Syndromes (RTRS) are inherited conditions associated with high lifetime cancer risk. Early identification enables surveillance and risk-reduction strategies, yet clinical decision-making regarding care pathways remains underexplored. This study, within PREVENTABLE (an EU-Horizon-funded project aiming to evaluate the clinical, social, and economic impact of preventive care pathways for RTRS), examined barriers and enablers influencing how clinical teams address, refer patients and recommend specific procedures in RTRS care pathways.

Methods

A sequential exploratory mixed-methods design was employed across six European countries (Portugal, Spain, France, Germany, the Netherlands, and Norway). Phase 1 involved a cross-cultural survey with RTRS specialists (n = 113), measuring capability, opportunity, and motivation factors influencing specialists' recommendations of RTRS care pathways, informed by the behavioural science COM-B model. Phase 2 comprised six focus groups with 35 participants exploring survey findings in depth. Quantitative and qualitative findings were integrated through joint display analysis.

Results

Survey and focus group findings were broadly convergent, with qualitative data adding explanatory depth. Psychological capability emerged as the most frequently cited domain, with clinicians reporting confidence in their own skills while identifying knowledge gaps among non-specialist colleagues in recognising when RTRS should be suspected. Skills-related findings highlighted the importance of communication skills for discussing genetic testing and tailoring recommendations to patients' life context. Physical opportunity was predominantly identified as a barrier, particularly appointment logistics, care coordination, and access to specialised centres. Social opportunity was mainly described as an enabler, with emphasis on the importance of inter-specialty collaboration and patient-clinician relationships. Reflective motivation revealed how professional identity and beliefs about consequences shape recommendations, while automatic motivation captured emotional responses, particularly when clinicians first encounter RTRS cases. Although common COM-B determinants were identified across countries, their manifestation differed by local context, reflecting variation in referral pathways, access to specialist services and organisational structures.

Conclusions

This COM-B-informed mixed-methods study identified interacting capability, opportunity and motivation factors shaping clinician-reported RTRS practice. Improving care requires locally adapted strategies that support non-specialist clinicians in recognising possible RTRS, strengthen communication skills for genetic testing discussions, clarify referral pathways, reinforce multidisciplinary coordination and normalise genetic testing discussions within routine care.

Trial registration

Not applicable

Background

This study is part of the PREVENTABLE consortium[1], an EU-Horizon-funded project aiming to evaluate the clinical, social, and economic impact of preventive care pathways for Rare Tumour Risk Syndromes (RTRS). RTRS are inherited conditions

associated with up to 100% risk of developing cancer across an individual's lifetime.[2, 3] Individuals affected by these genetic conditions have a 50% chance of transmitting the condition to their offspring.[4–6] When genetic predisposition to RTRS is not timely diagnosed or monitored, individuals often develop aggressive cancer that leads to premature death. Confirmation of a pathogenic or likely pathogenic germline variant enables entry into individualized clinical pathways, including genetic counselling, tailored surveillance, risk-reducing interventions, and, where appropriate, early or targeted treatment. These pathways are not uniform and depend on several factors, including the specific syndrome and gene involved, variant pathogenicity and penetrance, tumour spectrum, age, comorbidities, personal and family history, patient preferences, available guidelines and shared clinical decision-making.[7–10]

After the genetic diagnosis, individuals at risk must make complex decisions about surveillance, the possibility of risk-reduction surgeries, lifestyle changes, and communicating genetic risk to relatives, while facilitating cascade testing.[11, 12] On the other hand, clinical teams managing RTRS must decide what to recommend for each individual at risk, balancing genetic and clinical risk with patient preferences, multidisciplinary input, local resources, organisational constraints and referral pathways. Because guidance for RTRS is often limited, fragmented or inconsistently implemented, there is a need to understand the behavioural and contextual barriers and enablers that shape clinicians' capability, opportunity and motivation to deliver consistent, patient-centred care.[13, 14][11, 12]

Behavioural science frameworks offer a structured way to examine these factors. The Capability-Opportunity-Motivation-Behaviour (COM-B) model is widely used to identify factors – barriers and enablers - influencing behaviours.[14, 15] According to this model, for any given behaviour to take place, the individual must have the capability, opportunity, and motivation to engage in that behaviour.[14, 15] Capability refers to both physical capability, involving skills, strength, and stamina; or psychological capability, involving knowledge and cognitive ability to perform the behaviour.[14, 15] Opportunity refers to external factors and includes physical opportunity, which refers to environmental aspects such as resources and time, and social opportunity, which relates to cultural influences, including family and social networks.[14, 15] Motivation includes reflective motivation (e.g., conscious planning) and automatic motivation (e.g., emotions and impulses).[14, 15] The use of the COM-B model provides a comprehensive and systematic understanding of the factors influencing behaviour, and offers a structured approach for the development of tailored interventions by mapping the types of strategies likely to influence each construct effectively.[16] In the qualitative thematic analysis, the Theoretical Domain Framework (TDF) - created in the context of health care systems and health professionals' behaviours - was also used to support a more granular identification of barriers and enablers to change.[17] The TDF maps directly to the COM-B model and contains 14 key domains (e.g., knowledge, skills, environmental context, social influences).[17]

This study is the first to identify the barriers and enablers influencing the recommendations and referral of care pathways for RTRS by members of clinical teams managing these syndromes. Specifically, we aimed to: (1) identify the capability, opportunity, and motivation barriers and enablers that influence clinicians' recommendations and referrals; (2) explore how these factors manifest across different European healthcare contexts; and (3) integrate quantitative and qualitative findings to develop a comprehensive understanding of clinical decision-making in RTRS care. The barriers and enablers for the uptake of RTRS care pathways by patients were also explored and will be published separately, as they are beyond the scope of the present study.

Methods

Study Design

This is a cross-cultural mixed-methods study with a sequential exploratory design comprising two phases.[18, 19] First, a quantitative phase was conducted through an anonymous web-based survey. Second, findings from the survey were explored in focus group sessions to obtain an in-depth understanding of the survey results. This sequential approach was chosen to ensure that qualitative exploration was grounded in, and could elaborate upon, quantitative findings. Both phases were developed based on the COM-B Model. The TDF was integrated in the second phase (qualitative analysis) to provide a

more granular and systematic analysis of the barriers and enablers. The protocol with a detailed description of the method employed is published elsewhere.[20] Fig. 1 shows the flowchart with the study design, step-by-step.

Figure 1. Flowchart: study design step-by-step. COM-B, Capability-Opportunity-Motivation-Behaviour Model; TDF, Theoretical Domains Framework.

Participants

This study was developed within the PREVENTABLE consortium, which includes six European countries – Portugal, Spain, France, Germany, the Netherlands, and Norway. Participants in both phases were members of clinical teams who are RTRS-specialists (e.g., medical doctors, nurses, geneticists). Inclusion criteria were: i. having experience in providing care recommendations/referring patients in at least one of seven RTRS included in PREVENTABLE (i.e., Birt-Hogg-Dubé, Familial Melanoma, Hereditary Diffuse Gastric Cancer, Li-Fraumeni, Peutz-Jeghers, PTEN Hamartoma Tumour, Hereditary Leiomyomatosis, and Renal Cell Carcinoma syndromes); ii. were able to provide informed consent; and iii. were fluent in English or one of the consortium languages (Portuguese, Spanish, Catalan, French, German, Dutch, or Norwegian)

Phase 1: Cross-cultural Survey

Recruitment

The survey dissemination strategy was coordinated with the support of the European Reference Network for Genetic Tumor Risk Syndromes (ERN GENTURIS) across Europe, while PREVENTABLE clinical partners shared the survey through their professional networks, email, and word of mouth. The survey was also sent by e-mail to 9 professional societies linked to RTRS (e.g., the Portuguese oncology society, the Portuguese society of human genetics), requesting dissemination through their networks. Additionally, the survey link was promoted through PREVENTABLE's social media channels, including the official website, LinkedIn, Instagram, and Facebook. Data were collected between June 2024 and October 2024.

Procedure

The survey was developed following a four-step process: i. Drafting of items by the social science team, informed by the COM-B model, a literature review on RTRS, and findings from a preliminary survey with PREVENTABLE RTRS-specialists; ii. expert review and refinement by consortium clinical team; iii. piloting; iv. translation into the official languages of each participating country using the European Commission's eTranslation service.[21] The PREVENTABLE clinical team was responsible for reviewing and culturally adjusting the translations for each site.

The survey was administered using LimeSurvey in compliance with the European Union's General Data Protection Regulation (GDPR). It consisted of three sections, as follows: sociodemographic characteristics, COM-B items rated on a 7-point Likert scale (1-strongly disagree to 7-strongly agree), and a ranking of barriers and facilitators. The survey could be completed on any internet-enabled device. Anonymity was guaranteed by not storing IP addresses, not using personalized URLs, and not collecting identifiable information. Participants first viewed a welcome page with study information and eligibility criteria and were required to provide digital informed consent before accessing the survey. Cookies were used to prevent multiple submissions from the same device. The survey is available on the OSF page: https://osf.io/krqfa/files/dgz2x

Data Analysis

Data analysis included descriptive and inferential statistics. Descriptive statistics (i.e., median, standard deviations, and percentages) were used to characterize the sample. Survey items were grouped by the corresponding COM-B domain, i.e., physical and psychological capability, social and physical opportunity, and reflective and automatic motivation. Within each COM-B domain, items were grouped in more granular categories of constructs. Pooled means were computed for each domain/category.

Inferential statistics were used to compare mean scores across the COM-B domains and their categories. The following comparisons were conducted: i. for items stratified by care pathway, differences in mean scores between pathway groups were examined; ii. within each COM-B domain, mean scores were compared across its more granular construct categories; iii. the overall mean scores of the six COM-B domains were compared across the different countries and specialties. To compare mean scores across the six COM-B domains, a one-way repeated measures ANOVA was used, as each participant rated all domains. To examine differences across care pathways, countries and clinical specialties, one-way independent ANOVAs were used, as each participant was attributed to a single care pathway, country, and specialty. Where a statistically significant difference was detected (set at 0.01), Bonferroni-adjusted pairwise comparisons were performed to determine which factors differed from the others. Statistical analyses were performed using Jamovi version 2.3.28 and plots created using GraphPad Prism version 9.5.1.

Phase 2: Focus Groups

Recruitment

The PREVENTABLE clinical teams at each site identified and recruited eligible participants. To avoid bias, participants could not be part of the PREVENTABLE project. Purposive sampling was used to ensure representation of different professional roles. A total of six focus groups with members of clinical teams were conducted, one per participating country. Each group aimed to include approximately six participants.[22]

Procedure

Semi-structured focus group guides were developed based on the existing literature, results from the quantitative phase (survey), and the expertise of consortium members. The guides were designed to ensure systematic exploration of predefined topics while remaining sufficiently flexible to capture additional issues raised by participants. The focus groups guide is available on the OSF page: https://osf.io/krqfa/files/jy3n9

Members of the PREVENTABLE social sciences team moderated the focus groups conducted in Portuguese or English. For focus groups conducted in the native language of each site, the respective PREVENTABLE clinical team provided a moderator and an assistant with experience in conducting focus groups. All moderators and assistants received supporting materials and participated in preparatory meetings to ensure a shared and consistent understanding of the guide.

The language of each focus group (English or native language) was selected based on participants' preferences. Focus groups were conducted either online via Microsoft Teams or in person, depending on group availability and preference. All focus groups were audio-recorded and transcribed using MAXQDA software.[23] The PREVENTABLE clinical teams were responsible for reviewing the transcripts, anonymising the data, and making any necessary adjustments. Focus groups conducted in languages other than English or Portuguese were translated into English by a certified translation company.

Data Analysis

Descriptive statistics (i.e., median, standard deviations, and percentages) were used to characterize the sample. Focus groups were analysed through thematic analysis and an interactive approach following procedures proposed by Braun and Clarke.[24] A two-stage interactive approach was followed: first, deductive coding using the 14 TDF domains; second, inductive analysis within each domain to identify emergent sub-themes. This analysis procedure was chosen because it provides a simple method for summarizing the findings while allowing exploration of unanticipated relevant factors. A coding framework adapted from the TDF was developed to promote consistent coding into appropriate domains. Codes were categorised as barriers, enablers, or mixed (containing both barrier and enabler elements).

To promote a greater coding consistency, a pilot focus group transcript was coded jointly by two members of the research team. After the piloting, two researchers were responsible for reading all the transcripts and independently coding them into the themes/subthemes identified in the piloting or creating new themes/subthemes as they emerged. The research team

reviewed the data coded under each theme/subtheme and contributed to the appropriate naming and definition of the themes. Discrepancies were solved through discussion. The final list of themes/subthemes was then deductively mapped to the TDF and COM-B domains, taking into consideration the definitions of each domain. Deductive mapping was conducted independently by two researchers, with any discrepancies resolved through discussion with a third researcher.

Triangulated Data Analysis

First, quantitative and qualitative results were analysed separately and sequentially. Then, the research team compared them to determine whether they converged (moved in the same direction), diverged (moved in different directions), or were complementary (related to a theme but only mentioned in the qualitative method). A joint display for each COM-B domain was created to integrate results from the quantitative and qualitative phases. This approach allows side-by-side presentation of findings to assess coherence between data and facilitate interpretation by identifying areas of convergence and divergence.[25]

Results

Phase 1

Participant characteristics

A total of 113 participants completed the survey. Mean age was 45.5 ± 11.4 years, and 85 (75%) identified as women. The survey completion rate was 46%, calculated from the number of completed surveys relative to all survey attempts. The most prevalent country of residence was France (n = 22; 20%), followed by Portugal (n = 21; 19%), Spain (n = 20; 18%), the Netherlands (n = 18; 16%), Germany (n = 17; 15%), and Norway (n = 8; 7%). Seven participants (6%) resided in other countries. The clinical speciality with the most responses was clinical genetics (n = 34; 30%). Most participants worked in university hospitals (n = 95; 84%). Full sociodemographic characteristics are presented in Table 1.

Table 1
Sociodemographic characteristics (survey) (n = 113)

Characteristics	
Age (in years)	
Mean age (all participants)	45.5 ± 11.4
Gender	
Woman	85 (75%)
Man	26 (23%)
Prefer not to say	2 (2%)
Country of residence	
France	22 (20%)
Portugal	21 (19%)
Spain	20 (18%)
Netherlands	18 (16%)
Germany	17 (15%)
Norway	8 (7%)
Other	7 (6%)
Clinical speciality	
Clinical geneticist	34 (30%)
Other	27 (24%)
Genetic Counsellor	22 (20%)
Oncologist	18 (16%)
Surgeon	12 (11%)
Workplace	
University Hospital	95 (84%)
Specialized RTRS Centre	10 (9%)
Other	8 (7%)
General Hospital	6 (5%)
Previous experience with RTRS	
PTEN Hamartoma Tumour Syndrome	81 (72%)
Li-Fraumeni Syndrome	80 (71%)
Hereditary Diffuse Gastric Cancer	72 (64%)
Peutz-Jeghers Syndrome	65 (58%)
Familial Malignant Melanoma	56 (50%)
Birt-Hogg-Dubé	46 (41%)

Characteristics	
Age (in years)	
Hereditary Leiomyomatosis and Renal Cell Carcinomas	44 (39%)

Age is represented as median ± standard deviation. Gender, country of residence, and clinical speciality are represented as: number of participants (percentage).

COM-B domain rating

Psychological capability was explored through the category's 'knowledge', 'skills', and 'access to skills training'. Within psychological capability, skills were the highest-rated category (6.1 ± 0.8), with "communication skills are important" receiving the highest individual item rating (6.7 ± 0.8), exceeding the mean value for the skills category overall. Knowledge was also highly rated (5.7 ± 1), while access to skills training received lower ratings (4.9 ± 1.6).

Physical opportunity was explored through the categories 'environmental context' (5.5 ± 1.2) and 'costs' (4.7 ± 1.2). Within these categories, the 'access to specialised healthcare centres' was rated the highest (6.4 ± 0.9). Social opportunity was explored through the categories social influences (4.4 ± 1.2), social support (5 ± 1.4), and social norms (4.5 ± 1.2). 'Patients' life context' was the highest-rated individual item in this domain (5.5 ± 1.3). Items related to cultural influences received lower ratings, including 'cultural background' (2.5 ± 1.7), 'social stigma towards specific procedures' (3.7 ± 1.6), and 'absence of a preventive culture' (3.7 ± 1.7).

Reflective motivation was explored through the categories 'professional role' (5.6 ± 1.1), 'personal beliefs' (4.8 ± 1.5), and 'beliefs about the patient' (4.7 ± 1.3). Religious beliefs received the lowest rating in this domain (1.7 ± 1.3). Automatic motivation was explored through the categories 'habits' (6.1 ± 1.1) and 'emotional regulation' (3.5 ± 1.8). Discussing the importance of genetic testing within routine clinical practice (6.4 ± 1) and surveillance procedures (6.4 ± 1) received particularly high ratings. Palliative care habits were rated substantially lower (4.2 ± 2). Results of all categories are shown in Table 2. For the results of all items, check the additional File 1.

Table 2
Main results of the COM-B domain ratings

Items	Mean ± SD
Psychological capability	
Knowledge	5.7 ± 1
Skills	6.1 ± 0.8
Communication skills are important	6.7 ± 0.8
Access to skills' training	4.9 ± 1.6
Physical opportunity	
Environmental context	5.5 ± 1.2
Access to specialized healthcare centres	6.4 ± 0.9
Costs	4.7 ± 1.2
Social opportunity	
Social influence	4.4 ± 1.2
Patients' life context	5.5 ± 1.3
Cultural background	2.5 ± 1.7
Social stigma towards specific procedures	3.7 ± 1.6
Social support	5.0 ± 1.4
Social norms	4.5 ± 1.2
Absence of a preventive culture	3.7 ± 1.7
Reflective motivation	
Professional role	5.6 ± 1.1
Previous experiences with patients	5.6 ± 1
Previous experiences with specialized centres	5.6 ± 1.2
Personal beliefs	4.8 ± 1.5
Religious beliefs	1.7 ± 1.3
Beliefs about the patient	4.7 ± 1.3
Automatic motivation	
Habits	6.1 ± 1.1
Palliative care	4.2 ± 2
Discussing the importance of genetic testing within routine clinical practice	6.4 ± 1
Surveillance procedures	6.4 ± 1
Emotional regulation	3.5 ± 1.8

Data are presented as mean±standard deviation. Values are the mean obtained in a 7-point Likert scale ranging from 1-strongly disagree to 7-strongly agree. SD, standard deviation

Comparisons between groups

All the following comparison results can be found in Additional File 2.

For the comparison of the total ratings attributed to each COM-B domain, members of the clinical teams rated psychological capability and automatic motivation significantly higher ($p < 0.001$), and social opportunity significantly lower ($p < 0.001$), than the other COM-B domains in their decision-making process of referring people with RTRS to care pathways (Figure S1).

A comparative analysis across care pathways (genetic testing and diagnosis, surveillance procedures, risk-reduction surgeries, and early and advanced treatment options) was conducted for the three items assessed by care pathways: knowledge, access to skills training, and communication skills. All three were rated significantly lower for palliative care compared to the other care pathways (Table S1).

No differences in the ratings of each COM-B domain were observed across countries (Figure S2) or clinical specialties (Figure S3).

Phase 2

Participants characteristics

In total, 35 members of clinical teams participated in the focus groups across six countries. Group size ranged from 4 (France) to 7 (Norway). Mean age was 48.4 ± 8.4 years, and 27 (77%) identified as women. The most represented clinical specialty was geneticists (n = 9; 26%), followed by dermatology (n = 4; 11%), genetic counselling (n = 4; 11%), and oncology (n = 4; 11%). Full sociodemographic characteristics are shown in Table 3.

Table 3
Sociodemographic characteristics (focus groups)

Characteristics	
Age (in years)	
Mean age (all participants)	48.4 ± 8.4
Gender	
Woman	27 (77%)
Man	8 (23%)
Country of residence	
Norway	7 (20%)
Portugal	6 (17%)
Spain	6 (17%)
Germany	6 (17%)
Netherlands	6 (17%)
France	4 (11%)
Clinical speciality	
Geneticist	9 (26%)
Dermatologist	4 (11%)
Oncologist	4 (11%)
Genetic Counsellor	4 (11%)
Genetic Nurse	2 (6%)
Gastroenterologist	2 (6%)
Nurse	2 (6%)
Nuclear Medicine	1 (3%)
Gynecologist-oncologist	1 (3%)
Paediatric surgeon	1 (3%)
Paediatrician	1 (3%)
Radiologist	1 (3%)
Surgeon	1 (3%)
Surgical Oncologist	1 (3%)

Age is represented as median ± standard deviation. Gender, country of residence, and clinical speciality are represented as: number of participants (percentage).

COM-B domains

A total of 781 codable segments were identified across the six focus groups. Psychological capability was the most frequently coded domain (n = 338; 43.3% of total codes), followed by physical opportunity (n = 209; 26.8%), reflective

motivation (n = 114; 14.6%), social opportunity (n = 90; 11.5%), and automatic motivation (n = 30; 3.8%). Table 4 presents the frequency of codes by COM-B domain, TDF domain, and country, with classification as barrier, enabler, or mixed.

Table 4
Frequency of codes by TDF domain, country, and classified as barrier, enabler, or mixed.

COM-B domain	TDF Domains	France	Germany	Netherlands	Norway	Portugal	Spain	B/E/M
		B/E/M	B/E/M	B/E/M	B/E/M	B/E/M	B/E/M	Total per site
		Total	Total	Total	Total	Total	Total	
Psychological Capability	Skills	0/4/3	5/10/2	9/6/10	13/13/17	13/7/7	3/9/19	43/49/58
		7	17	25	43	27	31	150
	Memory, attention and decision processes	4/6/4	0/5/2	1/5/4	2/6/9	3/18/8	0/7/18	10/47/45
		14	7	10	17	29	25	102
	Knowledge	5/7/2	5/3/2	4/3/2	0/7/1	6/12/3	4/4/16	24/36/26
		14	10	9	8	21	24	86
Physical Opportunity	Environmental context and resources	16/4/4	22/6/2	7/7/9	12/13/8	28/9/14	24/7/17	109/46/54
		24	30	23	33	51	48	209
Social Opportunity	Social influences	0/6/4	3/6/2	1/6/3	2/10/6	6/5/6	3/15/6	15/48/27
		10	11	10	18	17	24	90
Reflective Motivation	Social and Professional role and identity	5/2/1	0/0/2	4/1/2	1/6/8	2/2/1	1/3/1	13/14/15
		8	2	7	15	5	5	42
	Beliefs about consequences	0/3/0	1/5/0	2/0/1	3/6/2	2/2/2	2/1/0	10/17/5
		3	6	3	11	6	3	32
	Beliefs	2/2/1	1/0/0	1/1/4	0/1/6	1/0/0	0	5/4/11
		5	1	6	7	1		20
	Goals	0	0	0/7/0	0/4/0	0/2/3	0/1/1	0/14/4
				7	4	5	2	18
	Beliefs about capabilities	0	0	0	0	0/2/0	0	0/2/0
						2		2
Automatic Motivation	Emotion	0	0/1/3	3/0/0	0/0/3	2/1/0	5/0/6	10/2/12
			4	3	3	3	11	24
	Habit	0/1/0	0	0	0/2/0	0	0/2/1	0/5/1
		1			2		3	6
Total per site		86	88	103	161	167	176	781

Data are presented as frequency. Values are the number of times coded. B=barriers; E=enabler; M=mixed

Psychological capability

Psychological capability refers to the knowledge, cognitive processes, and communication skills that either hinder or enable members of clinical teams in recognising, understanding, communicating about, and managing RTRS. This domain was the most frequently coded (n = 338, 43.30%). Three TDF domains were identified, each one including sub-themes: Knowledge (sub-themes: professionals' knowledge and provide knowledge to patients); Memory, attention, and decision processes (sub-themes: decision-making, team expertise, and multidisciplinary discussion & experts); Skills (sub-themes: skills development, ability, and communication). Skills were predominantly coded as mixed (n = 58/150), reflecting both confidence in clinical abilities and recognition of training needs. Overall, the domains most frequently coded as enablers were 'memory, attention, and decision processes' (n = 47/102 codes) and 'knowledge' (n = 36/86 codes).

Communication emerged as a central theme, with members of clinical teams emphasizing the importance of tailoring information to patient needs, such as the amount of information patients prefer to receive, asking patients what they would like to know/if they have any curiosity or doubts, and reinforcing the importance of listening to patients' needs, providing tailored and helpful information for them. Respondents also discussed the need for skills development regarding genetics, particularly for non-specialist colleagues or during residency training. This training could facilitate non-experts to recognise the signs of genetic syndromes throughout their professional practice, referring possible genetic cases to specialised centres. The report of the need for training is also highlighted through respondents' identification of knowledge gaps in non-specialist colleagues. Additionally, they also explored how patients' life context (e.g., patients' age, work circumstances, reproductive age) may influence the patients' decisions and the care pathways chosen.

Physical opportunity

Physical opportunity refers to the environmental, organisational, and resource-related conditions that hinder or enable members of clinical teams in delivering timely, coordinated, and accessible care for individuals with RTRS. This domain was coded n = 209, 26.8% times. Physical opportunity was predominantly coded as a barrier (n = 109/209, 52.2%). One TDF domain was identified: Environmental context and resources (sub-themes: collaboration between services, economic/financial costs for patients, economic/financial costs to services, appointment logistics, material resources, human resources, workload, consultation time, communication channels, (des)centralised care, care organisation, psychological support, waiting times).

Respondents emphasised the need for more integrated and multidisciplinary care, including stronger collaboration between services and the inclusion of psychological support. Appointment logistics were presented as significant barriers, particularly for patients travelling long distances. The respondents reported that patients need to deal with many appointments split over different days and see different doctors, making it harder to follow surveillance or treatment. Barriers such as fragmented systems and poor access to shared medical records were also raised. Financial costs to both healthcare services and patients were described as additional barriers.

Social opportunity

Social opportunity refers to the interpersonal, cultural, and relational influences that hinder or enable how members of clinical teams and patients interact, make decisions, and navigate care for RTRS. Social opportunity was coded n = 90, 11.5% times. Social opportunity was predominantly coded as an enabler (n = 48/90, 53.3%). One TDF domain was identified: social influences (sub-themes social norms, peer influence, social support, intergroup professional relations, family pressure, family history).

Interprofessional collaboration emerged as a key enabler, emphasising the importance of having a good collaboration between different hospital departments. The respondents also highlighted the need for a good relationship between patients and members of clinical teams to provide more effective care. Family context was mentioned as a factor influencing clinical decisions, with respondents describing how family history, family pressure, and family communication patterns shaped recommendations. Additionally, social support networks, including patient associations and self-help groups, were mentioned as valuable resources to help patients understand their diagnosis.

Reflective motivation

Reflective motivation refers to the goals, beliefs, and professional self-perceptions that shape how members of clinical teams evaluate consequences and define their roles. Reflective motivation was coded n = 114, 14.6%. Five TDF domains were identified. Social/Professionals role and identity (sub-themes professional role, professional confidence), beliefs about consequences (sub-themes outcomes expectancies), beliefs, goals (sub-theme implementation intention), beliefs about capabilities. Overall, reflective motivation was predominantly coded as mixed for social/professional role and identity (n = 15/42 codes) and beliefs (n = 11/20 codes), and predominantly coded as an enabler for beliefs about consequences (n = 17/32 codes), goals (n = 14/18 codes), and beliefs about capabilities (n = 2/2 codes).

The respondents highlighted expectations associated with their professional responsibilities and role, such as a sense of duty to provide specialised care for RTRS patients, the importance of maintaining professional credibility, building patient trust, and finding solutions to gaps in services or resources. Additionally, preventive care was viewed as a responsibility that could reassure patients and improve long-term outcomes.

Automatic motivation

Automatic motivation refers to the emotional responses and habitual practices that shape how members of clinical teams instinctively approach, prioritise, and carry out care for individuals with RTRS. Automatic motivation was coded n = 30, 3.8%, and was the least frequently coded domain (n = 30, 3.8%). Two TDF domains were identified: emotion and habit. Overall, emotion was mainly coded as a barrier (n = 12/24 codes), and habit as an enabler (n = 5/6 codes).

Members of clinical teams reported different emotions, such as choking and stress, when first dealing with RTRS cases. They also mentioned routine processes, such as the recommendation to do a genetic test.

Cross-country differences

While common themes emerged across countries, variations in how COM-B determinants manifested reveal key differentiators that could inform context-sensitive interventions. Although the COM-B domains were consistent across countries, the mechanisms shaping capability, opportunity, and motivation were context-dependent. These differences reflected how services are organised, how teams collaborate, and how clinicians navigate uncertainty in their own settings. Table 5 highlights these key differentiators. For detailed information, see Additional File 3.

Table 5
Cross-country differences

Country	Key differentiators	Priorities for care improvement
France	Dual adaptation to uncertainty required from both clinicians and patients; unequal territorial access to specialised services; low incentives for preventive care; professional identity functioning as relational guide; routine-based referral practices.	Reduce regional disparities in specialist services; reform preventive care funding; systematise support for relational continuity.
Germany	Need for structured educational approach; variability across inter-centre knowledge; decentralised care with fragmented coordination; need of strong formal networks and self-help groups; guilt and moral duty as emotional drivers.	Formalise care transition pathways (e.g., paediatric to adult); fund coordination across decentralised services; integrate self-help groups into care pathways.
Netherlands	Tension between experience-based decision-making and rigid guideline; central role of team expertise and joint consultations; logistical barriers to attendance despite financial coverage; trust built progressively through experience.	Develop flexible, rare-disease-adapted guidelines; address logistical barriers (e.g., transport, appointment timing); support team-based decision structures.
Norway	Identified training gaps in workforce; reliance on national guidelines as structuring tool; seasonal and weather-related access barriers; lack of shared medical records across regions; high GP turnover affecting continuity of care; legal constraints limiting family outreach.	Implement shared digital records across regions; develop retention strategies for GPs; clarify legal pathways for family communication in rare diseases.
Spain	Multidisciplinary collaboration as foundation; existence of inter-centre knowledge gaps; highly heterogeneous regional models; rigid administrative referral pathways; importance of media and informal networks (e.g., WhatsApp) to communicate with patients; fear of over-referral and over-medicalisation.	Promote regional alignment and flexibility in referral systems; formally leverage informal networks for coordination; provide guidance on prevalence-informed decision-making.
Portugal	Need for ethical deliberation in complex cases; family context strongly influencing communication; short consultation times affecting quality of care; low prioritisation of surveillance patients; stigma around genetic consultations; reliance on informal coordination; anguish and frustration under uncertainty.	Increase consultation time for surveillance patients; implement anti-stigma campaigns for genetic services; provide structured support for managing uncertainty in complex cases.

The Mixed-Methods results

Integration of quantitative and qualitative data revealed convergence for most domains. Quantitative and qualitative data were integrated through a joint display to assess convergence, divergence, or complementarity between datasets. Table 6 summarises the survey items also explored in the focus groups, their corresponding qualitative themes, and the direction of the integration, i.e., convergence, divergence, or complementarity. Definitions of all codes are available in the Additional File 4.

Table 6
Joint display: integration of quantitative and qualitative findings by COM-B domain.

Survey categories	Quantitative items	Codes	Direction
Psychological Capability			
Knowledge (5.7 ± 1)	Knowledge to make clinical decisions and recommendations	Professionals' knowledge	Convergent
		Clinicians' awareness/familiarity of/with rare syndromes	Complementary
		Differences in knowledge across clinical sites	Complementary
		Challenges of rare diseases diagnosis	Complementary
		Guidelines availability	Complementary
		Clinicians approach to information delivery	Complementary
		Clinicians' communication of risks	Complementary
		Individuals' health literacy	Complementary
Skills	Receiving specialized skills-based training is important (5.9 ± 1.3)	Ability	Complementary
		Skills' development	Complementary
	Communication skills are important (6.7 ± 0.8)	Tailoring of explanations based on patients' preferences	Complementary
		Active listening to patients	Complementary
		Communication challenges	Complementary
		Empathy and emotional support	Complementary
		Guidance on patient care pathways	Complementary
		Simplification of medical information	Complementary
		System influences on communication	Complementary
		Training	Complementary
Memory, attention and decision-making	Not explored in the survey (theme related to decision-making)	Decision-making	Complementary
		Family history	Complementary
		Patient context	Complementary
		Patient decision	Complementary
		Previous experience	Complementary
	Not explored in the survey	Multidisciplinary discussion + experts	Complementary
		Team expertise	Complementary
Physical Opportunity			

Survey categories	Quantitative items	Codes	Direction
Psychological Capability			
Environmental context (5.5 ± 1.2)	Distance to specialized healthcare centres (5.1 ± 1.4)	Appointment logistics	Complementary
	Patients' access to psychological support (5.8 ± 1.3)	Psychological support	Convergent
	Complexity of the healthcare system (5 ± 1.6)	Care organization	Complementary
		Collaboration between services	Complementary
		(Des)centralized care	Complementary
	Length of the waiting lists (4.8 ± 1.4)	Waiting times	Convergent
	Not explored on survey	Human resources	Complementary
		Material resources	Complementary
	Not explored on survey	Consultation time	Complementary
Costs (4.7 ± 1.2)	Financial costs for the healthcare system (4.5 ± 1.7)	Economic/Financial costs to services	Convergent
	Financial costs for people (5 ± 1.6)	Economic/Financial costs to patients	Convergent
Social Opportunity			
Social influences (4.4 ± 1.2)	Patients' life context (5.5 ± 1.3)	Patient context	Convergence
	Patients' family history (5.2 ± 1.3)	Influence on patients' decisions	Convergence
		Influence on communication	Complementary
	Not explored on survey	Intergroup professional relation	Complementary
	Not explored on survey	Family pressure	Complementary
	Not explored on survey	Social influences	Complementary
Social support (5 ± 1.4)	Not explored on survey	Relationship patient-clinician	Convergence
Social norms (4.5 ± 1.2)	Level of support that patients receive (5.1 ± 1.4)	Social support	Convergence
	Not explored on survey	Social norms	Complementary
Reflective Motivation			
Professional role (5.6 ± 1.1)	Previous experiences with patients (5.6 ± 1)	Previous experience	Convergence
	Previous experiences with specialized centres (5.6 ± 1.2)	Impact of continuity and coordination of care	Complementary
	Not explored on survey	Professional confidence	Complementary
	Not explored on survey	Professional role	Complementary
	Not explored on survey	Beliefs	Complementary
	Not explored on survey	Implementation intention	Complementary

Survey categories	Quantitative items	Codes	Direction
Psychological Capability			
	Not explored on survey	Perceived emotional impact in patients	Complementary
	Not explored on survey	Cost-effectiveness	Complementary
Automatic Motivation			
Habits (6.1 ± 1.1)	Clinical routine to discuss importance of genetic testing (6.4 ± 1)	Habits	Convergent + Complementary
Emotional regulation (3.5 ± 1.8)	Psychological distress when discussing with patients about their condition (3.5 ± 1.8)	Emotion	Complementary

Quantitative data is represented as mean ± standard deviation on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree). Convergent: quantitative and qualitative findings align in the same direction. Complementary: theme identified in qualitative data only, adding depth to quantitative findings.

Overall, the integration of quantitative and qualitative data showed convergence or complementarity, with qualitative data providing depth and nuance to survey results.

Psychological capability. Focus groups confirm the influence of knowledge in decision-making processes. Gaps were mainly attributed to non-specialist colleagues and professionals outside major reference centres. Members of clinical teams' awareness of rare syndromes and the availability of guidelines were identified as complementary enablers in the qualitative data. For example, "*I often hear from my patients that the doctors aren't familiar with the syndrome they're dealing with*." (Germany)

Regarding skills, both phases identified strong communication skills as a central enabler. Survey data rated communication skills as the highest item, and focus groups further elaborated on this through sub-themes such as active listening, tailoring of explanations based on patients' preferences, empathy, and the simplification of complex medical information. Skills development needs, particularly in non-specialist contexts and residency training, were identified as complementary themes arising from the qualitative phase. As in: "*What I try to do is to ask them what they want to know. Because if I tell them* their *diagnose, you can give a lot of information, but sometimes it's better to ask, what do you want to know? (…) So that you really listen to the patient. What is helpful to tell them."*(Netherlands).

Additionally, qualitative findings highlighted that their decision-making processes are based on the role of clinical guidelines, multidisciplinary discussion, team expertise, patient context, and previous experience in shaping decision-making. For example: "It is always a patient decision, *even if we are talking about an oncological patient*." (Portugal) or "*However, we always start with the recommendations, if possible, and of course with guidelines*" (Germany)

Physical opportunity. These factors showed convergence across both phases for several sub-themes, including psychological support, waiting times, and financial costs. Complementary themes enriched the understanding of structural barriers in care delivery. For example, appointment logistics, fragmented care coordination, and patients travelling long distances were described as key barriers. Decentralised care and limited access to shared medical records across institutions were also highlighted as barriers. Human and material resources, such as consultation time, were identified as complementary barriers in qualitative data, adding specificity to the broader survey findings on environmental context. For example, members of clinical teams said: "*At the university hospital there are fairly long delays*" (France), "*There is a lack of people, they cannot attend patients*" (Spain), or "*In the risk consultation, patients are referred from very far away because that consultation doesn't exist in their local hospital.*" (Portugal)

Social Opportunity. Qualitative data showed convergence with survey findings in several sub-themes. The influence of family history on patients' clinical decisions was identified as convergent, supported by survey ratings of patients' family history and qualitative accounts of how family history shaped members of clinical teams' communication approach, as in "*So, family history will obviously play a role in whether or not the patient agrees to this type of monitoring*." (France). The patient-clinician relationship was identified as a convergent enabler, with members of clinical teams emphasising trust with the patient as an important factor for effective care, as mentioned by this member of clinical teams: "*But I think if you don't have their trust you won't be able to do that* [surveillance/treatment]. *I think that's still the crucial point."* (Netherlands). Social support through self-help groups, patient associations, or family was identified as an enabler. Complementary themes identified the importance of intergroup professional relations and the influence of family pressure and social norms. These findings add nuance to the survey's social opportunity domain, which was rated significantly lower than other COM-B domains.

Reflective Motivation. Integration of findings showed predominantly complementary patterns, with qualitative data elaborating extensively on survey items related to professional role and identity. The qualitative data expanded this by identifying sub-themes of professional confidence, sense of duty to provide specialised care, and the importance of maintaining credibility. For example: "*It's also a question of being able to hold ourselves as doctors who are supposed to be able to provide answers and care with a gap that needs to be filled*" (France). Beliefs about consequences emerged with members of clinical teams articulating beliefs in the value of early detection and the cost-effectiveness of surveillance, as in "*(…) the cost of treatment is ecologically enormous compared to what it would cost to monitor it once a year or once every six months*" (Norway). Goals were identified exclusively in qualitative data, with members of clinical teams describing ideas to address service gaps. Professional beliefs and beliefs about capabilities were coded as predominantly mixed or enabling, reflecting clinicians' overall confidence in providing RTRS care while acknowledging ongoing uncertainties in guideline-limited contexts.

Automatic Motivation. Habits were identified as a convergent and complementary enabler. Survey data rated clinical routines for discussing genetic testing and surveillance, and qualitative data confirmed that these practices are embedded in routine workflows, including the systematic referral to psychological services at the point of diagnosis, where available. For example: "*So, it's kind of built into our routines that this kind of information goes on repeat*" (Norway). Emotional regulation was rated low in the survey and identified primarily as a barrier in qualitative data, where clinicians described experiences of stress and emotional discomfort, especially when encountering their first RTRS cases, as in "*But when we started, I found it a little bit stressful*." (Netherlands).

Discussion

This study constitutes the first comprehensive analysis of the factors influencing the recommendation and referral of care pathways for RTRS by members of clinical teams. By integrating quantitative and qualitative findings, this study identifies the factors influencing clinical decisions and contextualizes them within the context of RTRS care across diverse European healthcare contexts.

Our findings highlight psychological capability (i.e., behaviour is influenced by factors related to knowledge, cognitive processes, and skills) as a central factor in the decision-making process of members of clinical teams in points of care. Knowledge about the syndromes and the care pathways, as well as skills in patient-centered communication, were shown to be important factors influencing the type of recommendation and referrals for care in RTRS patients. Members of clinical teams recognised the complexity of conveying genetic risk information and the importance of implementing tailored communication for content and delivery. While the respondents reported confidence in their own RTRS expertise, they identified knowledge gaps in colleagues, particularly those working in primary care and non-specialised hospital settings. These findings align with the literature documenting knowledge and communication barriers in genetic healthcare delivery.[26, 27] The predominance of reported psychological capability factors reflects well-established challenges in genetics practice, where the literature identifies a lack of knowledge in basic genetics and insufficient referral guidelines as primary barriers among healthcare providers.[26, 27] The complexity of patient-centered communication observed in RTRS care

pathways mirrors broader difficulties in genetic risk communication, where providers report insufficient knowledge and overall caution when conveying genetic information.[28] The identified knowledge gaps between specialists and primary care providers are particularly concerning, as effective referral processes rely on non-specialists' ability to recognize and appropriately refer potential cases.[29] This difference in expertise can create systematic breakdowns in the primary-specialty care interface, where clinical decision-making deficiencies can result in both underuse and overuse of specialist services.[30]

Regarding physical opportunity (i.e., behaviour is influenced by environmental, organisational, and resource-related factors), the main reported barriers related to access to specialised care centres, appointment logistics, and coordination and integration of care between different departments. A common theme was the direct impact of the organisation of the healthcare systems on patients' adherence to surveillance or treatment, and consequently, the recommendations of the care pathways. Members of the clinical teams reported that it would be important to adapt how care is organised to better reflect the specificities and needs of RTRS patients. For example, by coordinating appointments across different departments on the same day, addressing patients' limited availability to commute frequently to the hospital, and reducing difficulties in completing surveillance within the recommended timeframe due to healthcare system constraints. Broader cancer-related literature shows that physical opportunity barriers are consistently manifested as constraints that impede healthcare access and undermine patient engagement.[31] Members of clinical teams also identified common barriers across the healthcare system that have already been reported in the literature, such as barriers related to limited resources, consultation time, distance to the healthcare centre, lack of continuity of care, and workforce shortage are aligned with previous research.[31] These findings suggest that while the specific manifestations may vary by healthcare context and system organization, physical opportunity barriers fundamentally relate to the structural and resource limitations of healthcare delivery that either enable or constrain patient access to appropriate, timely, and coordinated care.

Social opportunity (i.e., behaviour is influenced by factors related to interpersonal, cultural, and relational influences) was mainly reported as an enabler for RTRS clinical decision-making and care delivery. Specifically, members of clinical teams reinforced the importance of relationships at multiple levels, including inter-specialty collaboration, patient-clinician bonds in navigating RTRS care, and support from patients' social networks. These findings are supported by a systematic review of barriers and facilitators to shared decision-making among patients with cancer and healthcare providers.[31] The review identified interprofessional teamwork and team-based care approaches as primary facilitators for enhancing communication among healthcare professionals and increasing patient participation in decision-making.[31] Within social opportunity, members of clinical teams also highlighted how patients' life context influences clinical decisions, for example, when providing recommendations related to patients' reproductive concerns, family dynamics, and psychosocial circumstances, highlighting that clinical decisions are not made in isolation but within complex relational networks.

Reflective motivation (i.e., behaviour is influenced by factors related to goals, beliefs, and professional self-perceptions) findings highlighted professional role and identity as a central anchor for reflective motivation, with members of clinical teams expressing a strong sense of duty to provide answers and care despite existing knowledge gaps. This expectation of "holding their own" as specialists may lead clinicians to assume a guiding role in the absence of established protocols. Members of clinical teams derived confidence from structured care pathways, suggesting that clear protocols can reinforce professional self-efficacy. However, professional identity also emerged as a mixed influence, functioning as a source of motivation when supported by system structures, but potentially becoming a source of frustration when clinicians are unable to fulfil their perceived responsibilities due to healthcare system fragmentation or resource constraints.

Automatic motivation factors were less frequently coded but revealed important insights into the emotional dimensions of RTRS care pathway recommendations. Members of clinical teams reported emotional responses such as guilt, anguish, and frustration, particularly when encountering their first cases or challenging clinical scenarios. The literature documents various emotional responses among healthcare providers in other medical contexts, including fear and conflicting goals in shared decision-making contexts.[31] However, to our knowledge, the literature does not identify automatic motivation factors specifically addressing the temporal pattern of emotional responses or the emotions of guilt and anguish in other

healthcare contexts. This suggests that the emotional trajectory of clinical teams' experience with RTRS care pathways may represent a unique aspect of healthcare delivery, where the complexity and high-stakes nature of genetic risk information create distinct motivational challenges that evolve with clinical experience and expertise development.

The cross-country variations observed in our study are particularly important. While common themes emerged across all six countries, such as the importance of specialist knowledge and the challenges of care coordination, the specific manifestations of these barriers and enablers differed according to national healthcare contexts. For example, in France, clinicians described a dual adaptation to uncertainty, required from both clinicians and patients, unequal territorial access to specialised services, and low systemic incentives for preventive care; professional identity functioned as a relational guide in the absence of clear structural support. In Germany, decentralised care with fragmented coordination created a need for strong formal networks and structured educational pathways, with guilt and moral duty emerging as distinctive emotional drivers. Formalisation of care transition pathways, particularly from paediatric to adult services, was identified as a priority. In the Netherlands, a tension between experience-based decision-making and rigid guidelines was pointed out, with joint consultations and team-based structures serving as central enablers; logistical barriers to attendance persisted despite financial coverage of care. In Norway, seasonal and weather-related access barriers, a lack of shared medical records across regions, high GP turnover, and legal constraints limiting outreach to at-risk family members represented a distinctive combination of structural challenges. In Spain, highly heterogeneous regional models coexisted with a strong foundation of multidisciplinary collaboration; members of clinical teams also described a specific concern about over-referral and over-medicalisation, and highlighted the informal use of messaging platforms to maintain contact with patients. In Portugal, short consultation times, low prioritisation of surveillance patients, stigma around genetic consultations, and reliance on informal coordination were identified as interrelated barriers, alongside clinician-reported anguish and frustration under diagnostic uncertainty. These variations suggest that while there may be opportunities for cross-national learning and collaboration, implementation strategies must be tailored to local contexts rather than adopting a one-size-fits-all approach.

LIMITATIONS

This study has some limitations. First, social desirability bias may have influenced both survey responses and focus group discussions, particularly regarding more sensitive topics. Second, while we achieved good representation across six European countries, the healthcare systems included may not be representative of all European contexts, limiting generalizability to countries with different organizational structures. Third, despite the wide dissemination of the survey, recruitment was made through a specialized center, which may have led to underrepresentation of participants from other healthcare settings. Fourth, qualitative data from non-English focus groups required translation into English, raising the possibility of loss of nuance, even with certified translation and local review. Fifth, despite extensive dissemination through professional societies, ERN GENTURIS networks, and PREVENTABLE partners, reaching RTRS-experts proved difficult. RTRS specialists constitute a small and highly distributed workforce, and many operate under substantial clinical workload pressures, which likely constrained participation. Additionally, the need to exclude PREVENTABLE consortium members from the qualitative phase further reduced the eligible pool, particularly in countries with fewer specialists.

Conclusions

This study identifies psychological capability as the most prominent determinant of RTRS clinical decision-making, while highlighting physical opportunity as the main barrier across European health settings. The findings reveal a complex interplay of psychological capability, relational dynamics, and systemic constraints that shape how RTRS care is delivered. In practice, our results support multi-level action: strengthening clinician capability through education and decision support, while addressing organisational barriers such as referral pathways, coordination, and access to specialist expertise. They also provide an evidence base for practical recommendations to improve communication between members of clinical teams and RTRS patients (currently being developed within PREVENTABLE). The identification of key behavioural barriers influencing recommendations of RTRS care pathways allows for the development of specific, actionable strategies to mitigate these barriers, as well as enablers that could strengthen clinical team members’ communication skills in the context

of RTRS care. These recommendations could also support context-sensitive strategies to improve earlier identification, referral, and management of RTRS patients. Although common patterns suggest opportunities for cross-national learning, country-level differences in the COM-B domain underline the need to tailor implementation strategies to local contexts. Future research should focus on developing and evaluating context-specific interventions that address the modifiable barriers identified in this study, particularly targeting knowledge dissemination to RTRS non-specialists and improving care coordination across services.

Abbreviations

RTRS
Rare Tumour Risk Syndromes
TDF
Theoretical Domain Framework
COM-B Model
Capability-Opportunity-Motivation-Behaviour Model

Declarations

All manuscripts must contain the following sections under the heading 'Declarations': Ethics approval and consent to participate, Consent for publication, Availability of data and materials, Competing interests, Funding, Authors' contributions, Acknowledgements, and Authors' information (optional). If any of the sections are not relevant to your manuscript, please include the heading and write 'Not applicable' for that section.

Ethics approval and consent to participate

The study was conducted in full conformance with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. It complied with the ethical principles of all involved Institutions and Bodies, in accordance with European Union Regulation 2018/1725. Written informed consent was obtained from all participants before any data collection. Oral consent was also obtained at the beginning of the focus groups.

Ethical approval was obtained by the Ethical Committees of all the involved institutions – NOVA Medical School (ref. 73/2024/CEFCM; ref. 175/2024/CEFCM), i3S (ref. N10/CECRI/2024), Unidade Local de Saúde São João (ref. 265-23), University Hospital of Bellvitge (ref. PR075/24), University Hospital of Girona (ref. 2024.137), University Hospital Vall d'Hebron (ref. PR(AG)330/2023), CHU-Rouen (ref. 2025/0043/OB), RADBOUDUMC (ref. 2024-17792), Haukeland University Hospital (ref. 757236; ref. 789646; ref. 850836) and University Hospital Bonn (ref. 281/23-EP).

Consent for publication

This manuscript does not contain any individual person's data in any form.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This work has received funding from the European Union's Horizon Europe Research and Innovation action under the Grant Agreement nº 101095483 (PREVENTABLE). Disclaimer: Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or The Health and Digital Executive Agency (HaDEA). Neither the European Union nor the granting authority can be held responsible for them.

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Acknowledgements

The authors wish to express their gratitude to all participants who contributed their time and expertise to this study. This work was supported (not financially) by the European Reference Network on Genetic Tumour Risk Syndromes (ERN GENTURIS). We also acknowledge all institutions, clinicians, and staff who supported the recruitment process across the six participating countries.

Alexander S. Zhang, Karolinska Institutet, Sweden; Ana Maria Pedro, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Andrew Titman, Lancaster University, United Kingdom; Annette Erle, St. Josef Hospital Bonn, Germany; António Moreira, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Arjen R. Mensenkamp, Radboud University Medical Center, Netherlands; Carolina B. Di Fabrizio, NOVA School of Business and Economics, Portugal; Cécile Guillemet, Centre Henri Becquerel, France; Celina São José, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Céu Mateus, Lancaster University, United Kingdom; Daniel Ferreira, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Diana Ferreira, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Edwige Kasper, CHU Rouen, France; Gaëlle Bougeard, CHU Rouen, France; Irene Stenfors, Karolinska University Hospital, Sweden; João Fonseca, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; João Paulo Brás, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; João Vinagre, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Judite Gonçalves, NOVA School of Business and Economics, Portugal; Katrin van Beekum, University Hospital Bonn, Germany; Laurène Mathey, European Health Management Association, Belgium; Marbélia Fernandes, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Margaux C. Le Choismier, CHU Rouen, France; Marianne T. Haavind, Haukeland University Hospital, Norway; Mariette Renaux-Petel, CHU Rouen, France; Maud Branchaud, CHU Rouen, France; Mia Quante, University Hospital Bonn, Germany; Nathalie Parodi, CHU Rouen, France; Nicoline Hoogerbrugge, Radboud University Medical Center, Netherlands; Núria Dueñas, Catalan Institute of Oncology (ICO), Spain; Paula Boaventura, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Paula Soares, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Per-Olof Lundgren, Karolinska University Hospital, Sweden; Rachel S. van der Post, Radboud University Medical Center, Netherlands; Rebecca-Evelyn Papp, European Health Management Association, Belgium; Rita Barbosa-Matos, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Robert Hüneburg, University Hospital Bonn, Germany; Rui Sousa, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Silvana Lobo, Instituto de Investigação e Inovação em Saúde (i3S), Portugal; Stéphanie Bart-Desurmont, CHU Rouen, France; Svetlana Bajalica-Lagercrantz, Karolinska University Hospital, Sweden; Tanya M. Bisseling, Radboud University Medical Center, Netherlands; Thomas Vermeulin, Centre Henri Becquerel, France; Zillur Rahman Shabuz, Lancaster University, United Kingdom

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Figures

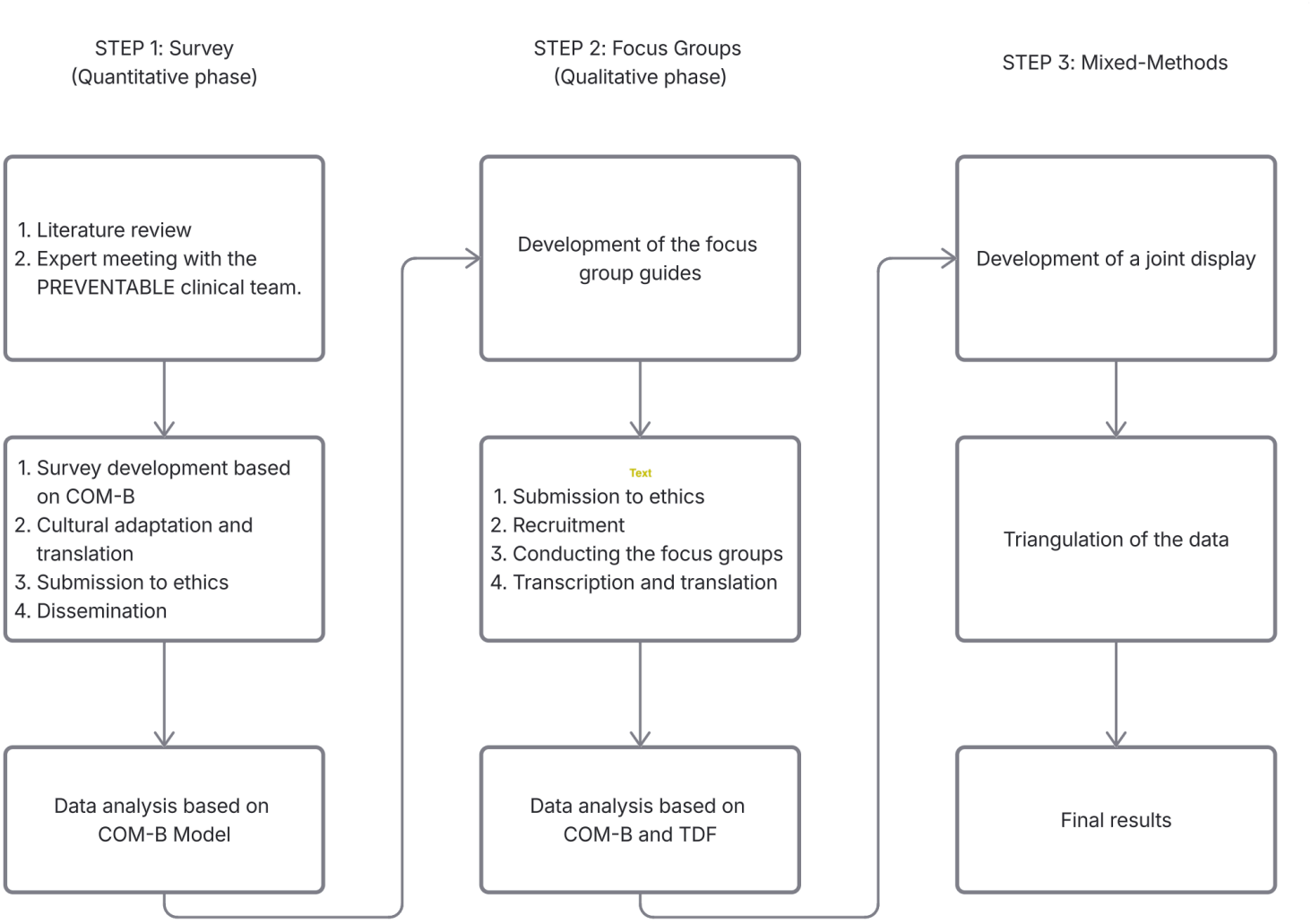


Figure 1

Flowchart: study design step-by-step. COM-B, Capability-Opportunity-Motivation-Behaviour Model; TDF, Theoretical Domains Framework.

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