Game changing technologies: Horizon Scan of Wearable Devices for Chronic Disease Management in Health Care

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Conflicts of interest

No conflicts of interest to declare.

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Abstract

Introduction

Chronic diseases account for almost three quarters of deaths globally, meanwhile the UK Government have explicitly stated cardiovascular disease, mental health, frailty and dementia to be top clinical priorities in their 10-year health plan. Wearable devices are growing recognition as a non-invasive tool in healthcare offering real-time monitoring and management of disease. Such technologies have been recommended in the UK health system for management of chronic disease and have been proposed to help shift care from the clinical to home setting. However, these technologies often lack rigorous regulatory oversight, raising concerns about data privacy, accuracy, and reliability that can lead to poor self-management decisions and compromised patient safety. Gaining early insights into emerging innovations is critical for shaping adaptive regulatory frameworks that ensure safe and effective integration of these devices into clinical and home settings. This report forms part of a horizon scan of current innovations and trends in wearable healthcare technologies across the emerging (innovation and preclinical), transitional (clinical trials), and imminent horizons (on the market). The scope of this report covers global developments with focus on the UK and on applications for chronic disease management.

Methods

Searches were conducted across bibliographic databases (Embase, IEEEXplore, INAHTHA), funding portals (CORDIS), clinical trial registries (ClinicalTrials.gov and ICTRP) and patent databases (Espacenet and Patentscope) in March 2025. Records were screened and deemed eligible if they included wearable technologies developed for the prevention, diagnosis, prognosis, or treatment response of health conditions and diseases across the three priority areas (remote monitoring of vital signs, chronic disease management and rehabilitation). Semi-automated screening and data extraction was performed using a large language model, previously validated in the previously published report on remote monitoring of vital signs. Data was subsequently summarised to indicate development trends including technology readiness levels and targeted indications. To explore the attributes and functionalities of wearable technologies that may promote user acceptance, concerns or barriers to adoption, patient insights from the Innovation Observatory Patient Advisory Group (PAG) was collected.

Results

In total 5,125 records were retrieved after deduplication and after screening, 576 records were included describing wearable technologies for chronic disease management. Across sources searched 423 records were included from bibliographic databases (Embase and IEEE Xplore), 45 from ClinicalTrials.gov, 34 from funding databases (CORDIS) and 75 patents (Patentscope and Espacenet). Neurological conditions, diabetes and other endocrinal, nutritional and metabolic conditions, cancer, cardiovascular conditions and respiratory conditions were the predominant disease areas reported. Bibliographic records presented in total 69 distinct wearable technologies for chronic disease management, of which 25 were identified as consumer devices and 14 as medical devices (indicated by CE-mark or FDA approval). The regulatory status of remaining technologies could not be confirmed.

Conclusion

This horizon scan highlights the rapid emergence of wearable technologies for chronic disease management across the research pipeline. The large volume of records underscores both the growth of this MedTech field and the unmet needs in targeted disease areas. Successful integration into healthcare will depend on adaptable regulatory frameworks and overcoming challenges in accessibility, validation, and patient acceptance.

Background

According to the World Health Organisation, chronic diseases account for 74% of deaths globally, which include cardiovascular disease, diabetes, cancer, and chronic lung disease.[1] In its 2023 Major Conditions Strategy, the UK Government identified six chronic diseases, namely cancer, cardiovascular disease, musculoskeletal disorders, mental ill-health, dementia, and chronic respiratory disease, as priority areas due to their significant contribution to ill health and mortality in England.[2] Whilst more recently, the UK Government's 10-year health plan explicitly stated top clinical priorities to include cardiovascular disease, mental health, frailty and dementia.[3] In 2023, the National Institute for Health and Care Excellence (NICE) Listens prioritisation dialogue involving public stakeholder input, identified clinical areas requiring accelerated improvement including severe mental illness, chronic respiratory disease, early cancer diagnosis and hypertension.[4] While this reflects growing awareness of the unmet needs in chronic disease management, identifying the most promising technologies to help address these challenges is essential.

Wearable devices are becoming increasingly recognised as useful non-invasive tools in the management of chronic diseases, offering real-time monitoring that supports personalised care and improves patient outcomes. Wearable technologies represent a valuable means of supporting national efforts to improve outcomes in priority long-term conditions. Applications of wearables span across endocrinology (e.g., diabetes and thyroid monitoring), cardiology (e.g., hypertension and arrhythmia detection), respiratory care (e.g., asthma management), oncology (e.g., early complication detection), and mental health (e.g., stress and anxiety monitoring, PTSD support). By facilitating continuous monitoring and fostering patient engagement, wearable technologies have the potential to transform chronic disease management across multiple specialties.[5,6] They address current gaps in timely detection, personalised treatment and patient involvement in long-term self-management. In recent years, NICE has recommended, within the NHS, use of medical grade devices for Parkinson's disease,[7] diabetes management[8] and for detecting cardiac arrhythmias.[9] Moreover, the UK government's 10-year health plan proposed that by 2035 wearables are to become standard in preventative, chronic and post-acute NHS-treatment.[3]

In the UK, the Medical Devices Regulations 2002[10] is the legal framework for devices with an intended medical use stated by their manufacturer, to ensure consumer safety and effectiveness standards are met. The Medicines and Healthcare products Regulatory Agency (MHRA), allocates devices to a risk-based classification system, (Class I, IIa, IIb, III) to indicate those devices which encompass greatest risk and thus rigorous evaluation into their safety and efficacy.[11] Particularly within the technology market for wearable devices, many are not subject

to the same regulatory oversight and instead are marketed as consumer devices, facing less stringent oversight and validation. This raises concerns regarding data privacy, accuracy, and reliability. Inaccurate, poorly validated, or misleading information can lead to inappropriate self-management decisions, delayed clinical intervention or unnecessary anxiety, undermining trust and potentially compromising patient safety. Obtaining early insights into emerging innovations in wearable healthcare technology is therefore essential for anticipating future trends and shaping proactive, adaptive regulatory frameworks that support the safe and effective development and integration of these devices into clinical practice and in the home setting. As such wearable technology may introduce novel capabilities,

This report forms a part of a horizon scan searching for current innovations and gaps in wearable healthcare technologies across the MedTech research and development pipeline focusing on three priority areas (remote monitoring of vital signs, chronic disease management and rehabilitation). This report focuses on the second priority area identified by stakeholders: wearable devices for chronic disease management.

Aim

The overall aim of this research is to provide a comprehensive overview of the latest progress and remaining gaps in the research pipeline of innovative wearable devices in healthcare. By using horizon scanning methods, the project will deliver reports for three priority areas across wearable devices, identified during consultation with our stakeholders.

Project objectives:

- Identify and describe innovative wearable devices for chronic disease management across the MedTech development pipeline for application in health care and to provide strategic insights and foresight, which may address key issues in healthcare policy and regulation.
- Map the trends of innovative wearable devices for chronic disease management being developed across the health technology landscape including disease areas, target population, country, and maturity of a technology for market access.
- Explore the attributes and functionalities of wearable devices in health care that enhance user acceptance, while also identifying potential concerns or barriers to adoption by patients.
- Indicate wearable devices for chronic disease management which implement the use of AI, pose a higher risk to patients, or more likely to face regulatory hurdles.

The findings from this horizon scan will inform policy and regulatory decisions by providing a detailed overview of emerging wearable healthcare technologies for chronic disease management. The insights will support the development of adaptive regulatory frameworks, ensuring the safe and effective integration of these devices into clinical and home settings. Additionally, the findings will highlight patient acceptance enablers and barriers, guiding strategies to enhance accessibility and trust in these technologies.

Methods

The methods for this horizon scan have previously been described in the first priority area for wearable devices with application in remote monitoring of vital signs.[12] The following provides a brief overview of the steps taken, with focus on the chronic disease management priority area for application.

Scope

The framework for this horizon scan, outlined in the first priority area, extends to this priority area and, is outlined in Table 1 below. The scope of this horizon scan is structured to capture technologies across their development lifecycle, categorised into three horizons: emerging, transitional, and imminent.

Table 1. The scope of the horizon scan for wearable technologies in healthcare

Item	Description
Horizon	Across the MedTech development pathway from initial concept to recently-approved devices ready for implementation into healthcare: therefore the emerging (innovation and preclinical), transitional (clinical trials) and imminent (on the market) horizons will be searched.[13]
Innovation	New technology or new application of existing technology
Population	Global with focus on the UK
Data sources	The following patent and funding databases will be searched to identify relevant technology across the emerging horizon: • CORDIS • Patentscope • Espace The following trial registries and bibliographic databases will be searched to identify relevant technology across the transitional and emerging horizons: • International Clinical Trials Registry Platform (ICTRP) • ClinicalTrials.gov • Embase • IEEEXplore
Interest holders	• Government departments and policy makers to inform strategic planning and regulatory foresight of innovative technology for improving public health. • Regulators and health technology assessors to ensure relevant clinical efficacy and safety evidence, as well as cost effective evidence for decision-making, is generated.

	• Funders, accelerators and catapults to ensure the appropriate support and investment is available for game changing technologies that can boost public health and economic development. • SMEs, patient groups and charities to ensure the relevant guidance and support for innovations that address unmet needs can obtain market access and reach underserved populations.

Source: Whitehall et al. (2025)[12]

Search strategy

Search strategies for bibliographic databases (Embase, IEEEXplore, INAHTA), clinical trial registries (ClinicalTrial.gov, ICTRP), funding (CORDIS) and patent (Espacenet, Patentscope) databases are available in the previous report.[12] The searches were conducted between 17th and 18th March 2025. As a single wearable device may be applied to one or more priority area bibliographic databases were searched simultaneously, while distinct search terms were applied in the clinical trial registries, funding and patent databases.

Eligibility criteria

During the screening of titles and abstracts/summaries retrieved during the searches, records were included in the chronic disease management priority area if they met the inclusion criteria and none of the exclusion criteria as listed in Table 2.

Table 2. Eligibility criteria for wearable devices for chronic disease management

Inclusion criteria	Exclusion criteria
• Devices that were used to manage, monitor, treat, prognose or diagnosis chronic diseases. • Diseases had to be chronic. For example, a device for Covid-19 monitoring would be excluded, but a device for managing long-term Covid would be included. • Wearable devices that can be worn on the body, attached to clothing or implanted in the body, and able to control, manage or monitor symptoms. • The full device did not need to be the focus of the record; records presenting a component of a device (e.g., a material or algorithm) were eligible if the component was tested or demonstrated within the context of a full device.	• Review articles and compilations of papers, abstracts or conference proceedings. • Records where the abstract or summary explicitly concluded that the technology was ineffective or not a viable substitute for current standard of care, as these were not considered 'game changing technologies'.

• Improvements to existing devices or new applications for existing technologies were also included. • Devices could be worn intermittently or continuously. • Studies involving healthy participants.	

Screening

All records retrieved from the searches were screened manually in a pilot screen by two independent reviewers, using a predefined eligibility criteria (detailed below) defined for wearables devices for chronic disease management. Any discrepancies were resolved through consolidation with a third reviewer. As described previously,[12] following the pilot screening a 3-step process was implemented, which applied the use of a large language model (LLM) for screening together with a priority ranking system to automate the detection of likely included records and to expedite review of records likely missed by the LLM.

Automation of screening

To help reduce the number of records manually screened, a LLM (GPT-4o-mini) was applied, accessed via the OpenAI Application Programming Interface.[a]

Step 1: We drafted LLM prompts based on the inclusion criteria for this scan and refined them based on the manually screened pilot data. We developed prompts with the primary aim of high sensitivity (identification of true positives), while also considering precision (fraction of false positives; also called positive predictive value). These parameters were calculated from the output of the pilot screen and prompts were refined and evaluated iteratively. We adapted prompts for each specific data source, using one of the bold text options as applicable:

*"You are a researcher screening **[references/clinical trial registry entries/patents/funding records]** for inclusion in a literature analysis. The inclusion criteria are the following: Any reference that describes wearables used on humans, for prevention, diagnosis, prognosis, or treatment response of health conditions such as diseases, impairments, or disability. Devices must be wearable, eg. biosensors worn on the body or attached to clothing, in case of implants worn invasively, or as sensors within fabrics. Examples of wearables include, but are not limited to, smart watches, tattoos, lenses, glasses, earbuds, necklaces, smart patches, smart bracelets/bands, smart rings, exoskeletons, wearable robots, or virtual reality and immersive technology. Included reference should describe wearables being tested for health-relevant functions such as remote monitoring of vital signs, support of rehabilitation, chronic disease management, or measuring other health-related data on patients. Exclude all references describing review articles, multiple conference proceedings, protocols,*

[a] https://openai.com/index/gpt-4o-mini-advancing-cost-efficient-intelligence/ https://platform.openai.com/docs/models/o4-mini

software development, materials development, and other papers reporting no results on wearables on humans. Answer YES if the article is relevant to the inclusion criteria or unclear. Answer NO if it is not. Then reproduce the exact context from the paper that contained the information on which basis you made the decision. Here is the text of the article: [..]"

Results on the pilot data showed high sensitivity (>0.98) on all data sources (full results are presented in Appendix C for the report on Remote Monitoring of Vital Signs in Health Care which shared the reference screening stage with this report[12]).

Step 2: We then applied the LLM to the remaining unscreened records. To validate the LLM output, all the records that were predicted to be included, plus a random sample of 10% excluded by the LLM, were manually screened by a single reviewer, blinded to the LLM prediction. Any queries over records during single screening were discussed amongst the team to reach a consensus.

For bibliographic data, nine records were falsely excluded by the LLM. Subsequently, to mitigate the risk of missing relevant references and biasing the horizon scan outcome, we conducted additional screening of likely relevant evidence. To retrieve missing relevant unscreened bibliographic records, we used a prioritisation tool developed within the Innovation Observatory, Artificial Intelligence Document Organiser and Classifier, to re-rank the remaining records excluded by the LLM based on their predicted similarity to previously included records.[14] Likely relevant records were subsequently screened until a sustained pattern of consecutively excluded records was encountered, indicating that further screening was unlikely to yield additional includes. All remaining clinical trial registry entries, patent and funding records were screened due to a high miss-rate of the LLM. Full results for this second step of automation are reported in Appendix C for the report on Remote Monitoring of Vital Signs in Health Care.[12]

Step 3: We continued screening the whole trial registry, funding, and patent datasets due to the relatively small numbers of records and concerns of missing relevant technologies. For trial registry entries, the LLM falsely excluded three records in the random sample. However, full evaluation of the LLM predictions against manual screening results revealed high sensitivity (>95%) on all datasets. Full results are shown in Appendix C.

Documentation of the number of records searched, retrieved, and screened for eligibility was conducted using an adapted Preferred Reporting Item for Systematic reviews and Meta-Analyses (PRISMA) diagram.[15]

Semi-automated data extraction and quality assurance

As a single wearable device may be applied to one or more priority area, data from records included in this current priority, which were eligible and included in the previous priority area, are included in this report.

Bibliographic sources

As previously reported,[12] data were extracted from all included bibliographic records into Excel using a LLM (GPT-4o-mini)[b] via the OpenAI Application Programming Interface[c]. This process was carried out as part of a semi-automated workflow that included manual oversight and verification of automatically extracted data to improve performance and reduce misclassifications. Items extracted included: *Device name; Target population; Disease area; Country; Type of device including implantable devices.* Manually extracted items further included *technology readiness levels (TRLs); intended purpose; AI use and the approval body if approved as a medical device.* For many of these, multiple items could be extracted. For example, one abstract could contain multiple disease areas, target populations, intended purposes and wearable devices. However, each record was only assigned one TRL.

In practice, the LLM was provided with the title and abstract for each report. It was prompted to identify information related to each of the data extraction items listed before. For each item, the LLM pre-filled a column in the data extraction spreadsheet with its predictions and marked the data with a prefix to indicate LLM output for human review, allowing only verbatim and exactly matching text within the provided source context to be extracted to avoid hallucinations. It also provided a visual output of the title and abstract with highlighted text for each detected item. Human reviewers then manually reviewed the LLM's pre-extracted data for each record, by referring to abstract with highlighted text, to clean and correct the data. Results from an initial assessment of automatically extracted data on 20 pilot records is shown below.

Table 3 Results of evaluation of data extraction automation. Within the disease area and Vitals records, the LLM missed one data point for automated extraction each.

	Disease area	Target population	Device name	Type of device	Vitals
Sensitivity	0.92	1	1	1	0.93
Precision	0.75	0.15	1	0.4	0.7

Clinical trials

All National Clinical Trial numbers (NCT) of trials included from trial registries were input into the ClinicalTrials.gov search query and a CSV file with the following data fields was created: *NCT Number; Study Title; Study URL; Acronym; Study Status; Brief Summary; Study Results; Conditions; Interventions; Primary Outcome Measures; Secondary Outcome; Measures; Other Outcome Measures; Sponsor; Collaborators; Sex; Age; Phases; Enrolment; Funder Type; Study Type; Study Design; Other IDs; Start Date; Primary Completion Date; Completion Date; First Posted; Results First Posted; Last Update Posted; Locations; Study; Documents; Funding; Patents.*

[b] https://deepmind.google/models/gemini/flash/ (last accessed 20/08/2025)
[c] https://pypi.org/project/langextract/ (last accessed 20/08/2025)

Funding
The funding projects retrieved from the searches encompassed total costs, EU contribution costs, and start/end dates. The country co-ordinating the projects was found by manually searching the project on the CORDIS website.

Data analysis

Technology development characteristics
The technologies from included records were summarised narratively with graphical representation to describe the geographic location of developers, types of devices, disease areas, target population, and implementation of AI.

Technology readiness levels
To evaluate the maturity level of included technologies, the development of each technology was mapped against the TRLs,[16,17] which can be mapped to the emerging, transitional and imminent horizons respectively.[13] Technologies reported with a brand name were identified and searches were conducted manually to distinguish devices regulated as consumer devices or medical devices. The country of the developer was found during this search and so was only able to be identified if the device was named. A single record was assigned one TRL, and if the device was already marketed but evaluated in a novel indication or setting, the TRL was assigned accordingly. Graphical representation of TRLs, technology radars, were generated for identified technologies.

International Patent Classification
The International Patent Classifications (IPCs) allocated to each patent, indicating the technical field and application to which the patent belongs to, were pooled, and mapped according to the IPC hierarchical system organised into sections, classes, subclasses and groups. For instance, patents related to wearable sensors for cardiovascular monitoring were classified under IPC section A61B, which pertains to diagnostic and monitoring devices. The number of patents at each level were summed for graphical representation of the most frequent allocated subclasses.

Missing data

If information was not reported in the title, abstract or summary of the record, or could not be found from the developer's website, data was stated to be not reported (NR) and treated as missing. For example, if the technology was only described as a 'wearable device' the type of wearable would be stated as NR.

Public and patient engagement

To explore the attributes and functionalities of wearable devices that may promote user acceptance, concerns or barriers to adoption, two 30-minute focus groups (3-months apart) as part of the Innovation Observatory Patient Advisory Group (PAG) yearly quarterly meetings, were conducted. During the first session (n=7), a brief introduction to the project and overview of wearable devices and their application in healthcare were presented followed by an open discussion guided by prespecified questions (see Appendix A). Insights and views from the PAG

in the first session were discussed afterwards and transformed into a checklist for wearable devices from the patient perspective. Elements and features that the PAG identified as useful in a wearable, along with perceived drawbacks, limitations and concerns, informed the creation of the checklist. In the second session (n=8), examples of wearable devices identified in our searches were presented along with the checklist for open discussion. The discussions were analysed thematically to identify key themes related to user acceptance and barriers to adoption, and findings were presented narratively.

Results

Weak signal selection

Of the 5,125 records retrieved from searches, 576 records met inclusion criteria and none of exclusion criteria for chronic disease management. The flow of records through the record retrieval and screening processes to identify relevant technologies is presented in the adapted PRSIMA diagram in Figure 1.

The included records represent the weak signals across the emerging (innovation and preclinical), transitional (clinical trials) and imminent (on the market) horizons, for wearables devices for chronic disease management which may hold most potential for significant future impact in health care.

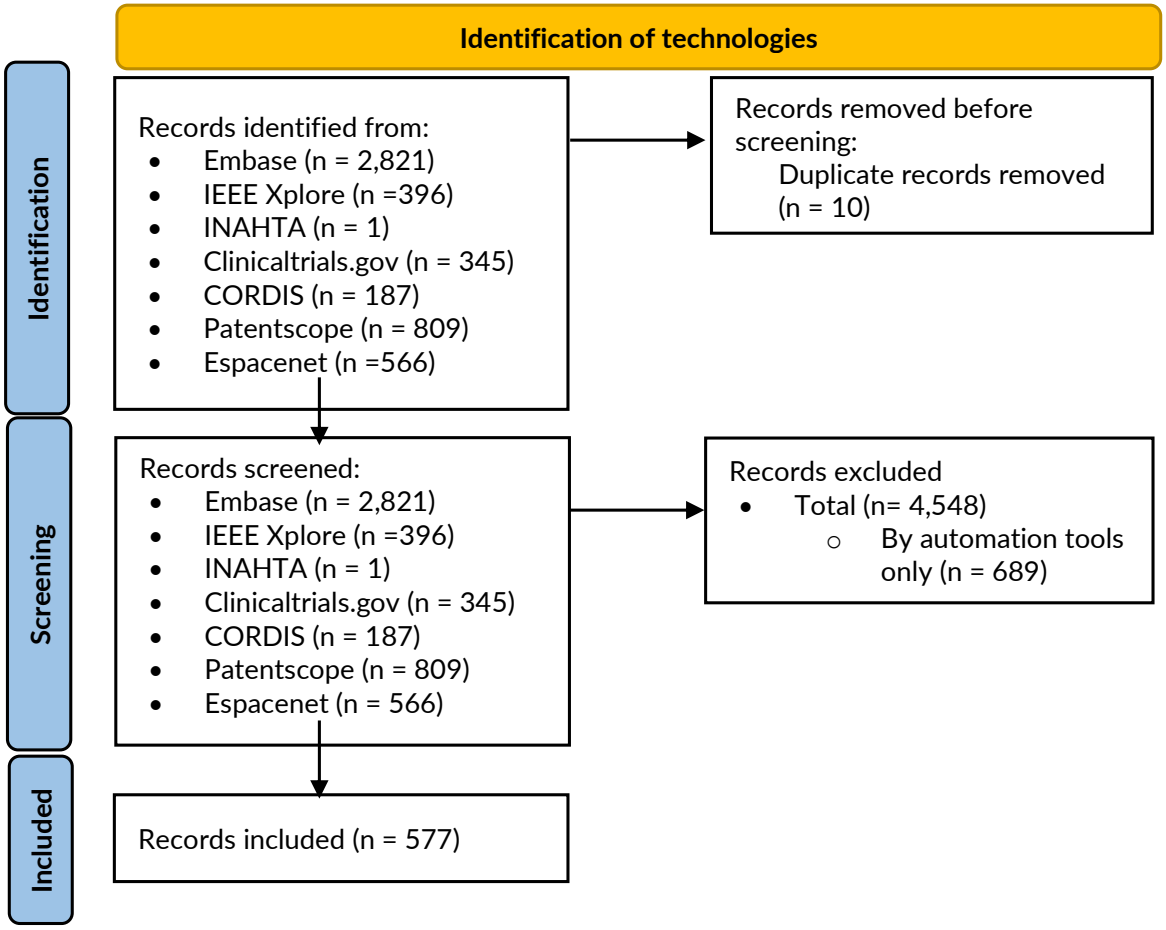

Figure 1 PRISMA 2020 flow diagram for identification of wearable technologies showing the number of records at each stage

Single source of information characteristics

The total number of records included for wearable devices for chronic disease management are presented in Figure 2, stratified by data source. No records were included from INAHTA, while 423 records were included from bibliographic databases (Embase and IEEE Xplore), 45 from ClinicalTrials.gov, 34 from funding databases (CORDIS) and 75 patents (Patentscope and Espacenet).

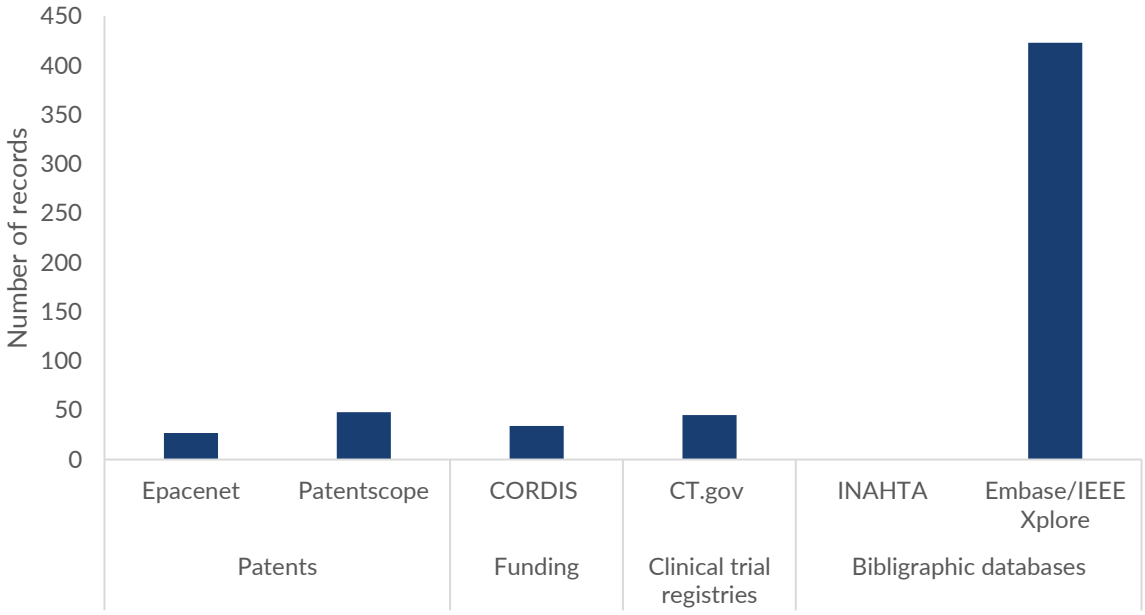

Figure 2. Number of records included for wearable devices for chronic disease management from each data source searched.

Funding

Funding databases were searched to provide an indication of where investments were being made across the wearable technology landscape and to highlight the specific areas that are attracting investor interest and priority in relation to chronic disease management. Overall, 34 funding projects were identified as relevant form searches conducted in CORDIS and are presented in *Table 5* in Appendix B. From records that reported total cost invested, projects ranged from approximately 1.6 to nearly 20 million Euros. Countries co-ordinating the projects were all based in Europe, Italy being the most common, co-ordinating 5 out of 34 projects included (Figure 3). The UK co-ordinated two projects. The first is the "NextTremor" (ID: 101210542) which started September in 2025 and is to run until September 2027. NextTremor aims to develop an innovative personalised wrist exoskeleton for suppression of tremors observed in Parkinsons Disease. Whilst the second "PhotoMod" (ID: 101188662) is a wearable system that aid patients affected by cyber- or motion sickness during use of virtual reality. Diseases or conditions discussed within the project objectives were categorised and presented in Figure 4. Neurological conditions (8/34) were predominantly indicated, followed by diabetes and other endocrinal, nutritional and metabolic conditions (6/34).

Across all 34 projects, 16 directly described the implementation of AI in the project objectives. AI has been applied in a variety of ways, including real-time sound processing to assist individuals with hearing loss, predicting prediabetic risk, recognising emotions for psychiatric patient monitoring, and supporting the development of extended reality technologies. Although the remaining 18 records did not explicitly state the use of AI in the available project summary, the planned use of AI in these projects cannot be ruled out. Particularly as some

projects focus on other features of wearable development e.g., hardware processing, biomedical signal processing, and therefore could still integrate the use of AI in their devices. Additionally, the advanced technologies in these projects make AI integration highly likely.

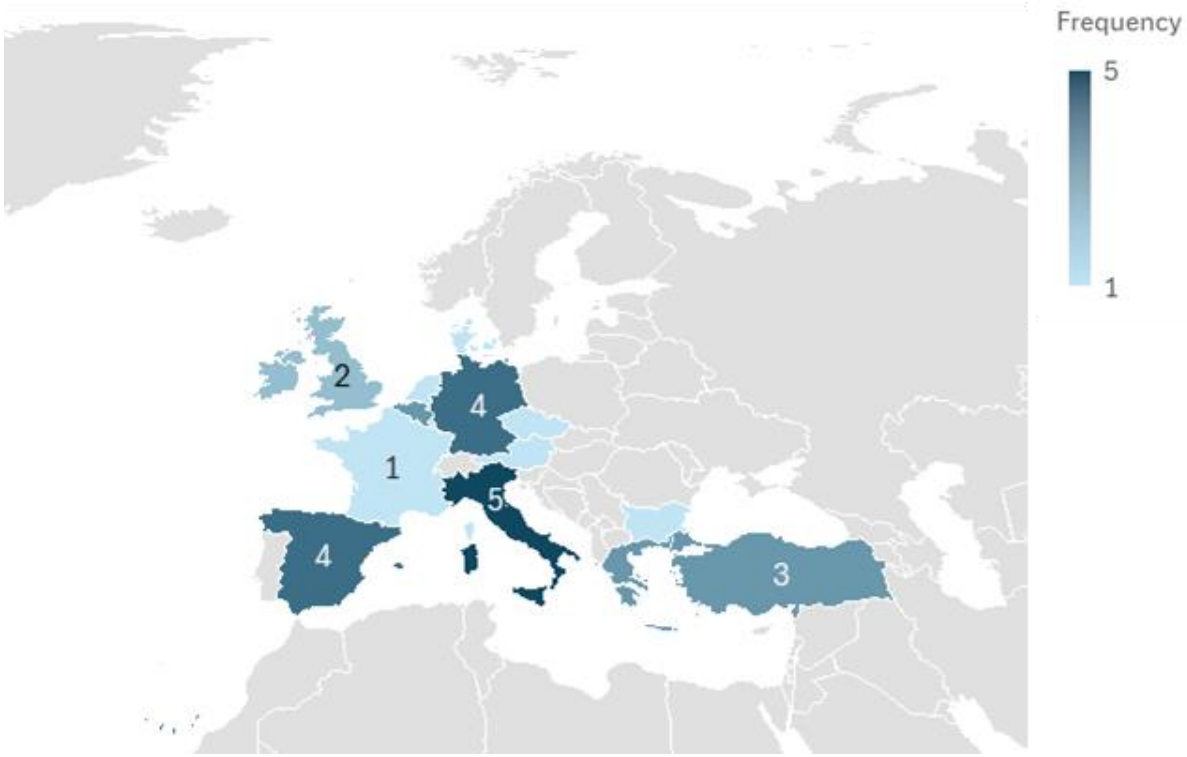

Figure 3. Locations of funding project co-ordinators focusing on wearable devices for chronic disease management

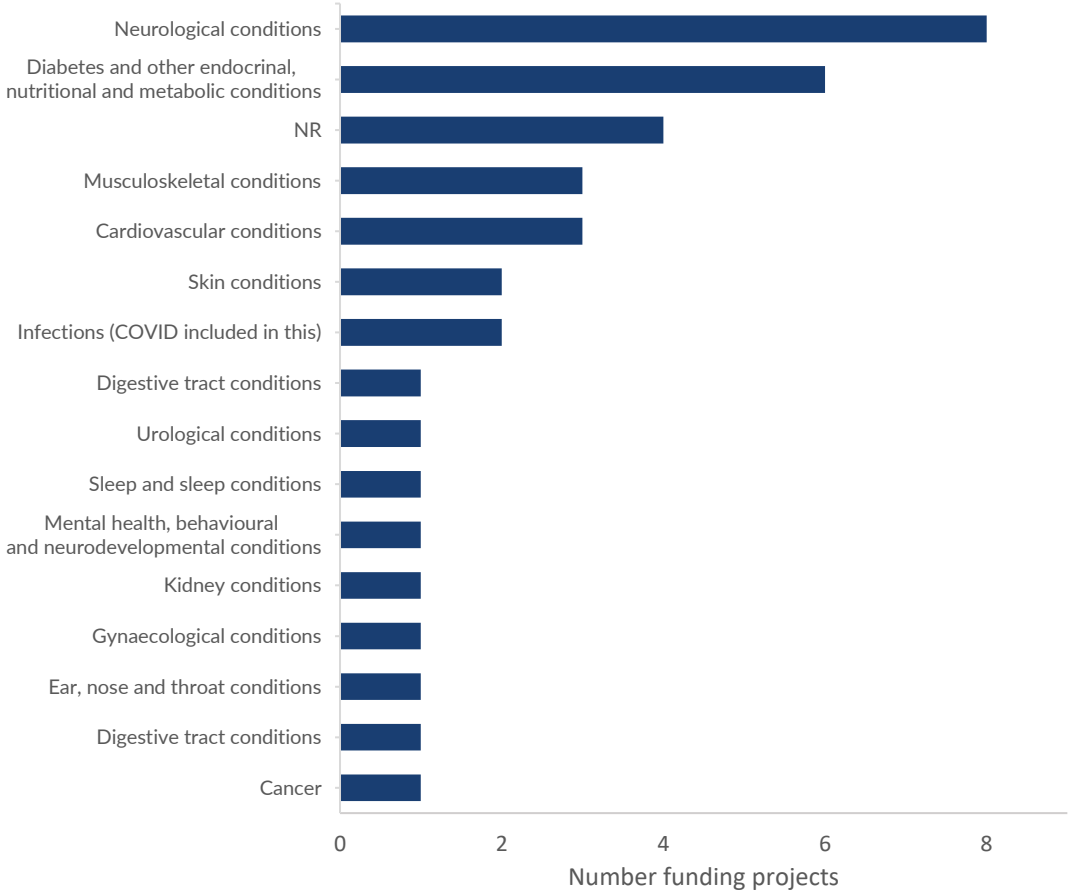

Figure 4. Disease or condition areas stated in funding project objective

Patents

Typically reflecting the earliest stages of innovation, setting out intellectual property of conceptual ideas or initial prototypes, patents represent during the horizon scan. Overall, 75 patent records were identified for wearable devices for chronic disease management. For 69 records, country codes indicated China, the USA and India to be the top three countries where patent applications were filed or granted (Figure 5) while 6 records were assigned 'WO' (5/6) or 'EP' (1/6), indicating WIPO and the European Patent Office, respectively.

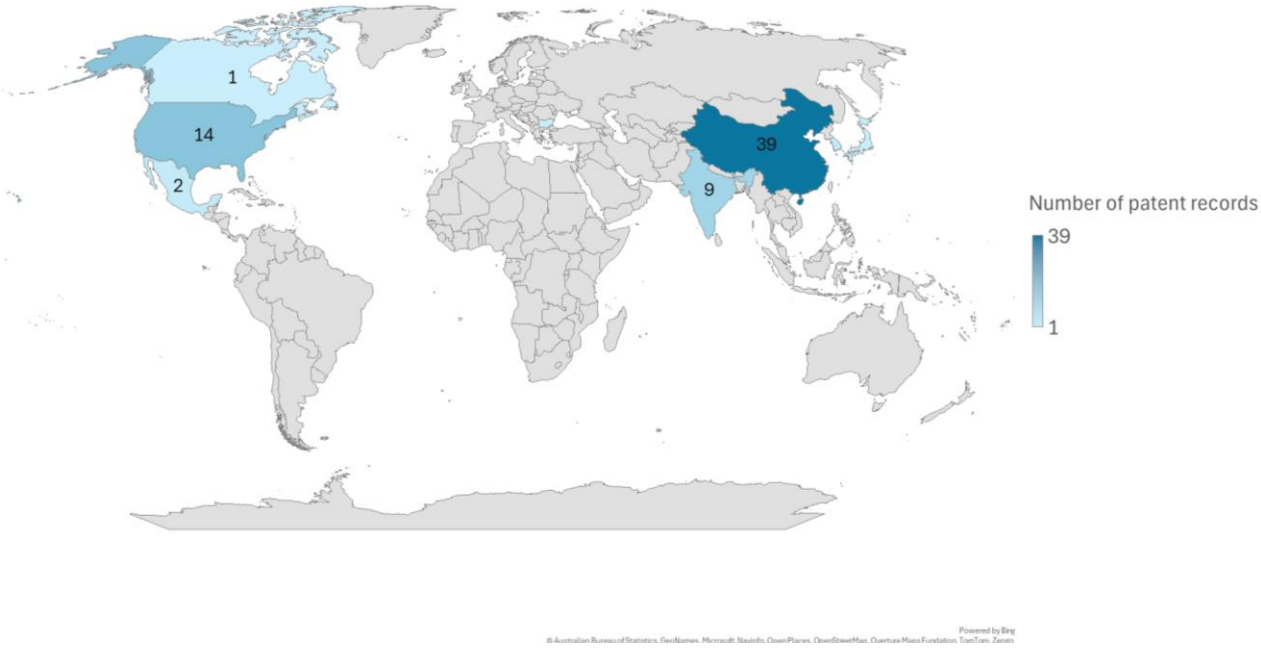

Figure 5 Locations of where patent applications were filed or grated

To characterise the technical fields and applications the included patents aligned to, the IPCs allocated to the included 75 patents were pooled generating a list of 325 symbols which were grouped in hierarchical order according to the IPC system (See Table 6 in Appendix B). Class A61 representing inventions within the field of "Medical or veterinary science; hygiene", was the most commonly assigned class (177/325). Within this class, the majority (157/177) of patents were assigned to the subclass "Diagnosis; surgery; identification" (A61B). In further descending order of hierarchy, the most frequently assigned group within the latter subclass was "Measuring for diagnostic purposes" (A61B 5/00), allocated to 141 out of the 157 patents. The top ten groups and subgroups pertaining to the invention's specific application within this subclass, indicative of dominant applications, are displayed in Figure 6.

The second most common class from all included patents was G16 (65/325) representing inventions within the field of "Information and communication technology [ict] specially adapted for specific application fields". Within this class, all were assigned to the subclass for

"Healthcare informatics, i.e. information and communication technology [ict] specially adapted for the handling or processing of medical or healthcare data" (G16H). The nine groups and subgroups in G16H which were reported more than once are displayed in Figure 7.

Lastly, the class G06, which encompasses inventions within "computing; calculating; counting" was the third most commonly assigned class assigned to included patents (45/325). Within this class, G06H, pertaining to interventions with "electric digital data processing" predominated (20/45).

Figure 6. Bubble chart showing the nine highest occurring International Patent Classification (IPC) symbols for subgroups in the A61B 5/00 group reported by included patents (measuring for diagnostic purposes. Footnote: a, Measuring characteristics of blood in vivo, e.g. gas concentration, pH-value; b, Measuring pulse rate or heart rate.

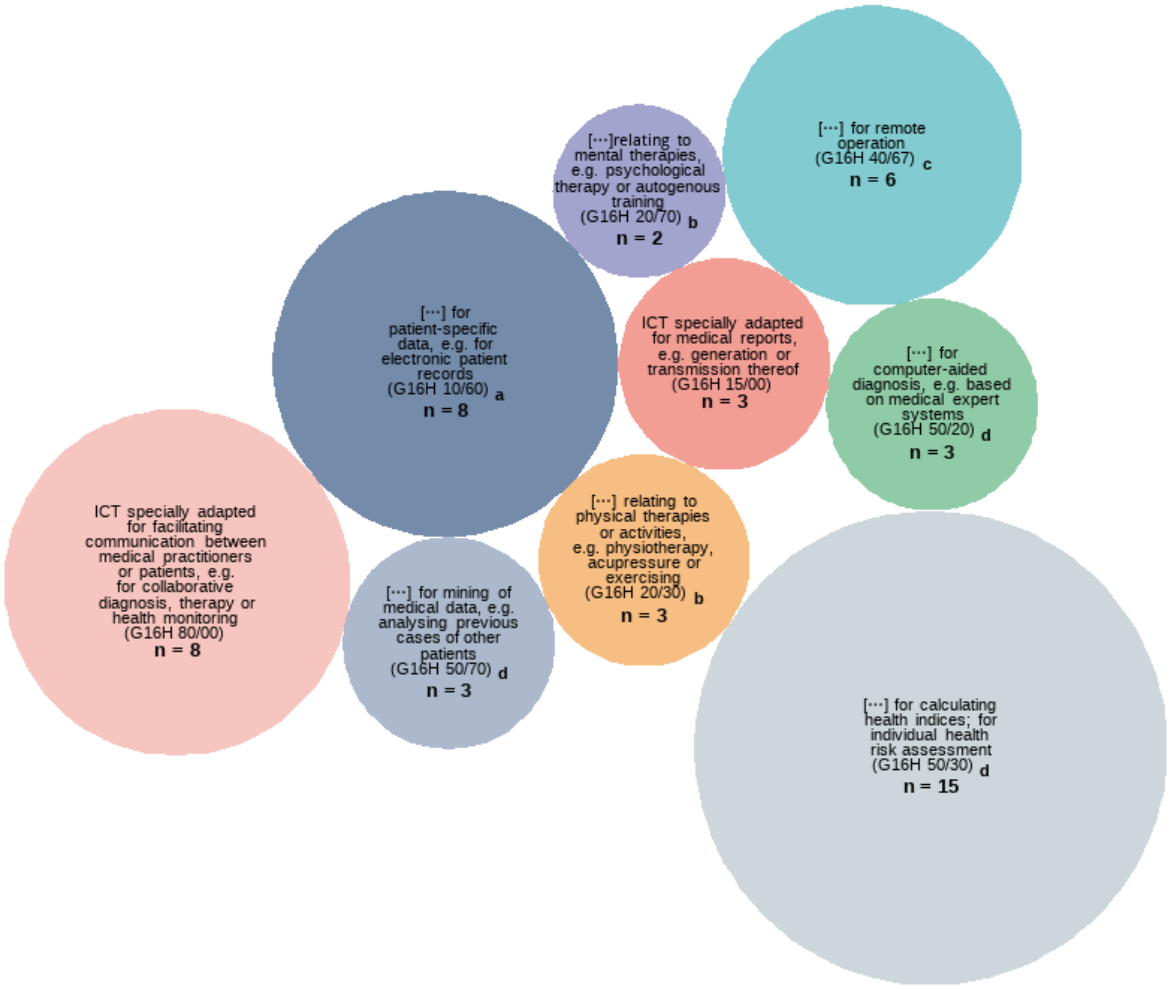

Figure 7. Bubble chart showing the nine highest occurring International Patent Classification (IPC) symbols for groups and subgroups in the G16H (Healthcare informatics, i.e. information and communication technology [ICT] specially adapted for the handling or processing of medical or healthcare data) subclass reported by included patents. Higher level description of those with a footnote: a, ICT specially adapted for the handling or processing of patient-related medical or healthcare data; b, ICT specially adapted for therapies or health-improving plans, e.g. for handling prescriptions, for steering therapy or for monitoring patient compliance; c, ICT specially adapted for the management or administration of healthcare resources or facilities; ICT specially adapted for the management or operation of medical equipment or devices; d, ICT specially adapted for medical diagnosis, medical simulation or medical data mining; ICT specially adapted for detecting, monitoring or modelling epidemics or pandemics

Trial registries

In total 45 clinical trial registrations were identified in line with the scope for wearable devices for chronic disease management and are listed in *Table 7* in Appendix C. While there were 3/45 UK based sponsors, the US (n=14) and Cananda (n=6) were the predominating countries sponsoring included clinical trials (Figure 8). There were indicated to be nine consumer devices under investigation amongst trials, eight medical devices approved by the MHRA, FDA or EU and one device. Additionally, one device C-Mo, to help record and generate clinically objective data based on coughing, was highlighted by the developers to be currently undergoing regulatory approval. Majority of remaining trials (26/45) were suggested to be investigating devices that were placed at TRL6 within the MedTech development pipeline. Across all included trials Respiratory conditions, cardiovascular conditions and cancer, are the top three disease areas where wearable devices were being investigated, all three areas being evaluated in 9 trials each (Figure 9). The majority (42/45) of trials enrolled adult participants, while three trials included children. With regards to the usage of AI by wearable devices under evaluation, across all included trials, six explicitly stated the use of AI. The use of AI was stated to aid earlier diagnosis, personalised treatment planning, predict disease exacerbation occurrence and to help map physiological measurements to patient reported outcomes. The type of wearables most frequently reported were watches, with 14 trials describing such wearable devices.

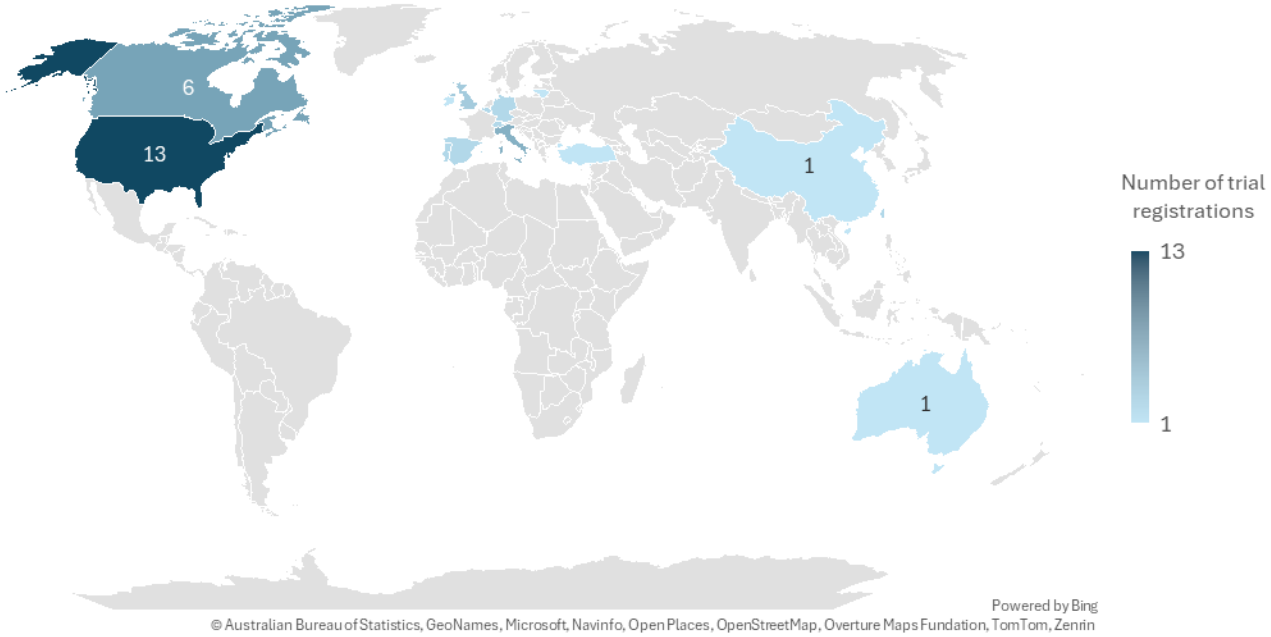

Figure 8. Locations of clinical trial registrations

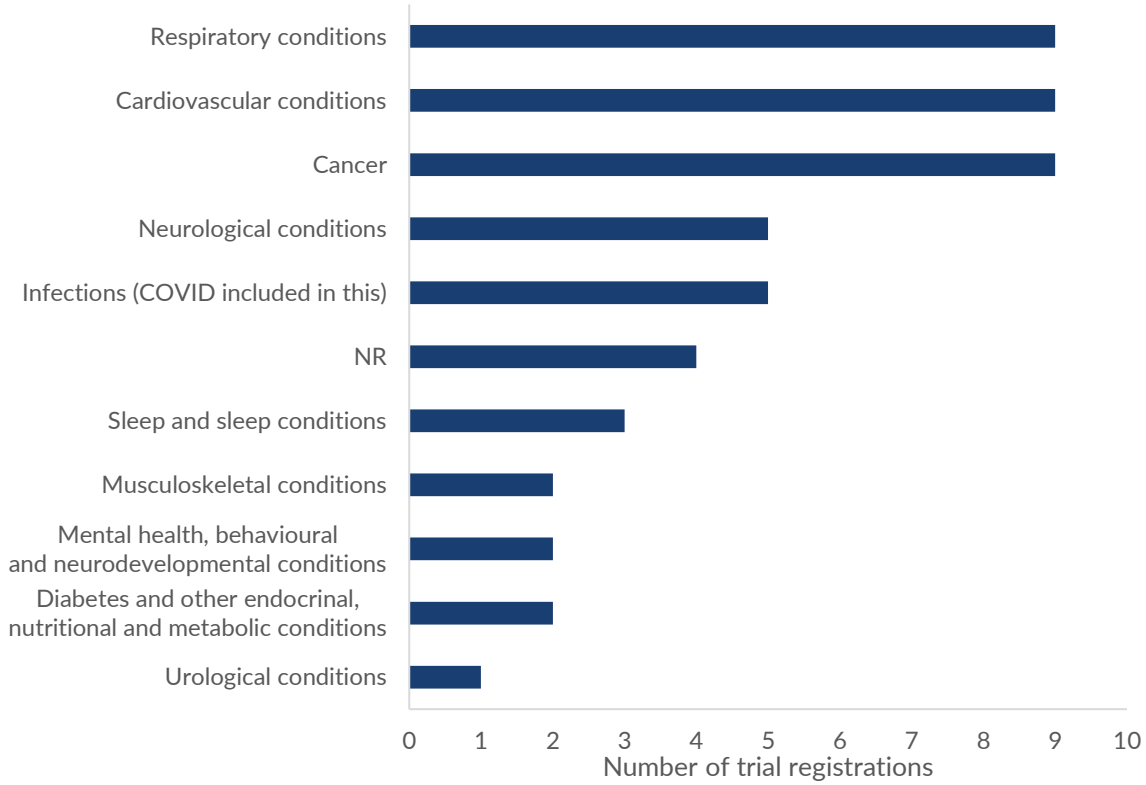

Figure 9. Conditions or disease areas trial registries were investigating wearable devices in
Abbreivations: NR, not reported

Bibliographic sources

Bibliographic records offer peer-reviewed, evidence-based insights into the areas of research and development that are gaining research interest and can serve as a useful source for assessing the maturity and credibility of technologies. In this horizon scan a total of 423 records, including 11 clinical trial protocols, were identified as relevant studies reporting wearable devices with application in the chronic disease management.

Conditions and diseases

The number of records which reported wearable devices categorised by the condition or disease area the device is indicated for is shown in Figure 10. The most common target disease areas were cardiovascular conditions (106/423) and neurological conditions (76/423), while less commonly reported conditions included those regarding oral and dental health, liver conditions or skin conditions. However, the target condition or disease was not reported for 16.5% (70/423) records and therefore it remains uncertain as to whether these technologies have been developed for a specific indication and represent some of these latter conditions or whether they are used for multiple conditions.

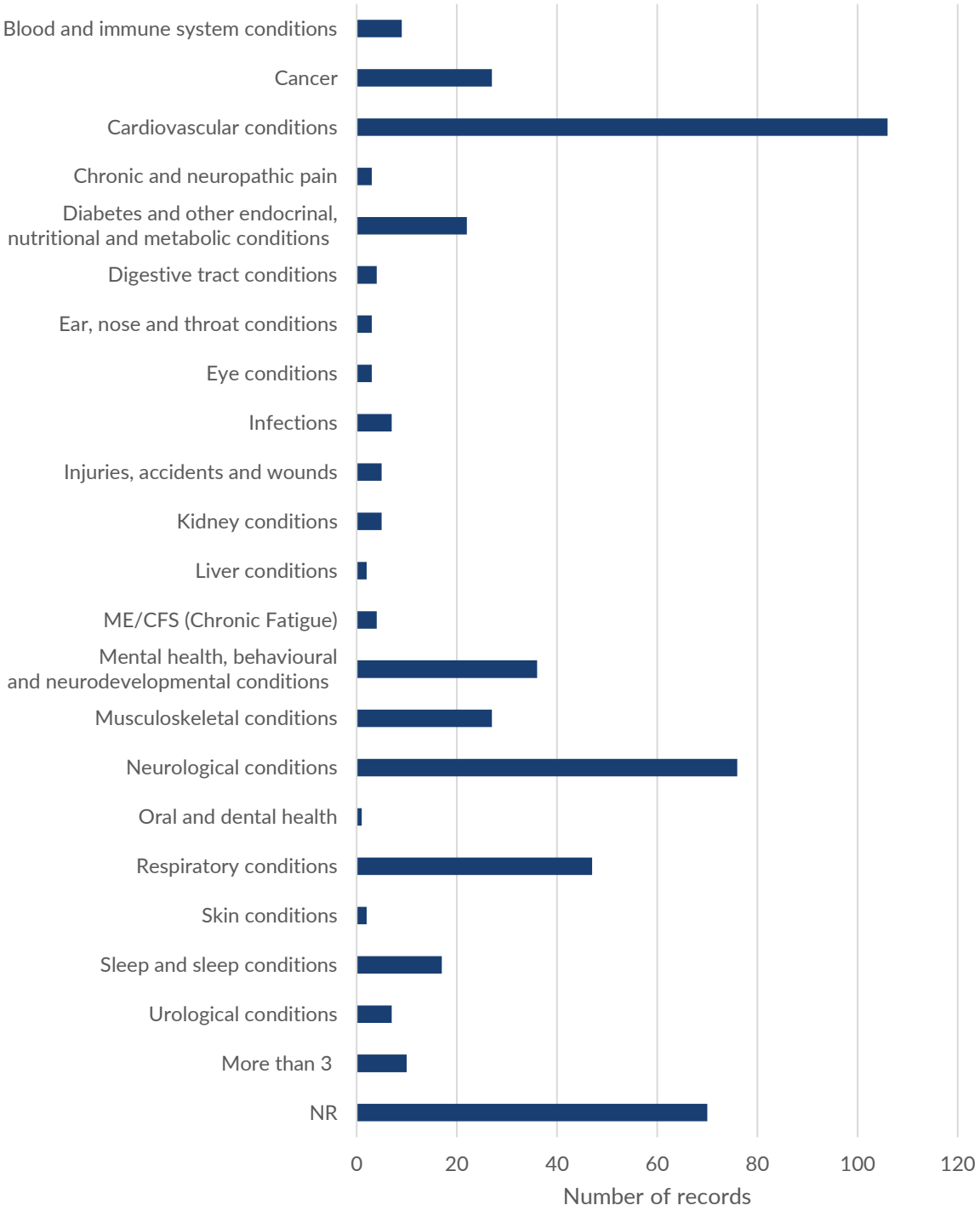

Figure 10 Counts of condition or disease area. Abbreviations: ME/CFS, myalgic encephalomyelitis or chronic fatigue syndrome; NR, not reported

Target population

Over half of the records (283/423, 66.9%) studied the technology in a defined patient population and 3.3% (14/423) of records investigated the technology in healthy subjects; the

remaining records did not specify the patient population the technology was being studied or intended for. The age of the target population the technologies were intended for was reported by 117/423 records (27.7%), while 336 records did not report a target age for the technology (Figure 11). The most common age range reported was adults, which was an identified population age in 12.3% of records (52/423).

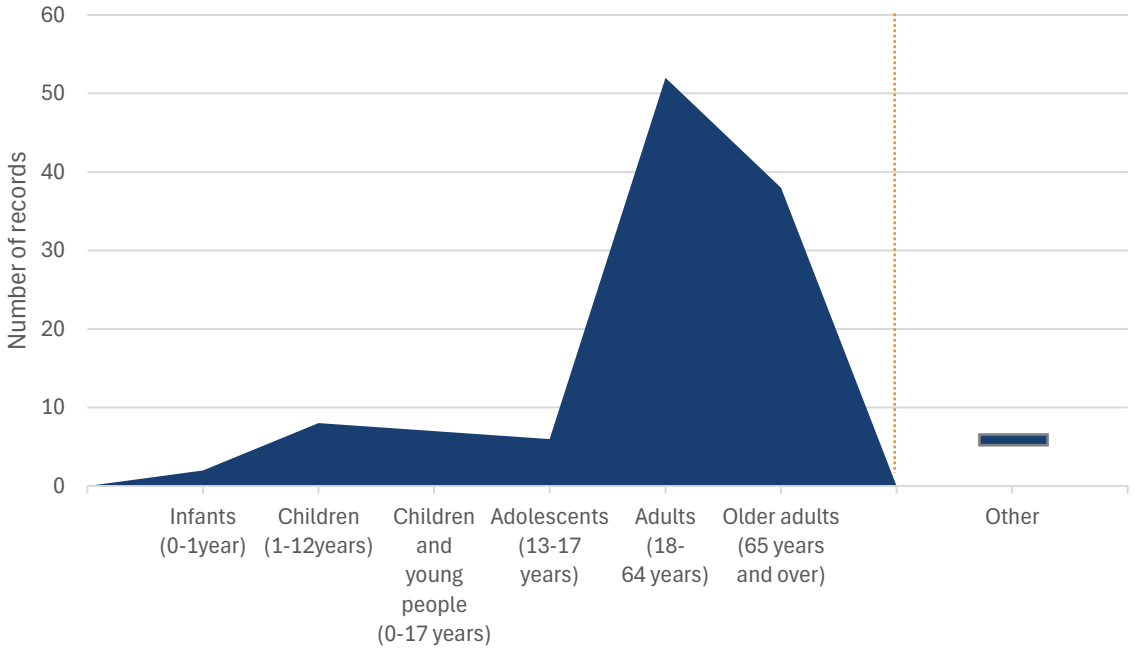

Figure 11 Number of technologies identified for each target population

Type of wearable and implantable devices

The most common type of wearable was a watch. The type of wearable was reported in the abstract by 294/423 records (69.5%), while 129 records did not specify the type of wearable being studied within the abstract (

Figure 12). Seven records describing implantable devices were identified. More unusual types of wearable were identified such as an in-ear photoplethysmography for unobtrusive respiratory monitoring and COPD screening,[18] a nose clip respiratory sensor system for patients with apnea,[19] and a penile ring used to measure erectile dysfunction.[20]

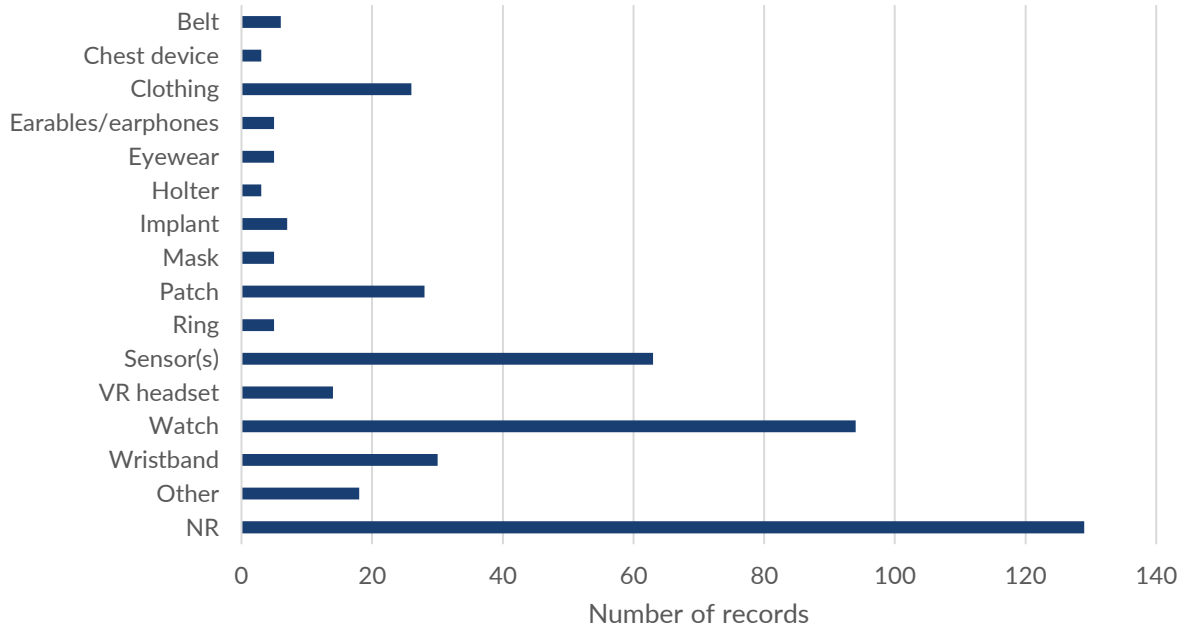

Figure 12 Types of wearable devices reported by included bibliographic records

Intended purpose or outcome

Most records focused solely on management (297/423, 70.2%), with a total of 380 records involving management in some way (Figure 13). This compared to 80 which involved diagnosis (18.9%), 16 which involved prevention (3.8%) and 27 which involved treatment (6.4%).

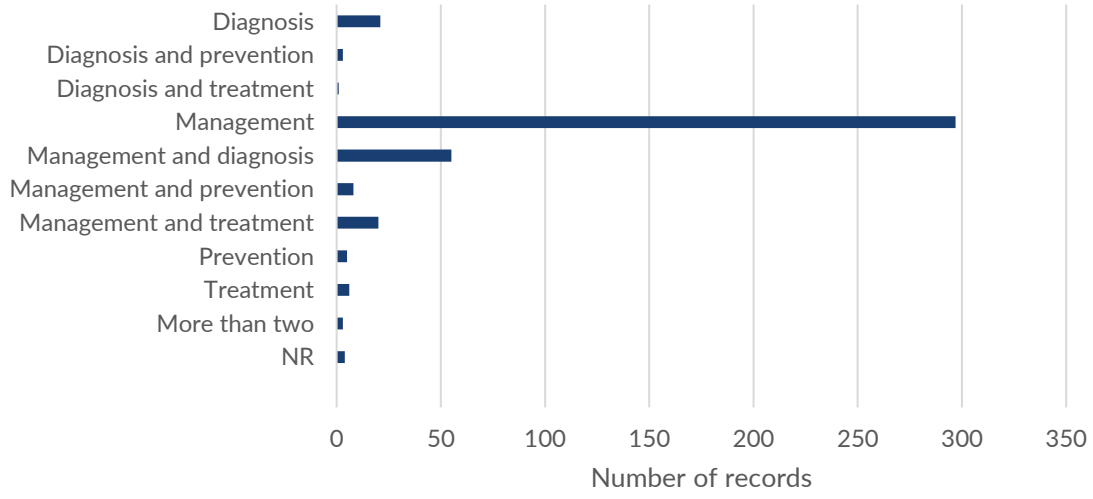

Figure 13 Intended purpose of wearable technologies per bibliographic record

AI

The number of records that stated to implement AI was 99/423 (23.4%). Among technologies that implemented AI, the most common target disease areas where technologies implemented/involved AI were cardiovascular conditions (24), neurological conditions (20) and respiratory conditions (14). Most records focused on management, with a total of 88 records involving management in some way (88/99, 88.9%). Over a quarter of the records involved diagnosis (25/99, 25.3%).

Named devices

The brand name of the device under development was reported in the abstract by 143/423 records (33.8%) (Table 8 in Appendix D). There were 120 consumer devices (including 31 un-named) in 114 consumer device records, but due to the same technologies being used in multiple records, these corresponded to 25 distinct wearables (Figure 14). The most common consumer devices were Fitbit (38/120) and Apple Watch (17/120). There were 56 named, non-consumer technologies, but due to technologies being used in multiple records, these corresponded to 43 distinct wearables. We identified FDA approval for eight of these and CE-certification for six. Seven technologies were discontinued and so no longer in production. The remaining were either not approved, or not enough information could be found to make a decision on whether they were.

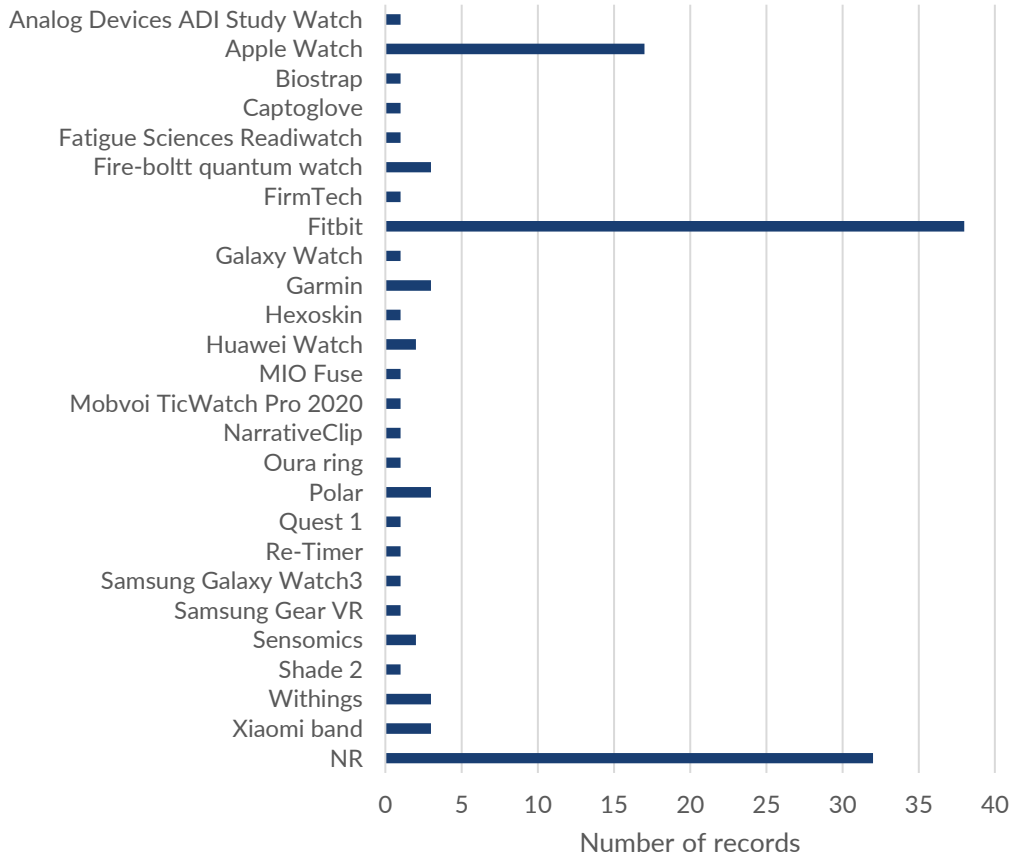

Figure 14 Named wearable consumer devices used for chronic disease management

The consumer devices found mainly focused on cardiovascular conditions (33) and neurological conditions (22) (Figure 15). Mental health, behavioural, and neurodevelopmental conditions represented a higher proportion of the disease areas linked to consumer devices (9.3%) than of those linked to devices overall (36/493, 7.3%). This was the same for sleep and sleep conditions (5.2% compared to overall 17/493, 3.4%). Whereas respiratory (7.2%) and neurological conditions (11.3%) represented a smaller proportion linked to consumer devices compared to those linked to devices overall (47/493, 9.5% and 76/493, 15.4 respectively).

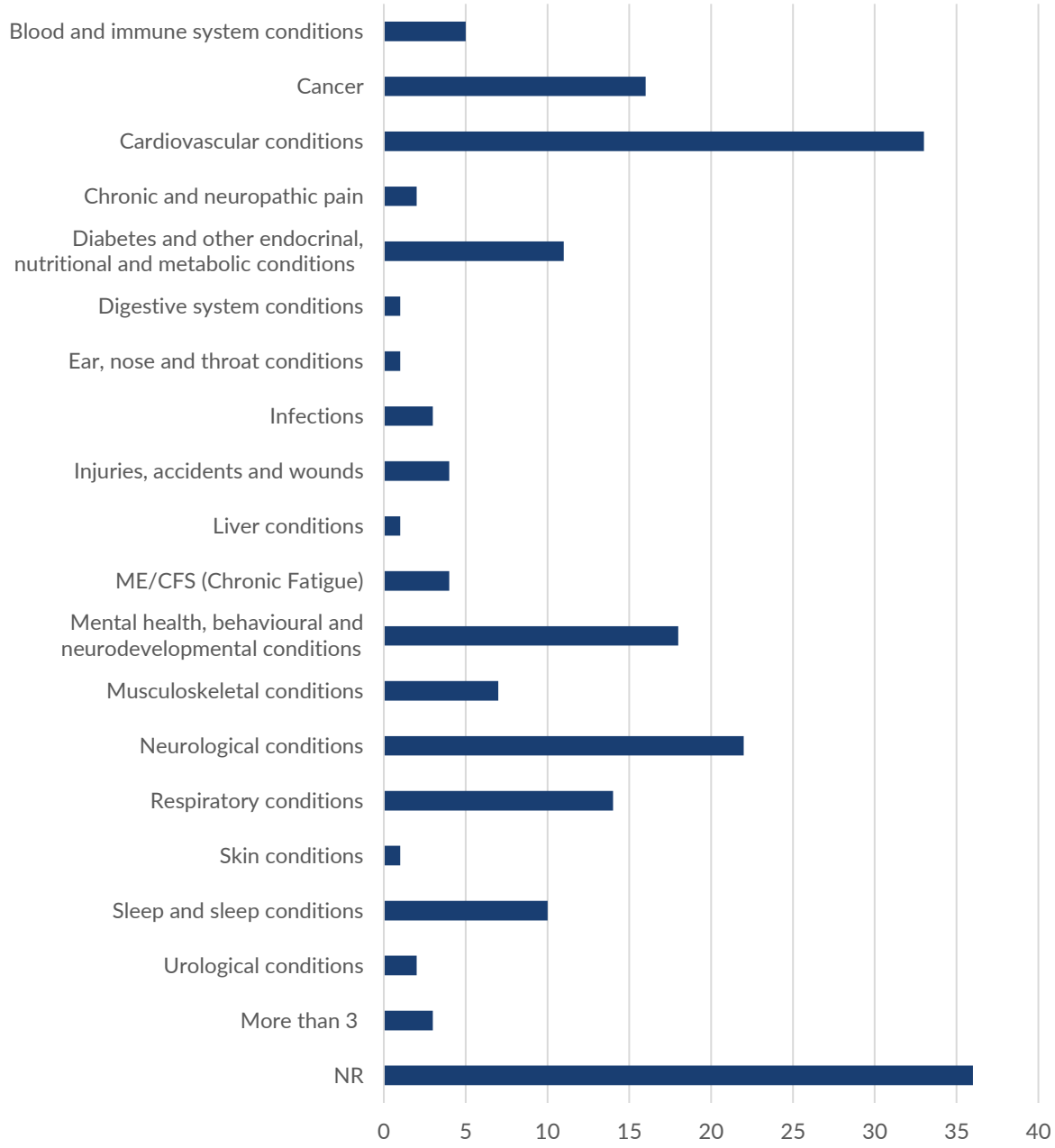

Figure 15 The disease areas of the consumer devices used for chronic disease management

Location

The most common developer country was the US (85), with only five counts of named devices being developed in the UK, representing two distinct technologies. Counts represent the total number of occurrences of named wearables developed in that country, so the number of unique wearables may be lower than the total count. For example, 61 of the occurrences of US-developed wearables were Fitbits and Apple Watches. The developer locations of named wearable devices (128 devices) identified in bibliographic abstracts are displayed in Figure 16.

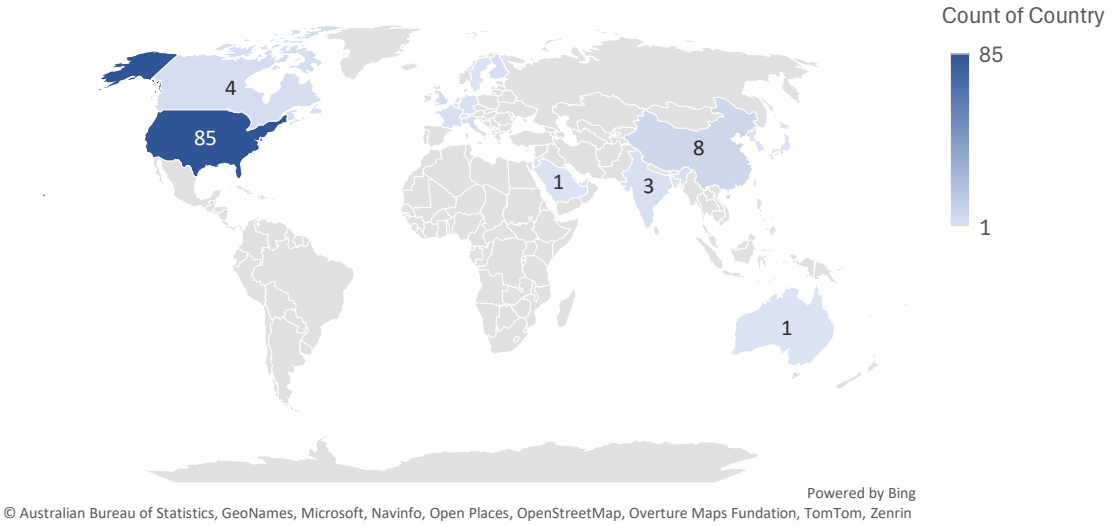

Figure 16. Developer locations of named wearable devices identified in bibliographic records. Counts represent the total number of occurrences of named wearables developed in that country, so the number of unique wearables may be lower than the total count

The devices developed in the UK were iRhythm Zio ECG monitor (featured in two records),[21] and the Respeck respiratory monitor (featured in three records).[22-24]

Technology readiness levels

Within the 423 records identified, 302 technologies were assigned an individual TRL (Figure 17). The consumer device label was given to 114 records where technologies were a commercially available general-purpose wearable, such as a Fitbit or Apple Watch, not regulated as a medical device, but used within the study for health-related purposes. Therefore, these were not assigned a TRL. Seven technologies were discontinued. TRL 6 was the most common, observed in 43.7% (125/302) of technologies. 49% (148/302) of technologies were in the earlier stages of development (TRL 2-5), and 4.3% (13/302) in or passed the regulatory stages (TRL 8-9).

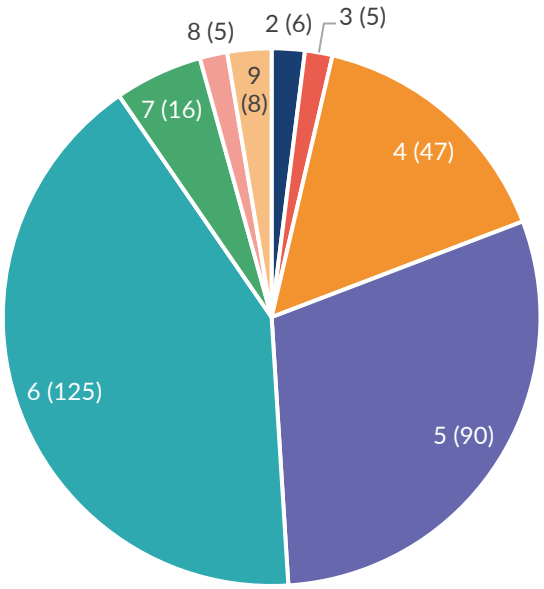

Figure 17 TRLs of technologies (n = 302)

Some disease areas, such as: cancer; chronic and neuropathic pain; ear, nose and throat conditions; eye conditions; injuries, accidents and wounds; liver conditions; sleep and sleep conditions; skin conditions; and oral and dental health did not appear in records that studied technologies later in development, remaining in TRLs 2-6 (Figure 18). Some records were identified to be at later stages of development, such as those targeting cardiovascular conditions or those studying more than one condition.

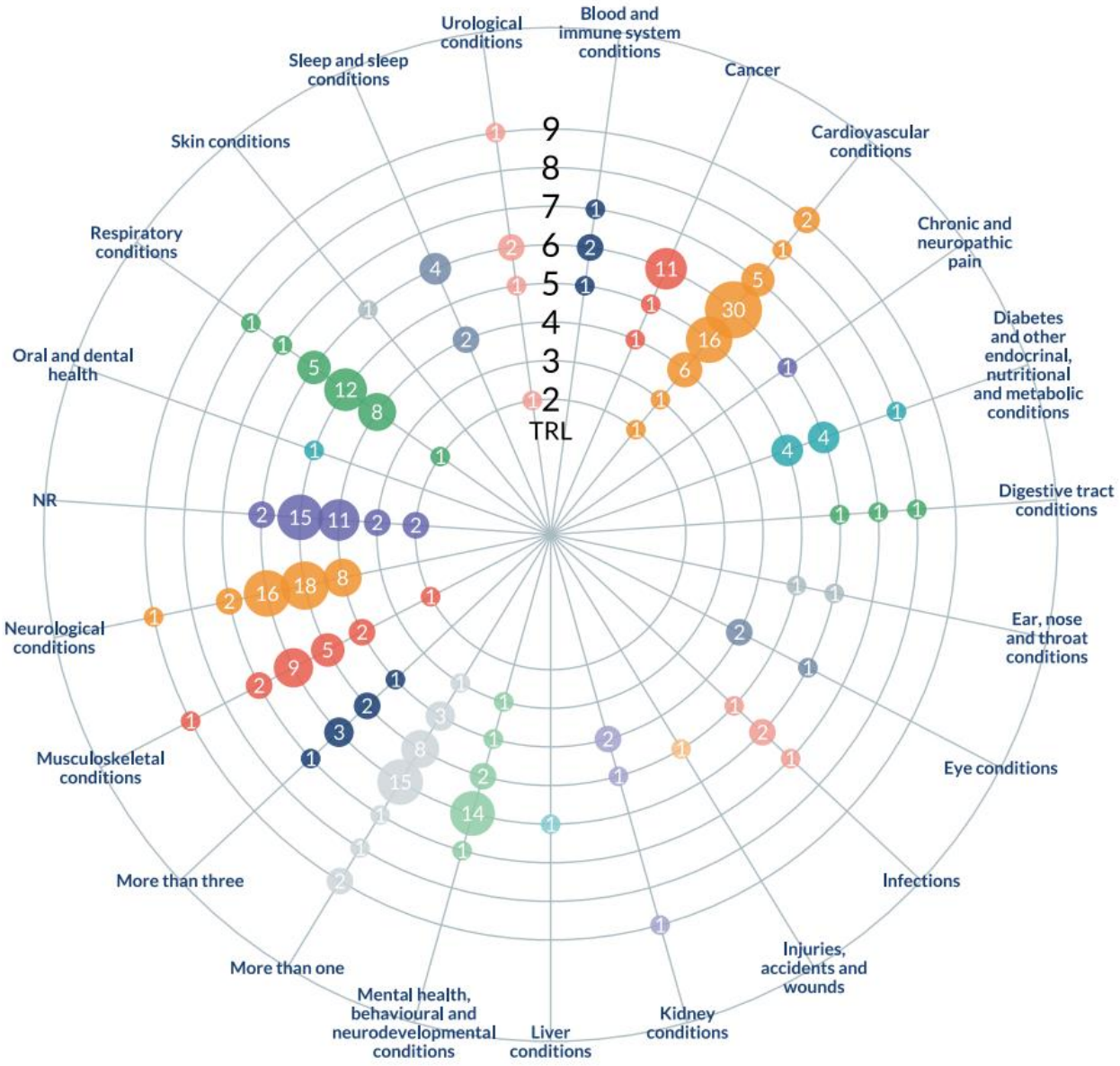

Figure 18 Technology radar to represent technologies by disease area and TRL. In a TRL radar, the distance from the centre indicates development stage: the farther a technology is from the centre, the closer it is to full deployment or commercial readiness. Abbreviations: NR, not reported

The eight types of wearables in later stages of development (TRL 8-9) were a belt, watch, sensor, implant, other, patches or not reported (Figure 19).

Records concerning wristbands, chest-based devices, earables/earphones, eyewear, holters, masks and rings were not at later stages of development, remaining in TRLs 2-6, whereas patch technologies often appeared later in the developmental stages.

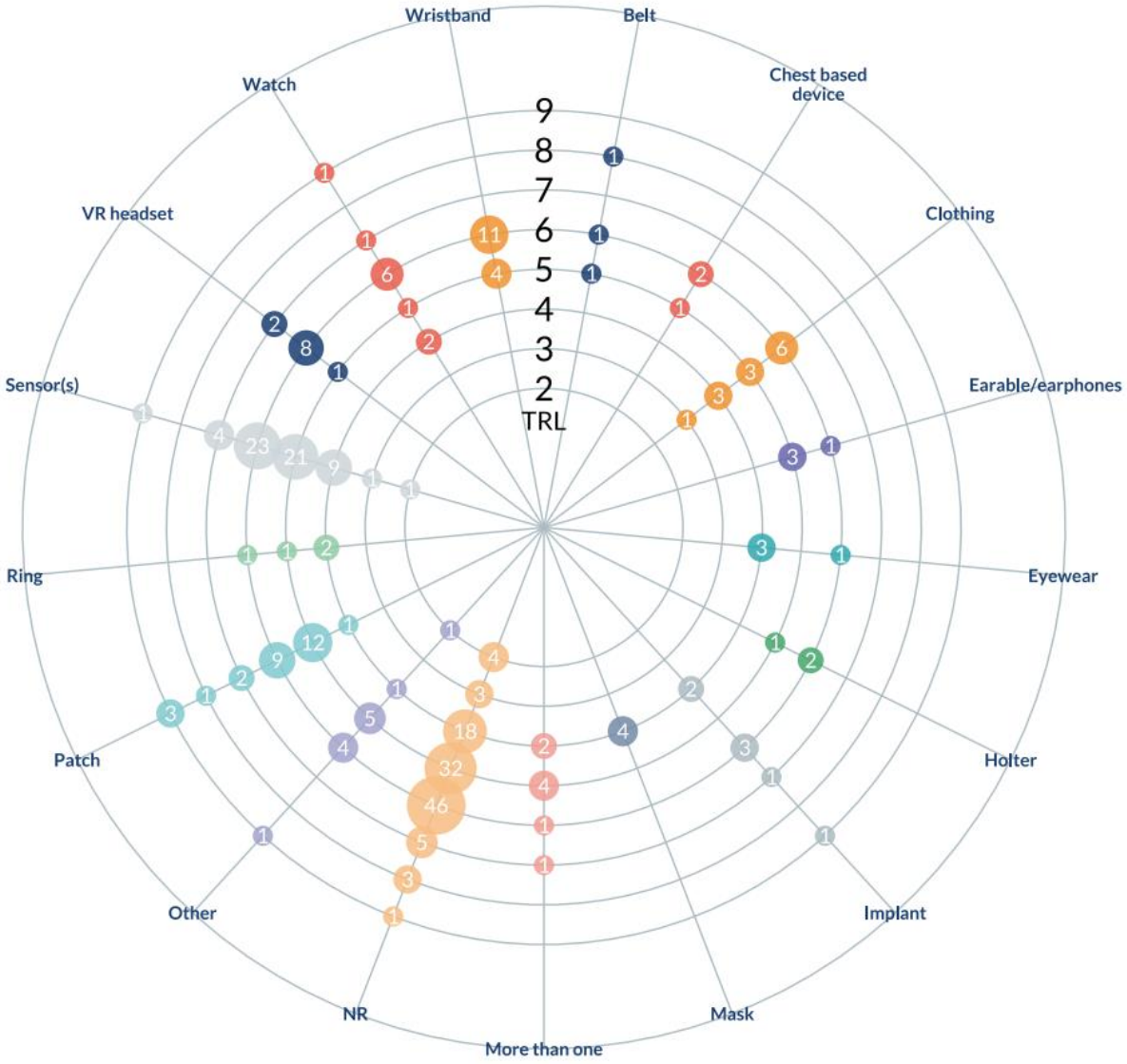

Figure 19 Technology radar to represent technologies by wearable type and TRL. In a TRL radar, the distance from the centre indicates development stage: the farther a technology is from the centre, the closer it is to full deployment or commercial readiness. Abbreviations: NR, not reported.

Patient feedback and checklist development

Through meeting with the PAG, attributes and functionalities of wearable devices that may promote user acceptance, concerns or barriers to adoption were discussed, which highlighted the five following major themes: *outcomes*, *safety*, *health equality and accessibility*, *aesthetics and usability*. The following narrative provides an overview of the key statements raised during the focus groups and how these were applied in the development of the patient preference checklist to be considered for wearable devices in health care presented in Table 4.

Outcomes from using wearable technologies

PAG members expressed that if a wearable helps patients become more informed about their condition, this is seen as a positive feature and can serve as a psychological aid. They noted that such benefits are particularly valuable for conditions like diabetes or arthritis, where wearables could have a preventative role. Members suggested that some wearables may be used as essential tools for condition management, while others may be used as supportive aids that help patients better understand themselves and live more comfortably with their condition.

Facilitated checklist item: Is there evidence that wearables improve disease outcomes or improve patient quality of life by helping the patient better manage their condition?

The group highlighted that wearables can help reduce reliance on clinicians and promote greater patient independence.

Facilitated checklist item: This could be achieved by allowing reducing the need for frequent clinician visits, enabling patients to engage in activities they might otherwise avoid, and supporting greater self-management of their condition with less clinician input.

The group emphasised the importance of wearables being integrated into standard care pathways and taken seriously by clinicians. It was also considered important that the data provided is useful for both patients and healthcare professionals, filling current information gaps relevant to chronic diseases. Members stressed that if the device provides alerts or notifications, it should include clear guidance on what actions to take. Otherwise, there is a risk of unnecessary anxiety if patients cannot respond meaningfully to the information. They stressed the need for clear instructions not only on how to use the device, but also on how to interpret its feedback and what to do in response. They also emphasised adaptability of the device and whether it can be personalised to the user.

Facilitated checklist item: All the data provided by the device should serve a meaningful purpose. The focus should be on reassuring the patient rather than causing unnecessary anxiety. When the device issues a warning or alert, it should be accompanied by actionable information, such as next steps or guidance to contact a healthcare professional.

Safety

The group asked who receives the data or has access to the data and how it is stored. Ensuring there was compliance with data governance standards was highlighted as a major concern amongst members.

Facilitated checklist item: There should be full transparency on what data is shared and who it is shared with. Data should not be shared unnecessarily.

Health equality and accessibility

Cost was identified as the most important factor, as high prices could limit access and restrict the size of the market. Participants raised concerns about accessibility for people who are not technologically confident or who do not own a smartphone. Useability concerns were raised, such as whether the data is automatically shared with the GP or requires patient input. Elements that affect accessibility include the cost of the device and the access and useability

to all groups of people. The group discussed how certain cultural or religious practices may affect use, such as the need to remove devices for washing or prayer.

Facilitated checklist item: Will the device's useability, accessibility or cost limit its availability to certain groups, thereby contributing to health inequalities?

Aesthetics

Visibility of the device was an important consideration, particularly for individuals who may not wish to disclose a diagnosis or health condition. Members suggested that wearables should be designed to be discreet and available in skin tones that make them less noticeable. Some noted that devices like smart glasses can feel intrusive or socially awkward unless designed to be very unobtrusive. Future innovations seen as most desirable included subtle, chip-level technologies that are integrated seamlessly into daily life.

Facilitated checklist item: Is the device as hidden or unobtrusive as it can possible be while still fulfilling its purpose?

Usability

Comfort was identified as a major factor in wearability, especially for specific groups such as pregnant people. Members of the PAG stressed that a device would need to be comfortable enough to wear while sleeping. For certain devices, such as rings, consideration should be given to swelling that may occur due to health conditions. Participants highlighted the importance of easy removal for washing or other daily activities, and that the design should accommodate varying user needs. They noted that some devices may not adhere well to all skin types or levels of perspiration.

Facilitated checklist item: Is the device suited for ease of wear for the intended user. For devices that need to be worn continuously, does it matter if they are removed for certain activities. Is it waterproof? Can they device be easily removed and set-up again?

Table 4 Patient preference checklist to be considered for wearable devices in health care

Theme	Question
Outcomes	• Does the technology improve patient quality of care? • Does the technology increase patient independence? • Is the data provided to the patient useful, necessary, and presented in an effective manner?
Safety	• Does the technology ensure privacy of patient data?
Health equality and accessibility	• Will this technology be accessible for all who need it? (including access, useability and costs) • Does the technology exacerbate health inequalities?
Aesthetics	• Is the technology visible? If so, is the design unobtrusive?
Usability	• Is the device reasonably comfortable? • Is the device designed to ensure adaptability and ease of wear?

Reporting of missing data

During data extraction and analysis, missing data from records retrieved or information that was unretrievable from the developer's website, was stated to not be reported and included in the analysis.

Risk of bias and quality of evidence

Due to a lack of full text or supporting information retrieved for each record that would permit a robust assessment of the risk of bias and quality of evidence, this was not performed.

Implications and recommendations

During this horizon scan for wearable technologies for chronic disease management in the MedTech development pathway, 576 records were identified, including patents, funding projects, clinical trials and bibliographic records.

Data sources

Similar to in the remote monitoring arm of the project,[12] most of the records identified were sourced from bibliographic databases and patent registries. A quarter of records described technologies within the emerging horizon, indicating this field of MedTech is still expanding and being explored by developers. Just over 10% of records were sourced from clinical trial registries. Given this and considering that such a large proportion of the identified wearables are consumer devices, the accessibility and motivation to pursue formal clinical validation may be constrained. Clinical trials often demand substantial funding and institutional support. However, the proportion of records from funding sources was higher in this report (nearly 6%) when compared to remote monitoring of vital signs (nearly 2%),[12] indicating greater early-stage research investment. However, this has not translated into a higher concentration of clinical trial studies, likely because most funding supports early feasibility and development work rather than expensive late-stage trials, and because chronic disease management technologies face additional barriers to progressing into full clinical evaluation. It may be because small companies dominate this space, and many do not have sufficient capital to progress beyond feasibility studies even when initial funding is available.

Location

Across all sources, development activity originating in the UK was relatively low. A potential concern is that evidence generation is occurring in populations and healthcare systems irrelevant to the health technology appraisal process in the UK.

One device developed in the UK identified in bibliographic records was the iRhythm Zio ECG monitor, which was found to be more effective at detecting atrial fibrillation after ischaemic stroke than conventional holter monitoring.[21] The other UK-based device was the Respeck respiratory monitor. One study developed computational methods for classifying episodes of rapid-shallow breathing collected from patients with chronic lung diseases using Respeck.[24] Another aided pulmonary rehabilitation by classifying exercises using machine learning techniques with a maximum accuracy of 93%.[23] The final record studied the use of the Respeck

device in monitoring coughs, using deep learning-based cough classification method, achieving an accuracy of greater than 82%.[22]

China, the USA and India were the top countries for patent filings. This pattern was consistent across all three arms of the wider wearables project. This may reflect differences in government incentives, market size, and national research priorities. The higher number of filings from China compared with the USA may also relate to differences in patent filing behaviour or the coverage of the databases searched (e.g., Patentscope, Espacenet), which index Chinese filings comprehensively.

Funding, patents and clinical trials

In the funding landscape, the top two disease areas were neurological conditions and diabetes and other endocrinal, nutritional and metabolic conditions. This is promising as neurodevelopmental conditions and diabetes are NICE priority topics for 2024 to 2025. However, there was only one funding record relating to mental health, another NICE priority.[25] One example is a record that demonstrated a VR nature intervention to reduce reported fatigue, depression and improve reported quality of life, in woman with metastatic breast cancer.[26]

The most frequently stated classification associated with included patents pertained to inventions simultaneously evaluating both cardiovascular conditions and different types of body conditions. As the NHS 10-year plan sets out cardiovascular disease as one the top clinical priorities,[3] these technologies may warrant particular attention to ensure they progress effectively through subsequent stages of development and regulatory assessment.

The most common disease areas represented in the clinical trial records were respiratory, cardiovascular, and cancer conditions. The high volume of cardiovascular-related records in both patents and clinical trials indicates that technologies receiving intellectual property protection are also attracting sufficient investment to progress into early-stage clinical evaluation. However, given that TRL 6 was the most frequently assigned level among clinical trials, this suggests that many technologies may be entering initial human studies but are not advancing into larger, later-stage clinical trials. Additional support mechanisms may be required to help promising technologies progress beyond early evaluation and toward regulatory approval.

Bibliographical records

In line with some of the priority topics highlighted by NICE and the UK Government,[3,25] the most common disease areas for application were cardiovascular conditions and neurological conditions. There were also 36 bibliographic records focusing on mental health, behavioural and neurodevelopmental conditions.

When the abstract reported a target population age, most technologies were studied in adults (18-64 years) whereas in remote monitoring of vital signs and rehabilitation,[12,27] most technologies were studied in older adults (65 years and older). This pattern may reflect a distinction between proactive disease management earlier in adulthood and functional support needs in older adults. Older adults may have a greater need for continuous monitoring and

rehabilitation due to age-related conditions and frailty. However, care must be taken to ensure technologies are accessible, usable, and effective for all relevant age groups, not just the most studied populations.

Like in the other arms of the project, very few technologies were studied in a non-adult population, aged 17 years and under. This suggests a broader lack of child-specific disease-management devices and strategies. Children often have different physiological baselines, developmental needs, and patterns of disease, meaning adult-designed technologies may not be appropriate or validated for paediatric use. This gap may therefore pose a problem, as it limits the availability of suitable tools for early diagnosis, monitoring, and long-term management of chronic conditions in younger populations. This is a major issue because many chronic diseases, such as asthma, type 1 diabetes, epilepsy, neurodevelopmental conditions, begin early.

There was a larger variation of types of wearables for chronic disease management when compared to remote monitoring.[12] This variation may relate to their intended use, as many chronic disease wearables are designed not only for monitoring but also to deliver treatment or support behaviour change. However, watches were still the most common type of wearable. This may be partly caused by the large number of Apple Watches and Fitbits used in these studies, which represented just under two thirds of the watches.

As expected for chronic disease management, the most common intended purpose of bibliographic records was management. However, devices were also used to diagnose as well as manage the condition (over 50). Relatively few devices focused on prevention of chronic diseases, despite prevention leading to better long-term health than managing symptoms after onset, as well as being widely recognised as more cost-effective than treatment. Additionally, the NHS Long Term Plan puts an emphasis on prevention,[28] and the PAG also considered prevention an important priority.

Additionally, the large proportion of wearables marketed as consumer devices suggests an accelerating use of these devices within healthcare. This may be further emphasised by the lack of records retrieved from the INAHTA as such consumer devices will fall outside of the INHTA's scope. Such trend raises important questions regarding their clinical validity, accuracy, data governance, and suitability for decision making in medical contexts. It is notable that consumer devices were more frequently associated with mental health, behavioural, neurodevelopmental, and sleep-related conditions. This likely reflects the growing use of consumer technologies for promoting wellbeing and self-management, rather than a difference in the perceived importance of these conditions. On the other hand, respiratory and neurological diseases often require specialised measurements or clinical validation, which may limit their representation among consumer-grade devices. However, this distinction raises concerns, as regulated and clinically validated technologies are particularly important in mental health, where inaccurate monitoring or feedback can have significant consequences for patients. It is also important to note that some consumer devices do obtain medical-device clearance for specific functions. For instance, Fitbit and the Withings ScanWatch have received regulatory clearance (e.g., FDA and EU) for certain features, such as Fitbit's ECG app for detection of atrial-fibrillation-related

irregular rhythms.[28] Although, clearance usually applies to specific functionalities, not the entire device.

In terms of maturity, most non-consumer technologies were at mid-stage TRLs (TRL 5-6), representing a bottleneck of technologies which are being evaluated early human studies but have not progressed to larger clinical trials or regulatory approval. Compared with remote monitoring of vital signs,[12] a greater proportion of chronic disease management technologies were at earlier development stages (TRL 4 and below). Whereas a smaller proportion of chronic disease management technologies were at mid-stage clinical evaluation (TRL 6–7) or approved as medical devices (TRL 8-9). Technologies that remotely monitor vital signs may progress more easily through later TRLs because they typically rely on well-established physiological measurements (e.g., heart rate, oxygen saturation, respiratory rate) and often require shorter evaluation periods. In contrast, chronic disease management technologies frequently involve behavioural components, long-term outcomes, or complex data, making them harder to validate, more expensive to trial, and slower to progress toward regulatory approval. Therefore, a larger and more strategically targeted allocation of funding may be needed to support chronic disease management technologies through later stages of development and towards regulatory approval.

Several disease areas, such as cancer, chronic and neuropathic pain; ear, nose and throat conditions; eye conditions; injuries, accidents and wounds; liver conditions; sleep and sleep conditions; skin conditions, did not appear among technologies at later development stages, with most remaining at TRLs 2–6. This may indicate barriers such as the need for highly specialised sensors, or smaller market sizes. As ophthalmology is a NICE priority topic for 2024 to 2025,[25] the three technologies identified relating to eye conditions may require targeted investment to progress towards clinical trial evaluation.

Wearable patches were more often at later stages of technology compared to other types of devices. This may reflect the relative maturity of medical patches, which are generally simpler to manufacture, easy for users to wear, and already well-established within clinical practice. The larger number of diverse device types in the earlier stages of development suggests that the future landscape of wearables may be changing, as new monitoring methods and technologies continue to emerge and advance. However, many of these emerging, more unusual wearables may ultimately bypass formal medical regulation by entering the market as consumer devices, as their 'cutting-edge' appeal may drive market demand. Instances of this happening include certain VR headsets and smart rings, such as the Oura Ring. [29] This raises important considerations about their clinical validity, safety, and integration into healthcare pathways.

AI use

In alignment with fast evolving MedTech and healthcare priorities, the UK Government announced the Software and AI As A Medical Change Programme in 2022 to ensure regulatory requirements for these integral components was clear to manufacturers and that the public and patients are protected.[30] Nearly a quarter of bibliographic records implemented AI. This is a considerably higher use of AI when compared to devices used for remote monitoring or rehabilitation.[12,27] Possible explanations include the suitability of AI for analysing complex

multimodal data typical of chronic disease management, the rapid growth of AI-driven decision support tools, and greater availability of labelled datasets in these conditions.

One record that proposed AI integration used a pair of smart glasses, called LidSonic V2.0 to aid in the identification of obstacles for the visually impaired.[31] This technology predicts objects using deep learning for environment perception and navigation. Another record used machine learning to forecast migraine attacks based on diary entries and physiological measurements collected by wireless wearable sensors.[32]

Records that implemented AI had a higher proportion of diagnosis as an intended purpose compared with those that did not use AI. This likely reflects the strength of AI-based methods in identifying complex patterns within physiological, behavioural, or imaging data. AI-enabled wearables may therefore have important potential in supporting national priorities such as the NICE focus on earlier detection of cancer and prevention.[4,28] By automating the recognition of subtle or early signals of disease, these technologies could contribute to faster diagnosis, triage, and referral, especially in areas where early intervention is critical to improving outcomes. For example, one record presented a smart watch which collects physiological measurements and used machine learning to continuously report the user's body condition and predict multiple disease vulnerabilities.[33]

Implantable devices

Implantable devices identified included the Abbott Confirm Rx and the BlueWind RENOVA iStim System, as well as devices which were not named. The Abbott Confirm RX is an implantable cardiac monitor. Three studies looked at automated seizure detection,[34-36] with a sensitivity of 92.6% reported in one.[34] The BlueWind RENOVA iStim System is an implantable battery-less tibial nerve stimulator to treat refractory overactive bladder patients.[37,38] Although implantable devices are typically considered more invasive, they may still be appropriate in clinical areas where non-invasive alternatives are ineffective or unavailable, and where the potential therapeutic benefits outweigh the procedural risks.

Patient preference checklist

The patient preference checklist for wearable devices in health care consists of nine questions within five topics. Further comments and input from the PAG should be used in combination with the checklist during its use. This checklist can be used by developers during the design and production stages, as well as to evaluate existing wearables either internally or by external reviewers. An attempt was made to evaluate some of the wearables identified in this report; however, obtaining all the necessary information proved challenging without direct access to the device and without input from the intended user population. Therefore, it is recommended that the checklist be applied only when both the device itself and feedback from target users are available.

Limitations of the data and horizon scanning processes used

Owing to the resources available and time constraints, full texts were not retrieved for bibliographic records. Subsequently, this limited the retrieval of all potentially relevant and supporting information, as well as the capacity to assess risk of bias and certainty of evidence. This contributed to substantial missing data, frequently recorded as 'not reported', and reduced

the depth of some analyses. For instance, AI-related methods and components could not be extracted consistently across all records and therefore could not be analysed. Furthermore, while information for named technologies was retrieved from developer websites, when possible, required information was not always accessible or clearly reported. As a result, this may limit the accuracy, transparency and depth of the derived results and conclusions stated here.

The horizon scan was restricted to a defined number of data sets and did not include soft intelligence sources. Additionally, judgement of TRLs were based on information retrieved and available during the project, which may therefore be subject to bias. Lastly, in this horizon scan a semi-automated approach was used for screening and data extraction. While the process involved significant human input to ensure quality assurance, it contributed to the validation of using a LLM in horizon scanning methods.

Limitations associated with automation in screening and data extraction

The usage of LLM automation in the screening process may potentially lead to missing records. We took steps to mitigate this limitation by using separate prompt development and evaluation datasets, screening additional samples of excluded records, and implementing an additional priority screening workflow step to enable review of likely relevant records excluded by the LLM.

The usage of LLM automation in data extraction may equally lead to missing pieces of information. Errors may be caused by the LLM missing information that is present in a title and abstract, by missing information that is implied, or by the LLM not being able to seek additional information outside a given source context (eg. by accessing device manufacturer websites as humans may do). To quantify errors and categorise them, we analysed the two missing pieces of information within the Disease area and Vitals categories. These errors were minor (LLM detected heart rate in one record when extracting Vitals; humans extracted heart rate, sleep, activity. In disease area, the disease in the one false negative record was not directly reported within the context available to the LLM and thus missed). High sensitivity indicated that the LLM did not miss relevant information, and slightly lower precision indicated that the LLM tended towards extracting additional or unspecific information that would require deletion by humans upon review. We therefore proceeded with LLM semi-automation, where humans verified the automatically extracted data, which led to time-savings during data extraction while ensuring human oversight and quality control throughout.

Conclusion

This horizon scan provides an indication of the emergence of wearable technologies, with application in chronic disease management across the research development pipeline. The high numbers of records included highlights the rapid growth in this field of MedTech, and chronic disease areas which are being target and where further research and support is unmet. Ensuring regulatory and data governance frameworks remain adaptable to these emerging developments is essential for fostering innovation while safeguarding privacy, security, and ethical standards. Overcoming challenges in accessibility, and clinical validation and patient

acceptance for safe and effective uptake, will be important for successful integration of these wearable technologies into the health care system.

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Appendix A: Patient Advisory Group meeting

Questions to guide the discussion in the first PAG focus group:

- What do you as view “game-changing” tech?
- What elements are most important to you for a wearable medical device e.g., comfort, appearance, accuracy, convenience, safety, user friendly, effectiveness, cost, time required/saved etc
- Are there any chronic diseases/disorders/conditions you think would benefit from wearable tech?
- There are many different types of wearables, rings, watches, glasses, etc is there any type of wearable that you wouldn’t like to wear? If not, why?
- (If happy to discuss) are there any wearable medically approved devices that you have used? How was your experience? Good/bad?
- Are there any levels of healthcare that you think wearables would be most impactful and vice versa?

Appendix B: Funding

Table 5. Funding projects identified from CORDIS relevant to wearable devices for chronic disease management

Grant agreement ID	Acronym	Title	Total cost, €	EU contribution, €	Start date	End Date	Co-ordinated by
101046333	INTEGRATE	Biointegrable soft actuators alimented by metabolic energy	1698750	1698750	01/06/2022	31/05/2026	Belgium
101058278	EarDiTech[a]	Precision Hearing Diagnostics and Augmented-hearing Technologies	2499416	2499416	01/08/2022	31/01/2026	Belgium
101057436	PRISMA	MICRO-MECHANICAL PUMP FOR NEXT GENERATION INSULIN DELIVERY SYSTEMS	2499839	2499838	01/07/2022	30/06/2025	Denmark
101068646	HAMP	Heart Attack Monitoring Patch (HAMP)	NR	148478	16/06/2022	15/06/2024	Turkey
101070477	SusFE	Innovative Processes & Methodologies for Next Generation Sustainable Functional Electronic Components and Systems	2811561	2811561	01/10/2022	31/03/2026	Spain
190180051	SUNRISE Tx	Elisa –a connected, affordable light solution for treating sleep apnea.	2771250	1939875	01/07/2022	31/12/2024	Belgium

101066123	GlymphoSleep	Exploring neuro-glymphatic coupling during sleep using wearable technology	NR	203464	01/03/2023	28/02/2025	Netherlands
101095672	PRAESIIDIUM[a]	PHYSICS INFORMED MACHINE LEARNING-BASED PREDICTION AND REVERSION OF IMPAIRED FASTING GLUCOSE MANAGEMENT	5 808 741	5808740	01/01/2023	31/12/2025	Italy
101092612	SUN[a]	Social and hUman ceNtered XR	7482543	7482543	01/12/2022	30/11/2025	Italy
101099210	AEGEUS[a]	AEGEUS - A Novel EEG Ultrasound Device for Functional Brain Imaging and Neurostimulation	2998989	2998989	01/03/2023	28/02/2027	Germany
101098826	SKINDEV	SKIN MICROBIAL DEVICES	1718409	1718408	01/02/2023	31/01/2027	Spain
101095697	iPROLEPSIS[a]	iPROLEPSIS: PSORIATIC ARTHRITIS INFLAMMATION EXPLAINED THROUGH MULTI-SOURCE DATA ANALYSIS GUIDING A NOVEL PERSONALISED DIGITAL CARE ECOSYSTEM	6483 091	6483 091	01/01/2023	31/12/2026	Greece
101099481	RELIEVE[a]	First Closed-loop non-Invasive Seizure Prevention System	2809260	2809260	01/04/2023	31/03/2026	Czech Republic

101113995	SensCare	AI-based wearable sensors for continuous monitoring of diabetes and cardiovascular diseases	NR	75000	01/07/2023	31/03/2024	Turkey
101114304	identifyHer[a]	A DIRECT 2 CONSUMER SOLUTION FOR PERIMENOPAUSAL SYMPTOM DETECTION	NR	75000	01/07/2023	31/01/2024	Republic of Ireland
101099093	Prometeus	Preterm Brain-Oxygenation and Metabolic EU-Sensing: Feed the Brain	3554156	3554156	01/02/2023	31/01/2027	Italy
101115504	KERMIT	Kidney Disease Sweat sensor patch for Early diagnosis and Remote MonIToring	3080624	3080624	01/07/2023	30/06/2026	Austria
101115337	WOUNDSENS	A Paradigm Shift in Health Monitoring with Electrospun Enzymatic Neomaterials	2934319	2934319	01/11/2023	31/10/2027	Spain
190144382	FLUAR[a]	FLUAR - A novel solution for fluorescence-guided surgery based on augmented reality	3514695	2458000	01/04/2023	31/03/2025	Luxembourg
190189473	SONOPHORESIS SMARTPATCH	Sonophoresis smartpatch for pain-free, controllable, and wearable transdermal drug delivery	3840375	2499999	01/08/2023	31/05/2026	Spain

190185304	ARCHANGEL[a]	Advanced Remote Continuous patient Health mANaGemEnt SoLution	3480000	2436000	01/08/2023	31/07/2025	Bulgaria
190129251	ADAPTE[a]	A novel and accurate emotion recognition system for real-time and continuous patient monitoring in psychiatry	3568155	2497708	01/11/2023	30/04/2026	France
101137227	ThrombUS[a]	ThrombUS+: Wearable Continuous Point-of-Care Monitoring, Risk Estimation and Prevention for Deep Vein Thrombosis	9565764	8141251	01/01/2024	30/06/2027	Greece
101130192	UltraSense[a]	ULTRA-SOUND COMBINED WITH BIA AND GRAPHENE FET-ENHANCED WEARABLE SENSING FOR DECENTRAL HEALTH-MONITORING	NR	6984473	01/09/2024	31/08/2028	Greece
101163362	INTEGRAL[a]	Enabling Unobtrusive Real-World Monitoring of Brain-Networks with Wearable Neurotechnology and Multimodal Machine Learning	1654850	1654850	01/01/2025	31/12/2029	Germany
101180173	GESTUS[a]	Solution for body kinematics monitoring	1764975	1362420	01/10/2024	31/03/2027	Italy

101188662	PhotoMod	Transcranial photobiomodulation for motion sickness mitigation	NR	150000	01/01/2025	30/06/2026	UK
101189448	BladderWatch	WEARABLE ULTRASOUND FOR CONTINUOUS BLADDER MONITORING	0	150000	01/10/2024	31/03/2026	Turkey
101057524	TARA	Disrupting the Migraine continuum of care for resource constrained settings	5744005	4260220	09/01/2022	02/28/2026	Italy
101156542	PerPrev-CID[a]	Personalized disease prediction and prevention in chronic inflammatory disorders	NR	11000247	01/01/2025	31/12/2029	Germany
101136376	SmILE[a]	Smart Implants for Life Enrichment	19992183	19992183	01/01/2025	31/12/2029	Germany
101164780	NOBIAS	Novel diffuse Optical method to combat skin color bias in non-invasive optical biomarker sensing devices such as pulse oximeters	1582349	1582349	01/03/2025	28/02/2030	Republic of Ireland
101208856	OASYS	Optimizing Antiambipolarity in OMIECs for Efficient Biohybrid Synapses	NR	236340	15/08/2025	14/08/2027	Sweden
101210542	NextTremor	New-generation wrist exoskeleton with variable stiffness and optimized	NR	276188	02/09/2025	01/09/2027	United Kingdom

		biomechanics for tremor suppression					

Abbreviations: NR, not reported
Footnote: a, projects stated to implement artificial intelligence within the project objectives summary.

Appendix C: Patents

Table 6. All International Patent Classification (IPC) symbols from included patent records and their count

IPC symbols	Count	IPC symbols	Count	IPC symbols	Count
A41D 13/12	1	A61G	1	G16H 10/60	6
A41D 27/00	1	A61G 10/02	1	G16H 10/65	2
A41D 27/20	1	A61H 9/00	1	G16H 15/00	3
A42B 3/04	1	A61J 1/00	1	G16H 20/10	1
A44C 5/00	1	A61J 7/04	1	G16H 20/13	1
A44C 5/02	1	A61M	1	G16H 20/30	1
A61B	3	C12M	1	G16H 40/20	2
A61B	8	G01C 21/00	1	G16H 40/60	2
A61B 3/10	1	G01K 1/024	1	G16H 40/63	1
A61B 5/00	42	G01K 13/20	1	G16H 40/67	9
A61B 5/01	5	G01P 15/00	1	G16H 50/00	1
A61B 5/02	1	G06F	1	G16H 50/20	3
A61B 5/0205	27	G06F 16/174	1	G16H 50/30	9
A61B 5/021	6	G06F 16/25	1	G16H 50/50	1
A61B 5/022	1	G06F 18/213	1	G16H 50/70	1
A61B 5/024	12	G06F 18/241	3	G16H 50/80	1
A61B 5/053	1	G06F 18/25	2	G16H 80/00	6
A61B 5/08	5	G06F 21/44	1	G16Y 10/60	1
A61B 5/11	10	G06F 21/62	2	G16Y 20/10	1
A61B 5/113	1	G06K 7/14	1	G16Y 20/40	1
A61B 5/117	2	G06N 3/045	1	G16Y 40/10	1
A61B 5/145	14	G06N 3/0464	1	G16Y 40/20	1
A61B 5/1455	3	G06N 5/022	1	G16Y 40/50	1
A61B 5/256	1	G06Q	2	H04L	1
A61B 5/265	1	G06Q 10/0631	1	H04L 67/12	1
A61B 5/268	1	G06Q 30/00	1	H04N	1
A61B 5/27	1	G06Q 50/26	1	H04W	2
A61B 5/28	1	G07C 9/00	1	H04W 4/02	3

A61B 5/282	1	G08B 15/00	1	H04W 4/029	4
A61B 5/291	1	G08B 21/02	5	H04W 4/18	1
A61B 5/296	1	G08B 21/04	2	H04W 4/20	1
A61B 5/318	3	G08B 21/24	1	H04W 4/38	3
A61B 5/33	2	G08B 25/01	2	H04W 4/80	5
A61B 5/332	2	G08B 25/04	1	H04W 4/90	3
A61B 5/363	1	G08B 25/08	1	H04W 84/06	1
A61B 5/369	2	G08B 29/18	1	H04W 84/12	1
A61B 5/384	1	G08C 17/02	1	H04W 84/18	2
A61B 90/90	1	G16H	5	H05K	1

Appendix D: Clinical trials

Table 7. Clinical trials investigating wearable devices for chronic disease management

Title and accession number	Country of sponsor/ developer	Start date	Study status	Disease area	Brand name	Type of device	AI used	Intended purpose	TRL
Adaptive, Real-time, Intelligent System to Enhance Self-care of Chronic Disease; NCT03643692	UK/NR	26/02/ 2019	Completed	Diabetes and other endocrinal, nutritional and metabolic conditions	ARISES	NR	N	Management	6
Wearable Technology to Assess Gait Function in SMA and DMD; NCT04193085	US/NR	25/11/ 2019	Completed	Neurological conditions	NR	Insoles	N	Management	6
Evaluation of ECG Transmission and AI Models Using Apple Watch ECGs and Symptoms Data Collected Using a Mayo	US/US	05/05/ 2021	Completed	Cardiovascular conditions	Apple watch	Watch	N	Management	Consumer device

iPhone App; NCT05324566									
Accessing Mobility Using Wearable Sensors; NCT04306588	US/US	21/05/2018	Withdrawn	Respiratory conditions; Cardiovascular conditions	LEGSys, BalanSENS	Sensor Straps/ Clips	N	Management	9
The Use of Wearable Technology to Acquire Signals for COPD Research; NCT04495062	UK/NR	01/09/2020	Completed	Respiratory conditions	NR	NR	N	Management	6
WEAICOR: Wearables to Investigate the Long Term Cardiovascular and Behavioral Impacts of COVID-19; NCT04605965	US/NR	09/06/2020	Active Not Recruiting	Infections (COVID included in this); Cardiovascular conditions	NR	NR	N	Management	Not enough information
Application of Wearable Devices to Build a Self-Management Model in Chronic Kidney Disease	Taiwan/NR	13/01/2019	Completed	Urological conditions	NR	NR	N	Management	6

Patients; NCT04617431									
Walking After Surgery to Improve Recovery and Outcomes After Surgery, AIRTECH Study; NCT04783168	US/NR	30/11/2020	Recruiting	Cancer	NR	Nr	N	Management	Not enough information
Apollo Device for Metastatic Breast Cancer (MBC); NCT04983342	US/US	01/02/2021	Completed	Cancer; Sleep and sleep conditions	Apollo Armband	Armband	N	Management	Consumer device
Wearable Health Technology for Perioperative Risk Assessment; NCT05083598	Italy/NR	10/06/2021	Completed	NR	NR	NR	N	Management; prevention	6
SENSING-AI Cohort for Long COVID Patients; NCT05204615	Spain/France	18/01/2022	Completed	Infections (COVID included in this)	Withings Scanwatch	Watch	Y	Management; diagnosis	Consumer device
Wearable and Patient-reported Outcome-	Australia/Switzerland	15/04/2021	Completed	Cancer	Garmin VivoSmart 4	Watch	N	Management	Consumer device

based Continuous Assessment and Support Alerts in Palliative Care; NCT05273580									
Evaluation and Implementation of Mobile Tracking Devices to Increase Safety in Hospitalized Patients (MONITOR); NCT05418881	Germany/ Finland	01/11/ 2021	Unknown	NR	MoveSense	Sensor	N	Management	9
Development of The Pediatric Physical Activity Tracking Platform (Pedi@Ctivity) and Smartwatch-based Big Data Analysis; NCT05509907	Turkey/ Turkey	30/08/ 2022	Unknown	Musculoskeletal conditions	Pedi@ktivite	Watch	Y	Management	6
Verily Clinical Study Watch Analytical	US/US	18/09/ 2023	Active Not Recruiting	NR	Verily Clinical Study	Watch, Patch	N	Management	9

Validation Study; NCT05534477					Watch: Vivalink ECG Patch; Modus StepWatch 4				
Remote Physical Activity Monitoring in Individuals With Metabolic Syndrome; NCT05592704	Lithuania/ NR	21/08/ 2017	Completed	Diabetes and other endocrinal, nutritional and metabolic conditions	NR	NR	N	Management	6
Feasibility Study of AdheraÂ® Fatigue Digital Program for Patients With Long COVID-related Fatigue; NCT05631171	Spain/NR	13/12/ 2022	Completed	Infections (COVID included in this)	NR	Watch	N	Management	6
Feasibility of Remote Activity Assessment and PRO Collection Among Transgender	US/NR	01/02/ 2023	Recruiting	Cancer	NR	NR	N	Management	6

Cancer Survivors; NCT05391217									
Wearable Devices in the Recovery Phase of Acute Exacerbations of COPD (AECOPDs); NCT05776654	Canada/ NR	16/02/ 2023	Completed	Respiratory conditions	NR	NR	N	Management	6
IntelligentCare : Wearable-based Intervention; NCT05777291	Portugal/ NR	01/04/ 2023	Recruiting	NR	NR	Watch	N	Management	6
Effects on Physical and Mental Prognosis and Quality of Life of Elderly People With Depressive Symptoms; NCT05852912	Taiwan/NR	01/06/ 2023	Unknown	Mental health, behavioural and neurodevelopmental conditions	NR	NR	N	management	6
Remote Assessment of Lung Disease and Impact on Physical and	UK/NR	26/07/ 2021	Unknown	Respiratory conditions; Infections (COVID included in this)	NR	NR	N	Management	6

Mental Health; NCT05630599									
Innovative Approaches for Personalised Cardiovascular Prevention; NCT05883878	Italy/NR	24/07/2023	Recruiting	Cardiovascular conditions	NR	Nr	N	management; prevention	6
DTx Algorithms for Personalized Parkinson's Disease Treatment and Medication Plan Optimization; NCT05904288	Italy/NR	10/10/2023	Completed	Neurological conditions	Garmin Vivosmart 5	Watch	Y	management; prevention	Consumer device
Exploring to Remediate Behavioral Disturbances of Spatial Cognition; NCT05944601	Italy/NR	01/03/2023	Active Not Recruiting	Neurological conditions	NR	NR	N	management	6
CHARM-COPD Program of Care; NCT06253013	Canada/US	15/09/2023	Recruiting	Respiratory conditions	Hyfe Smartwatch; FitBit Versa 2	Watch	N	Management; treatment	Consumer device
Effect of Monitoring	Switzerland /US; Ireland	07/02/2024	Recruiting	Cardiovascular conditions	Fitbit Inspire 2:	Watch; Patch	N	Management; treatment	Consumder device;

Continuous Glucose Levels and Physical Activity Via Wearables on Cardiovascular Risk Factors; NCT05969665					Abbott Freestyle Libre 3				MHRA approved
Validation of the C-mo System - Cough Monitoring; NCT05989698	Portugal/ Portugal	11/12/ 2023	Recruiting	Respiratory conditions	C-mo system	Patch	Y	management	7
Telerehabilitation and Tele-psychological Support in Cancer Patients eCANJA; NCT06007001	Belgium	25/09/ 2023	Recruiting	Cancer	NR	Watch	N	management	6
Mindfulness Interventions to Improve Health Activation, Coping, and Stress Among Childhood Cancer Survivors; NCT06053268	US/NR	23/05/ 2024	Active Not Recruiting	Cancer	EmbracePlus	Watch	N	management	9

iCardia4HF: Multi-component mHealth Intervention for Patients With Heart Failure; NCT06205225	US//US	04/10/2024	Recruiting	Cardiovascular conditions	NR	NR	N	Management	6
Preventing the Progression of Multiple Sclerosis: Early Rehabilitative Treatment and Multimodal Assessment - Part A; NCT06219291	Italy/NR	01/07/2022	Enrolling By Invitation	Neurological conditions	GENEActiv	Watch	N	management	9
Evaluation of Product Effectiveness of the Intervention for Patients With Knee Osteoarthritis; NCT06220565	China/NR	01/06/2023	Active Not Recruiting	Musculoskeletal conditions	NR	NR	N	Management	6
Skiin-PSG Sleep Apnea; NCT06247878	Canada/Canada	01/02/2024	Recruiting	Sleep and sleep conditions	Skiin	Chest band	N	Management	9
ETERNALS: Remote	Belgium/Finland	01/07/2024	Not Yet Recruiting	Cancer	Oura Ring	Ring	N	Management	Consumer device

Monitoring in Lung Cancer Patients; NCT06479005									
Digital Cognition Study During Long-COVID; NCT06391970	Luxembourg/US	15/04/2023	Recruiting	Infections (COVID included in this)	ViewMind	Headset	N	Management	6
A Wearable In-phase Chest Wall Vibration Device for Relief of Dyspnoea in COPD: a First-in-human Exploratory Study; NCT06432920	Ireland/Ireland	06/07/2023	Completed	Respiratory conditions	ResWave	Vest	N	Management	6
Wearable Cardiac Monitor to Enhance Detection of Arrhythmia Recurrence After Catheter Ablation of Atrial Fibrillation; NCT06564012	Canada/Canada	01/07/2025	Not Yet Recruiting	Cardiovascular conditions	Skiin (duplicate)	Chest Band Or Bralette	N	Management; diagnosis	9

Validation of Cuffless Blood Pressure Measurements Using the Perin Health Patch; NCT06574113	US/US	15/08/2024	Recruiting	Cardiovascular conditions	Perin Health Patch	Patch	N	Management; diagnosis	6
Digital Interventions for Adults with Treatment-Resistant Depression: a Pilot Study; NCT06732089	Canada/NR	16/12/2024	Recruiting	Mental health, behavioural and neurodevelopmental conditions	NR	NR	N	Management	6
DigiPall; a Trial of Digital Patient Reported Outcome and Biomarker Monitoring in Palliative Care; NCT06615349	Switzerland/NR	11/06/2025	Recruiting	Cancer	NR	Watch; Ring	N	Management	6
Lymphedema Sensor Technology Development Study; NCT06778837	US/NR	20/01/2025	Recruiting	Cancer	NR	NR	N	management	6
COR-INSIGHT:	US/NR	16/11/2024	Enrolling By Invitation	Cardiovascular conditions; Sleep and	COR 1.0; COR 2.0	NR	Y	management	6

Optimizing Cardiovascular and Cardiopulmonary Outcomes with AI-Driven Multiplexed Indications Using COR ECG Wearable; NCT06763549				sleep conditions; Respiratory conditions					
Migraine Research with Smartwatch Application; NCT06862544	Germany/ France	17/05/ 2024	Active Not Recruiting	Neurological conditions	Withings Scanwatch 2	Watch	N	Diagnosis	7
Predicting Acute Exacerbations of COPD Using Wearable Devices and Remote Monitoring Technology With AI/ML Models; NCT06802003	Cananda/ NR	22/05/ 2025	Recruiting	Respiratory conditions	NR	Wristband; Ring	Y	Management	Consumer device
Abbreviations: NR, not reported									

Appendix D: Bibliographic

Appendix B: Named technologies

Table 8 Technology brands and/or names, whether they have been approved as medical devices, and who by, or if they are consumer devices. Those highlighted in blue have been approved but are being tested in a different indication.

Device brand and/or name	Count	Approved?
Abbott Confirm Rx	3	FDA, CE-certified/EU
Abbott Freestyle Libre	1	CE
Acesight	1	No
ActiGraph GT9X Link	1	Discontinued
ADAM	1	No
Alio Inc SmartPatch	1	FDA
ANNE	3	FDA
Aventusoft LLC Hemotag	1	No
BACTrack Skyn	1	No
Biobeat	1	No
BlueWind RENOVA iStim System	2	FDA
BTE Primus RS	1	No
CARDIF	1	No
ChromaSense	1	No
Cometa	1	No
Cosinussdegree	1	No
Current Health Inc.	1	Not enough information
Dexcom G6	1	CE-certified/EU
Dreem 3 Headband (now known as waveband headband)	1	No
Empatica E4	5	Discontinued
ePatch	1	No
EXIT 360degree	1	No
FabSense	1	No
GlandyTM	1	FDA and CE-certfied/EU
GlucoMen Day	1	No
HEEL2TOE sensor	1	No
INSPIRA	1	Not enough information
iRhythm Zio	2	CE
Leo	2	Not enough information
Lepu ER1	1	CE-certfied/EU
LidSonic V2.0	1	No
MedAi	1	No
Parkinson's Kinetigraph	1	FDA
Philips Actiwatch	1	Discontinued

Philips MCOT	1	FDA
Physiopatch	1	No
ReModuWear	1	No
Respeck	3	Not enough information
R-GUARD wearable single-lead Holter monitors	1	No
Spire RPM system	1	Not enough information
VRSway	1	No
YouCare	1	Not enough information
Zmachine Insight+	1	FDA
Analog Devices Inc. ADI Study Watch	1	Consumer device
Apple Watch	17	Consumer device
Biostrap	1	Consumer device
Captoglove	1	Consumer device
Fatigue Sciences Readiwatch	1	Consumer device
Fire-boltt quantum watch	3	Consumer device
FirmTech	1	Consumer device
Fitbit	38	Consumer device
Galaxy Watch	1	Consumer device
Garmin	2	Consumer device
Hexoskin	1	Consumer device
Huawei Watch	2	Consumer device
MIO Fuse	1	Consumer device
Mobvoi TicWatch Pro 2020	1	Consumer device
NarrativeClip	1	Consumer device
Oura Ring	1	Consumer device
Polar H10	3	Consumer device
Quest 1	1	Consumer device
Re-Timer	1	Consumer device
Samsung Galaxy Watch3	1	Consumer device
Samsung Gear VR	1	Consumer device
Sensomics	2	Consumer device
Shade 2	1	Consumer device
Withings ScanWatch	3	Consumer device
Xiaomi Band	3	Consumer device

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