Scoping review of patient monitoring solutions using Biometric Monitoring technologies (BioMeTs) in oncology care

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Introduction

- **Biometric Monitoring Technologies (BioMeTs)[1]** are connected digital health tools that process data captured by mobile sensors using algorithms to generate **measures of behavioral and/or physiological function**.
- They are increasingly used as **lifestyle devices**, through wearables, in-built phone sensors, e-patches, and portable biosensors[2].
- With the increasing **need to enhance clinical outcomes and reduce care burden in oncology care**, health systems are turning to monitoring technologies; hence, **understanding the clinical evidence supporting the use of BioMeTs** is essential.

Aim: To map and synthesize the clinical evidence supporting the use of BioMeTs for monitoring in oncology care through aspects of clinical evaluation, including exploratory (proof-of-concept), feasibility, validity and reliability, and clinical effectiveness.

Methods

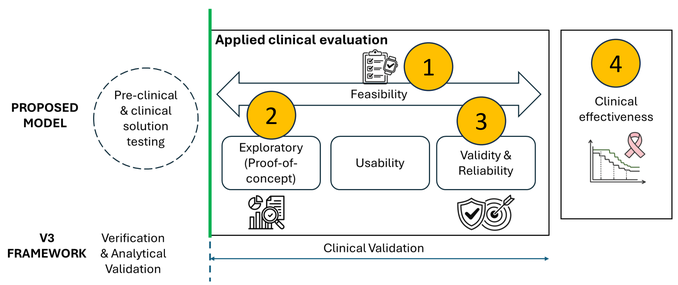
- We followed the **Joanna Briggs Institute Manual for Evidence Synthesis guidelines[3]**.
- Databases included: Ovid, Embase (ELSEVIER), Clarivate Web of Science™, IEEE Xplore® Digital Library
- The **search terms** included oncological terms, cancer pharmacological treatments, sensor-based devices or tracking technologies, monitoring, and adverse events.
- The search was conducted by an experienced **medical librarian** in consultation with the author team.

Inclusion criteria:
- BioMeTs collecting health parameters that could support monitoring of adverse events, including those without medical device regulatory clearance;
- patients receiving pharma-oncological treatment w/curative intent in clinical care or clinical trials;
- studies evaluating clinical evidence of BioMeTs;
- original studies, protocols, abstracts.

Exclusion criteria:
- BioMeTs used for purposes other than monitoring health parameters;
- patients only receiving surgery or palliative care as treatment;
- BioMeTs not for remote or home-based use, or designed for inpatient settings;
- reviews or commentaries.

- Screening of abstracts, and full-text review was conducted by three independent reviewers, and discrepancies were resolved by another reviewer or through discussion until consensus was reached.
- Data extraction was performed by one researcher and cross-checked by a second independent reviewer.
- The clinical evidence was classified using our own proposed model (Figure 1):
  1) Feasibility[4]; 2) Proof-of-concept[5]; 3) Validity & reliability[4]; and 4) Clinical effectiveness[4].

Figure 1. Aspects of clinical based evaluation for BioMeTs



Results

1,766	205	110	29
Articles screened	Full-text articles assessed	Articles & abstracts identified	Articles included

Most common devices were smartwatches/ activity trackers, and the most frequent signals monitored were heart-rate and activity related parameters.

Figure 2. BioMeT classification[2]

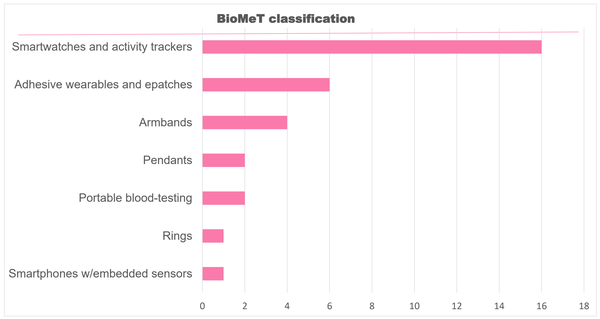
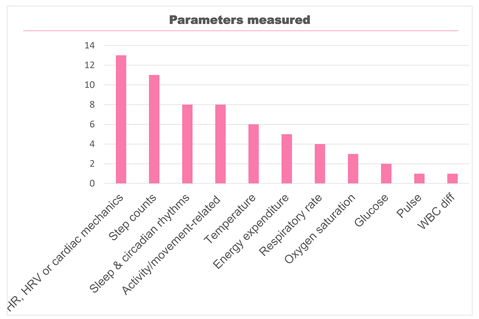


Figure 3. Frequency of parameters measured



How are BioMeTs used in oncological specialties?

- 17 studies (58,6%) used BioMeTs to monitor treatment-related symptoms in single oncological conditions: **hematological (n=7),** breast (n=3), lung (n=3), head & neck (n=2), and urological (n=1).
- 11 studies (37.9%) used BioMeTs to monitor treatment-related symptoms in multiple oncological conditions including lung, breast, gastrointestinal, colorectal, pediatrics, hematology, pancreas, liver, ovary, prostate, Head & Neck, brain, and others.
- One study did not report the specific cancer.

- 27 studies generated clinical evidence supporting the use of BioMeTs for monitoring purposes

1

16 feasibility studies:
- Indicators included measures of acceptance, adherence, compliance, completion rate, data availability, data acquisition rate, recorded time rate, and quality scores.

2

12 exploratory studies:
- Reporting significant between-group differences in adverse events in observational studies, or
- Reporting measures of association in a timepoint (e.g., correlations, odds ratio), and several timepoints (e.g., hazard ratio) between outcomes of interest (e.g., AEs) vs. BioMeT parameters.
  - Death, hospitalizations, fatigue**, vs.** number of steps.
  - Survival, weight loss, fatigue **vs.** sleep/circadian rhythms.

3

12 Validity & Reliability studies:
- Indicators included sensitivity, specificity, positive (or negative) predictive value, Area Under the Curve for predictive models, accuracy, correlation of measures, % of change.
  - Models were univariate and multivariate from BioMeTs or other sources.
  - Alerts based on pre-defined thresholds, machine-learning, or AI.
- Precision measures in terms of error rates or mean absolute differences.

4

3 clinical effectiveness studies:
- In all studies, participants served as their own controls.
- All studies demonstrated temperature BioMeTs could detect infections or febrile neutropenia earlier than standard of care.

Conclusions

There is a lack of standardized definitions for the stages and aspects of clinical evidence for BioMeTs, as well as insufficient definitions within each individual stage and aspect.

Although most studies reported feasibility evidence for the BioMeTs, indicators criteria varied greatly. In general, BioMeTs meet goals of adherence, acceptance, and data availability.

In addition to pre-defined thresholds, prediction models are also using machine-learning and AI strategies, creating opportunities to develop individualized thresholds.

Several BioMeTs may be used as proxies in innovative ways to monitor symptoms and as such help prevent higher grades of toxicities, including death, cardiotoxicities, hematological toxicities, diarrhea, fatigue, among others.

Unlike the benefit of using PROs to monitor symptoms relevant to adverse event[6], evidence supporting the use of BioMeTs is still emerging.

Abbreviations
AE: Adverse events; BioMeTs: Biometric Monitoring Technologies; PROs: Patient-Reported Outcomes

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Disclosures
Evinova authors are employees of Evinova, a healthtech business under AstraZeneca.

References in poster
1. Goldsack et al. 2020
2. Mukherjee et al. 2022
3. Peters et al. 2020
4. Mayo (ed.) 2015
5. Hawthorne et al. 2022
6. Basch et al. 2025

Included studies in QR code

Poster topic: Poster Session 4
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