Remote Monitoring for Early Detection of CRS and ICANS in CAR-T Therapy: A Systematic Review with Geriatric Considerations

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BACKGROUND

- Cytokine release syndrome (CRS) and immune effector cell-associated neurotoxicity syndrome (ICANS) are potentially life-threatening toxicities of CAR-T therapy.
- Given their use in malignancies affecting older adults, the applicability of remote monitoring in this population warrants evaluation.

OBJECTIVES

Primary Objective:

- To assess whether remote monitoring facilitates early detection of CRS and/or ICANS in patients receiving CAR-T therapy, with considerations in older adults.

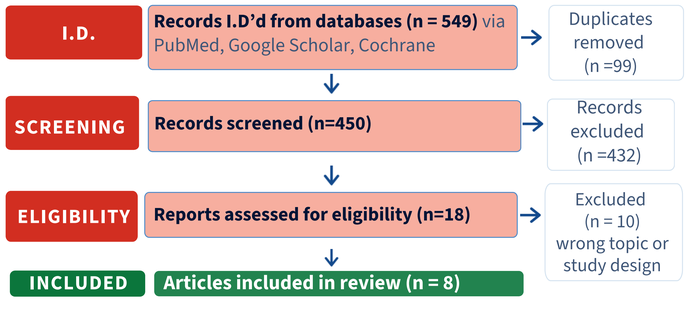
Secondary Objectives:

- To characterize remote monitoring modalities used across studies
- To evaluate adherence and feasibility rates in older adult populations
- To assess availability of diagnostic performance metrics
- To identify gaps in geriatric-specific evidence for remote monitoring in CAR-T therapy

METHODOLOGY

Design: Systematic Review following PRISMA-2020 guidelines
Period: 2011-2025

FIGURE 1. PRISMA FLOW



Analysis: Descriptive synthesis; statistical pooling not performed due to heterogeneity across monitoring modalities and outcome reporting
Bias Assessment: Newcastle-Ottawa Scale

RESULTS

Study Characteristics

- **380** patients across all 8 studies
- Median age: 62–69 years
- 75% assessed both CRS and ICANS; 25% focused primarily on CRS
- Commonest cancers: DLBCL, ALL, multiple myeloma, NHL

FIGURE 2. MONITORING MODALITIES AND REPORTED LEAD TIMES

Study	Monitoring Type*	Lead Time Reported
S1 (Shafagati et al. 2025)	Passive (Apple Watch)	13.75 hours before clinical diagnosis
S2 (Moore et al. 2025)	Hybrid	Early detection reported, no quantitative measure
S3 (Dholaria et al. 2025)	Hybrid (Biofourmis)	Early detection reported, no quantitative measure
S4 (Cox et al. 2025)	Hybrid	96–98% detected within 15 days
S5 (Cox et al. 2024)	Hybrid	84% of alarms captured
S6 (Rajeeve et al. 2023)	Passive (wearable)	Median 103 minutes earlier
S7 (Rajeeve et al. 2023)	Passive (wearable)	Median 195–205 minutes earlier
S8 (Dholaria et al. 2023)	Hybrid	No quantitative nor qualitative measure

performance metrics to validate these tools were not reported in any study

FIGURE 3. ADHERENCE RATES ACROSS INCLUDED STUDIES, WHERE REPORTED

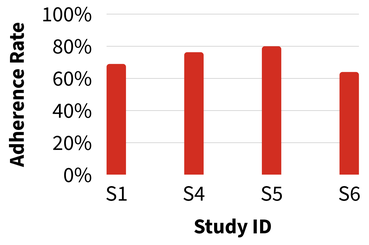


*FIG 3. Adherence rates **exceeded 64%** across studies that reported device use; however, four studies did not report adherence data, limiting cross-study comparison.*

FIGURE 4. BIAS ASSESSMENT ACROSS INCLUDED STUDIES

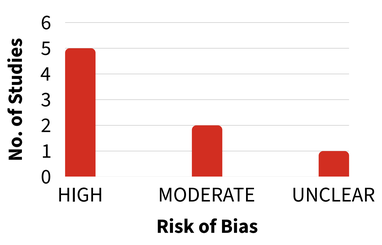


FIG 4. Risk of bias was assessed using the Newcastle-Ottawa Scale. Five studies were rated high risk (S2, S5, S6, S7, S8), two moderate (S1, S3), and one unclear (S4), reflecting the predominance of small pilot studies and conference abstracts in the current evidence base.

GERIATRIC CONSIDERATIONS

- Patient ages ranged from 24 to 84 years across all studies
- Several studies included patients in their 70s and 80s
- Only one study (S2, N=3) enrolled an exclusively older adult population (age range 65–80 years)
- No study performed age-stratified outcome analyses
- Adherence rates of 64–80% suggest potential feasibility in older adults despite limited geriatric-specific data

CONCLUSIONS AND LIMITATIONS

- Remote monitoring shows promise for facilitating earlier recognition of CRS and ICANS and enabling timely intervention.
- Adherence rates suggest potential feasibility in older adults, who face heightened risk for treatment-related complications and barriers to in-person evaluation.
- Dedicated geriatric evidence remains limited to a single study of 3 patients, representing a key gap for future investigation

FUTURE DIRECTIONS

- Dedicated trials enrolling older adults including those with functional or cognitive limitations
- Standardized reporting of diagnostic performance metrics
- Development of geriatric-specific remote monitoring protocols in CAR-T pathways

ACKNOWLEDGEMENTS

This study is supported by the **Tele-Geriatric Research Fellowship**, part of The Combined Research Foundation, Okemos, MI, USA.

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3-Multiple studies included in the review (n=8)

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