

Peer Review

Review of: "Next-Generation Space Cardiology: Developing a COMSOL-Enabled Digital Heart Twin for Long-Duration Missions"

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The manuscript addresses a very important topic intertwining space medicine, computational modeling, and digital health technologies. The authors propose a COMSOL-based digital heart twin to simulate cardiovascular dynamics in microgravity. The applications could be focused on long-duration spaceflight scenarios, such as in missions to the Moon or Mars, but also in providing a reproducible framework for virtual medical evaluation and pre-mission risk profiling in space cardiology. The manuscript is well-structured, and the core idea is clear. Minor revisions requested:

1. Please clarify what the sources are for the anatomical data of the heart (MRI?, generic template?);
2. How microgravity conditions were quantitatively simulated (e.g., reduction in preload or boundary pressure changes);
3. Please add a diagram or a flowchart to better elucidate the pipeline of the work;
4. Please analyse your model with existing studies (2022-2025);
5. Correct minor typos;
6. Please add some recent articles focused on digital twin applications in medicine and spaceflight-induced heart changes.

Declarations

Potential competing interests: No potential competing interests to declare.