nature portfolio

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Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our Editorial Policies and the Editorial Policy Checklist.

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed	
☐	☒	The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒	A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☐	☒	A description of all covariates tested
☒	☐	A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☒	For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐	Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	Data was collected and recorded in Google Sheets and Trialkit clinical study data management software (Crucial Data Solutions). These software tools are software-as-as-service.
Data analysis	Data was analyzed in Google Sheets and in Google Colaboratory. These software tools are software-as-as-service and do not have explicit version numbers. The Python version of Google Colaboratory used in analysis was 3.11.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our policy

The data that support the findings of this study are not openly available due to reasons of study participant privacy; clinical study data have been registered (NCT06430216).

Research involving human participants, their data, or biological material

Policy information about studies with human participants or human data. See also policy information about sex, gender (identity/presentation), and sexual orientation and race, ethnicity and racism.

Reporting on sex and gender	Demographics of study participants at the cohort level are provided in Supplementary Table S2.
Reporting on race, ethnicity, or other socially relevant groupings	Demographics of study participants at the cohort level are provided in Supplementary Table S2.
Population characteristics	Demographics of study participants at the cohort level are provided in Supplementary Table S2 and additional population characteristics are in the Methods section.
Recruitment	Participants were recruited via website, email, phone calls, and posters, as detailed in the protocols for individual studies that are provided with the submission. We are not aware of any potential causes of self-selection bias that may impact the results that are presented in this manuscript. Recruitment for the prospective validation studies was performed by a 3rd party contract research organization (CRO); participants were not told the identity of the company sponsoring the research at the recruitment stage in order to minimize the risk of potential selection bias.
Ethics oversight	All cohorts were enrolled under informed consent (IRB #00068623, 00071247, 00077141, 00078212, 00079675, Advarra (Columbia, MD)).

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	The sample size of the prospective validation studies was estimated a priori. The sample size for Cohort E was estimated a priori to be 135 participants to provide 90% power, using conservative estimates for participant dropout rates and within-participant correlation. Similarly, the sample size for Cohort F was estimated to be 21 participants to provide 90% power. The sample size of Cohort A was pre-specified at 100 participants.
Data exclusions	No data were excluded from the prospective validation studies. Data from 10 (of 100) participants from Cohort A were excluded due to a lack of analyzable data: investigational device failures occurred for five participants; ventricular fibrillation was not successfully induced in four participants; and an artifact from an automated blood pressure cuff that inflated at the time of VF was present for one participant. This is described in the main text.
Replication	All attempts at replication were successful, as indicated by the consistency of results across Cohorts D and E (specificity) and Cohorts E and F (sensitivity).
Randomization	This is not applicable because all data from all participants were analyzed for the prospective validation studies.
Blinding	The investigators were blinded to the interim results of the prospective validation studies, which were performed under design control.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☐	☒ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Clinical data

Policy information about clinical studies

All manuscripts should comply with the ICMJE guidelines for publication of clinical research and a completed CONSORT checklist must be included with all submissions.

Clinical trial registration	NCT06430216
Study protocol	The protocols were included in the original submission for the convenience of the reviewers and have been submitted to regulators for their review. The CONSORT checklist was not completed because the validation study was not a phase II or phase III randomized controlled trial.
Data collection	The prospective validation studies were conducted at the following locations in 2024: - Cohort E: The laboratory component was conducted at 3 contract research organization (CRO) sites in the United States (Georgia, Nebraska, and Ohio). - Cohort F: The study was conducted by a CRO in California. These details are disclosed in the Methods section.
Outcomes	The prospective validation study primary outcomes were the sensitivity and specificity of the Loss of Pulse Detection system at the stage at which emergency services is contacted. The secondary outcomes entailed quantifying the sensitivity and specificity of the stages before emergency services is contacted. Both the primary and secondary outcomes, along with a detailed data management plan, were pre-specified in the clinical study protocols, submitted to the Institutional Review Board, and maintained under design control as part of our Quality Management System. These endpoints were met in the prospective studies as described above and shared with, and reviewed by, regulatory agencies.

Plants

Seed stocks	Not applicable as no plants were used in this study.
Novel plant genotypes	Not applicable as no plants were used in this study.
Authentication	Not applicable as no plants were used in this study.