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Focus Article

Enhancing the trustworthiness of pain research: A call to action.

The ENTRUST-PE Network, Neil E. O'Connell [a,*], Joletta Belton [b], Geert Crombez [c], Christopher Eccleston [d], Emma Fisher [d], Michael C. Ferraro [e,f], Anna Hood [g], Francis Keefe [h], Roger Knaggs [i], Emma Norris [j], Tonya M. Palermo [k,l], Gisèle Pickering [m], Esther Pogatzki-Zahn [n], Andrew SC Rice [o], Georgia Richards [p,q], Daniel Segelcke [n], Keith M. Smart [r], Nadia Soliman [o], Gavin Stewart [s], Thomas Tölle [t], Dennis Turk [u], Jan Vollert [v], Elaine Wainwright [w,x], Jack Wilkinson [y], Amanda C.de C. Williams [z]

[a] Department of Health Sciences, Centre for Wellbeing Across the Lifecourse, Brunel University London, United Kingdom
[b] Patient Advocate, CO, USA
[c] Department of Experimental, Clinical and Health Psychology, Ghent University, Belgium
[d] Centre for Pain Research, The University of Bath, UK
[e] Centre for Pain IMPACT, Neuroscience Research Australia, Australia
[f] School of Health Sciences, Faculty of Medicine and Health, University of New South Wales Sydney, Australia
[g] Division of Psychology and Mental Health, Manchester Centre of Health Psychology, University of Manchester, UK
[h] Pain Prevention and Treatment Research Program, Department of Psychiatry and Behavioral Medicine, Department of Medicine, Duke University, USA
[i] School of Pharmacy, University of Nottingham, UK
[j] Department of Health Sciences, Brunel University London, UK
[k] Department of Anesthesiology and Pain Medicine, University of Washington, USA
[l] Center for Child Health, Behavior and Development, Seattle Children's Research Institute, University of Washington, USA
[m] Investigation Centre CIC 1405, University Hospital Clermont Ferrand and Université Clermont Auvergne, Clermont-Ferrand, France
[n] Department of Anesthesiology, Intensive Care and Pain Medicine, University Hospital Muenster, Germany
[o] Pain Research Group, Department of Surgery & Cancer, Imperial College London, UK
[p] Centre for Evidence-Based Medicine, Nuffield Department of Primary Care Health Sciences, University of Oxford, UK
[q] Institute of Pharmaceutical Science, Faculty of Life Sciences and Medicine, King's College London, UK
[r] School of Public Health, Physiotherapy and Sports Science, University College Dublin, Ireland
[s] School of Natural and Environmental Sciences, Newcastle University, UK
[t] Technische Universitaet Muenchen, Germany
[u] Department of Anesthesiology and Pain Medicine, University of Washington, USA
[v] Exeter Brain, University of Exeter, UK
[w] Epidemiology Group, School of Medicine, Medical Sciences and Nutrition, University of Aberdeen, UK
[x] Centre for Pain Research, The University of Bath, UK
[y] Centre for Biostatistics, Manchester Academic Health Science Centre, Division of Population Health, Health Services Research & Primary Care, University of Manchester, UK
[z] Dept of Clinical, Educational & Health Psychology, University College London, UK

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ABSTRACT

The personal, social and economic burden of chronic pain is enormous. Tremendous research efforts are being directed toward understanding, preventing, and managing chronic pain. Yet patients with chronic pain, clinicians and the public are sometimes poorly served by an evidence architecture that contains multiple structural weaknesses. These include incomplete research governance, a lack of diversity and inclusivity, inadequate stakeholder engagement, poor methodological rigour and incomplete reporting, a lack of data accessibility and transparency, and a failure to communicate findings with appropriate balance. These issues span pre-clinical research, clinical trials and systematic reviews and impact the development of clinical guidance and practice. Research misconduct and inauthentic data present a further critical risk. Combined, they increase uncertainty in this highly challenging area of study and practice, drive the provision of low value care, increase costs and impede the discovery of more effective solutions.

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* Corresponding author.
E-mail address: neil.oconnell@brunel.ac.uk (N.E. O'Connell).

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In this focus article, we explore how we can increase trust in pain science, by examining critical challenges using contemporary examples, and describe a novel integrated conceptual framework for enhancing the trustworthiness of pain science. We end with a call for collective action to address this critical issue.

Perspective: Multiple challenges can adversely impact the trustworthiness of pain research and health research more broadly. We present ENTRUST-PE, a novel, integrated framework for more trustworthy pain research with recommendations for all stakeholders in the research ecosystem, and make a call to action to the pain research community.

1. Introduction

To meet the needs of those most impacted by pain, pain research must ultimately be trustworthy. In this context, to trust means to strongly believe that the facts or arguments being presented are valid, generated and presented free from bias, deceit or misdirection, and offered in a spirit of knowledge sharing.

The aims of this focus article are:

- to explore key challenges to the trustworthiness of pain science
- to describe an integrated conceptual framework for enhancing the trustworthiness of pain science, with recommendations for different stakeholders and examples of actions that can be taken now by all pain researchers.
- to call for collective action to address this critical issue.

2. Are there reasons to lack trust in pain science?

When we weigh our trust in research findings, we usually think of methodological rigour and the risk of bias associated with how a study was designed, conducted and reported. In qualitative research, the term “trustworthiness” has historically been associated with credibility, transferability, confirmability, and dependability[1,2].

Factors that are important to consider include: whether the design is suitable for the question; if the study avoids or controls for biases in methodology; if the methods and results have been reported accurately and comprehensively; and whether questionable research practices, that is, methods “employed with the purpose of presenting biased evidence in favour of an assertion”[3] have been avoided. There are many examples of how research in general and pain research specifically falls short of high standards in this area. For example, in a series of recent reviews, the International Association for the Study of Pain Presidential Task Force on Cannabis and Cannabinoid Analgesia[4] found that 86% of systematic reviews of the clinical efficacy of cannabinoids were rated at low or critically low confidence[5]. In fact, all 36 clinical trials included in their review were at unclear or high risk of bias[6]; and in all 374 pre-clinical (animal) studies, reporting of markers of methodological quality was very poor, leading to judgements of unclear risk of bias.[7] The critical lack of rigour and transparency across cannabinoid research resulted in substantial, avoidable and ongoing clinical uncertainty and research waste. Research waste is reflected in terms of wasted funding, resource, researcher and participant time and in opportunity costs[8,9]. This is not an issue limited to research on cannabinoids, but can be seen across other fields of pain evidence. Indeed most trials evaluating psychological, pharmacological, physical and interventional treatments for chronic pain are judged as being at unclear or high risk of bias[10–18].

These issues are apparent across all types of study. Reviews of observational clinical studies frequently identify issues of quality or risk of bias in the included literature[19,20]. For example, a meta-epidemiological study of observational studies in spinal pain and osteoarthritis found that misalignments between study aims, methods and interpretations were common[21]. In fact, the majority of published systematic reviews in pain have been reported to be of low methodological quality[17,22,23]. Avoidable biases and incomplete reporting are common across our research literature. Although methodological rigour is clearly a critical factor for trustworthiness, there is a need to consider wider problems and threats.

Trustworthiness of research is undermined by failure to meet contemporary standards of governance and integrity[24–26], unethical practices, undeclared or poorly managed conflicts of interest[27], inadequate quality assurance and/or poor data stewardship. Research that excludes specific groups of society (for example, racialised groups, women, elderly people, rural communities or veterans), or entire global regions, or research that applies inaccurate and discriminatory approaches to measuring and reporting participant characteristics, limits generalisability and transferability within and across countries[28–31]. This can reinforce inappropriate conclusions and inequities of care and fails to meet the fundamental ethical pillar of justice[32,33,28]. Yet each of these issues of systemic underrepresentation remain common across pain research (e.g.[32,33,29,31,34]).

Research that does not engage in active partnership with people with lived experience of pain or members of the public may exclude critical knowledge about the pain experience and address questions that do not have relevance or benefit to people with pain[35–37]. Meaningful patient and public involvement and engagement (PPIE) avoids tokenism, occurs across the research spectrum, includes diverse PPIE partners, and values, integrates, and recognizes the contributions of those partners[35–38]. Although PPIE in pain research is increasing, it currently features in only a minority of published health studies. PPIE often fails to be meaningful, and is largely only incorporated in human studies with PPIE partners who inadequately reflect the diversity of the relevant populations[38–42].

Where important details of the research process and data are concealed, trustworthiness becomes a judgement based on faith, reputation or assumption. Open research practices are a vital mechanism to enhance transparency and ultimately trust in research for all methodological disciplines[43–46]. Nonetheless, pain journals have been slow to embrace and promote open research practices[47] and those practices are inconsistently applied in pain research and the broader health research community[48–55].

Who could argue against the proposition that the results of scientific research should be communicated with balance, in a way that accurately reflects the results, with neither selectivity nor distortion? Yet research findings are often reported selectively, through omission, outcome switching or “interpret information as part of a larger story or pattern, regardless of whether the facts support the full narrative”[56]. These “narrative biases”[56] (i.e., tendencies to exaggerate (“spin”), accentuate the positive, disregard or undervalue uncertainty, extrapolate beyond reasonable interpretation and oversell the importance of results), undermining the trustworthiness of research[56,57]. Moderate to high levels of spin or narrative bias have been identified in the abstracts of 33% of analgesic trials[58] and recently in 24% of RCTs and 17% of systematic reviews of cannabinoids and cannabis-based medicines for pain[56].

We should also consider the possibility of inauthentic data. Inauthentic data can arise from honest error, but also from deliberate research misconduct, such as fabrication and falsification of results or entire studies. The scale of research misconduct is unclear, but in surveys of scientists across the whole scientific community, 2% admitted to modifying, falsifying or fabricating data, and up to 33.7% admitted to using questionable research practices. When asked about other colleagues, 14% reported having observed falsification, fabrication and modification and 72% reported observing questionable research practices[59]. A recent review in the pain literature[60] found that 66% of retracted papers were retracted for reasons related to misconduct, a likely underestimate given that some misconduct is misclassified as error[60,61]. The result of research misconduct is the proliferation of inauthentic data. The rise of paper mills[62–64], predatory journals[65–67] and generative artificial intelligence[68] creates the conditions for a rapid escalation of the problem.

Combined, these threats demonstrate that trustworthiness is complex and multidimensional. For evidence from pain research to be trustworthy, each threat must be acknowledged and addressed. We must also reflect on why they exist.

3. The ENTRUST-PE framework

The key messages in this paper represent a summary of the ENhancing TRUSTworthiness in Pain Evidence (ENTRUST-PE) network project (https://entrust-pe.org/, Open Science Framework https://osf.io/cua7g/?view_only=ec1d9e6b1d774dbca9306ff5ae4dec67). Our group received funding in 2023 from the ERA-NET NEURON Consortium to convene an international network of members from the pain research and experience community with the primary goal of developing a novel integrated framework for enhancing and facilitating the trustworthiness of pain research evidence. An interdisciplinary international network group was convened. Individual network members had expertise in equity, diversity and inclusivity, the involvement and engagement of people with lived experience and the public in research, clinical research methods including observational and experimental, qualitative and social science methods, preclinical and mechanistic research, clinical trials, evidence synthesis, guideline development, and statistical methods, including the detection of fabricated or inauthentic data. Members represent a range of clinical disciplines including medicine, pharmacology, psychology, physiotherapy and several had experience in senior journal editorial/publishing roles. The network took a discursive and non-hierarchical approach to sharing expertise, exploring challenges and practical solutions and agreeing on an integrated framework for trustworthy evidence. The resulting framework is based on a set of core values and a series of proposed behaviours and actions, in the short- and long-term, that aim to guide research practice and standards towards those values. Full details of the process, the framework, and its underpinning rationale are described in the ENTRUST-PE White Paper[69]. This focus article draws from the work of the ENTRUST-PE project, taking examples from the pain and wider research literature, but does not represent a systematic review of the full literature.

We conceptualise the construct ‘Trustworthiness’ of research to be underpinned by the following core values: 1. Integrity and Governance, 2. Equity Diversity and Inclusivity, 3. Patient and Public Involvement and Engagement, 4. Methodological Rigour, 5. Openness and Transparency, 6. Balanced Communication, and 7. Data Authenticity. Each of these core values should drive universal actions and behaviours in researchers and stakeholders across all roles and stages of the research process. These are presented in Table 1.

4. A complex, incentivized ecosystem

It would be simple to assume that the responsibility for creating trustworthy research lies solely with researchers. That assumption, however, fails to recognise that researchers operate within cultures and a wider ecosystem of powerbrokers and stakeholders containing myriad pressures, politics and incentives that drive both positive and negative behaviours.

It is crucial that practices that enable and ensure trustworthy research are reflected in structures of reward and incentives. Important initiatives such as the Declaration on Research Assessment (DORA)[70] and the Hong Kong Principles for assessing researchers[71] have sought to highlight this issue and to guide the research community towards more

Table 1
Core Values for trustworthy research and desired universal actions and behaviours.

Element	Core Value	Universal Actions and Behaviours
Governance and Integrity	Demonstrate high standards of research integrity and governance.	• Value, follow and promote the principles of research integrity. • Comply with best standards of research governance. • Consider markers of integrity and good governance as key quality indicators for research.
Equity, Diversity and Inclusivity	Design, undertake and report equitable, diverse and inclusive research.	• Prioritise inclusivity, diversity and equity in the design, conduct and reporting of research. • Value and promote anti-discriminatory practices as a key quality indicator for research. • Cultivate equitable diverse and inclusive research environments/ communities.
Patient and Public Involvement and Engagement (PPIE)	Undertake research in partnership with the public and people with lived experience.	• Embed Patient and Public Involvement and Engagement throughout the research process. • Value Patient and Public Involvement and Engagement practices as a key quality indicator for research.
Methodological Rigour	Design and conduct research to optimise methodological rigour (appropriate to the question). Report research completely and transparently.	• Value, conduct, educate and promote high quality, methodologically rigorous research. • Avoid and call attention to Questionable Research Practices.
Transparency and Openness	Make research as open and transparent as possible.	• Value and promote transparency of methods and compliance with accepted best standards of reporting. • Adopt and promote Open Research practices and FAIR principles as the norm. “As open as possible, as closed as necessary.”[43]
Balanced Communication	Communicate research with appropriate balance.	• Report all planned results regardless of the findings. • Make clear the distinction between exploratory and confirmatory research. • Make clear the distinction between reasonable interpretation of the data and speculation. • Be aware of markers of unbalanced communication and call attention to them.
Data Authenticity	Identify and exclude inauthentic data from the literature.	• Be vigilant to markers of potential inauthentic data and research misconduct, call attention to them and take action. • Commit to timely action to remove inauthentic data from the literature. • Commit to timely correction of errors in the published literature.

positive practices. As rewards and incentives for researchers are aligned better to responsible research practises, their implementation needs to aim for equitability, transparency, and responsibility. Regulators and Policymakers are gatekeepers for the approval of healthcare interventions for pain and of clinical practice guidelines. Funders are gatekeepers to the allocation of research resources. Research Institutions can foster cultures that promote, support, and incentivise positive behaviours. Editors, publishers and peer reviewers are gatekeepers to the published research literature. All have the responsibility to use that power to promote trustworthiness.

As researchers we routinely perform multiple roles in the ecosystem, holding different levels of power in each. For example, researchers are also leaders, mentors, peer reviewers, funding panel members, editors, institutional managers, consumers of research and people with pain. This provides opportunities to promote and model the values and behaviours of trustworthy evidence consistently through our actions across each of these roles. The trustworthiness of pain evidence can be sustainably improved through action from all stakeholders and systems-level change. On that basis, for each core value of the framework, we offer specific recommendations for how each stakeholder group can promote trustworthiness and signpost the reader to resources to support those recommendations[69].

Fig. 1 visualises the framework. Integrity and Governance encapsulate all other core values, which, in turn, underpin the concept of trustworthiness. Recommended actions and behaviours for all stakeholders in the research ecosystem support the core values.

5. From values to action

How do we, as a community, enact these core values more consistently? As stated earlier, change is needed from all stakeholders in the pain research ecosystem and across the entire research process. This change includes developing and maintaining governance with effective enforcement mechanisms; empowering inclusive research cultures that model and reward the core values; and providing adequate resources and support systems to facilitate and encourage best practice. We recommend that researchers normalise activities that promote the core values throughout their research processes, from project inception to post-publication, and for editorial and publishing practices that safeguard the core values at paper submission, during the peer review process, and post-publication.

Fig. 2. illustrates the roles of different stakeholders and the specific actions needed to realise each core value throughout the journey of a research project.

For researchers approaching a new research project or programme, planning is essential. Reflecting carefully on one’s own team and its interests and biases is a fundamental starting point. To guard against bias, we must first acknowledge and recognise its effects. It is important to reflect, with honesty and humility, on your position as a researcher, your relevant professional, financial and personal background and interests, financial and practical constraints and how these factors may influence your approach to the research. Table 2 offers examples of interests that may present important influences.

Seeking or conducting a high-quality and up-to-date evidence synthesis in the area you plan to research will avoid redundancy and enable identification of important questions. Within that process, ensuring that included studies are scrutinised for these markers of trust is critical. Ensuring awareness of and compliance with local and wider research governance requirements and seeking to act in alignment with the principles of research integrity is also essential[26,72–74].

Planning early, for meaningful, active and robust PPIE throughout the project can help address the limitations of the “Researcher as Gatekeeper” paradigm[35]. This improves the likelihood that we pursue relevant research questions, measure outcomes of relevance to patients and affected communities, and translate that knowledge more effectively[36]. Proactively seeking engagement and partnership with appropriately diverse communities, planning for the recruitment of an appropriately diverse and inclusive sample, and aligning collaboratively and sharing power with local researchers when engaging in global research, are key features of high-quality research that may ultimately

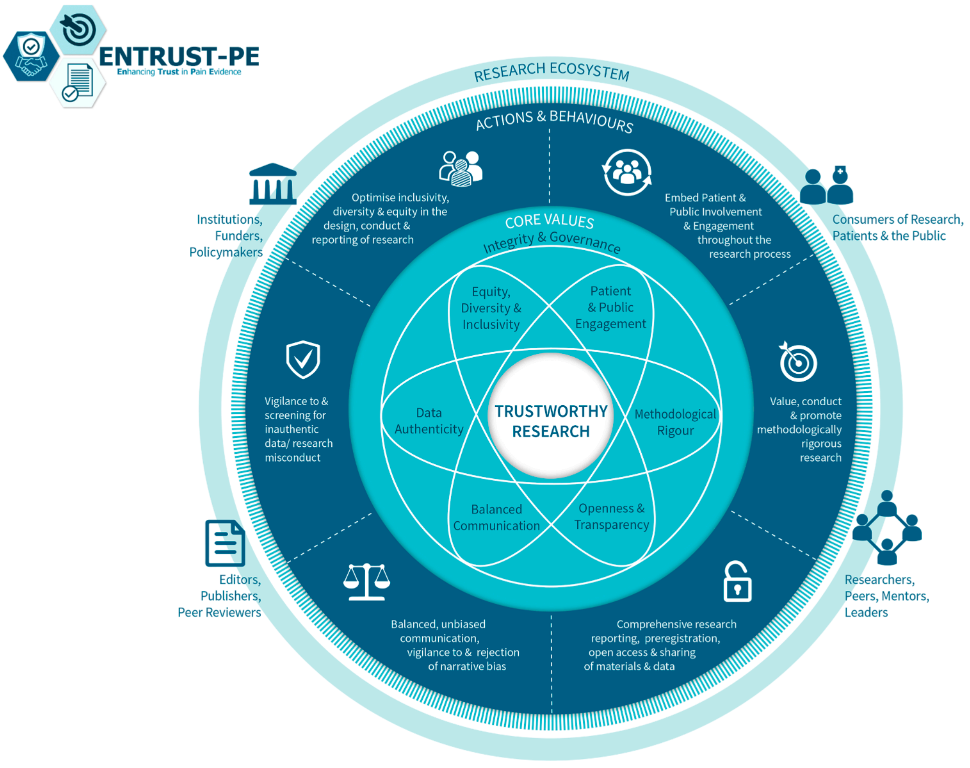

Fig. 1. The ENTRUST-PE Framework. A visual summary.

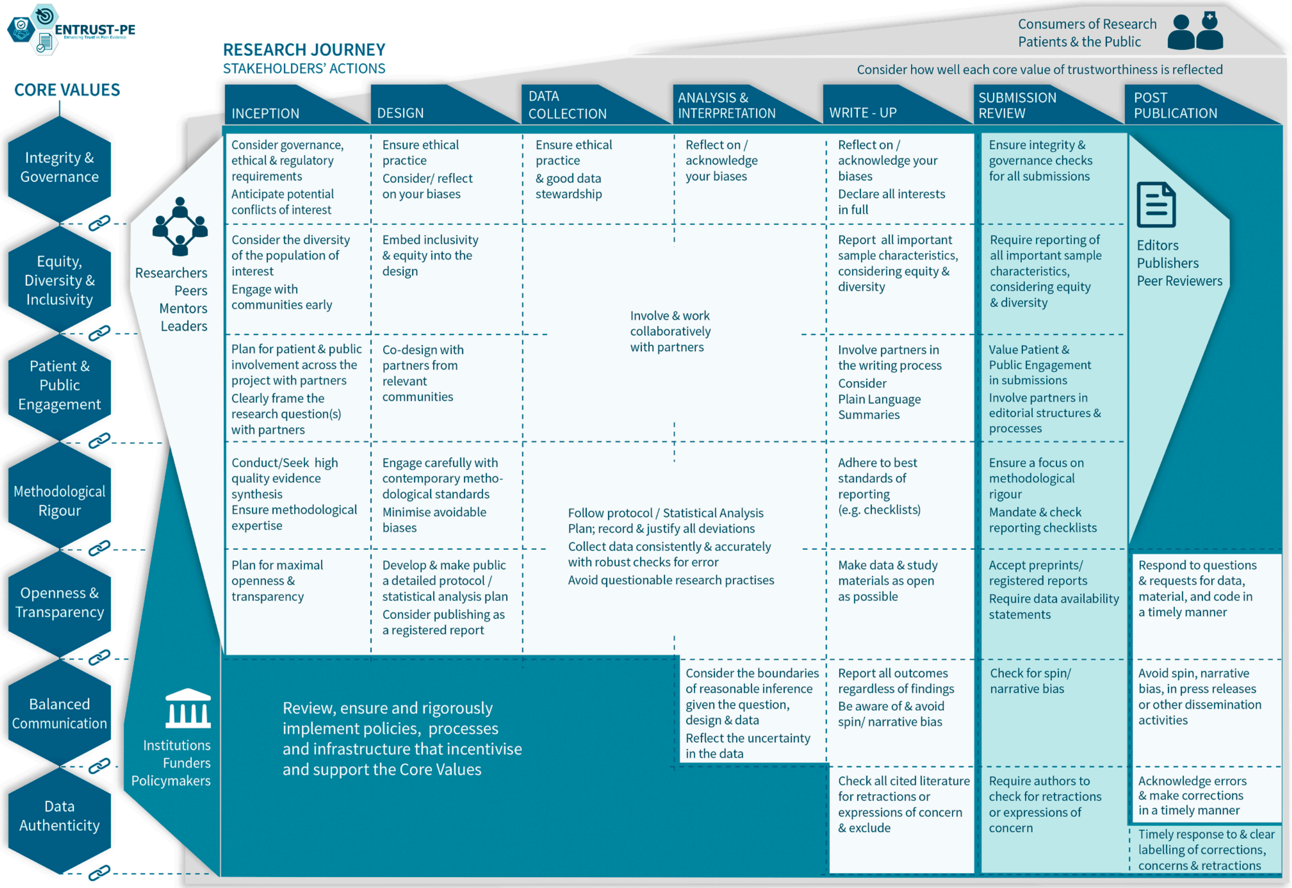

Fig. 2. The role and recommended actions of different stakeholders across the research process.

Table 2
Examples of potential researcher interests.

Type of Interest	Examples
Financial/ Commercial	Industry research sponsorship. Consultancy payments. Employment. Speakers fees. HospitalityStock/ share options/ holdings
Professional	Professional Identities, Motivation to protect, promote and/or expand professional scope of practice.
Personal	Personal beliefs and investment in specific interventions, theoretical models or models of care.Loyalties towards certain researchers or leaders.Bias towards or against a specific outcome.Personal experience of pain and healthcare.Cultural beliefs and values.

address the significant burden and inequities in pain and pain care.

Choosing optimal methods and ensuring adequate knowledge of contemporary methodological and reporting standards and the expertise to apply them is important for enhancing trustworthiness. Carefully planning for maximal openness and transparency at project inception (e.g., through protocol registrations) and reporting any modifications to study protocols during the conduct of the study builds trust and ultimately strengthens the study's credibility, reproducibility, and impact.

Communicating research findings with appropriate balance involves presenting results accurately and objectively, acknowledging strengths and limitations, and contextualizing findings with the pain field. This transparency helps audiences feel confident that the information is trustworthy. Post-publication, responding constructively and quickly to requests for information and to critical feedback and, where error has occurred, taking timely and transparent action to correct the record, ensures and communicates trustworthiness.

Our actions towards each core value are important markers of the quality and trustworthiness of our work, so complete and transparent reporting of those is critical to communicating that excellence. Importantly, while the details of how the values are enacted may vary, they apply to all research methodologies and disciplines, quantitative and qualitative, pre-clinical and clinical, human and laboratory and exploratory and confirmatory research.

For regulators and policymakers, it is important that policies and processes that safeguard the core values and mandate good practice are both designed and rigorously enforced. This enforcement includes safeguarding the trustworthiness of research from commercial and other vested interests[75–77], and ensuring that core values are consistently reflected in the criteria used for regulatory approval and the adoption of research into policy. Research ethics approval processes can promote equity, diversity and inclusivity by ensuring equal consideration to aspects of justice in proposals, alongside beneficence, non-malfeasance and autonomy.

Institutions that undertake research have a critical role in cultivating positive research cultures. They should create positive career incentives for researchers that reward behaviours and ensure sustainable resources and structures that both reflect and enable the core values. But they are also critical to ensure data authenticity through their responsibility to consistently conduct robust, timely and transparent investigations of potential research misconduct and inauthentic data.

Research funders should promote trustworthiness by: ensuring that characteristics that reflect the core values are scrutinised in funding applications and considered important quality indicators in decision making; adopting clear guidance for researchers outlining good practice and expectations; and providing sustainable resource that enables meaningful implementation of best practice within funded research.

Editors and Publishers can incentivise each core value by making them key quality indicators and/ or requirements within publishing decisions and by adopting policies and guidance that promote and support them. As an example, the requirement for pre-registration of all research, acceptance of pre-prints, the adoption of the registered reports model, and data sharing statements are all important positive steps toward promoting the core values of openness and transparency.

Requesting the reporting of activities demonstrative of each core value for all submissions could be a powerful behavioural nudge, as would focusing peer-reviewer's attention toward the core values through structured questions. As custodians of the scientific literature, editors and publishers have a further critical role in responding to expressions of concern regarding data authenticity in a timely and transparent manner and in ensuring that inauthentic data are removed from the literature quickly and transparently.

Peer reviewers can ensure that characteristics reflecting these core values are scrutinised in funding applications and research submissions and included as quality indicators in their reviewing recommendations. Consumers of research can reflect on how well each core value is reflected in a piece of research when weighing its relevance and value.

Crucially, researchers and stakeholders can commit to upholding and promoting the core values across **all** of their roles. Vigilance t to suboptimal practice, inauthentic data or research misconduct throughout the research process is necessary. Timely action appropriate to each role is critical where concerns arise.

There is a rich body of existing work and ongoing efforts across the wider international research community aimed at enhancing and supporting better research governance and integrity (e.g.[72,74,78]), promoting inclusivity, equity and diversity (e.g.[32,79,80]), supporting meaningful patient and public involvement (e.g.[81–83]), improving the quality of methods and reporting in pre-clinical and clinical research and evidence synthesis (e.g.[84–88]), establishing core outcome sets (e.g.[89,90]), increasing openness (e.g.[91–93]), identifying spin and miscommunication (e.g.[56,94]), and screening for potential research misconduct (e.g.[95–97]). Yet engagement with these resources is inconsistent in pain research. Therefore, a secondary goal of the ENTRUST-PE project is to curate and signpost a selection of these resources for the pain research community to support positive action[69] (pages 63–70).

6. A call to action for the pain research community

We present this framework with a sense of urgency, in that change is needed now, but also in a spirit of collaboration. To meaningfully improve the trustworthiness of pain research requires both systems-level change and collective development of our research culture(s) to truly embrace research integrity. Across the entire research ecosystem and all of our roles, there is a need to take collective responsibility to foster positive change. Although that might appear ambitious and will require resource and investment, it is worth noting that much of the framework simply reflects contemporary good research practices and a correction to where we, or our systems, may have fallen short. The framework and its recommendations are clearly applicable beyond the realm of pain and broadly address the challenge of simply doing any health research to a high standard. Our goal in the ENTRUST-PE project was to highlight these critical challenges and offer a framework to specifically support change for the pain research community.

The need for senior researchers to demonstrate values-based leadership across their many roles in the ecosystem is critical. This leadership includes advocating for changes to policy and systems, making those changes with a sense of the urgency of the mission, modelling the behaviours recommended in the framework, and creating cultures, incentives and environments that allow early career researchers to safely adopt them. Creating systemic change in complex and stressed multi-level systems is notoriously challenging. We acknowledge that in the current research ecosystem, some recommended actions may threaten specific commercial and other vested interests, at least in the short to medium term. We also recognise that language, concepts of trust and best practice in research will evolve over time and that the recommendations of the framework should evolve with them. Future research is needed to further develop our understanding of best practice across the core values of the framework and to understand the broad impacts of and barriers to engaging in trustworthy research. This includes impacts on our research but also economic impacts, impacts on research systems, careers and patient care.

As members of the pain research community, we believe lasting change comes from within. There are examples of excellent practice in pain science for each of the core values, but they are not consistent across the community, and excellence in addressing one core value is not necessarily reflected across all. Neither do we consider ourselves to be outside or mere observers of current practice. We are all at varying stages of engaging with many of the values and actions presented here, and humility and reflection in relation to where our own practice can improve is essential. The framework is offered as a lever for quality improvement for all. We hope that readers use this resource as an opportunity to reflect on their own practice and where it might be improved.

The framework's recommendations may seem challenging, both in terms of the burden of work and resources, and in terms of researchers feeling confident and competent to engage. To meet the core values will require investment of time, money and resource across the ecosystem. It is also important to recognise that the burden should not be borne solely by researchers "on the ground". The framework makes clear recommendations for various power brokers in the research ecosystem to facilitate activity to meet these values. Taking PPIE as an example, we now see major international funders adopting mandates for PPIE in funded research and the development of networks of patient and public partners and resources and toolkits to support more meaningful engagement and the need for meaningful engagement and involvement now reflected in the Declaration of Helsinki[98]. Moreover, there are emerging state laws in the U.S. requiring diversity in clinical trials and engagement with community organizations for institutions who receive federal funding, and institutions are responding through developing resources and infrastructure to support investigators in meeting these regulations.

There are many existing processes fundamental to integrity, safety, rigor, and quality including ethical and regulatory approvals, developing data management plans, and trial registration, that place some level of burden on the ecosystem. But few would argue that these processes, now considered standard parts of our research process, are not necessary for trustworthy research. We propose the same is true for recommendations across all values of the ENTRUST-PE framework. Change will be incremental, but if the pain research community invests time and resource now we can create a future environment that makes each process more efficient and sustainable.

But consider for a moment the unlimited costs and consequences of not acting: research waste, stalled progress, inadequate care and potentially avoidable suffering. For the researcher considering how to enhance the trustworthiness of their research, we suggest they might conduct an inventory of the current core values they are already incorporating and then commit to seeing what changes they can implement immediately and what medium-to-long-term changes they can plan a path towards. A "commitment to making one change now", may be more realistic than "do everything immediately." We have attempted to offer clear and specific short-term actions for each element of the framework including suggestions for "What change can I make now?" to enable any researcher to move towards each of the values in the framework (see Table 3).

Each of these actions has the potential to improve the trustworthiness of your research going forward, and each action should make the next improvement easier. We have curated some key resources to assist in that goal[69]. We recommend visiting the project website at https://entrust-pe.org/ for the full ENTRUST-PE white paper with more

Table 3
What change can I make now?.

Research Integrity and Governance	Act consistently in alignment with the principles and values of research integrity. Be aware of local and wider research integrity and governance policies and act in alignment with those.Senior investigators: lead by example.
Equity and Inclusivity	When reporting research: • comprehensively report sample characteristics • adopt inclusive language, • use accurate interpretations of constructs of race, ethnicity, sex and gender • clearly make and report efforts to promote diversity and inclusion of study samples
Patient and Public Involvement and Engagement	Engage diverse potential patient and public partners before the project begins and involve them throughout the process. Plan PPIE at the very start (conception and planning) of the research process. Clearly report PPIE.
Methodological Rigour	Ensure the aims and questions of research are clearly conceptualised and communicated.Choose appropriate research designs for the research question.Provide adequate detail to reproduce study methodology.
Transparency and Openness	Pre-register your research, regardless of design. Update registrations with modifications to plans and results.
Balanced Communication	Report all planned results regardless of the findings. Consider the range of possible alternative interpretations as well as study limitations in your interpretation of study findings.
Data Authenticity	Draw attention to any errors in your work and issue corrections in a full, transparent and timely fashion.

context for the framework and detailed recommendations for each stakeholder; factsheets with specific recommendations for research funders[99], regulators and policymakers[100], institutions that undertake research[101], researchers[102], peer reviewers[103], editors and publishers[104], patients and the public[105], and learned societies[106], downloadable versions of the Fig.s presented here and curated links to resources to support each core value.

7. Conclusions

Trustworthy research is undertaken with integrity, is equitable and inclusive, rigorous, accessible, transparent, authentic, and communicated with balance. Untrustworthy research is inequitable, exclusionary, done or applied to people rather than with them, is not rigorous, transparent, accessible, or authentic, is not fully communicated or is communicated with bias and spin. Only one of these problems may be sufficient to diminish the trustworthiness of research. We propose that trustworthy evidence is necessarily underpinned by each of the core values of the framework and that action across the pain research community has the potential to radically improve our science and, ultimately, the lives of people with pain. Although many influences, incentives and disincentives might divert us from that end, the challenge is that we collectively commit and act to maintain that focus.

Disclosures

NOC is a member of the Cochrane Central Editorial Board. Between 2020 and 2023 Neil was Co-ordinating Editor of the Cochrane Pain, Palliative and Supportive Care group, whose activities were funded by an infrastructure grant from the UK National Institute of Health and Care Research (NIHR). He is the Chair of the International Association for the Study of Pain (IASP) Methodology, Evidence Synthesis and Implementation special interest group.

JB is co-chair of IASP Global Alliance of Partners for Pain Advocacy Task Force, a voluntary role; is Patient & Public Partnerships Editor at the Journal of Orthopaedic & Sports Physical Therapy; member PAINSTORM Advisory Council, receives travel support to attend annual meetings received an honorarium and travel support for the 2023 Canadian Pain Society annual meeting and 2024 San Diego Pain Summit; received travel support for the 2024 New Zealand Pain Society Annual Meeting; is a co-researcher on MRFF Grant 2022802 "Our Recovery – A consumer-led, evidence-based online program to optimise pain self-management in the community".

GC has been awarded research grants of the Research Foundation Flanders (FWO) and Ghent University for research on the psychological aspects related to pain, distress and disability, and for research on the promotion of physical activity in diverse populations. He is currently involved in the UK Advanced Pain Discovery Platform (APDP) PAINSTORM (as co-PI), in the APDP Consortium to Research Individual, Interpersonal & Social Influences in Pain (CRISSP, as member of advisory board), and in the APDP projects CHIPP and Forecast (as affiliated researcher). He receives consultancy for advising a company MoveUP in developing a digital intervention to promote a healthy lifestyle in bariatic patients. Geert Crombez is currently editor in chief of Health Psychology Review. He is also member of the steering committee of the Behavioural and Social Sciences Ontology (BSSO) Foundry. He is also member of the international advisory board of GALENOS (Global Alliance for Living Evidence on aNxiety, depressiOn and pSychosis), which aims to develop an ontology in the domain of mental health.

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MCF is funded by an Australian Government Research Training Program PhD scholarship and a Neuroscience Research Australia PhD Pearl supplementary scholarship. He is the Treasurer of the International Association for the Study of Pain (IASP) Methodology, Evidence Synthesis and Implementation special interest group, and the Early Career Researcher Representative of the IASP Complex Regional Pain Syndrome special interest group.

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RK has consulted for Pfizer, Caramus, Mibe Pharma and Sandoz. Payments were made to his institution through Nottingham University Consultants.

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EN is Local Network Lead for Brunel University London's UK Reproducibility Network, Co-Chair of European Health Psychology Society's Open Science Special Interest Group and Associate Editor for

Health Psychology & Behavioural Medicine.

TP has received research grants from the US National Institutes of Health; honorarium from the United States Association for the Study of Pain (USASP) in her role as Editor-in-Chief of The Journal of Pain; and author royalties from Oxford University Press.

GP has received consultancy and lecture fees from Grünenthal, Voatris, GSK, Haleon, Sanofi.

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ASCR declares the following interests: Employee Imperial College London; Hon Consultant Chelsea and Westminster Hospital NHS Foundation Trust (retired from direct clinical practice); Consultancy and advisory board work for Imperial College Consultants- in the last 36 months this has included remunerated work for: AsahiKasei Pharma, Lateral, Pharmnovo, Novartis, Mundipharma, Toray, Confo, Combigene, Orion, Shanghai SIMR Biotech, Vertex, & Science Practice (Wellcome Trust); ASCR is named as an inventor on patents: Rice A.S.C., Vandevoorde S. and Lambert D.M Methods using N-(2-propenyl)hexadecanamide and related amides to relieve pain. WO 2005/079771, Okuse K. et al Methods of treating pain by inhibition of vgf activity EP13702262.0/ WO2013 110945; Committee membership: International Association for Study of Pain- multiple activities related to President -elect position, and Federation liaison roles (SE and S Asia), Member Joint Committee on Vaccine and Immunisation- varicella subcommittee, Analgesic Clinical Trial Translation: Innovations, Opportunities, and Networks (ACTTION) steering committee member, Medicines and Healthcare products Regulatory Agency (MHRA), Commission on Human Medicines - Neurology, Pain & Psychiatry Expert Advisory Group; Grants and studentships - UKRI (Medical Research Council & BBSRC), Versus Arthritis, Alan and Sheila Diamond Trust, Royal British Legion, European Commission, Ministry of Defence, Dr Jennie Gwynn Bequests, The British Pain Society, Royal Society of Medicine, Royal College of Anaesthetists - Heritage and Archives Committee (2020 - date); Lecture honoraria: MD Cancer Cancer Center –2021, University California San Francisco. CSF12th Pediatric Pain Master Class (USA) Dec 2021, Bioevents – Controversies in Neuropathic pain – 2021, Royal Marsden Hospital 2019, Indonesian Neurological Association Pain Study Group International Lecture Series Donated to (Association of Southeast Asian Pain Societies (ASEAPS) –Oct 2022, Malaysian Society of Anaesthesiologists – July 2022, Siriraj Hospital Bangkok international relations programme- visiting Professorship Nov 2022 – used for expenses, Pain Association of Singapore- lecture honorarium March 2023; Author royalties: Amazon KDP- Dardanelles to Dunkirk – donated to Halo Trust, Royal Pharmaceutical Society- British National Formulary- finished 2023.

GR has paid casual contract at the University of Oxford to teach Evidence-Based Medicine (EBM) and supervise research.Her expenses have been reimbursed for speaking at conferences and events, and she has received fees for speaking to and training coroners by the Judicial College. She is an Associate Editor of BMJ Evidence Based Medicine for which she receives a small annual remuneration. She is the Director of a limited company that has been independently contracted to conduct research and work in the private sector, including for AstraZeneca and Field Fisher. She receives remuneration from subscriptions to her personal SubStack publication. Between September 2017 and March 2021, she was financially supported by the NHS National Institute of Health Research (NIHR) School for Primary Care Research (SPCR), the Naji Foundation, and the Rotary Foundation to study for a Doctor of Philosophy (DPhil) at the University of Oxford. She has received grants to conduct research from NIHR SPCR and the Primary Care Research Trust of Birmingham and Midlands Research Practices Consortium Grant.

KS has received a conference fee waiver from the European Pain Federation (EFIC) He is scientific co-ordinator on the ERA-NET Neuron CO-Fund OptiMeth-CRPS project.

NS is local Network Lead for Imperial College London UK Reproducibility Network, an Associate Editor for PAIN and Openness and Transparency Editor for Journal of Pain. She is funded by the Jennie Gwynn legacy fund.

TRT declares consultancies, travel grants and speaking fees for AOP Orphan, Almiral Hermal, Bionest Partners, Benkitt Renkiser, Grünenthal, Hexal, Indivior, Kaia Health, Apurano, Lilly, Medscape, Mundipharma, MSD, Novartis, Pfizer, Recordati Pharma, Sanofi-Aventis and TAD Pharma.

DT in the past 3 years has received research grants and contracts from the US Food and Drug Administration and the US National Institutes of Health, US Patient-Centered Outcome Research Institute, and US National Center for Occupational Health and Safety; received compensation for serving on advisory boards from Eli Lilly, GlaxoSmithKline, Novartis, and Pfizer, and Vertex Pharmaceuticals.

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JW declares funding from NIHR (NIHR203568) as PI on the INSPECT-SR project, which will produce a tool for assessing trustworthiness of RCTs. JW additionally declares Stats or Methodological Editor roles for BJOG, Fertility and Sterility, Reproduction and Fertility, Journal of Hypertension, and for Cochrane Gynaecology and Fertility.

AH, FK, DS, GS and JV have no declarations of interest.

Patient and public involvement and engagement statement

The ENTRUST-PE project included a patient partner (JB) as a full and equal network member from the inception to completion of the project. JB is a co-author of ENTRUST-PE publications.

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References

1. Adler RH. Trustworthiness in qualitative research. *J Hum Lact Off J Int Lact Consult Assoc*. 2022;38:598–602. https://doi.org/10.1177/08903344221116620.
2. Lincoln YS, Guba EG. But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. *New Dir Program Eval*. 1986;1986:73–84. https://doi.org/10.1002/ev.1427.
3. Banks GC, Rogelberg SG, Woznyj HM, Landis RS, Rupp DE. Editorial: evidence on questionable research practices: the good, the bad, and the ugly. *J Bus Psychol*. 2016;31:323–338. https://doi.org/10.1007/s10869-016-9456-7.
4. International Association for the Study of Pain. Iasp Presidential Task Force on Cannabis and Cannabinoid Analgesia Collection, 162 2021, S1-S2.
5. Moore RA, Fisher E, Finn DP, et al. Cannabinoids, cannabis, and cannabis-based medicines for pain management: an overview of systematic reviews. *Pain*. 2021;162:S67–S79. https://doi.org/10.1097/j.pain.0000000000001941.
6. Fisher E, Moore RA, Fogarty AE, et al. Cannabinoids, cannabis, and cannabis-based medicine for pain management: a systematic review of randomised controlled trials. *Pain*. 2021;162(Suppl 1):S45–S66. https://doi.org/10.1097/j.pain.0000000000001929.
7. Soliman N, Haroutounian S, Hohmann AG, et al. Systematic review and meta-analysis of cannabinoids, cannabis-based medicines, and endocannabinoid system modulators tested for antinociceptive effects in animal models of injury-related or pathological persistent pain. *Pain*. 2021;162:S26–S44. https://doi.org/10.1097/j.pain.0000000000002269.
8. Chalmers I, Glasziou P. Avoidable waste in the production and reporting of research evidence. *Lancet Lond Engl*. 2009;374:86–89. https://doi.org/10.1016/S0140-6736(09)60329-9.
9. Macleod MR, Michie S, Roberts I, et al. Biomedical research: increasing value, reducing waste. *Lancet Lond Engl*. 2014;383:101–104. https://doi.org/10.1016/S0140-6736(13)62329-6.
10. Williams AC de C, Fisher E, Hearn L, Eccleston C. Psychological therapies for the management of chronic pain (excluding headache) in adults. *Cochrane Database Syst Rev*. 2020;8:CD007407. https://doi.org/10.1002/14651858.CD007407.pub4.
11. Fisher E, Law E, Dudeney J, Palermo TM, Stewart G, Eccleston C. Psychological therapies for the management of chronic and recurrent pain in children and adolescents. *Cochrane Database Syst Rev*. 2018;9:CD003968. https://doi.org/10.1002/14651858.CD003968.pub5.
12. O'Connell NE, Ferraro MC, Gibson W, et al. Implanted spinal neuromodulation interventions for chronic pain in adults. *Cochrane Database Syst Rev*. 2021;12:CD013756. https://doi.org/10.1002/14651858.CD013756.pub2.
13. Birkinshaw H, Friedrich CM, Cole P, et al. Antidepressants for pain management in adults with chronic pain: a network meta-analysis. *Cochrane Database Syst Rev*. 2023;5, CD014682. https://doi.org/10.1002/14651858.CD014682.pub2.
14. Geneen LJ, Moore RA, Clarke C, Martin D, Colvin LA, Smith BH. Physical activity and exercise for chronic pain in adults: an overview of cochrane reviews. *Cochrane Database Syst Rev*. 2017;4:CD011279. https://doi.org/10.1002/14651858.CD011279.pub3.
15. Fisher E, Villanueva G, Henschke N, et al. Efficacy and safety of pharmacological, physical, and psychological interventions for the management of chronic pain in children: a WHO systematic review and meta-analysis. *Pain*. 2022;163:e1–e19. https://doi.org/10.1097/j.pain.0000000000002297.
16. Gibson W, Wand BM, Meads C, Catley MJ, O'Connell NE. Transcutaneous electrical nerve stimulation (TENS) for chronic pain - an overview of cochrane reviews. *Cochrane Database Syst Rev*. 2019;4:CD011890. https://doi.org/10.1002/14651858.CD011890.pub3.
17. Ferraro MC, Cashin AG, Wand BM, et al. Interventions for treating pain and disability in adults with complex regional pain syndrome- an overview of systematic reviews. *Cochrane Database Syst Rev*. 2023;6, CD009416. https://doi.org/10.1002/14651858.CD009416.pub3.
18. Cashin AG, Wand BM, O'Connell NE, et al. Pharmacological treatments for low back pain in adults: an overview of cochrane reviews. *Cochrane Database Syst Rev*. 2023;(4), CD013815. https://doi.org/10.1002/14651858.CD013815.pub2.
19. Rabbitts JA, Fisher E, Rosenbloom BN, Palermo TM. Prevalence and predictors of chronic postsurgical pain in children: a systematic review and meta-analysis. *J Pain*. 2017;18:605–614. https://doi.org/10.1016/j.jpain.2017.03.007.
20. Hayden JA, Wilson MN, Riley RD, Iles R, Pincus T, Ogilvie R. Individual recovery expectations and prognosis of outcomes in non-specific low back pain: prognostic factor review. *Cochrane Database Syst Rev*. 2019;2019:CD011284. https://doi.org/10.1002/14651858.CD011284.pub2.
21. Gleadhill C, Lee H, Kamper SJ, et al. Mixed messages: most spinal pain and osteoarthritis observational research is unclear or misaligned. *J Clin Epidemiol*. 2023;155:39–47. https://doi.org/10.1016/j.jclinepi.2023.01.005.
22. Almeida MO, Yamato TP, Parreira P do CS, Costa LOP, Kamper S, Saragiotto BT. Overall confidence in the results of systematic reviews on exercise therapy for chronic low back pain: a cross-sectional analysis using the assessing the methodological quality of systematic reviews (AMSTAR) 2 tool. *Braz J Phys Ther*. 2020;24:103–117. https://doi.org/10.1016/j.bjpt.2019.04.004.
23. Dosenovic S, Jelicic Kadic A, Vucic K, Markovina N, Pieper D, Puljak L. Comparison of methodological quality rating of systematic reviews on neuropathic pain using AMSTAR and R-AMSTAR. *BMC Med Res Methodol*. 2018;18:37. https://doi.org/10.1186/s12874-018-0493-y.
24. Kolstoe SE, Pugh J. The trinity of good research: distinguishing between research integrity, ethics, and governance. *Account Res*. 2023;0:1–20. https://doi.org/10.1080/08989621.2023.2239712.
25. Shaw S, Boynton PM, Greenhalgh T. Research governance: where did it come from, what does it mean? *J R Soc Med*. 2005;98:496–502.
26. Bouter L. Why research integrity matters and how it can be improved. *Account Res*. 2023:1–10. https://doi.org/10.1080/08989621.2023.2189010.
27. D'Souza RS, Klasova J, Kleppel DJ, Prokop L, Hussain N. Hidden influence? Unmasking conflicts of interest from randomized clinical trials on spinal cord stimulation for chronic pain. *Reg Anesth Pain Med*. 2024. https://doi.org/10.1136/rapm-2024-105903.
28. Palermo TM, Davis KD, Bouhassira D, et al. Promoting inclusion, diversity, and equity in pain science. *Pain*. 2023;164:217–220. https://doi.org/10.1097/j.pain.0000000000002847.
29. Jiang TE, Edwards KA, Dildine TC, et al. Trends in patient representation in low back pain pharmacological randomized clinical trials, 2011-2020: a systematic review. *J Pain*. 2024;25(6), 104456. https://doi.org/10.1016/j.jpain.2023.12.013.
30. Letzen JE, Mathur VA, Janevic MR, et al. Confronting racism in all forms of pain research: reframing study designs. *J Pain*. 2022;23:893–912. https://doi.org/10.1016/j.jpain.2022.01.010.
31. Sharma S, Verhagen A, Elkins M, et al. Research from low-income and middle-income countries will benefit global health and the physiotherapy profession, but it requires support. *Braz J Phys Ther*. 2023, 100530. https://doi.org/10.1016/j.bjpt.2023.100530.
32. Hood AM, Morais CA, Aroke EN, et al. Antiracism coalition in pain research (ACTION-PR): guiding principles for equity in reporting. *j pain*. 2023;24:19–21. https://doi.org/10.1016/j.jpain.2022.11.002.
33. Morais CA, Aroke EN, Letzen JE, et al. Confronting racism in pain research: a call to action. *J Pain*. 2022;23:878–892. https://doi.org/10.1016/j.jpain.2022.01.009.
34. Briggs AM, Jordan JE, Sharma S, et al. Context and priorities for health systems strengthening for pain and disability in low- and middle-income countries: a secondary qualitative study and content analysis of health policies. *Health Policy Plan*. 2023;38:129–149. https://doi.org/10.1093/heapol/czac061.
35. Haroutounian S, Holzer KJ, Kerns RD, et al. Patient engagement in designing, conducting, and disseminating clinical pain research: IMMPACT recommended considerations. *Pain*. 2024;165(5):1013–1028. https://doi.org/10.1097/j.pain.0000000000003121.
36. Belton J, Hoens A, Scott A, Ardern CL. Patients as partners in research: it's the right thing to do. *J Orthop Sports Phys Ther*. 2019;49:623–626. https://doi.org/10.2519/jospt.2019.0106.
37. Smith BH, Belton JL. Patient engagement in pain research: no gain without the people in pain. *PAIN*. 2022. https://doi.org/10.1097/j.pain.0000000000003122.
38. Fox G, Fergusson DA, Daham Z, et al. Patient engagement in preclinical laboratory research: a scoping review. *EBioMedicine*. 2021;70, 103484. https://doi.org/10.1016/j.ebiom.2021.103484.
39. Woolley KL, Stones SR, Stephens R, et al. Patient authorship of medical research publications: an evolution, revolution, and solution? *Learn Publ*. 2024;37(3), e1607. https://doi.org/10.1002/leap.1607.
40. Ocloo J, Garfield S, Franklin BD, Dawson S. Exploring the theory, barriers and enablers for patient and public involvement across health, social care and patient safety: a systematic review of reviews. *Health Res Policy Syst*. 2021;19:8. https://doi.org/10.1186/s12961-020-00644-3.
41. Lang I, King A, Jenkins G, Boddy K, Khan Z, Liabo K. How common is patient and public involvement (PPI)? Cross-sectional analysis of frequency of PPI reporting in health research papers and associations with methods, funding sources and other factors. *BMJ Open*. 2022;12, e063356. https://doi.org/10.1136/bmjopen-2022-063356.
42. Dawson S, Campbell SM, Giles SJ, Morris RL, Cheraghi-Sohi S. Black and minority ethnic group involvement in health and social care research: a systematic review. *Health Expect*. 2018;21:3–22. https://doi.org/10.1111/hex.12597.
43. The British Psychological Society Research Board. Position Statement: Open Data 2020. Published June 9 2020. Accessed November 21 2023. ⟨https://www.bps.org.uk/guideline/open-data-position-statement⟩.
44. Allen C, Mehler DMA. Open science challenges, benefits and tips in early career and beyond. *PLOS Biol*. 2019;17, e3000246. https://doi.org/10.1371/journal.pbio.3000246.
45. Munafò MR, Nosek BA, Bishop DVM, et al. A manifesto for reproducible science. *Nat Hum Behav*. 2017;1:1–9. https://doi.org/10.1038/s41562-016-0021.
46. Thibault RT, Amaral OB, Argolo F, Bandrowski AE, Drude Alexandra RD. NI. open science 2.0: towards a truly collaborative research ecosystem. *PLOS Biol*. 2023;21, e3002362. https://doi.org/10.1371/journal.pbio.3002362.
47. Cashin AG, Bagg MK, Richards GC, Toomey E, McAuley JH, Lee H. Limited engagement with transparent and open science standards in the policies of pain journals: a cross-sectional evaluation. *BMJ Evid-Based Med*. 2021;26:313–319. https://doi.org/10.1136/bmjebm-2019-111296.
48. Gabelica M, Bojčić R, Puljak L. Many researchers were not compliant with their published data sharing statement: a mixed-methods study. *J Clin Epidemiol*. 2022;150:33–41. https://doi.org/10.1016/j.jclinepi.2022.05.019.
49. Dufka FL, Munch T, Dworkin RH, Rowbotham MC. Results availability for analgesic device, complex regional pain syndrome, and post-stroke pain trials: comparing the RReADS, RReACT, and RReMiT databases. *Pain*. 2015;156:72–80. https://doi.org/10.1016/j.pain.0000000000000009.

50. Smith SM, Dworkin RH. Prospective clinical trial registration: not sufficient, but always necessary. *Anaesthesia*. 2018;73:538–541. https://doi.org/10.1111/anae.14189.
51. Smith SM, Wang AT, Pereira A, et al. Discrepancies between registered and published primary outcome specifications in analgesic trials: ACTTION systematic review and recommendations. *Pain*. 2013;154:2769–2774. https://doi.org/10.1016/j.pain.2013.08.011.
52. Hamilton DG, Hong K, Fraser H, Rowhani-Farid A, Fidler F, Page MJ. Prevalence and predictors of data and code sharing in the medical and health sciences: systematic review with meta-analysis of individual participant data. *BMJ*. 2023;382, e075767. https://doi.org/10.1136/bmj-2023-075767.
53. TARG meta-research group & collaborators. estimating the prevalence of discrepancies between study registrations and publications: a systematic review and meta-analyses. *BMJ Open*. 2023;13, e076264. https://doi.org/10.1136/bmjopen-2023-076264.
54. Hahnel M., Smith G., Schoenenberger H., Scaplehorn N., Day L. The State of Open Data 2023. Digital Science; 2023. https://doi.org/10.6084/m9.figshare.24428194.v1.
55. Naudet F, Sakarovitch C, Janiaud P, et al. Data sharing and reanalysis of randomized controlled trials in leading biomedical journals with a full data sharing policy: survey of studies published in The BMJ and PLOS Medicine. *BMJ*. 2018;360:k400. https://doi.org/10.1136/bmj.k400.
56. Moore A, Karadag P, Fisher E, Crombez G, Straube S, Eccleston C. Narrative bias ("spin") is common in randomised trials and systematic reviews of cannabinoids for pain. *Pain*. 2024;165(6):1380–1390. https://doi.org/10.1097/j.pain.0000000000003140.
57. Boutron I. Spin in scientific publications: a frequent detrimental research practice. *Ann Emerg Med*. 2020;75:432–434. https://doi.org/10.1016/j.annemergmed.2019.11.002.
58. Gewandter JS, McKeown A, McDermott MP, et al. Data interpretation in analgesic clinical trials with statistically nonsignificant primary analyses: an ACTTION systematic review. *J Pain*. 2015;16:3–10. https://doi.org/10.1016/j.jpain.2014.10.003.
59. Fanelli D. How many scientists fabricate and falsify research? a systematic review and meta-analysis of survey data. *PLoS ONE*. 2009;4, e5738. https://doi.org/10.1371/journal.pone.0005738.
60. Ferraro MC, Moore RA, de C Williams AC, et al. Characteristics of retracted publications related to pain research: a systematic review. *Pain*. 2023;164(11):2397–2404. https://doi.org/10.1097/j.pain.0000000000002947.
61. Fang FC, Steen RG, Casadevall A. Misconduct accounts for the majority of retracted scientific publications. *Proc Natl Acad Sci*. 2012;109:17028–17033. https://doi.org/10.1073/pnas.1212247109.
62. Candal-Pedreira C, Ross JS, Ruano-Ravina A, Egilman DS, Fernández E, Pérez-Ríos M. Retracted papers originating from paper mills: cross sectional study. *BMJ*. 2022;379, e071517. https://doi.org/10.1136/bmj-2022-071517.
63. Committee on Publication Ethics (COPE). Systematic manipulation of the publishing process via "paper mills." Published September 4 2020. Accessed June 22 2023. ⟨https://publicationethics.org/systematic-manipulation-paper-mills⟩.
64. Byrne JA, Christopher J. Digital magic, or the dark arts of the 21st century-how can journals and peer reviewers detect manuscripts and publications from paper mills? *FEBS Lett*. 2020;594:583–589. https://doi.org/10.1002/1873-3468.13747.
65. Beall J. Predatory publishers are corrupting open access. *Nature*. 2012;489:179. https://doi.org/10.1038/489179a.
66. Cortegiani A, Longhini F, Sanfilippo F, Raineri SM, Gregoretti C, Giarratano A. Predatory Open-Access Publishing in Anesthesiology. *Anesth Analg*. 2019;128:182–187. https://doi.org/10.1213/ANE.0000000000003803.
67. Grudniewicz A, Moher D, Cobey KD, et al. Predatory journals: no definition, no defence. *Nature*. 2019;576:210–212. https://doi.org/10.1038/d41586-019-03759-y.
68. Ganjavi C, Eppler MB, Pekcan A, et al. Publishers' and journals' instructions to authors on use of generative artificial intelligence in academic and scientific publishing: bibliometric analysis. *BMJ*. 2024;384, e077192. https://doi.org/10.1136/bmj-2023-077192.
69. O'Connell NE, Belton J, Crombez G, et al. ENTRUST-PE: an integrated framework for trustworthy pain evidence. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/e39ys.
70. The San Francisco Declaration on Research Assessment. Declaration on Research Assessment (DORA); Published May 13 2013. Accessed June 30 2023. ⟨https://sfdora.org/⟩.
71. Moher D, Bouter L, Kleinert S, et al. The Hong Kong principles for assessing researchers: Fostering research integrity. *PLoS Biol*. 2020;18, e3000737. https://doi.org/10.1371/journal.pbio.3000737.
72. Singapore Statement on Research Integrity. World Conferences on Research Integrity (WCRI); 2010.; Published September 22 2010. Accessed January 10 2024. ⟨https://www.wcrif.org/guidance/singapore-statement⟩.
73. Mejlgaard N, Bouter LM, Gaskell G, et al. Research integrity: nine ways to move from talk to walk. *Nature*. 2020;586:358–360. https://doi.org/10.1038/d41586-020-02847-8.
74. Standard Operating Procedures for RI (SOPS4RI) SOP4RI Research Integrity tools for RFOs.; Published 2022, Accessed 20/6/2023 ⟨https://sops4ri.eu/⟩.
75. Traeger AC, Bero LA. Corporate influences on science and health—the case of spinal cord stimulation. *JAMA Intern Med*. 2024;184:129–130. https://doi.org/10.1001/jamainternmed.2023.6962.
76. Rickard E, Ozieranski P. A hidden web of policy influence: the pharmaceutical industry's engagement with UK's all-party parliamentary groups. *PLOS ONE*. 2021;16, e0252551. https://doi.org/10.1371/journal.pone.0252551.
77. Brennan TA, Rothman DJ, Blank L, et al. Health industry practices that create conflicts of interest: a policy proposal for academic medical centers. *JAMA*. 2006;295:429–433. https://doi.org/10.1001/jama.295.4.429.
78. Universities UK. The Concordat to Support Research Integrity. 2019; Published October 25 2019. Accessed June 21 2023. ⟨https://www.universitiesuk.ac.uk/topics/research-and-innovation/concordat-support-research-integrity⟩.
79. Palermo TM. Editorial: introducing new reporting guidelines to address inclusion, diversity, equity, antiracism, and accessibility: implementation at the journal of pain. *J Pain*. 2023;24:22–23. https://doi.org/10.1016/j.jpain.2022.11.001.
80. UKRI Medical Research Council. Embedding diversity in research design. Published 2023. Accessed May 20 2023. ⟨https://www.ukri.org/who-we-are/mrc/our-policies-and-standards/embedding-diversity-in-research-design/⟩.
81. National Institute for Health and Care Research (NIHR) UK. PPI (Patient and Public Involvement) resources for applicants to NIHR research programmes. Published Devcember 18 2019, Accessed June 21 2023. ⟨https://www.nihr.ac.uk/documents/ppi-patient-and-public-involvement-resources-for-applicants-to-nihr-research-programmes/23437⟩.
82. Jones J, Cowe M, Marks S, et al. Reporting on patient and public involvement (PPI) in research publications: using the GRIPP2 checklists with lay co-researchers. *Res Involv Engagem*. 2021;7:52. https://doi.org/10.1186/s40900-021-00295-w.
83. National Institute for Health and Care Research (NIHR) UK. UK Standards for Public Involvement in Research. Published 2019. Accessed June 21 2023. ⟨https://nihr.ac.uk/pi-standards/home⟩.
84. Hemingway H, Croft P, Perel P, et al. Prognosis research strategy (PROGRESS) 1: a framework for researching clinical outcomes. *BMJ*. 2013;346, e5595. https://doi.org/10.1136/bmj.e5595.
85. Vollert J, Macleod M, Dirnagl U, et al. The EQIPD framework for rigor in the design, conduct, analysis and documentation of animal experiments. *Nat Methods*. 2022;19(11):1334–1337. https://doi.org/10.1038/s41592-022-01615-y.
86. Higgins J.P.T., Thomas J., Chandler J. et al. Cochrane Handbook for Systematic Reviews of Interventions version 6.3. Cochrane; 2022.
87. Analgesic, Anesthetic, and Addiction Clinical Trial Translations, Innovations, Opportunities, and Networks (ACTTION): Publications. Analgesic, Anesthetic, and Addiction Clinical Trial Translations, Innovations, Opportunities, and Networks; Accessed June 22 2023 ⟨https://www.acttion.org/publications⟩.
88. Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT): Publications. Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials. Accessed June 15 2024. ⟨http://www.immpact.org/publications.html⟩.
89. Bova G, Domenichiello A, Letzen JE, et al. Developing consensus on core outcome sets of domains for acute, the transition from acute to chronic, recurrent/episodic, and chronic pain: results of the INTEGRATE-pain delphi process. *EClinicalMedicine*. 2023;66, 102340. https://doi.org/10.1016/j.eclinm.2023.102340.
90. Grieve S, Perez RSGM, Birklein F, et al. Recommendations for a first core outcome measurement set for complex regional PAin syndrome clinical sTudies (COMPACT). *Pain*. 2017;158:1083–1090. https://doi.org/10.1097/j.pain.0000000000000866.
91. The Centre for Open Science. Accessed January 15 2024. ⟨https://www.cos.io/⟩.
92. The UK Reproduciblity Network. Global Reproducibility Networks.Accessed May 2 2024.
93. Campbell R, Javorka M, Engleton J, Fishwick K, Gregory K, Goodman-Williams R. Open-science guidance for qualitative research: an empirically validated approach for De-identifying sensitive narrative data, 25152459231205832 *Adv Methods Pract Psychol Sci*. 2023;6. https://doi.org/10.1177/25152459231205832.
94. Andaur Navarro CL, Damen JAA, Ghannad M, Dhiman P, van Smeden M, Reitsma JB, et al. SPIN-PM: a consensus framework to evaluate the presence of spin in studies on prediction models. *J Clin Epidemiol*. 2024, 111364. https://doi.org/10.1016/j.jclinepi.2024.111364.
95. Parker L, Boughton S, Lawrence R, Bero L. Experts identified warning signs of fraudulent research: a qualitative study to inform a screening tool. *J Clin Epidemiol*. 2022;151:1–17. https://doi.org/10.1016/j.jclinepi.2022.07.006.
96. Weibel S, Popp M, Reis S, Skoetz N, Garner P, Sydenham E. Identifying and managing problematic trials: a research integrity assessment tool for randomized controlled trials in evidence synthesis. *Res Synth Methods*. 2023;14:357–369. https://doi.org/10.1002/jrsm.1599.
97. Mol BW, Lai S, Rahim A, et al. Checklist to assess trustworthiness in randomised controlled trials (TRACT checklist): concept proposal and pilot. *Res Integr Peer Rev*. 2023;8:6. https://doi.org/10.1186/s41073-023-00130-8.
98. World Medical Association. Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Participants. Published 22/10/2024. Accessed 28/10/2024. ⟨https://www.wma.net/policies-post/wma-declaration-of-helsinki/⟩.
99. O'Connell NE, Belton J, Crombez G, et al. Enhancing trust in pain evidence: the entrust-PE framework. A summary for funders of research. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/xuanr.
100. O'Connell NE, Belton J, Crombez G, et al. Enhancing trust in pain evidence: the entrust-PE framework. A summary for regulators and policymakers. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/3fvyt.
101. O'Connell NE, Belton J, Crombez G, et al. Enhancing trust in pain evidence: The entrust-PE framework. A summary for institutions that undertake research. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/3ernv.
102. O'Connell NE, Belton J, Crombez G, et al. Enhancing trust in pain evidence: the entRUST-PE framework. A summary for researchers. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/y6e3s.
103. O'Connell NE, Belton J, Crombez G, et al. Enhancing trust in pain evidence: the entrust-PE framework. A summary for peer reviewers. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/8hg2v.

104. O`Connell NE, Belton J, Crombez G, et al. Enhancing trust in pain evidence: the entrust-PE framework. A summary for editors and publishers. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/sn76u.

105. O`Connell NE, Belton J, Crombez G, et al. Enhancing trust in pain evidence: the entrust-PE framework. An explainer for patients and the public. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/6s5e9.

106. Enhancing trust in pain evidence: the entrust-pe framework. a summary for learned socieities. *OSF Preprints*. 2024. https://doi.org/10.31219/osf.io/ygaec.