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Integrity and Misconduct, Where Does Artificial Intelligence Lead?

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ABSTRACT

This paper, part of the third stage of the *Harbingers* project studying early career researchers (ECRs), focuses on the impact of artificial intelligence (AI) on scholarly communications. It concentrates on research integrity and misconduct, a ‘hot’ topic among the publishing community, in no small part due to the rise of AI. The interview-based study, supported by an extensive literature review, covers a convenience sample of 91 ECRs from all disciplines and half a dozen countries. It provides a new and fresh take on the subject, using the ‘voices’ of ECRs to describe their views and practices regarding integrity and misconduct. We show that ECRs are clearly aware of research misconduct and questionable practice with three-quarters saying so. A big indictment of the scholarly system, but, not surprising given a rising number of retractions and questionable journals. The main blame for this is levelled at the haste with which researchers publish and the volume of papers produced. ECRs also feel that things are likely to get worse with the advent of AI. They believe that they are aware of the problems and how to avoid the pitfalls but suspect that things are approaching a cliff-edge, which can only be avoided with strong policies and an overhaul of the reputational system.

1 | Introduction

With the scholarly community widely held to be overwhelmingly motivated by values of honesty, rigour, transparency, open communication, accountability, and care and respect for all participants (ALLEA—All European Academies 2023; UK CORI—The UK Committee on Research Integrity 2023; US National Academies 2017), research integrity can never be far from the minds of the various stakeholders involved in the advancement of knowledge. Indeed, the decade-long exploration of early career researchers’ scholarly attitudes and behaviours in the three stages of the *Harbingers*¹ project², covering more than 50 scholarly communication aspects in interviews with around 170 ECRs from eight countries, identified misconduct

and questionable practices as a crucially important ‘crack’ in the scholarly system (Nicholas, Boukacem-Zeghmouri, et al. 2023). There is a clear danger of the ‘publish or perish’ culture trumping scientific integrity.

Further aggravating the problem is that threats to research integrity have come to the fore and multiplied now that artificial intelligence (AI) is fast being integrated into research (see literature review). No doubt, all this helps explain why today research integrity and misconduct is said to be the hottest topic in the scholarly world, with countless discussions of the topic and prognostications of future developments published (see, e.g., Dwivedi et al. 2023; Fui-Hoon Nah et al. 2023; Kardes and Tuna Oran 2024; Lund et al. 2023; Ray 2023; Susarla

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Summary

- ECRs are very aware of existing levels of research misconduct and low-grade practices, putting the main blame for this on the speed with which researchers are encouraged to publish as many papers as possible.
- The widespread availability of questionable, predatory or grey journals is also seen as a contributory factor.
- AI is believed to make matters much worse. The genie has come out of the bottle and the remedy must be a change in the reputational system, rather than greater prescription.

et al. 2023). Hardly surprisingly, the menace of a ‘ghostwriter in the machine’ and its capability to jeopardise research quality and integrity (Clark et al. 2025) have recently been the focus of deliberations in industry conferences and meetings, too (Jones 2024).

The consensual view seems to be that whilst AI-powered technologies afford novel opportunities, they also enable widespread scholarly misconduct (see literature review), a view that ECRs, as a cohort, are best-positioned to stress-test. As discussed elsewhere, they are the largest cohort in today’s research community, heavily involved in all the various aspects of scholarly work, who, empowered by their millennial values, possess the openness needed to bring about change (Kent et al. 2022; Nicholas, Herman, et al. 2023). In the specific case of adopting AI-based tools, as Herman et al. (2024) suggest, they certainly stand to gain a lot, especially when it comes to enhancing their productivity, the key to all scholarly rewards and career advancement. However, they are also the ones most likely to lose out if they do not exercise caution and succumb to the siren-song of AI-enabled questionable behaviours. ECRs, then, are the perfect specimen to put under the microscope when we set out to explore how scholarly integrity is safeguarded (or not) in today’s scholarly realities.

2 | Aims

The broad aim of the study is to discover and report in their very own words what ECRs think about research integrity, research misconduct, and questionable research practices, as they focus on the difference AI might bring about to the situation.

Specific objectives are to explore:

1. Their awareness and knowledge of the extent of bad and low-grade research practices and how they define them.
2. Their views on the influence of AI on research quality, integrity and ethics.
3. Their awareness of extant policies and practices regarding questionable journals.
4. Their knowledge and views of retraction.
5. To place all the above in the context of an extensive literature review.

3 | Scope and Working Definitions

3.1 | Artificial Intelligence—AI

Artificial Intelligence has no firm or formal definition. Consequently, when asking about attitudes to and anticipations of the place of AI it is necessary to consider—‘what do you mean by AI?’ The earliest attempts at AI focused on activities closely related to the formal logic inherent in the digital machine, mathematics, cryptography, games such as chess. There was also a strong interest in natural language translation. In parallel, a biological interest, in particular neurology and psychology, gave rise to ‘cybernetics’ where the computer was seen as a possible tool by which to model cognitive processes. Thus, from the beginning there were divisions in AI; between cybernetics and computation and latter between those who saw a foundation of intelligence in abstraction and logic and proponents of heuristics and models.

Briefing notes were provided for interviewers giving an outline of the history and scope of ‘AI’ but for the most part what is reported here is what our respondents considered to be AI; a definition by literary or user warrant. It should be noted that we were not interviewing specialists in ‘AI’, for the views of passive observers, uninterested or uninformed, may be just as influential. Thus, we found that even quite unremarkable word processing tools were considered ‘AI’ by some of our respondents (Clark et al. 2025). The scope of ‘AI’ here is inevitably biased by a contemporary interest in Generative AI and Large Language Models, thus only a sub-set of what may be considered as Artificial Intelligence.

To put it simply, for the most part we are talking about the capacity to generate a plausible text and image—a convincing and realistic fiction. In essence, the process is statistical, the output text is plausible because the words are arranged in ways that match the probabilities derived from the training input. But the process is occult, there is no facility to determine, verify, or analyse the logic or ‘reasoning’ of the process. Contrast that with symbolic AI, autonomic and mathematical models where there is an ‘audit trail’—an algorithm that may be verified or an activity that can be tested and demonstrated to work. Perhaps the advent of ‘reasoning’ models may change that, we think it too early to say. With Generative AI we must judge appearances, what is presented: truth or fiction? And that, perhaps, is the appropriate focus when considering the role of ‘AI’ in research integrity and misconduct: is it true evidence, knowledge and belief?

3.2 | Research Integrity

As Armond et al. (2024) suggest, research integrity is definable as ‘the conduct of the research process ethically, with honesty, robustness, and transparency when proposing, conducting, evaluating, and reporting research findings’. Indeed, the literature leaves no doubt that the integrity of research is based on individual and collective adherence to the core values and principles of objectivity, honesty, openness, fairness, reliability, accountability and rigour (ALLEA—All European Academies 2023; UK CORI—The UK Committee on Research Integrity 2023; US National Academies of Sciences, Engineering,

and Medicine 2017). Thus, as the UK Research Integrity Office (UKRIO—Research Integrity Office 2025a, 2025b) suggests, complementing the definition of the term, research integrity refers to all the factors that underpin good research practice and promote trust and confidence in the research process. As such, it covers the whole lifecycle of research, from the initial idea and design of the project through the conduct of the research and its dissemination, in all disciplines of research (UKRIO—Research Integrity Office 2025a, 2025b).

3.3 | Research Misconduct and Questionable Research Practices

According to UKRIO—Research Integrity Office (2025a), a definition of research misconduct might be behaviours that deliberately or recklessly fall short of the standards expected, through all stages in the research cycle and all aspects of it, from the initial idea through to reporting outcomes. However, whilst manipulating data (falsification), making up data (fabrication), and stealing words/ideas/data (plagiarism), often referred to as FFP, are the behaviours most considered research misconduct; there is a whole range of poor behaviours outside the definition of misconduct (Kolstoe 2024). These are known as ‘questionable research practices’, in that they do not meet the ideal standard, but do not quite reach the definition of research misconduct. Thus, inappropriate behaviours form a spectrum rather than a hard and fast line, ranging from errors and sloppiness to falsification and criminality, from misunderstanding and incompetence to fabrication (Kolstoe 2024; UKRIO—Research Integrity Office 2025b). It is important to note here, however, as it can be seen in the Results Section below, that our cohort had their own views as to the definition of the terms ‘research integrity’ and ‘research misconduct’.

3.4 | Early Career Researchers—ECRs

With different, conflicting and country-specific definitions of an ECR circulating (Teixeira da-Silva 2021), a pragmatic conceptualisation of the term was decided on. Our definition of an ECR thus focuses on the common denominators of their standing, that is, their being employed in a research position but, being relatively young and in an early phase of their career, not yet established as permanent faculty:

Researchers generally not older than 40³, who either have received their doctorate and are currently in a research position or have been in research positions, but are currently doing a doctorate. In neither case are they researchers in established or tenured positions. In the case of academics, some are non-tenure line faculty research employees.

4 | Literature Review

When it comes to the importance of integrity to the conduct of research, the preamble to World Conferences on Research Integrity (2010), the first international effort to foster greater

integrity in research worldwide, says it all: ‘the value and benefits of research are vitally dependent on the integrity of research’. Indeed, with new research offerings inevitably based on previous contributions to the body of knowledge, only an appropriate level of research integrity can ensure that subsequent work is built on solid foundations. Obviously, though, as Bouter (2023) points out, what is good for the quality and reliability of research is not always good for a scholarly career, so it is up to research institutes, funding agencies and scholarly journals to foster research integrity, perhaps above all by improving the quality of peer review and reforming researcher assessment.

The basis for doing so is obviously seeing to it that the principles that underpin research integrity, most notably honesty, rigour, reliability, accountability, transparency, open communication, and respect for all participants, as well as the professional responsibilities these principles entail and behaviours they instil, are safeguarded (ALLEA—All European Academies 2023; UKRIO—Research Integrity Office 2025a; World Conferences on Research Integrity 2010). Only then can research integrity provide the comprehensive framework for researchers that can guide them in carrying out their work within accepted ethical frameworks and following good scientific practice (ALLEA—All European Academies 2023).

However, as noted, the all-pervasive publish-or-perish atmosphere in academe (Moosa 2018; Van Dalen and Henkens 2012), coupled with the ever-more competitive environment among the burgeoning numbers of active researchers (Roach and Sauermann 2017), poses hard-to-resist temptations for researchers to engage in questionable research practices or, worse, resort to misconduct to comply with the challenges they face. Hardly surprisingly, research productivity is still a major yardstick by which scholarly success is measured (Blankstein and Wolff-Eisenberg 2019; Herman 2018; Lee 2024; Niles et al. 2020), which renders the building up of a voluminous publishing record a key goal of ECRs (Carcu 2021; Herman and Nicholas 2019; Jamali et al. 2020; Lee 2024; Nicholas et al. 2018; Nicholas et al. 2020). Indeed, as Yeo-Teh and Tang (2022) found in their analytic review of the pertinent literature, perceived publication pressure is associated with a higher engagement with research misconduct and questionable research practices, even if a direct causal relationship between the two phenomena is difficult to establish because of the multiple personal and environmental factors involved.

Study after study indicates that the prevalence of misbehaviour in the scholarly world is not only already worrisome, but on the rise, too, as evidenced by Xie et al. (2021) systematic review of studies into the prevalence of research misconduct and questionable research practices in the years up to 2020. As they found, 2.9% of the researchers had committed research misconduct—at least 1 of FFP (falsification, fabrication and plagiarism), and 12.5% had engaged in 1 or more questionable research practices. In addition, 15.5% of researchers witnessed certain behaviours of research misconduct. Tellingly, whilst the prevalence of research misconduct was consistent with findings of previous meta-analyses, the prevalence of questionable research practices was considerably higher: for example, in Fanelli’s (2009) study 28.53% of the researchers knew researchers who had engaged in questionable research practices.

Later studies provide further empirical evidence as to the ongoing prevalence of research misconduct and questionable research practices; indeed, their upsurge. Take, for example, a nation-wide survey on research integrity, which targeted all disciplinary fields and academic ranks in The Netherlands. Among the 6813 respondents who completed the survey (2021), the prevalence of fabrication was 4.3% and of falsification 4.2%. The prevalence of questionable research practices ranged from 0.6% to 17.5%, with 51.3% of respondents engaging frequently in at least one questionable practice. Thus, over the 3 years preceding the study, one in two researchers engaged frequently in at least one questionable practice, while one in 12 reported having falsified or fabricated their research at least once. Finally, and arguably most importantly, the survey found a higher prevalence of misconduct than earlier surveys (Gopalakrishna et al. 2022).

There are additional indications that an escalation in unethical behaviours is underway. A case in point is the uptick in the number of 'extremely productive' authors: according to a study that explored the phenomenon of extreme publishing, up to four times more researchers produce more than 60 papers in a single calendar year, compared to the data from a study published less than a decade before (Ioannidis et al. 2024). Although the researchers made no effort to identify if some of these authors were associated with overtly unethical practices, in a *Nature* article, reporting on the findings of their study, Ioannidis was cited as saying: 'I suspect that questionable research practices and fraud may underlie some of the most extreme behaviours...' (Conroy 2024).

Another study, which found that an accelerating number of researchers are achieving implausibly high publication rates, with many producing tens to hundreds of papers per year, extrapolates their actual number potentially on the order of one million researchers. This is obviously a rather concerning number of potentially unscrupulous researchers, although the authors warn against assuming that such rates are inherently and solely indicative of poor research quality or unethical practices, as it is yet to be definitively established under what circumstances research quantity might affect quality. However, as the authors go on to suggest, at excessive rates, these cases are likely to be the result of paper pumping and low quality and/or unethical behaviour (Mora and Pilia 2024).

Perhaps, unsurprisingly, considering just how crucially important research productivity is for ECRs, it is among them that a greater incidence of unethical behaviours has been found. Thus, the study in The Netherlands showed that being a PhD candidate or junior researcher increased the odds of frequently engaging in at least one questionable research practice (Gopalakrishna et al. 2022). Similarly, Mora and Pilia's (2024) study found that extreme publishing practices, which, as noted, refer to the phenomenon of accelerating number of researchers achieving implausibly high publication rates, are emerging even at early career stages, linking the phenomenon to the systemic incentive structures that encourage metric inflation.

Lending further support to the trend identified, a study by Ioannidis et al. (2024), which used data from the Scopus

citation database to compile a list of top-cited researchers early in their careers—those whose citation indices were in the top 2% for their field or in the top 100,000 across all fields. The study found a marked rise between 2019 and 2023 in the number of both the 'precocious' authors—those who reached the top-cited list within 8 years of their first publication, and the 'ultra-precocious' ones—those who did so within 5 years. In the case of the former the number increased from 213 to 469, and in the case of the latter, from 28 to 59. True, the trend cannot be unequivocally put down to questionable research habits, but it still raises questions about how so many ECRs have racked up such many citations so quickly, especially as 2024 data indicates that 17 of the authors who qualified as ultra-precocious had at least one paper retracted. Indeed, the study concludes with the observation that 'while some authors with precocious citation impact may be stellar scientists, others probably herald massive manipulative or fraudulent behaviours infiltrating the scientific literature' (Ioannidis 2024; Soliman 2025).

The most revealing indicator of the severity of the problem is that the number of retractions issued for research articles in 2023 passed 10,000—a new record. Indeed, according to *Nature's* analysis, the retraction rate—the proportion of papers published in any given year that go on to be retracted—has more than trebled in the past decade (Van Noorden 2023). This is a wake-up call, for publications based on retracted articles are rendered, at least in part, unreliable (Bolland et al. 2022). Easier said than done, though, for the most frequent causes of retractions are traceable to scientific misconduct. Thus, for example, the reasons for the increasing number of retractions in the Middle East over the last two decades were found to be plagiarism, duplicate publishing, fabricated peer review and fraud (Liu and Lei 2021).

If the problems surrounding the quest for maintaining a healthy research climate were not troubling enough, the advent of AI threatens to make things worse. Even proponents of harnessing AI-powered tools and systems to research practices warn against its potentially harmful utilisation (Susarla et al. 2023), some even oppose their adoption for this very reason, as exemplified by Chomsky's characterising ChatGPT as "basically high-tech plagiarism" (Chomsky et al. 2023).

Certainly, as Van Dis et al. (2023) suggest, AI might very well accelerate research, but it could also degrade the quality and transparency of research, producing poor-quality papers with text that may look convincing but often contains inaccuracies, bias and plagiarism. Indeed, according to a *Nature* survey of 1600 researchers, AI was feared to have the potential to spread misinformation, to make plagiarism easier to do and harder to detect, to introduce mistakes and bias into research texts, and to make it easier to fabricate or falsify research (Van Noorden and Perkel 2023). Similarly, the European Research Council (ERC) found that 62% of the respondents expressed concern that generative AI could spread false information or inaccurate scientific knowledge (ERC—European Research Council 2023).

The most talked-about worry, though, concerns the so-called hallucinations—texts that give the impression of being fluent and natural, despite being unfaithful and nonsensical (Ji et al. 2023), although there are techniques that can limit their

damage (Jones 2025). Beyond that, the literature lists a few additional problems that render the undiscerning utilisation of AI tantamount to resorting to questionable research practices: using outputs that, having been manipulated, may not be authentic; using outputs that, having been elicited through inadequately engineered prompts, are erroneous or misleading; using outputs that lack citations, without which it is difficult to judge the credibility and trustworthiness of the ideas presented (Fui-Hoon Nah et al. 2023; Susarla et al. 2023).

5 | Methodology

5.1 | Recruitment of Interviewees

National interviewers (from China, Malaysia, Poland, Portugal, Spain, UK and US) recruited ECRs, using their local research networks and connections supplemented by mail-outs from scholarly publisher lists. For this pathfinder phase, each country was originally allocated a quota of interviewees (10), but happenings on the ground did not go according to plan. Malaysia, Portugal and Spain did recruit 10 interviewees each. However, in the case of China, AI turned out to be such a hot topic that 21 ECRs were recruited, and in the case of Poland, thanks to local funding⁴, an additional 22 Arts and Humanities (A&H) ECRs were recruited, making it 32 altogether. As local considerations delayed interviewing in the UK and US, just 7 ECRs were recruited in time for the start of the study. Given the exploratory nature of the project, the imbalance in country coverage was not seen as a limitation. The expanded pilot with 91 ECRs, the attraction of extending the study to the A&H and the opportunity to take a closer look

at China, given its growing importance in the international scholarly landscape, more than made up for it.

Interviewees included both ECRs who participated in *Harbingers-2* and were happy to continue (26 of them), as well as new ones, recruited to fill the ranks of participants who had left research, no longer qualified as ECRs, or declined because of work commitments or lack of interest.

The breakdown of the ECR cohort by country, discipline, gender and age-band are given in Table 1. Note especially the age of the cohort and how many relatively older researchers there are. There are three reasons for this. First, for reasons of convenience we retained ECRs from previous stages of the project, they were all a year or two older. Second, it is the nature of academic, or indeed any employment, that not everyone moves forever upward. Third, some of researchers who were ECRs at the time of *Harbingers-2* had since become tenured, so, technically, no longer fit our definition of an ‘early career researcher’.

5.2 | Data Collection

Semi-structured, free-flowing interviews of 60–90 min in duration were the main source of data. The interview schedule consisted of 7 pages of questions⁵, covering an exhaustive range of general scholarly communication topics and activities as well as questions about AI and its impact on research activities. There were 64 questions in all, but only 33 either asked about or mentioned integrity and its related terms and these are the focus of this analysis. A list of these questions can be found in the results

TABLE 1 | Demographic breakdown of convenience sample in 2024.

Discipline										
	CHEM	ENVIR	HUM/ARTS	LIFE	MATH	MED	PHY	SOCH*	SOCs**	Total
N	7	4	23	6	9	12	16	5	9	91
%	8%	4%	25%	7%	10%	13%	18%	5%	10%	100%
Country										
	CN	ES	GB	MY	PL	PT	US			Total
N	22	10	3	10	32	10	4			91
%	24%	11%	3%	11%	35%	11%	4%			100%
Age										
	Youngest (26–30)	Younger than most (30–34)	Median (35–37)	Older than most (37–39)	Oldest (39–51)	N/A	Median			Total
N	18	18	18	18	18	1***	36			91
%	20%	20%	20%	20%	20%	1%				100%
Gender										
	Male				Female				Total	
N	43				48				91	
%	47%				53%					

Note: * Includes Economics and Business, Geography and Psychology. ** Includes Anthropology, Politics and Sociology. *** did not supply.

section. Furthermore, a couple of questions were not asked of arts and humanities ECRs because of their lack of relevance.

5.3 | Data Analysis

All interview transcripts, having been read and approved by the interviewees, were translated to English where necessary and transferred by the national interviewers to a coding sheet, which closely matched the questions of the original interview schedule but left room for information derived from additional enquiries or clarifications during the interview process. Thus, the coding sheets, containing quantitative and qualitative data, as a question could and often did generate both, and capturing as they did quotations and sometimes explanatory comments from the interviewers, were multi-faceted.

Five questions directly addressed the topic of concern and these questions had a quantitative and qualitative component and the former were coded as Y/N and so forth, and the latter were subjected to a thematic analysis.

In addition, a search and collation of all the interview records was undertaken for mentions of the term research integrity and its associated terms and this identified questions for further quantitative and thematic analysis. Mentions alone of course are merely evidence of recognition, they may be negative, positive, or just mentioned in passing; the context is all-important. For insight and analysis, there is the need to dig-down—to the quotes and comments. Herein the number of ‘mentions’ is calculated to count a mention only once per interview, so total number of mentions is always relative to the total number of ECRs in the study (91).

6 | Results

The results focus on violations of research integrity, what ECRs think of it, do about it and what impact AI is having/going to have on it all. As a result, we examine unethical practices, research misconduct, questionable journals, low-grade research among many other things. There was a number of questions in the interview schedule about integrity because previous rounds of Harbingers had raised the issue as being one of the most important and now with: (a) the huge march of predatory/grey journals since driven by the prospects of money proffered by Article Publication Charges (APCs); (b) rise of papermills; and (c) the prospect of papers written by machines, it was felt that things might be running high in this area.

The source of the data are five direct questions about various aspects of the topics often focussing on the impact of AI and another two dozen or so questions about all aspects of scholarly communications, where the various manifestations of research misconduct were mentioned in answering these questions and identified by a keyword search.

6.1 | Direct Questioning

The 5 direct, largely open-ended, and slightly overlapping questions asked about: (1) awareness and extent of bad and

low-grade research practice; (2) The influence of AI on research quality; (3) Influence of AI on integrity and ethics; (4) Policies and practices regarding questionable journals; and (5) Retractions.

The first 3 topics formed a section of the interview entitled ‘research integrity and ethics’, the 4th part of an open science/access section and the 5th in a pre-print section.

6.1.1 | Awareness and Extent of Bad and Low-Grade Practice

Q. Are they aware of bad science/questionable/low grade practice being undertaken in their field and subsequently published?

This was an attempt to establish the scale of the problem and to place it in the context of surrounding factors impacting on research quality. Although this was not essentially a quantitative question, nearly everyone responded to it as if it was one, saying, yes, no and don't know and the ones that did not do so were manageable enough to be easily assigned a code. Thus, all ECRs (69—Polish A&H were not asked the question) answered this ‘close to the bone’ question with the large majority (51; three-quarters) saying that they were ‘aware of such behaviour’, which is admittedly a quite low hurdle to jump, but pressing researchers any harder might have resulted in fewer responses as they might have felt the question was aimed at them. Quite tellingly only a handful of researchers (3) said they did not know. Still, there seems a widespread belief that there are bad practices in their field or related fields. For instance, this Chinese medical ECR was certain that there was widespread poor practice:

Yes, academic misconduct in medicine is a very common phenomenon, such as trade authorships, image duplication, etc.

And another Chinese ECR, a soft social scientist this time, thought it would get even worse: *Yes, poor quality academic research will become more and more common*

Interestingly, the main blame was levelled at the speed with which researchers published and the sheer volume of papers produced, a consequence of a demanding and competitive environment. For instance:

A Chinese soft social scientist, like so many other ECRs, said that bad practice was down to speed: *Yes, some people publish papers extraordinarily fast, I'm sceptical about this.*

This Spanish chemist thought the problem was down to the volume of output that was demanded:

Yes, publishing 20 articles in any field, but especially chemistry, in one year is impossible. And there are many people who do it.

Questionable journals were raised as an increasing problem, such as by this Malaysian hard social scientist:

These days, dealing with phishing journals is a new headache. Even my [senior] colleagues can't tell the difference between the

real deal and the shady ones. Now, it feels like we have to play detective and figure out which journal is legit. It's becoming a whole new challenge.

Another Malaysian, this time a mathematical ECR, mentioned the problem of 'grey' publishers, too:

I tried my best to avoid questionable journals. Publishing integrity are key aspects that will hold ECRs in good stead on their scientific career path. I have a history of publishing articles in journals like MDPI and Hindawi. But recent surprise stems from a decision made by the Ministry. Unfortunately, the Ministry has chosen not to allow funding for APC in the case of these specific journals. This decision has raised concerns and has implications for my future publishing endeavours, as APC funding plays a crucial role in facilitating the dissemination of research findings.

A Portuguese life scientist on a similar theme, but placing the finger on poor reviewing practices of grey journals as a factor:

Unfortunately, there are journals where the review process is questionable and where the business model and charging for APCs takes precedence over scientific quality, for example some MDPI journals.

While numbers are relatively low and we should not read too much into the data Portuguese ECRs were most likely to say they were unaware (4/10) and the Malaysians the most likely to be aware (9/10). The latter is said to be down to the poor showing of the country in the retraction tables:

Yes. Sources like Retraction Watch reported this. The recent article about Malaysia being one of the top countries, and many are from IEEE conferences. We [Malaysia] have had quite a high of papers, but it is sad, some had to be pulled back because of integrity [issues]. There's this article in Malaysiakini [local newspaper], a study published by [in] Nature, looked at research articles from the past two decades and guess what? Malaysia landed in sixth place for the highest retraction rates worldwide. [Malaysian mathematical scientist].

There were also the few ECRs who did not feel there was a problem or were not sure there would be one, such as this Chinese medical ECR:

No. It's hard to say, sometimes it feels like the results of some papers don't turn out to be very truthful, but I haven't asked for proof. It's also very tightly regulated now, and there are special websites for checking, so we're all very rigorous.

6.1.2 | The Influence of AI on Research Quality

Q. Do they believe that the AI-associated potential for rapid production of low-quality scientific articles brings about a decline in the overall quality of research output, indeed, facilitated the growth of predatory journals and papermills?

In this question we addressed some of the concerns being voiced about AI, for instance, that it might increase the amount of

misconduct and would make the whole situation worse. While a long question and focusing on low-quality as opposed to outright misconduct, it was really quite a simple and direct one. It lent itself to a yes or no answer, which was typically accompanied by an explanation and often a lengthy one, even from the Chinese who tend to be wary.

In fact, it turned out that the question struck a chord with ECRs and we obtained fewer "don't knows" than normal (13% when it's more like 20% for other questions). They also tended to go into detail with some relish. The general verdict is—as was supposed—ECRs are clearly worried about diminishing quality and more misconduct, with 68% (62/91) thinking so.

Malaysians were the most likely to believe that quality would fall with 9/10 saying so, with the Spanish close behind with 8/10. Nearly half of those researchers believing it would not diminish quality were Chinese. Engineers also made the point that AI's impact on the quality of papers in their discipline was minimal, also noting a weak AI involvement in engineering fields.

Let us look at a selection of the large population of ECRs who had serious concerns:

True because AI can make papers quickly, it's a worry because it could be used by this shady publishers to churn out lots of content just for money, without caring much about quality. [Malaysian mathematical scientist]

I think AI, unfortunately, can indeed be used to 'manufacture' articles in order to gain as many ministerial points as possible for periodic assessment. I suspect that reputable editors will certainly be wary of accepting articles of questionable quality, but AI could lead to a lot of abuse, which is by the way already noticeable. [Polish A&H ECR]

I predict that in the near future, predatory journals will be 'fed' primarily by articles written by AI. There is also a significant risk that the galloping development of AI and the temptation to rely on this ever-improving technological tool will contribute to an increase in unreliable publications. [Polish A&H ECR]

And, now to the less populated "not so worried" category of ECRs:

First an ECR who felt it was easy to spot: No, in my opinion, this low-quality research and questionable publications are very easy to detect. Although there are more and more of them, AI also works the other way round—in addition to creating low-quality articles, it also detects and eliminates them. [Polish medical scientist]

Second one who believes measures will be introduced to prevent it happening: *No. This won't happen. If everyone uses it, the threshold will be raised, and those who can't use it will be eliminated. With a significant number of users, there will be measures to avoid exploitation. It won't encourage the development of predatory journals, and the quantity will eventually reach a balance through natural selection. [Chinese mathematical scientist]*

6.1.3 | Influence of AI on Integrity and Ethics

Q. Do they think AI is raising any other issues of scholarly integrity and ethics? If so, what are they and what can be done about it?

The purpose of this follow-up question was to prompt further on the topic and widen it to integrity and ethics and an excuse to prompt for such things as deepfakes, job displacement, autonomous systems etc. if not previously mentioned. And, in fact, the question clearly yielded much more data with ECRs' answers being long and thoughtful. There were widespread worries and concerns on show here, but not necessarily regarding deepfakes and job losses. A good number—mainly Malaysians who seem to be very drilled, acknowledging that while there were other issues to address, they could be dealt with. So, providing a 'yes, but' response really. Inevitably, this 'spill over question' (following two related questions) occasionally expanded on issues raised earlier and proved an excuse to expand further on what had already been said. This resulted in a 'yes, but' type of response. Fraud, plagiarism, poor ethical behaviour, low quality material, authenticity, copyright were the major concerns raised, and the issues anticipated. These quotes are representative of what we received, on problems of authentication, plagiarism and ownership:

Yes. It is difficult to guarantee the authenticity of the data when writing an article using artificial intelligence. In addition, it is difficult to determine whether the ideas and findings in the study are actually presented by the author himself or herself. (Chinese medical scientist)

Yes. it is filling the journals with unoriginal articles that do not contribute much to the research. Sincerely, from my point of view, they should be considered as plagiarism. [Spanish chemist]

AI raises the issue of not respecting copyright and not referring to source scientific texts. [Polish life scientist]

I suspect AI helps students [from country X] applying for PhD programmes by making research proposals better. It writes the content, makes the language perfect, nicely formatted, and customises for different academic programmes, especially for arts and social sciences. Yes, AI also checks for plagiarism and saves time. But students need to use AI responsibly and keep things honest in their applications. [Malaysian mathematical scientist]

Recently, as I reviewed a paper [from country X], very obvious it uses AI; a significant issue caught my attention—as usual, the cited sources were nowhere to be found. That's a serious red flag, isn't it. [Malaysian life scientist]

Some ECRs, while believing there were 'other issues' to raise, were clearly wrestling with the problem and suggested some quite big changes to overcome the worst excesses of the situation occurring. For instance, this from a Spanish chemist:

Modifying the evaluation criteria would be key to the integrity of the research. If the evaluation were not based on "weight"

(the more you have, the more valuable you are), the high concern for publishing a lot would probably decrease; the more the better, sometimes abandoning interest in the quality of what is published.

The views of Polish A&H ECRs are of special interest as we know little about A&H ECRs:

It is important to educate children and young people early on, so that they can consciously use AI as a tool, rather than [relying on it as] a solution to a problem. A public campaign on this topic would be welcomed.

Of the genuinely new topics raised that were raised for the first time were: (in order of magnitude) legislation/regulation, automation, job replacement, deepfakes and problems of assessing student coursework were raised in relatively small numbers. This quote from another A&H ECR is especially interesting as it was one of the few on deepfakes:

Violation of personal rights by deepfakes. In addition, too much automation of everyday life, aided by AI, can lead to convenience being prioritised over honesty and ethics, further exacerbating modern human isolation and social divisions. [Polish A&H ECR]

Finally, summing up and generalising the data shows 60/88 (two-thirds) believed there were 'other' issues, albeit including previously mentioned ones; just nine (one-in-ten) thought not and the remainder (19) were undecided or did not know. Malaysians were more likely to say yes and the Spanish undecided or knew too little to say anything.

6.1.4 | Policies and Practices Regarding Questionable Journals

Q. Does their research team/department/university have a policy on avoiding predatory and questionable journals? If yes, what is it?

While largely a qualitative question, it also obtained a coded response from nearly all researchers (not including Polish A&H ECRs who were not asked this question). Dealing with the quantitative side first, exactly half (32) of respondents said there was a policy, with the Malaysian most likely to say they had one (7/10) and the Chinese (9/12) and Portuguese (3/10) least likely to have one. In terms of subject, it was the soft social scientists that were more likely to say yes (7/9) and the mathematical scientists most likely to say no (7/9).

Looking at the comments that accompanied the yes's and no's (there were 59 of them) most mentioned lists of various kinds—black lists, early warning ones, indexed by lists (Web of Science [WoS], Scopus) and the like (25 mentions). Other ways of avoiding questionable journals included word of mouth (12) and published by MDPI—especially in China (10). Half a dozen said they were confident in identifying themselves (and did not need a list) and the like (25 times).

Illustrative quotes follow:

Portuguese life scientist on the importance of (several) lists:

Yes, we try to make a careful selection of the journals to which we submit our work. The journals have to be indexed, be in the first or second quartile, have an impact factor and not be on Beall's list of "predatory journals" (<https://beallslist.net/>).

A Chinese medic on a specific national list:

Based on the list of predatory journals from the Chinese Academy of Sciences.

A Polish mathematical scientist on word of mouth:

I wouldn't call it politics, but each person on the team can get advice from "someone more experienced" for an opinion about the journal or conference.

Spanish hard social scientist on avoiding certain publishers:

We don't publish in predatory journals and don't publish either in MDPI or Frontiers journals

6.1.5 | Retractions

Q. Making available research results quickly and openly can be at expense of quality and reproducibility and there is evidence for this: the number of retractions of preprints and final versions of papers. (a) Have any researchers you know retracted a paper? (b) Have any editors or publishers you know retracted a paper?

There has been a huge rise in retractions according to Nature (Van Noorden 2023) and while not every retraction is a case of misconduct as honest unfixable errors can also happen, but it seems misconduct is a big factor. Hence the direction of travel of the question on retractions provide a wake-up call or a light-bulb moment.

This was a more pointed and informative question. It was largely a yes or no question. As regards part a, only a relatively small number (13/65) ECRs knew any researchers who have had papers retracted and over half of them were Chinese. However, the numbers rose when they were asked the question more generally regarding publishers to 22/65, about a third and again most were Chinese. In both question cases (a and b) medical sciences was the discipline in which most occurred, although the numbers are small.

Some comments left by ECRs:

Personally, no. But I do know there are so many papers being retracted nowadays... there're this list Retraction Watch leaderboard listing those with the most retractions [Malaysian life scientist]

Not personally, but the publishers of the magazines I consult all have retracted publications. [Spanish life scientist]

Mostly from health and biology, you can check out the Retraction Watch database; there're more retractions of papers by publishers

these days. It's unclear if the reason is because they want to publish fast, but preprints are retracted due to errors or misconduct discovered post-publication. [Malaysian Life scientist]

6.2 | Indirect Questions Generating Relevant Content (Mentions Analysis)

Of course, ethical, integrity and misconduct issues can arise in respect to many of the other scholarly communications questions asked in our interviews (after all, there were 64 in all), so we conducted a keyword search to find if it did and in what scholarly contexts. Plainly, it is not easy to conduct a search because the subject can manifest itself in many ways and described variously. It is a soft topic. So, a keyword search is always likely to be only rough and ready and this was made less so by scanning a sample of the quotes to identify useful search terms. As a result, we ended up with these ones: fabrication; falsification; misconduct; cheating; plagiarism; predatory; (dis) honesty; quality; deepfakes; bad science; questionable; retractions and declining and all forms of these words. Then we excluded the false positives and these were mainly associated with the terms quality and honesty.

Before we look at the results of the analysis a word on the use of the term 'mentions', it is used as shorthand for 'ECRs who mentioned'. A 'mention' is counted once per ECR, repeat mentions by the same ECR do not count. But sometimes we look at the whole interview, sometimes we are considering individual questions. So, if you add up individual questions there may be multiple counts from the same ECR.

Twenty-three additional questions contained one or more of our 'ethics' terms and covered the whole area of scholarly communications (see Table 2). With 82 mentions being made in all, the most questions came from the authorship, writing and publishing areas (8). If we look at the individual questions 3 questions yielded 10 or more mentions. They were in order of most mentions:

- Does AI have any implications for research reputation? If so, what are they? (14)
- Are they concerned about the use of 'AI' in any way? If so, why? (13)
- Will 'AI' be a transformational force? If so, in what ways? What will be the advantages and disadvantages of the transformations that will take place? (11)

It seems then that AI is at the forefront of research misconduct and ethical concerns.

We will look in the main at the comments associated with the questions that received 10 or more ECR mentions and provide a representative sample of three quotes for each.

Does AI have any implications for research reputation? If so, what are they? (14)

First, a Chinese medic, clearly hoping it would, but unsure:

TABLE 2 | Non-direct questions that mention integrity et al.

Q. no.	ECRs	Scholarly topic
General AI questions (6 Q; 26 M)		
B01	2	What, if any, is their experience of, or at least encounters with 'AI'—not just in an academic or work context.
B03	1	What is the extent of their use or engagement. For instance (to be used to jolt the memory, if necessary, after answering question):
B04	5	How do they view 'AI', for instance (to be used to jolt the memory, if necessary, after answering the question):
B05	13	Are they concerned about the use of 'AI' in any way? If so, why?
B05a	4	Do you think they will come about (now, in a year or two, this decade, in your working lifetime)
B05b	1	In general, would these speculative uses be a good or bad thing?
Reputation (2 Q; 15 M)		
C07	1	There is a need to improve the ways in which scientific research output is evaluated by funding agencies and academic institutions by considering openness and transparency factors, such as OA, open data and outreach. What are your views on such a policy?
C08	14	Does AI have any implications for research reputation? If so, what are they?
Communication practices (3 Q; 4 M)		
D06	1	If not raised above, do they share their ideas and/or early stage/interim results over general social media channels, such as Instagram, Twitter, Facebook, TikTok and LinkedIn?
D12	2	To what extent do they feel that the peer review system vouches for the quality and trustworthiness of formally published research?
D14	1	What would make them suspect that published material was possibly AI generated?
Authorship, writing and publishing (8 Qs; 15 Ms)		
E02	1	Are these policies changing/ being challenged because of 'AI' becoming (sort of) another author?
E08f	1	(f) the geographical location/ origins of journal/publisher

(Continues)

TABLE 2 | (Continued)

Q. no.	ECRs	Scholarly topic
E09	3	Will 'AI' change their relative ratings or introduce any new factors?
E11	3	Have they done peer review themselves?
E12	1	Do they feel that the peer review system needs improving in any way?
E13	3	What do you think an AI-based peer-review should be capable of doing, if it is to replace the current system?
E14	2	Does their research team/department/ university have a policy regarding OA publishing? If yes, what is it?
E18a	1	Do they consider a preprint to be: (a) an alternative to; a traditional publication? Whether yes or no, why?
Transformations (4 Qs; 22 Ms)		
F01	6	What form do they think a transformed scholarly communications system might take?
F02	3	Do they think that journals will still have a central role to play in 10 years' time?
F03	2	What role do you think libraries will have for researchers in 10 years' time as compared to their current role, especially considering the growing utilisation of 'AI'?
F04	11	Will 'AI' be a transformational force? If so, in what ways? What will be the advantages and disadvantages of the transformations that will take place?

Yes. Using AI would bring up some academic integrity issues; we'd have to control the AI. If it's just polishing the language and such it's fine, but not being able to detect its truth or falsehood would be a mess.

Now a Polish A&H ECR who dwelt on the ghostwriter in the machine and what all this means:

Negative. AI can be a tool that will be used negatively. Instead of a human being, it will be the machine that writes the text; then the question of ethics comes into play. I don't see positive uses, but I don't use it either; I don't know these tools well.

Are they concerned about the use of 'AI' in any way? If so, why?

Chinese medic on acknowledging the use of AI in a paper:

Yes. Artificial intelligence has gradually penetrated into the academic field; some people in the medical field also use ChatGPT

to publish papers, although the paper will declare the use of ChatGPT in this study at the end, but with the increasing phenomenon, it is difficult to guarantee that all scientific researchers can have this sense of integrity. Maybe someone will use ChatGPT to publish some low-quality and meaningless papers

A Polish humanist who clearly does not feel threatened in any way by AI:

I am not concerned about the development of AI—AI is not capable of generating original philosophical research. I don't want to do futurology, but from what I observe, AI can help in purely mechanical matters such as programming, in that it can replace humans. In scientific work, on the other hand, I don't see a threat from AI. I am not afraid that someone can falsify my texts with AI tools, impersonate my person, my voice, etc.

A Chinese physical scientist about serious paper publishing concerns about AI 'polishing':

After the popularity of ChatGPT, everyone uses it to write or revise papers, but my point is that you can use ChatGPT to polish a paper, but you can't exactly use it to write a paper. But there is another problem, ChatGPT's polish function is powerful, which can make a poor quality paper look good, then if the peer reviewer is not serious and does not consider the idea and approach of the paper, but only judges by the language, then it may cause confusion. And now that the number of papers and manuscripts are increasing like crazy, it's fast to write papers with the help of AI.

And these worrying thoughts from a Polish Humanist, answering the follow-up question, Do you think they will come about (now, in a year or two, this decade, in your working lifetime):

I am afraid that in a perspective of two to three years it will be possible to fake my vote, falsify my article and, for example, discredit me as a researcher. Already now (not in a year-two) it is difficult to assess the credibility of information. I fear that in 10–15 years we as humans will not be needed for many activities.

Will 'AI' be a transformational force? If so, in what ways? What will be the advantages and disadvantages of the transformations that will take place? (11)

A Polish humanist on being vigilant regarding AI and the quality issues it will bring with it:

It will certainly be a transformative force. It will accelerate the development of civilisation. However, it may affect the quality of science—fake news, lack of information criticism, disinformation. The development of AI may induce scientists to use it to speed up research, which could potentially compromise the quality of research. Surely AI will further accelerate the circulation of information, driving progress in industries such as medicine, bioengineering, and high-tech.

A Malaysian life scientist is basically positive about the increases in quality it will bring with it, but also has some concerns:

AI is totally going to shake things up in academia and scientific publishing! It's going to make research easier by helping with

tasks like literature reviews and data analysis, which means more time to do quality research. Plus, it can even write manuscripts for us! But there are downsides too, like too much dependence, bias in AI, the data that they are trained on and worries about ethics and privacy. Still, if we use it right, AI could be a game-changer, speeding up discoveries and making research better for everyone.

A Chinese life scientist pointing out AI's function in identifying misconduct:

Mainly in two ways: 1. Academic production: a new content production tool; 2. Academic supervision: Make the entire academic operation process and the content of academic achievements more standardised and more in line with academic ethics, and can detect all kinds of academic misconduct through AI.

6.3 | National Preoccupations and Differences

Conscious that there are differences in attitudes and practices between countries national interviewers from Malaysia, Poland, Portugal and Spain were asked to summarise their position. Thus, Malaysian ECRs often equate research integrity with publication integrity, highlighting the critical areas of accurate reporting and authorship integrity. This includes ensuring proper citation, transparency in methodology, and upholding the ethical standards of authorship. Malaysia's ECRs demonstrate very strong academic output, but there are concerns about the levels of retraction in general and the potential decline in research quality with increasing AI use.

Polish respondents, clearly in a highly regulated system, abide by all ethical rules, and overall, they did not have much to report, as they had not heard of unethical cases in their environment. So, it was news to them. This is backed up by the fact that Poland has seen very few retractions. However, because of worries about faking/gaming reputational scores, there is an aversion to high Hirsch index scores, to multi-author publications and to too many papers published per year. Promotional boards are very suspicious of such phenomena. The Council for Scientific Excellence in Poland does not recommend the use of numerical measures (Hirsch index) in reviews of the scientific achievements of candidates for the degree of doctor habilitated or professor.

Portuguese ECR are seriously concerned with the safeguarding of integrity and it is thought that AI could be a dangerous territory for them. Particularly, in respect to the automation of writing. It is felt that researchers and above all institutions should avoid rewarding quantity over quality, and bad behaviours, such as, publishing the same content in several places, articles published by teachers and students with data from the students' own research and work, researchers who publish serially, articles on anything and everything.

The main concerns from Spanish ECRs are highly vocal, numerous and various: inappropriate authorship and the order of signatories; inappropriate citations; payment for publishing in open access journals; publication in predatory and other questionable journals; salami/duplicate slicing; misuse of data, as

well as the current and feared consequences of the use of generative artificial intelligence applications.

7 | Conclusion

We have seen that the published literature tells us, unsurprisingly, considering just how crucially important research productivity is for ECRs, that among them is to be found a greater incidence of unethical behaviours. This points to the importance of the research published here, especially as it portrays the issues and problems in their very own words. Qualitative studies like ours are thin on the ground and, arguably, importantly get much closer to this very challenging and personal topic.

It has been shown then that ECRs are clearly aware of research misconduct and questionable practice with three-quarters saying so. Of course, this is a big indictment of the scholarly system, but, perhaps not to anyone's surprise, given a rapidly rising increase in the number of retractions and questionable journals. The main blame for this is levelled at the haste with which researchers publish and the volume of papers they are encouraged to publish. This, because of the prevailing 'publish or perish' reputational environment. Blamed, too, was the widespread availability of questionable, predatory or grey journals; their proliferation being encouraged by the prospect of significant income from APCs.

As to how to avoid the reputational pitfalls that lie in wait for the unsuspecting ECR regarding questionable journals, only half said they had guidance and avoidance strategies were largely based on looking at lists—WoS, Scopus and cautionary lists from national authorities.

Retractions can be taken as a measure of misconduct, even though some are down to genuine mistakes. One in five ECRs knew directly of researchers who had papers retracted, with medical sciences featuring the most strongly.

As to whether AI was making matters worse, the general verdict was that AI would lead to a further diminishing of quality and even higher rates of misconduct. The main problems were encapsulated powerfully by this ECR: *AI contributes to declining research quality and fuels the growth of paper mills by automating article generation. AI can churn out loads of text that look like scientific papers but lack substance or scientific rigour. Paper mills use this technology to produce a high volume of low-quality articles, publishing them without proper review or oversight. This undermines the credibility of scholarly publishing and spreads unreliable scientific information. For some ECRs, AI even spelt the end of an era: I am afraid that in a perspective of two to three years it will be possible to fake my vote, falsify my article and, for example, discredit me as a researcher. Already now (not in a year-two) it is difficult to assess the credibility of information. I fear that in 10–15 years we as humans will not be needed for many activities.*

Our tentative conclusion, then, is that ECRs admit to seeing a research world seriously challenged regarding integrity and that matters are likely to get worse because of the advent of AI, but they think they are aware of the problems and how to avoid what is deemed bad behaviour. Also, in the case of countries

like Poland, their behaviour is highly regulated anyway and in Portugal universities are encouraged to develop policies regarding AI misconduct. Nevertheless, all ECRs exhibit worries about what lies ahead and the topic needs close monitoring, which we hope to do.

Note, this was a preliminary study, part of the long-running, longitudinal Harbingers project, attempting to inform and plan for a major study, which would have a larger and more representative cohort of ECRs. Findings should be treated with caution, more as informed observations, filling a knowledge vacuum.

Author Contributions

Nicholas provided oversight of the article and wrote much of it. Clark provided the data analysis, technical support and insights. Herman did the literature review. The rest of the authors undertook their country analyses and provided general feedback on the paper.

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Consent

Participants who freely opted to take part in the interviews were asked to provide their names and contact details for follow-up questions regarding the accuracy of the interview transcripts, but access to all personal data was restricted to the investigating team and was removed before the analysis of the results.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions. Polish data will be available in an open repository.

Endnotes

¹ <https://ciber-research.com/harbingers-3/index.html>.

² <http://ciber-research.com/harbingers.html>.

<http://ciber-research.com/harbingers-2/>.

<https://ciber-research.com/harbingers-3/index.html>.

³ By the third stage of the project there are more participants in their forties because our cohort has aged.

⁴ Poland. National Science Centre no. 2022/45/B/HS2/00041.

⁵ https://ciber-research.uk/download/ECRs_Harbingers%203_Pilot%20Interview_schedule_1610DN.pdf.

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