

Challenges that Early Career Researchers Face in Academic Research and Publishing: Pre- and post-COVID-19 perspectives

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Abstract

Early career researchers (ECRs) constitute a unique but important sector of the academic community. Yet, in some respects, they occupy a selectively inferior niche due to structural constraints, as well as personal and professional limitations. ECRs, who are at an initial stage of their careers, face multiple challenges in research and publishing due to a relative lack of experience. These may make them vulnerable to abuse and cause stress and anxiety. Those challenges may have been amplified in the COVID-19 era. ECRs' efforts may unfairly boost the reputation of their mentors and/or supervisors (Matthew Effect), so greater credit equity is needed in research and publishing. This opinion paper provides a broad appreciation of the struggles that ECRs face in research and publishing. This paper also attempts to identify extraneous factors that might make ECRs professionally more vulnerable in the COVID-19 era than their established seniors. ECRs may find it difficult to establish a unique career path that embraces creativity and accommodates their personal or professional desires. This is because they may encounter a rigid research and publishing environment that is dominated by a structurally determined status quo. The role of ECRs' supervisors is essential in guiding ECRs in a scholarly volatile environment, allowing them to adapt to it. ECRs also need to be conscientious of the constantly evolving research and publishing landscape, the importance of open science and reproducibility, and the risks posed by spam and predatory publishing. Flexibility, sensitivity, creativity, adaptability, courage, good observational skills, and a focus on research and publishing integrity are key aspects that will hold ECRs in good stead on their scientific career path in a post-COVID-19 era.

Keywords: anxiety; career development; citations; integrity; Matthew Effect; metrics; postdoctoral research; rewards; seniority; status; stress

Who are Early Career Researchers, and Why Does it Matter?

What parameters demarcate the limits of an early career researcher (ECR) prior to becoming a mid-career researcher or a tenured faculty member? To better appreciate which individuals are encompassed by the term 'ECR', including their age and/or qualifications, literature on ECRs from the past decade (2011-2021) was examined in search of a clear definition.

Sobey et al. (2013) defined ECRs as 'anyone who considers themselves to be at an early stage in their career, for example, final year PhD students, postdoctoral researchers and early-stage lecturers, or equivalent levels in nonresearch posts' (ibid: 170). However, the age of postdocs can range widely from 26 (or earlier) to 40 (or more) years, according to van der Weijden et al. (2016). Boeren et al., drawing on 23 papers related to ECRs, summarily defined an ECR as an individual 'with less than 10 years of experience from the start of their PhD' (2015: 69). This group thus includes postdocs who are simultaneously attempting to build their professional research profile, gain recognition, establish networks, obtain funding, and earn a salary within a narrow time frame (van Benthem et al., 2020). Both Boeren et al. (2015) and Forbrig (2020) claimed that their definition was the same as that indicated by the European Commission (EC, 2011). Strictly speaking, however, the EC document did not define ECRs using this term but instead defined other categories of postdocs. Browning et al. (2017), relying on the definition provided by the Australian Research Council, defined an ECR as an individual 'having been awarded a PhD "within five years, or longer if combined with periods of significant career interruption"'. They also defined, basing themselves on the EC's definition, a 'leading researcher' as someone who 'is leading research and making a substantial contribution to their field, and is likely to be within 5–10 years of having completed their PhD'. Finally, Browning et al. defined a 'research leader' as 'an established researcher, usually at professor level, and is typically 10 or more years post-PhD' (2017: 363). McAlpine et al. classified ECRs as 'doctoral students and, to a lesser extent, post-PhD university researchers' (2018, 149). Allen and Mehler (2019), in their abstract, simply defined ECRs as those who 'carry out the research'. Bielczyk et al., defined ECRs as 'individuals pursuing academic research at the sub tenure level, regardless of years of experience' (2020: 212). Brasier et al. defined ECRs as 'researchers within 5 years of a terminal degree' (2020: 2) or as '0-5 years Post-PhD' while describing mid-career researchers as '5-10 years Post-PhD' (ibid: 3). Bohleber et al. (2020) offered a more comprehensive definition of ECRs as 'university students (bachelor, master and PhD students), postdoctoral researchers and Early Career professionals (assistant professor or lecturer, research associate)'. They also stated that 'the European Union considers the time limit to apply for a starting grant no longer than 7 years after PhD completion. In the case of career breaks

and part-time working, an extension equal to the time spent away from academia can be granted' (**ibid: 2**). The age of Finnish graduates from a PhD course can vary widely, by as much as ~20 years (28-47 years of age) (**Vekkaila et al., 2018**). Nicholas et al., in a footnote (**2021: 57**), classified ECRs as '[r]esearchers who are generally not older than 35, 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'.

Thus, according to several academics, in papers published between 2013 and 2021, the definitions of who qualifies as an ECR varies widely, and there is wide variation in terms of age, experience and research and publishing status. Broadening the definition of ECRs by clustering them with mid-career researchers (**Oliveira et al., 2021; Richards et al., 2021**) makes it even more difficult to clearly define or identify an ECR. If mid-career researchers are clustered with ECRs, this may disadvantage the latter, while the former might benefit from policies that were originally put in place specifically for ECRs. As one example, funding that is destined for ECRs might be attributed to individuals whose careers are already quite established and who are, in fact, mid-career researchers. For the purposes of this paper, mid-career researchers are not considered. Moreover, in an attempt to accommodate as many published definitions as possible, an ECR is defined in this paper as a researcher or postdoc who has obtained their PhD but who is not tenured, regardless of their age and the length of their post-PhD period.

An academic might, in fact, start their career quite late in life, perhaps after changing careers or spending a few years travelling, working or in unemployment following graduation, or after life's path takes them on a new journey, such as marriage or the birth of a child. It might be erroneous to automatically equate an ECR with a 'young' academic. Thus, the term ECR tends to indicate an individual at an early developmental stage in a research and publishing career, an aspect that is not necessarily related to age. In this paper, the focus is placed exclusively on ECRs, and not on mid-career researchers. Views may differ as to what 'early' might be, or for how long one is considered to be an ECR before one is no longer considered an ECR, or what the dividing line might be. A broader and simpler definition could be an academic that has limited experience in research and publishing, but this might be perceived as a weakness or liability rather than as a growth phase. As for other aspects of life that require skills and experience for survival, multiple challenges will be faced as an ECR acquires experience. The ECR phase of a research career is an important and integral part of an academic's life cycle. In this phase of the struggle for recognition and security, their youthful and ambitious aspirations will give rise to ample ideas and ideals that will mould a future research and

publishing landscape. ECRs will face complex issues in research and publishing, as are described later in this paper.

The first purpose of this paper was to demonstrate that definitions about who is considered an ECR vary widely, even without consensus. This unclear limit of who precisely is an ECR might, in fact, disadvantage them, for example, when applying for funding. Another purpose of this opinion paper is to highlight some of the challenges in research and publishing that ECRs face, cognizant that even experienced researchers might also find such issues challenging.

Early Career Researchers: Academia's lifeblood embedded in a 'publish or perish' culture

Generally, as an older generation of academics fades, a younger and aspirant one replaces it. Some ECRs might perceive that position and reward are aspects of entitlement rather than a path of hard work and might resort to cheating to achieve their success (Stiles et al., 2018). A seasoned academic will hopefully advise a younger or less experienced one that in academia, there is no rapid gratification or easy path to success, much less using cheating to achieve it. In an ideal setting, less experienced ECRs are taught by their supervisors to appreciate the value of intellectual maturation and honesty, processes that take time and careful training to achieve. In a publish or perish culture, where research output is ultimately linked to publication output, the generation of papers might result in funding that is allocated to supervisors and principal investigators (PIs) rather than to ECRs. ECRs might thus feel that their efforts lead to the elevated status of their supervisors or PIs, i.e., the Matthew Effect (Teixeira da Silva, 2021a). ECRs might feel that their own merits, strengths, initiatives and efforts are insufficiently recognised because the supervisor or PI benefits from the often unrecognised work of ECRs. So, there is a risk of abusing ECRs for unfair benefits. Thus, a more realistic appreciation of ECRs' career and employment outcomes is needed even before they become ECRs (Silva et al., 2016), especially cognisance of the stress, job-related dissatisfaction, and salary limitations that they might encounter as a result of the lack of fixed positions, which may lead them to change career paths (Aarnikoivu et al., 2019).

The power struggle that an ECR can face as a result of the Matthew Effect, rigid and bureaucratic infrastructures in research and publishing, or the associated publish or perish culture may be massive, and the associated stress and anxiety should not be underestimated. Absent considerable research and publishing experience, ECRs may find the challenges of a career in research and publish overwhelming, and this may lead to anxiety, stress and/or depression (Bielczyk et al., 2020).

The attitude and philosophy of an ECR's supervisor towards academic publishing may influence the ECR's perspectives (**Parker-Jenkins, 2018**). For example, supervisors might inculcate an integrity-centred career in research and publishing and deemphasise rank and position in an ECR's career of research and publishing (**Pather & Remenyi, 2019**). For the purpose of this paper, academic integrity in research is defined using the definition provided by Cutri et al. (**2021: 3**): 'conducting research in a fair, respectful and honest manner, and reporting findings responsibly and honestly.' Yet, in reality, ECRs might encounter a playing field that consists of status quo indexed, ranked or metricised journals that are being gamed and driven by prestige and rewards (**Hatch & Curry, 2020**). Moreover, the sense of entitlement exhibited by some millennial ECRs might clash with a 'traditional' publishing culture (**de Winde et al., 2021**). Thus, it would be more productive to teach ECRs realistic values that point out weaknesses of the existing research and publishing system they find themselves integrated into and the fallibilities of the integrity tools at their disposal (**Teixeira da Silva, 2021b**). This is the third objective of this paper. Educating ECRs about these issues, which should be one responsibility of senior academics, might not change the current research and publishing culture, but it might better prepare ECRs. To preserve their mental well-being, ECRs need to be able to independently manage a wide array of complexities while trying to secure their career in research and publishing (**Bielczyk et al., 2020**). This includes not always relying on the advice of supervisors, who might be supporting a status quo culture. Finding a balance between these apparently contrasting value systems can be challenging for ECRs. How can the current publish or perish research and publishing culture be modified to better incentivise ECRs? This paper seeks to provide some answers to this question.

The success of a senior academic may come at the expense of the efforts of junior lab members such as ECRs. In a large laboratory, despite the appearance of a group effort, there may be competing postdoctoral researchers (postdocs), i.e., autonomous researchers without a tenured contract (**Teelken & van der Weijden, 2018**), including ECRs. Generally, in such laboratories, the success of publication output tends to be assigned to the supervisor or PI, who would likely not have achieved this success had there not been a formidable team, engendering a Matthew Effect (**Teixeira da Silva, 2021a**). Even though some postdocs perform a disproportional amount of work that accounts for the productivity of a laboratory, their careers might still be at risk, especially if there are more postdocs than there are available positions, causing a 'postdoc pile-up' (**van Benthem et al., 2020**). With an amplified publication curriculum vitae and prestige, funding may be amplified (**Bol et al., 2018**), but funding tends to be received by the supervisor rather than the ECR. Funding opportunity

for senior researchers tends to be many-fold higher than that for ECRs (**Daniels, 2015; de Winde et al., 2021**). Since funding drives and sustains research advancement, the lack of funding or the disproportionality of funding is one of ECRs' greatest preoccupations and sources of stress (**de Winde et al., 2021**). ECRs also contribute to the reputational advancement of institutes of higher education, but their efforts are often unrecognised and relegated to the shadows, while credit is assigned to their supervisors (**Hallinger, 2018**). ECRs should keep in mind, however, that their senior advisors were also, once upon a time, ECRs, and may have also faced similar struggles, so an attitude of respect, empathy, understanding, patience and perseverance is also needed by ECRs towards their supervisors. Through no fault of their own, often since such aspects are centralised to PIs, ECRs' inability to establish independent networks and become integrated into large-scale transdisciplinary projects (**Sobey et al., 2013**) comes from a relative lack of experience (**Brasier et al., 2020**) and lack of opportunity.

The publish or perish culture in academia is also, to some extent, driven by a set of complex relationships between seniors/PIs and ECRs, embedded in a hyper-competitive culture of research and publishing with more candidates vying for less funding per capita (**Lauer et al., 2017; Richards et al., 2021**). The struggle and challenges faced by these generationally diverse groups tend to be skewed towards ECRs (**van Dalen, 2021**). How can this publish or perish culture be challenged or reformed? The next section seeks to find solutions.

A New Research and Publishing Culture is Needed, but What is it, and What are its Challenges?

Key Questions and Core Challenges

Smart stated, referring to ECRs, that 'it is somewhat depressing that – with the exception of more use of social media – they seem to be treading the same path as their predecessors' (**2019: 195**). As indicated above, one way to survive in the status quo-driven research and publishing environment is by priming ECRs to adapt to it. How does one inculcate a new culture of success that does not involve prestige or rewards? How does one encourage ECRs to seek innovative ways of achieving career satisfaction and security when they are embedded in a publish-or-perish culture that might create dissatisfaction and carry risks (**van Dalen, 2021**)? How can ECRs fortify their academic research communication skills to be better prepared, in terms of research and publishing output, for a competitive job market (**Merga & Mason, 2021**)? How is a brain drain from research and publishing prevented, and how can ECRs be motivated to become career researchers and not lose motivation (**Roach & Sauermann, 2017**)? How do ECRs avoid or prevent disengagement, professional inefficacy,

psychological distress, and cynicism when facing career path limitations and job shortages (**Vekkaila et al., 2018**)? How can ECRs develop or acquire research and publishing competence, absent professional experience, to fulfil skills-rich job positions (**Kristoffersen et al., 2021**)? Although clear answers are likely not always evident to these questions, increasing efforts are being made to establish a new research and publishing culture that embraces ECRs, and is sensitive to their needs. The next sections of this paper seek to provide answers to some of these challenging questions.

The publish-or-perish culture does not have to assume a rigid structure, but what needs to change to make it more flexible? There is ample space for embracing novelty based on unique skill sets that allow for a new culture of creativity and desire to be developed (**Heron et al., 2021**). To some extent, this echoes the call by Bielczyk et al. (**2020**) for ECRs to foster a culture of curiosity and self-management, and a characteristic of 'agency', as a core element for ECRs' development. Yet, self-management is not possible for aspects such as administrative duties, for which few ECRs are prepared (**Pitt & Mewburn, 2016**). Moreover, 'agency' is difficult to achieve given ECRs' intellectual and occupational uncertainties (**Skakni et al., 2019**). Creativity and desire alone are likely not sufficient characteristics to define a new academic culture in research and publishing. Pyhältö et al. (**2017**) noted the importance of social support for reducing stress during an ECR's development. Allen and Mehler (**2019**) emphasised the need to adopt a culture of open science, with gains to their reputation and publication status as a result. Open science can be defined based on five component elements: 'open data, open analysis, open materials, preregistration, and open access' (**van Dijk et al., 2021**). However, in these cases, if recognition is based on an ECR's publication portfolio, then creativity and desire, social support, or open science do not create a new culture but rather reinforce the old publish or perish-based one, namely a publication-centred rewards system. Thus, there is a need to move away from a recognition system that emphasises quantity over quality or that under-emphasises the latter (**Richards et al., 2021**). Yet, 'good' qualitative research does not always necessarily translate into a 'good' qualitative researcher simply because the measures to assess each differ and because of the liminality that exists between the transition between an ECR and an established researcher (**Pagan, 2019**). ECRs thus need to feel a sense of inclusivity, acceptance and recognition by peers (**Skakni & McAlpine, 2017**).

How can ECRs cultivate a career based on creativity and desire if they are overwhelmed by peripheral tasks often assigned to them by their PIs or supervisors? As Clark et al. pin-pointedly stated, 'ECRs design and execute experiments, collect and analyse data, write papers, and are often solely

responsible for supervising more junior team members' (2018: 1). Thus, the opportunity for creativity and desire might be suppressed but may be – to some extent – compensated by obtaining experience in mentoring, guidance, and leadership associated with those peripheral tasks. There is pressure to establish the next generation of research leaders from the current pool of ECRs, encompassing six key qualities: passion, international networks, effective mentors, a proactive attitude, collaborative research, ability to supervise postgraduate students, and relevant involvement in administrative duties (Browning et al., 2017). It is not always easy to find candidates that possess all of these qualities.

Additional Challenges in Research and Publishing Environments that ECRs might Encounter

Allen and Mehler (2019) defined two publishing formats as part of the ECR-centered open science plan, preprints and open access publishing, which themselves are prone to abuse and misconduct, and whose use needs careful scrutiny and management. Preprints are documents that are not peer-reviewed. ECRs are mostly dependent on their supervisors for paying open access article processing charges. Misled into believing that preprints can effortlessly showcase their work and effort (Sarabipour et al., 2019), preprints might be abused by ECRs who think that they are a quick and easy way to boost productivity and pad their curriculum vitae, even with imperfect or incomplete work (Teixeira da Silva, 2018). ECRs might believe that preprints may allow them to reap more attention or citations (Fu & Hughey, 2019). Yet, unless ECRs make a concerted effort to publish preprinted work in peer-reviewed journals and have their ideas critically adjudicated by other professionals, a quick-and-easy preprint-based culture may actually harm their careers if their curriculum vitae are populated by an excessive amount of preprints (Teixeira da Silva et al., 2020b). Hiring committees and tenure review boards might not consider preprints. ECRs also need to cautiously appreciate that open access publishing includes predatory publishing, which – unknowingly – might be an enticing choice for ECRs (Mercier et al., 2018). Predatory publishing was defined by a consortium of researchers as: 'Predatory journals and publishers are entities that prioritise self-interest at the expense of scholarship and are characterized by false or misleading information, deviation from best editorial and publication practices, a lack of transparency, and/or the use of aggressive and indiscriminate solicitation practices' (Grudniewicz et al., 2019). Some ECRs might abuse such predatory venues to gain rapid publications (Nicholas et al., 2021). The latter risk becomes a moral and/or ethical issue if they pay for a publication that is not peer-reviewed. The selection of potentially unscholarly or predatory venues might also tarnish ECRs' reputations, so guidance by their mentors is essential. ECRs' attitudes towards publishing,

preprints, predatory publishing, and the development of their curriculum vitae will ultimately be determined by their career intentions (**Forbrig, 2020**). After all, within the space of their entire research career, an ECR is only fleetingly an ECR before they become a middle-career or senior researcher, so the intellectual publishing and digital (e.g., social media) footprint they create during the ECR phase may engender perceptions about that researcher in later years of their career. Therefore, ECRs need to very carefully select their publication choices as they attempt to integrate themselves into the research and publishing market.

One large challenge for ECRs is the feasibility of open science-centred objectives. Resources tend to still be limited to researchers that might not employ open science approaches, so available rewards to ECRs during scientific assessment might be less tangible than those who do not employ open science principles (**Moher et al., 2018**). That disparity is even more acute for researchers wanting to embrace transparent gender-neutral open science-based research and publishing principles (**Pownall et al., 2021**). In that sense, creativity and desire are insufficiently robust mechanisms for preparing ECRs for survival in a publish-or-perish culture. Consequently, more robust mentoring programs with appropriate academic guidance are needed (**Boeren et al., 2015**). Such guidance can emerge from career development programs that are also financially supported by awards or fellowships (**Pickett, 2019**). Racial and gender equality among minorities is becoming an increasingly important issue for some ECRs (**de Winde et al., 2021**). However, reform and culture change is not possible when the ethics status quo (i.e., research and publishing leadership) does not lead by example by not displaying racial equality in its highest ranks (**Teixeira da Silva, 2021c**). For ECRs to be more incentivised, they also need to feel consistency in values from leadership ranks.

Absent their own networks, ECRs will also likely face entry barriers into multidisciplinary projects. To overcome such barriers, to prepare ECRs for integrating into large and high-profile projects, and to fortify their own sets of research and publishing skills, Jaeger-Erben et al. (**2018**) suggest ECR-ECR networking, as well as mentoring that involves teaching best practices or skills that focus on moderation and science communication. An important part of achieving that objective is to use the research integrity tools that are at their disposal to protect them from threats in research and publishing, but also to be cognizant of the limitations of those tools and the fallacies that surround their robustness (**Teixeira da Silva, 2021b**). Thus, while appreciating the benefits and freedoms associated with preprints and the advantages of fortifying peer review, the weaknesses and limitations of both also need to be understood (**Teixeira da Silva & Dobránszki, 2015; Teixeira da Silva, 2018**). ECRs also need to

be aware of the costs and risks associated with establishing collaborative projects in order to gain a competitive edge (**Pannell et al., 2019**). Finally, like any researcher, ECRs' research and publishing do not exist in a vacuum, so they need to be aware of exploitative research and publishing practices and policies (**Teixeira da Silva et al., 2019a**). To enact reform, ECRs could try to pro-actively be part of policy creation and regulation (**Evans & Cvitanovic, 2018**). ECRs also need to be vigilant of being unfairly exploited as free labour to sustain the multi-billion dollar publishing industry. This may be in the form of superficial cents-on-the-dollar rewards and incentivisation schemes like online badges, Publons credits, or other 'rewards' schemes that may be inflating the profiles of these platforms at the expense of ECRs' efforts and naivety (**Teixeira da Silva & Katavić, 2016; Teixeira da Silva et al., 2019a**). In this imperfect system, it is challenging for ECRs to balance gaining experience while avoiding exploitation and finding safe publishing sanctuaries based on sound publishing-related judgements.

For an ECR to survive, Haider et al. (**2018**) proposed a decentralised model based on an undisciplined journey into undisciplined science. Robinson (**2008**) defined the latter as 'problem-based, integrative, interactivity and emergence, reflexivity, and strong forms of collaboration and partnership.' To ensure that an ECR's career is more sustainable, such a model would involve the dissociation from any single or defined discipline, allowing an ECR to redefine themselves as interdisciplinary and the establishment of a work ethos that is based on solid methodology and agile epistemology. Sustainability might clash with the rigidity of a research and publishing system that is often based on crisply defined disciplines. One risk that ECRs face should they follow this approach is that they might land up superficially appraising many disciplines but failing to profoundly master one, or land up creating a unique niche in which they do not feel comfortable. These are emotions associated with pioneering activities. However, by crafting a unique niche, ECRs might also create a new platform of impact, projecting themselves from a state of invisibility to one of enhanced visibility (**Rau et al., 2018**). The rewards of such visibility might not be traditionally rewarded (i.e., monetarily) but may carry multi-faceted societal benefits (**Singh et al., 2019**).

Independent of the model that an ECR adapts to advance their career, this can only be achieved when a culture of respect, gratitude, teamwork, support and mentorship, assignment of due credit, destigmatisation of failure, and a moderated celebration of success is inculcated (**Marcella et al., 2018; Maestre, 2019**). These principles are not restricted exclusively to ECRs but apply to all academics. The ability to work remotely to accommodate lifestyle choices might spur or improve productivity (**Hunter, 2019**). It will be interesting to see how such a culture of respect

can develop when one part of that advocacy for ECRs to become relevant involves calling for a replacement of the status quo (**Chapman et al., 2015**).

The success of ECRs obtained through strict and suitable training, guidance, and mentorship have the capacity to produce academic leaders of the future that have the ability to be knowledge producers, academic citizens, boundary transgressors and/or public intellectuals, just like their own mentors (**Uslu, 2020; Oliveira et al., 2021**). Such individuals must have accurate, verifiable and up-to-date curriculum vitae to showcase their strengths but also to honestly display their failures, such as retractions (**Teixeira da Silva et al., 2020b**). The job market, which tends to be precarious for many ECRs, needs to be able to absorb a large volume of graduates using fair, timely, gender-balanced, unbiased and transparent selection and recruitment processes (**Holzinger et al., 2018; Fernandes et al., 2020; Kwamie & Jalaghonia, 2020**). To meet research job market demands that also requires publishing as one criterion and to offer ECRs a competitive advantage, Pather and Remenyi (**2019**) suggested professional and personal qualities that could fortify their chances of success and survival in a publish-or-perish culture. Similarly, the employability of an ECR relies on their adaptability and professionalism (**Saffie-Robertson & Fiset, 2021**).

A topical issue is that of predatory publishing and the involvement of ECRs (**Mercier et al., 2018**) or their victimisation by predatory publishing practices (**Teixeira da Silva et al., 2019a**). Absent suitable guidance, for example, from peers, superiors or PIs, ECRs risk making an erroneous decision regarding the target journal in which they publish their work (**Glover et al., 2016**). When approached via a spam email (**Teixeira da Silva et al., 2020a**), an ECR might be enticed to submit their work to a relatively unknown journal or publisher. The email invitation may be laced with flattery-filled language, giving a false sense of pride or offering false promises or hyped claims (**Sousa et al., 2021**). Such email-based invitations might guarantee peer review even when none is provided or claim that the journal has metrics, even when these are false or hijacked, giving the impression of a valid scholarly journal (**Dadkhah et al., 2016; Moussa, 2021**). ECRs, therefore, need to be aware of risks and dangers when selecting a target journal, conscientious of the fact that the discernment of predatory from non-predatory (**Grudniewicz et al., 2019**), or the characterisation of scholarly and unscholarly are becoming increasingly difficult parameters to claim with certainty, with a wide grey zone in between (**Frederick, 2020; Teixeira da Silva, 2021d**).

At the same time that the world of publishing molds an ECR's experience, so too is it molded by the needs of ECRs. Integrating ECRs into editorial boards may create a mixed generational set of individuals with wider

backgrounds and perspectives, slowly allowing the future generation or the seed of peer review and academic quality control to be planted and trained (**Marshall & Fernandes, 2021**). However, there are ample spam-based invitations to join editor boards of potentially unscholarly or predatory journals. This risk, together with the relative meaningless of being an editor on a board with hundreds or thousands of editors, such as in open access mega-journals (**Teixeira da Silva et al., 2019b**), dilutes the 'value' of an ECR being on an editorial board. The curricular benefit gained versus the energetic output requested of the ECR needs to be carefully considered. Some postdoctoral training programs provide suitable training to avoid curricular pitfalls (**Moyo & Perumal, 2019**), but, absent sufficient training or faced with academic unpreparedness due to trainers who are equally unprepared, some ECRs may feel like impostors (**Cisco, 2020**), such as taking editorial credit when they have done nothing. Publishers need to appreciate the needs and behavioural trends of ECRs, such as their use of online scholarly communities like ResearchGate, the popularity of Google Scholar, their attraction to Altmetrics and social media, the rebellious nature of some against the senior status quo, the importance still afforded to traditional peer review or scepticism towards open peer review, criticism of open access mega-journals, or not wanting to embrace open science (**Nicholas et al., 2017a, 2017b; Rodríguez-Bravo et al., 2017; Nicholas et al., 2018, 2020**). In response, publishers could consider adjusting their publishing model, including systems and services, to make them more attractive to this segment of the academic community, appreciating ECRs' frustrations and concerns (**O'Brien et al., 2019**), but without lowering editorial or ethical standards. Despite ECRs' good intentions, several publishing models are inherently flawed, slow, and cumbersome, and in need of simplification, radical reform or even a total overhaul (**Teixeira da Silva & Dobránszki, 2015, 2017; Teixeira da Silva et al., 2018; Teixeira da Silva, 2020a**). These are structural complexities that ECRs on their own will not be able to reform. However, collectively, they might begin to enact reform, such as the establishment of a new open-access journal that targets ECRs, with higher established editorial and peer review standards than competing status quo journals.

At some point in their research and publishing careers, ECRs may encounter some of the issues discussed in this section. Not only will they have to deal with them as they publish their own papers, but they will also need to increasingly take a vocal stance on controversial issues. The future of their own publishing realm will be determined by what actions they proactively take throughout their careers (**Merga et al., 2018; Vuong, 2019**).

How have ECRs been Impacted by COVID-19? Effects and mitigation strategies

The tremendous pressures that ECRs face as they emerge into a hyper-competitive job market, the struggles that they face to secure job security, funding and a healthy research and publishing environment, as well as the responsibilities they are assigned related to student mentorship and publishing, can be sources of anxiety, stress and pressure (**Lauer et al., 2017; Evans et al., 2018; O'Neill & Schroijen, 2018**). Many of the challenges and difficulties that ECRs face might constitute stress, affecting their mental health. An attempt is made to extend the appreciation of this topic one step further by assessing if the coronavirus disease 2019 (COVID-19) pandemic may have exacerbated any mental or health issues of ECRs or affected (hampered or enhanced) their professional possibilities, opportunities and/or choices in research and publishing. Ghosh (**2020**) suggested that local governments should invest more in mental health support schemes.

The most evident impact has been a drop in productivity (**Termini & Traver, 2020**) and reduced mentorship (**Termini et al., 2021**). This arises from a lack of motivation (**Cahusac de Caux, 2021**). A sudden drop in international students and the move to online education and mentoring not only reduced university revenues, it placed additional pressure on ECRs to adapt to a new set of research and publishing conditions (**Witze, 2020**). This will ultimately impact career hopes and possibilities, and also accentuate job losses (**Woolston, 2020**). Even though travel may have been offset, opportunities are not necessarily dampened; merely ECRs have to adapt to virtual meetings and congresses in order to network, rather than relying on physical meetings (**Weissgerber et al., 2020**). Some have suggested the use of online forums of discussion and consultation services for ECRs to blunt asocial impacts of social distancing measures (**Stapleton et al., 2021**). Others have recommended greater exercise and a need to modify the ECR workplace environment to accommodate individual needs (**Kappel et al., 2021**).

In the UK, national research funding might be boosted to counter the impact of COVID-19 (**Subbaraman, 2020**), although budgetary boosts in other countries have yet to be appreciated in 2021/2022. This is likely to affect biomedical and natural sciences more than the humanities. Even though bold reformative proposals were made for the US (**Gibson et al., 2020**), it is also unclear how, in practice, ECRs will be considered for such funding, especially when funding is limited. In Nigeria, at least, ECRs are the least likely to receive funding (**Salihu Shinkafi, 2020**), likely even more so during COVID-19.

Faced with physical and mental restraints and observing health-related misinformation related to COVID-19 (**Teixeira da Silva, 2020b**), including in predatory publishing venues (**Teixeira da Silva, 2020c**), ECRs might lose motivation (**Torres et al., 2021**). Paula (**2020**) argued that since ECRs, especially postdocs, have short-term (typically 1-3 years) contracts in which they are expected to be productive, that COVID-19 might disrupt their financial stability. More importantly, their research plans and output or productivity might be impacted, especially during lockdowns where there might be physical limitations in terms of access to research facilities or laboratories (**Omary et al., 2020**). Only one of 150 autism research ECRs did not report a negative impact of the pandemic on their research (**Harrop et al., 2021**). Financial uncertainty might be enhanced by reduced government-funded research grants, as was briefly alluded to above, or the disproportional allocation of funding to COVID-19-related research (**Kaiser, 2020**). As a result of the intense focus on this disease and pandemic, COVID-19 has created an opportunity for some ECRs to pursue a career change and a shift in research objectives related to COVID-19 (**Gibney, 2020**). Collaborative efforts to support and sustain ECRs have been encouraged (**Levine & Rathmell, 2020**). For example, a consortium of ECRs in the field of addiction medicine teamed up to appreciate the risks associated with alcohol consumption during COVID-19 in 16 countries (**Calvey et al., 2020**). ECRs in the field of psychiatry banded together to provide a personal perspective of the pandemic in seven countries (**de Filippis et al., 2021**). An international peer support group of ECRs in psychology was established, but this requires initiative and a communal alliance of values (**Ransing et al., 2021**).

To sustain ECRs' motivation if research activities are restricted, Termini and Traver (**2020**) suggested the use of virtual meetings and online journal clubs to sustain intellectual incentives. However, some ECRs may find it difficult to approach strangers virtually. Making the most of unproductive time under limited physical research conditions, while also under long-term mental strain, requires a realignment of work ethos to realistically realign pre- and post-pandemic research and publishing objectives to allow for meaningful, but carefully achieved, productivity (**Teixeira da Silva, 2021e**). The mental health and stress caused by home confinement (**Paula, 2020**) or the long-term exhaustion, stress and anxiety caused by COVID-19 (CORONEX) (**Teixeira da Silva, 2021f**) should not be underestimated. Some have called for ECRs to embrace greater inclusivity to fortify productivity in the time of COVID-19 and to offer professional protection to less fortunate sectors of the academic community who may be under-represented (**Maas et al., 2020; Diallo et al., 2021**).

There is currently no tangible evidence to suggest that Publons or Clarivate Analytics, the proprietor of the impact factor, or Altmetrics, have fortified peer review at a time (the COVID-19 era) when the integrity of science – especially medical science – is most at risk (**Teixeira da Silva, 2020d; Teixeira da Silva & Al-Khatib, 2021**). This is particularly relevant because in a strained (mentally and physically) peer pool, where there are deficiencies in peers, ECRs may be increasingly called upon to fill in gaps (**Silver, 2016**). This may expose ECRs to exploitation and greater stress or anxiety, although some might consider this as a unique opportunity to partake in peer review at an early stage of their career.

Conclusion

This paper has set out to examine the challenges and pressures that ECRs face as they begin their careers in research and publishing prior to and during the COVID-19 pandemic.

To better appreciate how ECRs respond to several challenges in research and publishing, there is, at first, a need to clearly appreciate who they are. By doing so, there can be an appreciation of how they are affected, allowing the implementation of suitable measures to guide and support them. What was noted during a phase of literature exploration was that the definition of an ECR can vary widely. Depending on the source, age, years of experience, the period after a PhD, or number or ‘quality’ of publications might be taken into account. This variability may influence ECRs’ eligibility to research rewards, prizes or funding. For example, ECRs that are considered as individuals who obtained a PhD within the prior five years will, by the end of 2021, essentially be impacted by a two-year loss in opportunity and productivity (**Spagnolo et al., 2020**). However, if the definition of an ECR were to consider a 10-year period, then that negative impact might be considerably blunted or diluted.

To create scientifically competitive fields of research that are fair to ECRs, assuming that the rewards-based culture remains central to academic and scientific recognition, involves several key elements: embracing an attitude of creativity and desire, greater recognition of open science principles, and moving away from a metrics-based rewards scheme (**Teixeira da Silva, 2021g**); not encouraging ECRs to be guided by journal metrics and ranking, or traditional status quo perceptions (**Murphy et al., 2018; Nguyen et al., 2019**); the use of multiple elements to judge their academic and professional merit (**Teixeira da Silva, 2013**). Mentors, supervisors and PIs play a central role in offering suitable guidance to ECRs. Pushing ECRs towards adopting preprints may inadvertently encourage them to embrace the metrics gaming culture (**Teixeira da Silva, 2021g**). This might be compounded by convincing them that greater Altmetrics scores for their papers if posted initially as preprints, might result in

greater citations (**Fu and Hughey, 2019**). Thus, not all of the suggestions offered by Murphy et al. (**2018**) are recommended as useful scholarly advice for ECRs.

Ultimately, however, it is going to be difficult to disassociate the current rewards-based and publish-or-perish-centralised research and publishing culture from the pressures involved with establishing a professional network, publishing academic papers, erasing competition, securing a job, salary and research funds, while trying to maintain a healthy work-life balance. Under these continued pressures, there needs to be a solid mental health support structure that provides assistance, guidance and psychological relief when any number of challenges or threats are faced by an ECR on their hopefully exciting – but challenging – career paths (**Byrom, 2020; Son et al., 2020**).

COVID-19 is most likely to remain with humanity for the foreseeable future, so while ECRs struggle to establish themselves within the current publish-or-perish culture, they should also be vigilant (including self-vigilance) of system free-riders and those who will abuse uncertainty for their selfish benefit (**Teixeira da Silva, 2021h**). Ultimately, despite the insurmountable challenges, while attempting to retain their physical and mental health in these challenging times, ECRs should not be afraid to pursue their career objectives ambitiously but cautiously (**Teixeira da Silva, 2021e**).

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