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Transitioning to independence in medical research: A qualitative study using a systems theory perspective

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ABSTRACT

Early career researchers' transition to independence in academia is critical. Funding bodies across the world have established early career schemes specifically for researchers who are looking to lead on their first independent project, transitioning from postdoctoral researchers to principal investigators. We interviewed 51 individuals who had received an early career fellowship or award from the Medical Research Council in the UK and conducted 18 focused groups with 95 fellows using a novel tool to facilitate the discussion. Using a systems theory approach, we show that in the process of becoming independent, early career researchers often fall between the cracks of a system that fails to treat them as independent, they are not clear about career pathways in research, and they receive conflicting information about their career progression. More than individual influences, such as motivation for research and gender, contextual factors, such as funding support, institutional commitment and wider political factors influence the career progression of individuals. Early career researchers do not always feel they have the level of institutional support they expected. These findings highlight structural challenges that early career researchers face when transitioning to independence and suggest there is still ground to be covered to meet the commitment universities and research institutions to support the career development of researchers. The challenges identified are not unique to the UK context and can inform funding policies across the world.

1. Introduction

When considering the development of the research workforce, the transition to independence is a critical point in the career of a researcher (Venegas et al., 2019). The transition is not always straightforward, not least because a boom in the supply of scientists in the developed world post war, has resulted in an increased competition for the few posts left for the current generation of younger researchers (Teitelbaum, 2014; Stephan, 2013). Indicatively, while 80 % of biomedical PhD researchers in the United States go into postdoctoral positions after they complete their degree, only 18 % ultimately secure a tenure-track or permanent contract within 10 years of obtaining their PhD (National Academies of Sciences, 2018). In the UK the picture is similar, with 47 % of PhD students going in academic research but just under 3.5 % of them securing a permanent position (The Royal Society, 2010). As a result, precarity in research careers has gained ground in recent years in many countries around the world (Castellacci and Viñas-Bardolet, 2021) and is particularly prevalent in medical research (OECD, 2021).

Recognising the need to support Early Career Researchers (ECRs) to

navigate this challenging landscape, major funders across the world have developed schemes that allow them to develop their own research ideas and build their teams, competing for funding with peers at a similar stage. In the US, the National Institutes for Health (NIH) have established the Pathway to Independence Awards (NIH, 2022) that provide a combination of mentored and independent support to promising postdoctoral scientists preparing them for the very competitive Research Project Grant Program (R01). In the UK, ECRs in health and medical sciences can apply for a fellowship or award from the Medical Research Council (MRC), the National Institute for Health and Care Research (NIHR), the Wellcome Trust or a range of other medical research charities, while the European Research Council offers Starting Grants for scholars across Europe (European Research Council, 2024).

Yet, even among those who manage to secure their first fellowship or grant as Principal Investigators (PI), the transition to independence is far from evergreen (Acton et al., 2019). Indicatively, a study among recipients of early career awards in the UK, showed that about one third struggled to secure further funding to support their team and highlighted issues related to their career progression (Viney et al., 2020). A

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scoping review on the factors influencing career progression among postdoctoral clinical academics identified intrinsic motivation, work–life balance, inclusiveness, work environment, mentorship and availability of funding as key determinants (Ranieri et al., 2016). Nevertheless, the review highlighted that the studies in the area are mostly atheoretical and argued that embracing a theoretical stance when examining the perspectives of ECRs will provide a better understanding of the mechanisms that impact on their career development and progression (Ranieri et al., 2016).

This study aims to explore the barriers and facilitators faced by ECRs while transitioning to an independent academic career. To answer our research question, we conducted a theoretically informed, qualitative study with ECR, funded by the MRC in the UK, which was analysed using a systems theory framework. We drew on two datasets to capture the views of ECRs; one-to-one interviews and focus groups with ECRs who gathered at an MRC annual symposium.

We define ECRs as those researchers managing their first independent research project as Principal Investigators (PI) and seeking to set up a substantive research programme. This is what the UK Research and Innovation (UKRI) in the UK calls transition to independence ECR phase, following the doctoral and immediately post doctorate phases. In terms of eligibility for these transition to independence awards, the UKRI follows a flexible approach, moving away from previous criteria related to age and years of postdoctoral experience, unlike other countries or funding bodies. For instance, the European Commission welcomes applications for their Start Grant from researchers with 2–7 years research experience since completion of their PhD (European Research Council, 2024), while the NIH's Pathway to Independence awards are open to researchers with no more than four years postdoctoral experience though exceptions are considered for career breaks or changes (NIH, 2022).

Our findings contribute to both the academic and policy discussion on how best to support and develop ECRs in medical research. On the academic discussion, our paper is the first to provide a systems theory approach in understanding what supports and what hinders their transition to independence. We show that career progression is not always linear and ECRs are often unclear about career progression pathways. Crucial to their progression is the role that universities and research institutions play, yet many ECRs felt institutional support was not there. It is also original, in that in addition to in-depth interviews, we developed a novel approach to collect the views of a wider pool of ECRs using a 'Snakes and Ladders' game to organise our focus groups. On the policy front, in the UK the government launched their People and Culture Strategy, putting the development of a skilled and supported R&D (Research & Development) workforce at the heart of this strategy and committing to 'retain and develop talented people' (BEIS, 2021). Our findings show that funding at this career stage is crucial for researchers to become established in their own field. Yet, our study shows there is still ground to be covered to meet the commitment universities and research institutions show to ECRs as suggested by the UK's Concordat to Support the Career Development of Researchers (The Concordat, 2019). Our findings are relevant to other countries and fundings bodies, considering the significant levels of precarity observed among ECRs around the world (OECD, 2021).

The rest of the paper is organised as follows. Section 2 presents the theoretical framework we used to approach our empirical investigation as well as a review of the existing literature to identify the research gaps. Section 3 explains the empirical context and describes our methods and data in detail. Section 4 presents the results and Section 5 summarises the key points and concludes.

2. Theoretical considerations and empirical evidence

2.1. Theoretical considerations

We draw on the literature of career development theory to shape our

thinking around transition to independence in medical research. The field of career development has seen a rapid increase in the number of theoretical propositions and models aiming to explain career behaviour over the past decades. These theories come from different disciplines, including psychology, organizational behaviour and sociology, and offer explanations about various elements of the content (Nauta, 2010; McCrae and Costa Jr, 2008), process (Hartung, 2013; Gottfredson, 2005) or both content and process (Brown and Lent, 2004; Reardon et al., 2011) of career development. The empirical applications vary depending on the field and context. In understanding academic career development more specifically, Zacher et al. (2019) chose to use social cognitive career theory and life-span, life space theories as complementary 'grand theories' that combine elements of both content and process and allow them to apply theoretical lenses into a broad literature review.

The plethora of available theories in career development led Patton and McMahon (2014), among many others, to argue that the 'field remains segmented, incomplete and lacking in comprehensiveness and coherence'. They argued there is often a need to rely on more than one theory to understand such a complex phenomenon as career behaviour and called for the integration of career theories using systems thinking. This approach led to the development of a metatheoretical framework, the Systems Theory Framework (STF) for Careers Development, by Patton and McMahon (2014) which provides a wholistic approach in conceptualising career development, offering a constructivist worldview with a focus on the individual as central to the construction of their career.

The STF includes two broad components with regards to career progression: content and process. Within content, the framework identifies a number of influences that are divided in two broad categories: a) *the individual system*, which includes socio-demographic characteristics (age, gender, ethnicity), values and beliefs, skills and personality and b) *the contextual system*, including the social system and the environmental societal system, which includes peers, institutions, workplace, community groups, as well as geographical location, political situation and employment market. An individual could perceive an influence as a barrier or as a facilitator in relation to career development. Within process, the framework identifies the existence of recursive interaction processes within the individual and within the context, and between the individual and the wider context. The process component of the framework highlights the significance of recurrence and inter-connectivity of the various influences and identifies the relevance and importance of chance.

It has been argued that a system theory framework that integrates a number of influencing factors in the development of a researcher's career would be needed to understand the challenges they face when transitioning to independence (Ranieri et al., 2016). Yet, such theoretical framework has had very limited empirical applications. It has been used in understanding the influences on clinical academic physicians' decision to proceed to a postdoctoral career following the completion of their PhD (Ranieri et al., 2018), but wider applications in other career stages are missing.

2.2. Empirical evidence

The empirical evidence around career development in academia has grown over the past years, not least because precarity has increased and there is reduced availability of tenure-track faculty positions internationally (OECD, 2021; Johnson and Weivoda, 2021).

The literature has focused on specific groups of ECRs that are known to face more barriers, such as gender (Ceci et al., 2014; Buffington et al., 2016) and race (Ginther, 2021; Ginther and Kahn, 2004). Focusing on female academics, Gasser and Shaffer (2014) explore issues around career progression, who while transitioning to independence are faced with the "fundamental set of issues pertaining to gender inequalities" (Gasser and Shaffer, 2014). The issue seems more evident in science,

technology, engineering and mathematics (STEM) disciplines (O'Connell and McKinnon, 2021) although it is reported in most disciplines including health sciences and social sciences (Ginther and Kahn, 2004). To explore more in depth these challenges, Fernandez et al. (2021) conducted qualitative interviews with female early-stage investigators in health sciences in Florida, US and highlighted issues around family responsibilities, the importance of mentorship and perceived differences in institutional expectations as factors influencing career progression.

There is also evidence that funding can impact significantly on the career trajectory of young researchers. Azoulay et al. (2021) show that early career funding that physicians received from the NIH in the US increased their chances of choosing a research-focused career, generated high quality research and supported those around them too. In the UK, Burkinshaw et al. (2022) analysed ten years of NIHR research training and highlighted similar benefits of receiving research funding for individual researchers. Yet, they identify inequalities among researchers from less established research institutions, certain professional groups, such as nurses and allied health professionals as well as difficulties related to continuity of funding. When focusing on early career stages, a recent survey among new group leaders in the UK showed that securing permanent positions was a major barrier in the career progression of young researchers (Acton et al., 2019). A more recent study highlighted issues related to institutional support associated with precariousness (Menard and Shinton, 2022).

2.3. Research gap and research question

As shown above, the empirical work around on ECRs who are making their transition to independence is fragmented and remains largely atheoretical. In this study, we define ECRs as those researchers managing their first independent research project as PIs seeking to set up a substantive research programme and we aim to answer the following question:

What individual and contextual influences as well as processes impact on the transition to independence among ECRs in medical research who have received their first grant as Principal Investigators?

3. Methods

3.1. Empirical context

The MRC is the largest public funder of biomedical discovery science in the UK and one of the largest funders of medical research in the world (Viergever and Hendriks, 2016). Since 2019, it is one of the nine councils that form the UKRI, funded through the science budget of the Department for Business and Trade.

MRC's annual investment in support for ECRs, is approximately £30 million (4 % of the portfolio, supporting 40 researchers per year). The MRC's ECR schemes include two fellowship schemes, namely the Career Development Award (CDA) and Clinician Scientist Fellowships (CSF) and one grant scheme that is aimed at ECRs only: the New Investigator Research Grant (NIRG). Since 2019 UKRI has offered the Future Leader Fellowships (FLF) scheme which can support fellowships in any of the research council remits. The FLF scheme has similar characteristics to the fellowships the MRC offers (is offered in open competition, requires an interview), but is novel in that it requires the hosting institution to show stronger commitment to the fellow, by gradually taking over the salary of the fellow and offering them a permanent contract at the end of the fellowship.

In 2020, the MRC conducted an evaluation of ECR schemes by analysing ECRs success in securing follow-on funding (Viney et al., 2020). Although the study suggested reasonably good progression rates, it also confirmed a bottleneck with some researchers taking several years to establish their research careers.

To further investigate the barriers and facilitators that ECRs experience, the MRC decided to appoint an independent researcher on a part-time secondment to conduct an evaluation of the ECR schemes. By having an independent researcher (CS) recruiting and interviewing ECR fellows, the project aimed to give the participants the opportunity to speak freely about their experience, without the concern that their identities and views would be revealed to the funder of their research.

3.2. Data and methods

The study draws on two sets of data to capture the views of ECRs; one-to-one semi-structured interviews and focus groups. First, we conducted individual interviews to get an in-depth understanding of the experiences and personal journeys of ECRs, offering them space to further elaborate on points of particular interest. Then, the 2022 MRC Fellows Symposium presented a unique opportunity to seek the views of a wider group of ECRs, who were in different stages of their career. Hence, we decided to complement our data with focus groups which we conducted during the Symposium. Together the two approaches allowed us to go both deep (interviews) and wide (group) in seeking the views of the ECRs and engage in a 'thick description' (Payne and Williams, 2005) of the challenges ECRs face when transitioning to independence.

3.2.1. Semi-structured interviews

Semi-structured interviews were conducted with ECRs who had been awarded a fellowship or award from one of the MRC schemes since 2011. ECRs were stratified to include a balanced representation of both male and female researchers, from universities concentrated around London, Oxford and Cambridge and other institutions across the country. Although we interviewed both current and past fellows, we sought to interview predominately ECRs who had completed their award, aiming to capture their post award journey and explore what supported or hindered their transition to the next step.

Interviews were conducted between April 2021 and November 2021. Due to social distancing measures put in place during that period as a result of the pandemic, all interviews were performed online via Microsoft Teams or Zoom. Participants were interviewed individually with the researcher (CS) using a semi-structured interview schedule to guide the interviews (available from the corresponding author upon request). The interview guide was informed by a review of the literature identifying barriers and facilitators of ECRs to career progression; preliminary findings from the previous ECR analysis conducted by the MRC and the UKRI's action plan. The guide was structured in three main parts asking participants to talk about their career journey before, during and after their MRC fellowship.

The first two interviews were used for pilot testing of the guide. No changes were suggested as a result of the pilot phase and these interviews were involved in the final analysis. With the consent from participants, all interviews were audio-recorded and transcribed verbatim.

3.2.2. Focus groups

Focus groups were organised around the 2022 MRC Fellows Symposium. This is an annual showcase event with a mix of talks and interactive events, offering the opportunity to ECRs to network with peers, MRC board and panel members and head office staff. The 2022 Symposium, the first held face-to-face since the beginning of the pandemic, took place in central London.

We used this opportunity to seek the views of a larger and more mixed group of ECRs, who may be in different stages of their fellowship, by organising a workshop as part of the symposium. The workshop started with a presentation of the project (CS) and instructions on what the workshop involved. Participants, who were sitting randomly around a table in a big room of the venue, were asked to discuss the barriers and facilitators they experience as ECRs. To facilitate the workshop, we developed a 'Snakes and Ladders' game, co-developed with Design

Science, a company supporting researchers communicating their work to wider audiences, and two ECRs who had participated in the interview phase. Participants were asked to reflect on their experiences as ECRs and use snakes and ladders stickers to write their thoughts on barriers and facilitators. As with the individual interviews, the questions were focused on the individuals' journey since they received their award. They were then asked to place their stickers on a 'Snakes and Ladders' Board (Fig. 1) and share their stories with the group. The workshop lasted 45 min. Data were collected in the form of written notes that participants put on the stickers and place on the board. Photos of the boards with the stickers on were also taken. An example of nine such boards is presented on Fig. 1.

3.3. Participants' characteristics

3.3.1. Individual interviews

A total of 51 ECRs were interviewed individually. Of those, 40 individuals had already completed their fellowship or grant, and 11 individuals were current ECRs from the CDA scheme and the newly established FLF scheme. Of the total of 51 individuals, 24 were female (47.1 %) and 27 were male (52.9 %). Forty-six participants (90.2 %) were of white ethnic background and five (9.8 %) belong to an ethnic minority group. Eleven were CSF (21.6 %), 19 were CDA (37.3 %), 16 were NIRGs (31.4 %) and 5 were FLFs (Future Leaders Fellowships) (9.8 %). Twenty-eight participants (54.9 %) were based at research intensive institutions in London, Cambridge and Oxford and 23 (45.1 %) were from institutions across the remainder of the country. Only one person

had left academia to work in the industry and one had left the UK. Seven had moved from the institution they were originally based when they received the award or fellowship. Interviews lasted between 35 and 86 min.

3.3.2. Focus groups

Eighteen groups of approximately 3–7 individuals each participated in the workshop organised during the 2022 MRC Fellows Symposium. In total, that involved 95 individuals, representing all four ECR schemes and included individuals in various stages of their fellowship or award.

3.4. Analysis

Analysis was conducted in two stages. The first stage involved an inductive thematic analysis of the semi-structured interviews, in line with the guidance outlined by Braun and Clarke (2006). One researcher (CS) did the initial coding, discussed the codes with the second researcher (IV) and developed a codebook that was then applied to look at the data using Dedoose software (Dedoose, 2018). The written notes collected during the annual symposium's workshop were studied to identify common themes coming up that relate to the barriers ('snakes') and facilitators ('ladders'). The second stage of the analysis involved mapping these themes onto the core elements of the Systems Theory Framework for Careers Development. This mapping enables the research to provide a structured understanding of the influences that had an impact on the transition to independence in academia among the interviewed ECRs during their award/fellowship.

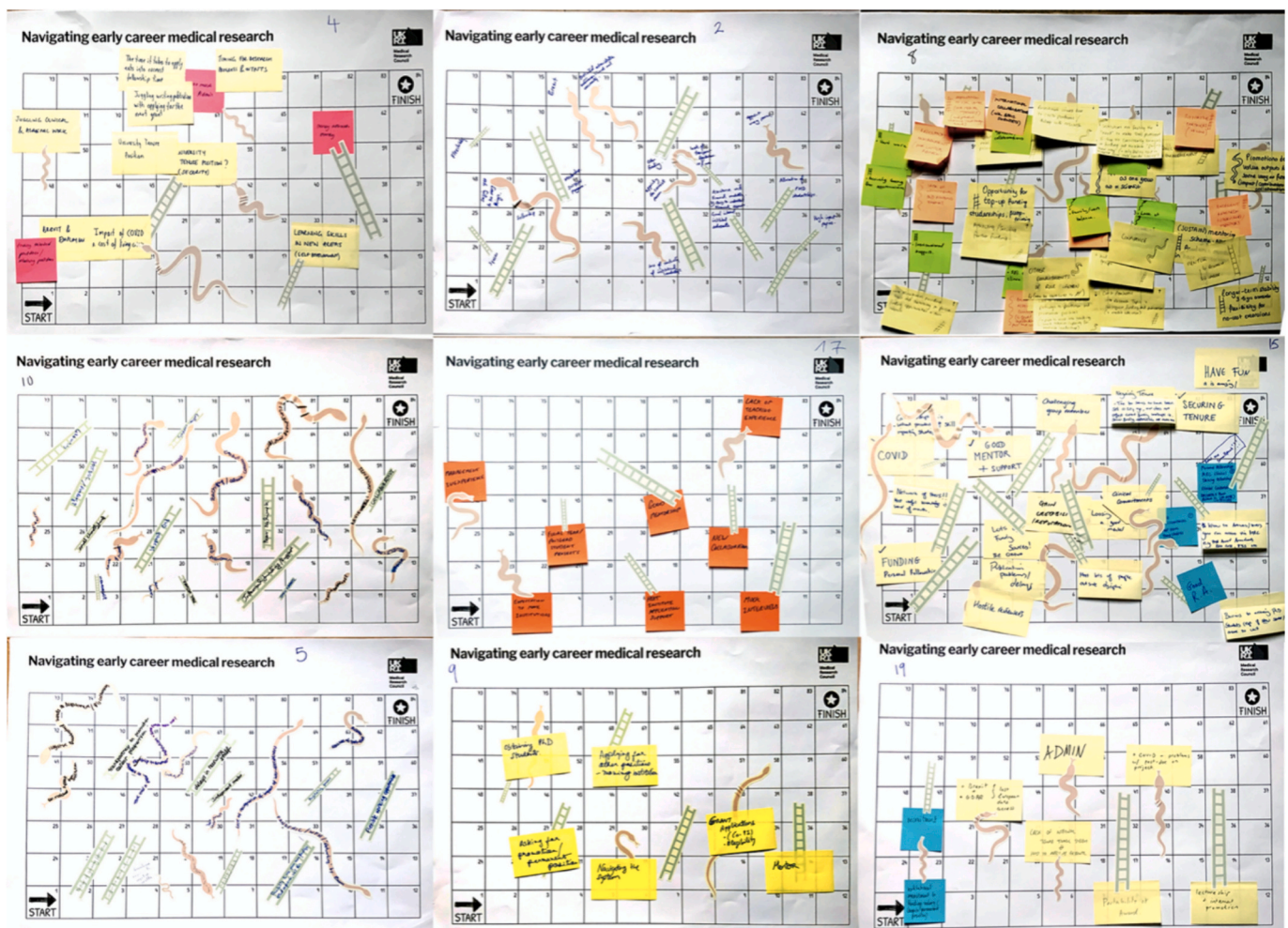


Fig. 1. The Snakes and Ladders game.

4. Results

4.1. Individual and contextual influences

Table 1 summarises the content factors that influence the development of ECRs during their fellowship or award. Following the Systems Theory Framework for Careers Development, these influences are divided into two broad categories: the individual and the contextual system. They are all analysed further in more detail below.

4.1.1. Individual system

The individual is the centre of the systems theory framework. The main individual influences identified in our study included motivation and gender which are further explored below.

Highly motivated researchers

The main motivation to apply for an ECR scheme was the researcher's love and passion for research and their wish to build their own team. ECRs felt that the award of fellowship allowed them to have control over teaching and support teaching activities in ways that they benefit from their research expertise.

For clinical fellows, this motivation arises from their clinical experience and is driven by a desire to improve patient outcomes. For them, the options to do research and stay in academia are limited, hence these fellowships were seen as the only way to continue on a research career pathway and control the time devoted into clinical work. They also felt they had control over the type of clinical work they do, which is very much on the area they do research for. Although clinical fellows' workload is heavily skewed towards research, they value the time that they could spend with their patients.

Women as team leaders

Female participants in the study talked about the challenges women face as ECRs. When reflecting on the impact that maternity leave had on their career, they talked about the well documented delays in publications and grant application submissions. Yet, they went beyond the impact on outcomes and highlighted the wider challenges of being a female leader of a team or lab. Female ECRs who took a maternity leave during their fellowship talked about the pressure they felt to ensure the team worked efficiently and that the project run smoothly in their absence. This pressure led many female ECRs to have to work during their maternity leave. This was in contrast to a member of the team, including a postdoctoral fellow or assistant, going on leave which felt less disruptive as their work could be covered by another researcher or sometimes a PhD student.

[...] but I felt like people are waiting in the lab and that's pressure. Then after three months, I felt itchy; that I need to help them. But I couldn't go back to work with them because legally I was on maternity leave, so I couldn't interrupt that. [...] Then what I ended up doing as a compromise is that I was meeting my team at the pubs [...].

(P14, NIRG, F)

The challenges experienced by female ECRs made some of them talk about their need to seek support from other female academics, when it came to mentorship. They felt that other women would understand better their challenges and would provide appropriate advice.

4.1.2. Contextual system

The systems theory framework sees the individual within a wider context in which they operate. The participants highlighted the award as a major facilitator in their career progression, allowing them the intellectual and financial flexibility to dedicate their time on research. Mentorship and training opportunities offered were seen as facilitators but did not work the same for everyone. Yet the strongest contextual influence was the role of the institution. While support from the institution was key, many researchers felt that their hosting university did not fulfil the promises to support them during their award and showed little commitment in supporting their next career steps. These influences

Table 1

Individual, contextual and process influences in career development of medical researchers.

Second-order themes	First-order themes	Quotes
Individual system Highly motivated researchers	Protected Research Time	<i>because I really wanted to do research and I wanted to have that protected time to be able to dedicate the majority of my time to research (P1, CSF, F)</i>
	Building a team	<i>I knew that if I wanted to get my own group together that I should be applying for a fellowship and get my own independent money. (P27, CDA, F)</i>
	Securing an academic job	<i>I had to transition to independence, because as you know, climbing career, that's the step to be taken, so it was at the end of my second postdoc, so I knew that it was the next step in order to continue in academia (P5, CDA, M)</i>
Women as team leaders	Challenging period for women	<i>It was very challenging in the sense that it's hard for anyone to start an intermediate fellowship, because it's quite a jump and you're starting your own study. With a small baby and all the things, it was hard, but at the same time it's like you're doing what you want to do, it's your own thing. It's very, very motivating (P1, CSF, F)</i>
	Impossible to stay off work	<i>what exactly happened is I took about a month, maybe, off completely. Afterwards I just started working again from home, managing from... Basically remotely controlling in a way. (P40, CDA, F)</i>
	Maternity leave harder for group leaders	<i>For example, if you have a post-doc that goes off on maternity leave during a fellowship. There's support to get other people in to cover. It's a bit difficult when you're the group leader because you're the one that knows the project and you're directing it all. So it would be amazing if they could clone you [laughs] while you're on maternity leave and have your clone continue supervising everybody that's involved with the project but that's never going to happen. So I did end up having to do bits of work. (P27, CDA, F)</i>
Contextual system Funding is instrumental	Breaking through the first glass ceiling	<i>The fellowship has really allowed me to break through the first glass ceiling really, within academia. I call it a double-glazed glass ceiling of academia. You first need to become a PI. That's the first glass ceiling. The second ceiling is to become an established PI. (P44, CDA, M)</i>
	Financial flexibility and intellectual freedom	<i>I think it's important for the Fellowship to have the flexibility to take other opportunities if they come up. For instance, one of the opportunities that came up was to do a lot of vaccine-related research separate, which was funded through NIHR. Actually, that's been one of the major outputs of that five-year block (P25, CSF, M)</i>

(continued on next page)

Table 1 (continued)

Second-order themes	First-order themes	Quotes
Institutional support is key	Lack of support during the award	<i>the institutions do sign a contract that says they will provide X, Y and Z support, but at that point, it wasn't really anything other than just a signature. (P16, CDA, M)</i>
	Lack of clarity on tenure & promotion processes	<i>at the end of my CDA, there was no plan, there was no commitment from the institution, no plan, no anything. So then, basically, if I hadn't got the senior fellowship, I would have had no position at [XXX], so I was facing a cliff edge [...] (P16, CDA, M)</i> <i>The university will never tell you. They'll never give you cast-iron guarantees, so the university will always give you lip service, saying, 'Oh, we'd like to keep you,' (P21, CSF, M)</i>
Mentorship and training: no one-size-fits all	Mentorship needs vary	<i>I think some people feel like they need to have formal mentorship, but personally, a long time ago, I was involved in a mentorship programme for postdocs, but I always feel that mentorship should be a fairly informal thing, because actually if you're motivated, you find the people to support you and you get advice. (P38, F, NIRG)</i>
	Training vs learning by doing	<i>No, I didn't get any management training or budget training. I mean, the way I picked most of those things up was by bugging the people in my department ... I think it would have helped, to some extent, to have some training about management. (P7, NIRG, M)</i>
Wider political and contextual challenges	Pandemic interruptions	<i>Recruitment issues due to Covid pandemic/delays with research (Focus group 8)</i>
	Brexit challenges	<i>Brexit on funding talented postdocs/retaining postdocs (focus group 4)</i> <i>Brexit and GDPR – lost European data access (focus group 19)</i>
Process influences Falling between the cracks of academia	Lack of clarity of where fellows fit	<i>I think, as a fellow, you fall between the cracks where, even [name of university], which had lots of experience of independent researchers, doesn't really have any clear, coherent understanding of what someone coming in with independent money is. (P16, CDA, M)</i>
	Treated as postdocs	<i>My clinician scientist fellowship was under my previous PhD supervisor. (P1, CSF, F)</i>
	Conflicting goals in achieving independence	<i>We're discouraged from applying for funding in our first three years, but after that time, I am no longer eligible to apply for funding, so it's a catch-22 situation, right. (P44, M, CDA)</i>
Career pathways are not linear	Unclear about available options	<i>One thing that perhaps MRC need to think about is what's going to happen to these fellows at the end of these awards? Since they don't have a matching number of fellowships for them - obviously some of them won't follow up, some of them will not - their research is not going to do as well. (P4, CDA, M)</i>

Table 1 (continued)

Second-order themes	First-order themes	Quotes
	Funders have leverage on institutions	<i>It will vary from person to person, some will be more savvy than others, but I think a much fairer way is to just write it down and put it in the rules. As a funder, I think they have the leverage and they also have the knowledge, they see this happening over and over again. (P4, CDA, M)</i>

are explained further below.

Funding is instrumental

There was a unanimous recognition across participants from all schemes of how instrumental the award was for their research career and development. It gave them formally allocated time to do the research, publish as senior author and establish their network. Differently from any other grant, the ECR schemes allowed researchers in early stages to compete with others in similar stages of their career, hence it gave them a higher chance of starting their own project and leading their own group.

The fellowship has really allowed me to break through the first glass ceiling really, within academia. I call it a double-glazed glass ceiling of academia. You first need to become a PI. That's the first glass ceiling. The second ceiling is to become an established PI, which is what I'm currently fighting towards, and so it was everything really.

(P44, CDA, M)

The award allowed ECRs to develop their proposed ideas, build their team and lead on a project they wanted to develop. Although most ECRs were encouraged to only focus on their MRC project, a number of them talked about side projects they worked on and how useful that was for their research development. The vast majority of participants talked about how generous the scheme was in allowing them to set up their lab, buy consumables and recruit research staff but also in attending conferences and supporting networking opportunities. But more than generous, the participants praised the schemes for the flexibility they offered them to use the funds in different ways adjusting the project to the direction the research was taking them.

Mentorship and training: no one-size-fits all

Mentorship was key for the majority of the ECRs, but took various forms and worked differently for different individuals. Most frequently, mentors provided academic advice on grant applications, overall opinion on their CVs (Curriculum Vitae) and direction for their research career more generally. In some cases, mentors supported ECRs more directly through collaborations and networks. Some Universities offered formal mentorship schemes, which suited some ECRs who found it helpful to have someone from their own institution.

Some ECRs were allocated an independent mentor through schemes offered as part of MRC initiatives, including the Academy of Medical Sciences. For many ECRs, having an independent mentor was eye-opening even if the mentor was from a different field or had no expertise in the area of the ECR. Others had found their mentors through their own initiatives, and often in more ad hoc ways. Those mentors are not necessarily part of a formal scheme, yet they often provide similar type of advice and support. For some a combination of local and independent mentors was beneficial and brings complementary advice to the researcher, while for others mentorship did not work and they relied on peer support that worked better. Similarly, although two female ECRs talked about how having a female mentor was helpful, another mentioned gender did not matter if the mentor was not someone they did not aspire to:

When you come in as a high-flying researcher from [...], with a stellar CV, and you're being given a mentor who you don't really admire - okay, they are female but it's somebody who is just there.

(P14, NIRG, F)

Equally, training was provided by both the MRC and the institutions hosting the fellows and came in different forms. Like with mentorship, researchers varied in the ways they felt training benefited them. Some fellows enjoyed the leadership courses and training on how to manage a lab, while others felt that some of these skills are developed organically and they learn them in practice.

Institutional support

Institutional support came in various forms and for some participants it had started before the beginning of the award or fellowship. Some universities were supportive and helped the applicants generate preliminary data or gave them the time to work on their ideas before applying for an ECR scheme. The support could have been financial, e.g., small amounts of money to buy consumables to run experiments to generate data, or administrative, e.g., dedicated teams supporting with grant applications through peer reviewing. For clinical fellows, it was vital to have someone supporting their salary prior to applying, as finding the time to write the application while doing clinical work was not easy.

During the fellowship or grant institutional support was vital. Yet not everyone felt supported and indeed a number of ECRs expresses dissatisfaction in the way the university supported them during the fellowship or award. In particular, participants referred to delays in being offered a lab space, lab facilities not being at the standards expected and lack of support with budgets or recruitment of their team members.

the institutions do sign a contract that says they will provide X, Y and Z support, but at that point, it wasn't really anything other than just a signature.

(P16, CDA, M)

Where ECRs felt they most needed support from their institution was in setting out what is expected from them during the fellowship and more importantly what happens at the end of it.

at the end of my CDA, there was no plan, there was no commitment from the institution, no plan, no anything. So then, basically, if I hadn't got the senior fellowship, I would have had no position at [XXX], so I was facing a cliff edge [...]

(P16, CDA, M)

Wider political and contextual challenges

A theme that was strongly emphasised particularly among more recent recipients of a fellowship and participants in the focus groups, was the impact of wider contextual challenges, such as Brexit and Covid in their transition to independence. In particular, ECRs felt that it was harder to recruit talented researchers for their project, more challenging to establish collaborations with European research groups and more complex to access European data essential for their work, as a result of Brexit. In a similar way, the pandemic had caused severe interruptions in ECRs research.

4.2. Process influences

A key aspect of a System Theory Framework is the process influences that describe the recursive nature of the interaction between the individuals and their contextual system as well as the interaction of influences within each system.

Falling between the cracks of the system

Despite being PIs of their award or fellowship, participants were often treated as postdoctoral researchers. As one participant described below, when she saw a list of funded projects in her institution, she discovered that she was not named as the PI of her fellowship, and her

funding was under her previous supervisor's name. Although this was not done intentionally, it highlighted the difficulties the system has to treat fellows as independent researchers.

...I was sent a document for the REF just a list, all the PIs were sent this document of funding. My clinician scientist fellowship was under my previous PhD supervisor. I was like, 'No, this is mine.' Like now, it's over, it's finished but it was still... I was like, 'No, this is mine.' I went in there and I explained. This was an admin person that doesn't know, of course, but sometimes it may slip...

(P1, CSF, F)

This was also demonstrated in the way that researchers were allocated to different career pathways. As explained by one researcher, there are two main pathways: the academic and the research stream. The former includes faculty members, such as lecturers and professors, who are associated with teaching activities and are often on a tenure track. The latter instead includes postdoctoral researchers who usually are not linked to teaching and belong to a PI's group. In most cases, ECRs were put under the research stream as they are not linked to teaching posts and hence often treated as postdoctoral staff.

Ultimately, these are structural issues often faced in academia where academic positions are mostly funded from teaching activities hence research is often seen as not viable to create financially sustainable posts. As a result, fellows, like P16 below, felt they often fall between the cracks of the system:

I think, as a fellow, you fall between the cracks where, even [name of university], which had lots of experience of independent researchers, doesn't really have any clear, coherent understanding of what someone coming in with independent money is.

(P16)

Career pathways are not linear

ECRs stated that the obvious next step after the MRC award or fellowship was seen as applying for a Senior Fellowship either from the MRC or another major funding body. This rather linear pathway to career progression was often described as the only way for ECRs in Universities in London, Oxford and Cambridge to secure a permanent job within their institution. Yet, reality is that the number of Senior Fellowships constitute only a fraction of the awards and fellowships for ECRs, implying that not everyone can follow this path. A number of ECRs felt that they would have benefited from having a clearer understanding early on of other schemes they could apply for, such as Programme Grants, to continue their labs and maintain their teams. Indeed, among our participants, ECRs managed to continue with their lab by developing collaborations with other Universities, both in the UK or overseas, and received research funding as part of a wider team. Others, applied for programme grants and were successful.

Equally, the way to a tenure position differed across different institutions, but sometimes even within the same institution too. For the majority of participants, the MRC award/fellowship was key in helping them get a tenure position at the end of their fellowship or award.

Definitely, that's just a golden key [...] to open the permanent position.

(P37, NIRG, F)

For others it was clear that the fellowship was not enough to secure them a position beyond the end of the award, and that was particularly true for institutions in London, Oxford and Cambridge.

Some ECRs were put into a tenure track pathway as soon as they received a fellowship and were given clear plans on what they had to achieve in order to get a permanent post. Yet, for many this was not a straightforward process or something that was explained to them when they started the fellowship.

The tenure, there was a big trauma, but I guess that you must have heard this from everybody. It's horrible. For some weird reason, I assumed that

once my fellowship was over, I would be employed by the department. I mean, nobody made me believe the opposite.

(P5, CDA, M)

What the participants highlighted was they did not want the institutions to commit to a permanent job, but to provide a plan and clarity of what happens at the end of the fellowship. Equally, they thought that the MRC had leverage with their institution and could help ensure that ECRs were appropriately supported especially towards the end of their fellowship:

I think more pressure from the MRC to the institution to properly support these individuals, and to think of a forward planner after the fellowships has ended would be good.

(P4, CDA, Male)

Indeed, the MRC has recently moved towards a model of supporting ECRs, the FLF described earlier, which has institutional commitment in the heart of their scheme. Yet, in practice this did not seem to translate into a full-time job. Out of the five FLF fellows we interviewed, two were already in tenure track position when they applied, one was given a clear plan as to how to secure one at the end, but two did not have any commitment from their institution.

So, there's nothing, there's nothing written down and I think across all fellows I detect a lot of unhappiness as to the ethos of the original fellowship proposals being undermined quite fundamentally.

(P47, FLF, F)

Conflicting goals on achieving independence

The schemes offer a generous financial package that often covers the ECRs salary, with the aim of protecting the individual researcher's research time. In practice, that means that ECRs need to do little or no teaching during their fellowship or award, and indeed as stated above, this is one of the elements ECRs appreciate mostly about their award. Yet, some institutions require that applicants for permanent positions need to show how their profile fits with the teaching portfolio, hence encourage ECRs to take teaching responsibilities on board to prepare themselves for when a position opens in their department.

Another conflicting area was highlighted by some ECRs who, in order to focus on their current project, they were discouraged from applying for other grants. Yet, to develop a competitive CV but also maintain their team or even expand it, a few participants highlighted the need to apply for multiple grants, often ignoring recommendations to do the opposite. In the case of participant P44, it also meant that past the three years, he was not eligible to apply for external funding as his institution did not allow him to apply for grants that went beyond the end of his contract.

We're discouraged from applying for funding in our first three years, but after that time, I am no longer eligible to apply for funding, so it's a catch-22 situation, right.

(P44, M, CDA)

5. Discussion

Using a systems theory approach, our study aims to understand what supports or hinders early career researchers' transition to independence. Independence means different things to different people and in this paper we approach it from a funder's perspective focusing on researchers leading their first independent grant as PIs. We show that in the process of becoming independent, there are a number of challenges ECRs face in navigating a system that often does not treat them as independent. Most participants were placed on short-term contracts usually aimed for postdoctoral researchers, and many were unclear about how to move to a tenure track academic position such as that of lecturers and professors. A possible explanation of our findings may be that career pathways in academia are financially more secured if linked to teaching roles as tuition fees are the main source of funding for England's higher

education system (IFS, 2022). This leaves researchers relying predominantly on external research funding. Indeed, as shown by data from the Higher Education Statistics Agency (HESA) from 2019/2020, only 32 % of academic staff on a research pathway had permanent/open-ended contracts, while the percentage of staff with permanent contracts in teaching or teaching and research pathways was 56 % and 76 % respectively (UCU, 2021).

Crucial to their progression is the role that universities and research institutions play. ECRs felt they wanted stronger support from their institutions during their fellowship and commented on how the letter of support they submit with their application did not provide a strong commitment in practice. Aware that institutional support is not always optimal, funding bodies have been exploring different ways to make research institutions and universities look after their researchers. Some are willing to take more extreme course of action such as withdrawing funding or preventing institutions from bidding for further funding if they fail to support their researchers, particularly women and young researchers (Nature, 2019). Other initiatives focus on the universities providing clear commitment to offer a permanent contract to fellows at the end of their award. Such schemes, like the FLF offered by the UKRI, have only recently been introduced and therefore it is not clear if they will succeed in their aim. Our findings from FLF, although limited, raised questions concerning the commitments made by some host institutions.

Other factors included contextual influences, such as the effect of Brexit and the pandemic, as well as individual influences, such as the challenges faced by female researchers. Although previous literature has focused on the issues women face in academia (Lerchenmueller and Sorenson, 2018; Jebson et al., 2020), our study reveals the challenges they face as team leaders. Female participants talked about how they feared that their maternity breaks would be disruptive for their team and hence often ended up working during their maternity leave.

Using both interviews and focus groups was beneficial and indeed complemented the analysis, justifying our choice for using both approaches to explore such a complex issue. In-depth interviews allowed ECRs to have open discussions about their experiences in ways that the focus groups may not have allowed. This was more evident when it came to individual system issues. For instance, the challenges female ECRs face as leaders came up very clearly in the interviews, when women talked openly about their experiences. Equally, certain themes, particularly around contextual factors, came from the focus groups where group discussions allow a wider discussion of the political context, such as the impact of Brexit.

Our findings contribute to a scarce literature on career progression of early career researchers. Some of these issues were highlighted in a recent study among NIHR supported researchers (Burkinshaw et al., 2022) as well as a survey among new group leaders in the UK, showing that securing permanent positions was a major barrier in the career progression of young researchers (Acton et al., 2019). Similar issues have also been observed in international studies. Sutherland (2017) interviewed ECRs from Canada, New Zealand and Sweden and found that career success is not well defined among ECRs, who receive conflicting information about how to achieve promotion and tenure. The lack of clarity on career structures and opportunities for clinician researchers was also highlighted in an Australian study (Brandenburg and Ward, 2022).

5.1. Policy implications

Major funding bodies across the world have established early career research schemes to support young researchers in academia. Yet, and although funding is invaluable for researchers to set up their first project and team, our findings suggest it is not enough for them to make their transition to academic independence. As highlighted by others in the past, an increase in budgets from funding agencies for early career researchers "could in fact produce an increase in precarity if there is not a clear plan for five years later" (Woolston, 2021). We show that

institutional support is crucial to make this transition smoother, by ensuring researchers are clear of their career pathways.

In the UK specifically, the then Department for Business, Energy and Industrial Strategy (BEIS) launched their People and Culture Strategy, putting the development of a skilled and supported R&D (Research & Development) workforce at the heart of this strategy and committing to 'retain and develop talented people' (BEIS, 2021). Our findings show that funding at this career stage is crucial for researchers to become established in their own field. Yet, our study shows there is still ground to be covered to meet the commitment universities and research institutions show to ECRs as suggested by the UK's Concordat to Support the Career Development of Researchers (The Concordat, 2019). To meet the objectives outlined in the Concordat, UKRI's Action Plan (UKRI, 2021) sets out clear expectations of research organisations hosting ECRs funded by the UKRI. This includes the expectation that these organisations provide access to career development support and advice to enable future career transitions. Our findings suggest that not every organisation offers this level of support to their researchers, who at the end of their fellowship often feel they are facing a cliff edge.

The main policy recommendation from our study is that institutions need to provide a clear career path, with clear decision points to their early career researchers. This does not mean that they all need to commit to long-term salary support, but the early career researcher needs to know what they need to do, over what timescale, to secure support from their institution. We encountered plenty of realism, participants wanted to know where they stand, not to be in "limbo". They suggested that funding bodies have leverage on institutions and should put more pressure on them to provide ECRs with clear career plans and a strategy to achieve them. They also suggested that visits from the MRC to the hosting institutions, may help the funder check on the support ECRs receive.

Although our findings have direct implications for research policy in the UK, where the study was conducted, the challenges identified are not unique to the UK context. The OECD highlighted that precarity in academic research careers is a problem all over the world (OECD, 2021). Funders across the world have long been concerned with how to best support postdoctoral researchers make a transition to independence (National Research Council, 2005). A Canadian study highlighted the challenges of keeping clinicians in research position and made recommendations that can support them (Strong et al., 2018). A qualitative study among Portuguese academics showed that some barriers may be context specific, such as poor collegiality and workplace relationships. But they also found similar challenges such as the lack of organizational support and employment precariousness as well as gender inequalities as barriers to career progression (Santos, 2016). Equally, our results are not only relevant to early career researchers funded by the MRC. A study analysing data from the NIHR in the UK highlighted the importance of supporting researchers in early stages of their career to make the transition to independence (Burkinshaw et al., 2022).

5.2. Strengths and limitations

Our study is the first to provide a systems theory approach in understanding what supports and what hinders ECRs' transition to independence. It is also original, in that in addition to in-depth interviews, we developed a novel approach to collect the views of a wider pool of ECRs using a 'Snakes and Ladders' game to organise our focus groups.

Yet, the study draws on the experiences and perceptions of early career researchers only. To complement our findings, we tried to seek the views of hosting institutions. We sent a survey to research institutions hosting MRC ECRs, as part of the 2021 series of visits that MRC conducts annually. The survey was sent to twenty institutions of which only nine responded, despite the fact that the MRC visits provided an opportunity to brief senior leaders in the institution about the survey and the interest in ECR careers that was the focus of the study. The lack of a high response rate did not allow us to conduct a more in depth

analysis, yet some of the responses confirmed our earlier findings. Despite specifically mentioning the schemes we were referring to, responses mentioned support for postdoctoral researchers, confirming that host institutions often fail to treat ECRs as independent researchers. In addition, only one institution made specific reference to tenure track positions that would apply to ECRs, while another mentioned they were in the process of developing clearer policies for researchers becoming PIs for the first time. Future studies should seek to explore the role of hosting institutions in supporting ECRs more systematically.

6. Conclusions

Our study shows that in the process of becoming independent, early career researchers often fall between the cracks of a system that fails to treat them as independent, they are not clear about career pathways in research and they receive conflicting information about their career progression. Universities and research institutions play an important role in the career progression of ECRs, yet many of our participants felt institutional support was lacking. Our findings can inform funding policies in the UK and across the world, as the challenges identified are not unique to the UK context.

CRediT authorship contribution statement

Charitini Stavropoulou: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ian Viney:** Writing – review & editing, Supervision, Resources, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Charitini Stavropoulou was seconded to the MRC on a part-time basis between January 2021 and May 2022 to conduct this study. Ian Viney is the UKRI Chief Data Officer, and was the MRC Director of Strategic Evaluation and Impact when the study was conducted.

The authors do not have any other conflicts of interest to declare.

If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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