Precarity of post doctorate career breaks: does gender matter?

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ABSTRACT

Against a background of Bologna process goals to improve employment prospects for PhD graduates, and the crisis of precarious employment conditions and prospects afflicting postdoctoral researchers – hitherto postdocs, the OECD ([2021]. "Reducing the Precarity of Academic Research Careers." In *OECD Science, Technology and Industry Policy Papers*. Paris: OECD Publishing.) called for research into postdoctoral careers and the precarity phenomenon. This paper responds by giving attention to career breaks as these represent a prevalent but under researched aspect of postdoc precarity in the contemporary academic labor market. Utilizing a substantial international mixed-method dataset with a sample of 950 postdocs, the study examined experiences and perceptions of the professional and personal implications of academic career breaks. Results reveal significant differences between males and females in key areas: maternity was the main reason for females' career breaks, and redundancy/end of contract for males. Females resumed employment more with the same employer and males with a different employer. Support surrounding career breaks was mixed, largely inadequate, but not associated with gender. Perceptions of career breaks differed significantly across groups of postdocs that previously experienced a career break, those on a career break, and postdocs that had never had a career break. The latter two groups perceived negative career outcomes and positive personal outcomes more than postdocs who had previously had a career break, however, significant gender differences indicate females were more negative about the personal implications of career breaks. Discussion of the findings concludes that under neoliberalism postdocs represent a growing lumpen proletariat, leading to recommendations for policy, practice and further research into gender, precarity and postdoctoral careers.

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Introduction

Postdoctoral researchers (postdocs) are an essential and expanding group within academia (Camacho and Rhoads 2015; van der Weijden et al. 2016), but due to the casualization of academic labor (Ivancheva 2015) and increased number of doctoral attainments globally (Sarrico 2022), the number of candidates for permanent academic positions far exceeds available jobs (Ramakrishnan, Giri, and Mei 2016). Consequently, postdocs can spend extended periods employed on temporary fixed-term contracts, some of a very short duration, with frequent job changes (Bebiroglu, Dethier, and Ameryckx 2020), sometimes leading to gaps or career breaks between employment

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periods. In discussing postdoc careers it is important to acknowledge the global issue of gender inequality that affects women working in higher education (Jones et al. 2018; Mott 2022). Females are considered more vulnerable to precarity in the postdoctoral career phase (OECD 2021), due to factors that include gender bias (Dutt et al. 2016), academic 'in-breeding' – where recruitment occurs within elite, often male dominated, inner circles of academia (Checchi and Cicero 2022) and the motherhood penalty (Ysseldyk et al. 2019). Females are also less internationally mobile than males (OECD 2021). Thus together, such factors are thought to explain why females are under-represented in tenure track positions – especially those based on personal invitation (Sarrico 2022). Arguably women's vulnerability increases when the postdoctoral career phase coincides with career breaks for maternity or family reasons (Mavriplis et al. 2010). Hence, this paper explores the links between postdoc career breaks and gender.

Precarity arising from lack of stable work and income has emerged as a central concern, both among critics of the present era of neoliberal-led global capitalism (Neilson 2015), and those writing about postdoctoral careers (Herschberg, Benschop, and van den Brink 2018; Jones and Oakley 2018; OECD 2021). Still, postdoctoral careers have not been widely researched (Cantwell 2011; van der Weijden et al. 2016), and even less has been said about postdoctoral career breaks, except for small-scale research with female postdocs (Mavriplis et al. 2010). Other than that, gender has largely been sidestepped in postdoctoral careers research.

In 2021 the OECD (3) committed to improve the conditions of the 'research precariat', defined as: 'postdoctoral researchers holding fixed-term positions or positions without permanent or continuous employment prospects', and called for research to examine the precarity phenomenon. This study responds to that call and empirical gaps in understanding the links between career breaks and gender. The study involved secondary analysis of a significant international mixed method survey with a sample of 950 postdocs. Comparing females and males, and different groups of postdocs, the analysis took into consideration the views of postdocs on a career break, compared with those that had previously experienced a career break and postdocs that had no experience of career breaks. Generating empirical results representative of different groups allows a range of experiences and perspectives to be examined and acknowledges the gendered nature of career experiences and paths in academia, thus expands contemporary debate on post-PhD careers. It is also hoped that the research will feed into policy and impact on practice to drive positive change.

The paper begins with a literature review on the growth and importance of postdoc appointments internationally, followed by the precarity phenomena, then examines evidence of the unique challenges that female postdocs face in comparison with their male counterparts. The materials and methods section explains use of secondary data, the sample and data analysis techniques. Findings are presented in relation to four research questions. Discussion of the findings, linked to the extant literature on postdoctoral career precarity, will argue that under neoliberalism postdocs have become reconstituted as a growing lumpen proletariat. This leads to conclusions and implications for institutions, policy makers and practitioners, and is followed by proposals for further research.

Neoliberalism and the rise in postdocs

Neoliberalism is a dominant economic and political ideology that promotes free markets, deregulation, privatization of the public sector, the roll back of the welfare state and increased individual responsibility. Rooted in neoliberalism, Higher Education Institutions (HEIs) have transformed into business like entities, driven by competition, marketization and managerialism to reduce costs, optimize efficiency, performance, productivity and profitability (Maisuria and Cole 2017). New managerial intensified systems of control include the commodification of academic labor, loss of control over labor and the casualization of labor, manifestations that Hall (2018) argues represent the proletarianization of academic work. A crucial consequence of the casualization of academic labor is the rise in precarious employment (Herschberg 2019), occurring through increased use of fixed-term,

temporary, part-time contracts and un-tenured positions (Ackers and Oliver 2007). Postdocs represent a reserve army of flexible labor for teaching, research, knowledge production, doctoral supervision and support (Müller 2014), and their increased utilization is evident in various studies. The United States (US) based National Postdoctoral Association (NPA) (2021) estimates that in 2019 there were 70,000 postdocs across 199 of its member institutions. Numbers have increased steadily in Europe since the early 1990s (Recotillet 2007). The OECD (2021) reports that postdocs represent the majority of the research workforce in some countries (e.g. 56% in Australia and 64% in Switzerland). In France they author 70% of publications.

Postdoc positions take different forms. Most are either on the basis of an individual fellowship award granted by a funding body or they occur through recruitment to an existing funded project under the leadership of a Principal Investigator. Fellowships are considered prestigious, but due to an oversupply of postdocs and undersupply of academic jobs, any postdoc post is usually in high demand. Postdoc positions may be viewed as offering some chance of an academic career (Lin and Chiu 2016), through socialization and the creation of knowledge, skills and human capital (Yang and Webber 2015). In some fields, such as the sciences, a postdoctoral position can act as an important probationary period (Lin and Chiu 2016; Stephen and Ma 2005). However, inside the golden gates of academia there is growing discontent over precarious working conditions and employment prospects among postdocs (Herschberg 2019), as shown next.

Postdoc precarity

The term precariat first appeared in the 1970s in response to the growth of neoliberal regimes that imposed decentralized flatter organization structurers, reduced welfare provision and labor rights across society (Masquelier 2019). At that time, the precariat was used to describe low status socio-economic groups of 'flexible workers with under-valued skills and little work-based identity' (Dean 2012, 356). Today precarity is viewed as a defining feature of economic and social life, playing 'a much more subtle and insidious role in society' under neoliberalism (Masquelier 2019, 144). This is echoed in research concerning postdocs and underlies the present research, which adopts the OECD (2021) definition of the precariat which, as explained earlier, is concerned with working conditions and employment prospects of postdocs who are without permanent or continuous employment prospects.

International concern for the postdoc precariat has risen broadly in line with rising postdoctoral numbers. Among a constellation of issues is low pay, reduced holidays and sickness benefits, inadequate pension, long hours, burnout, role ambiguity, marginalization, ad-hoc and outdated training, intense competition and pressure, lack of career guidance, as well as the extended period of the postdoctoral phase of fixed-term contracts, some of very short duration (Ålund et al. 2020; Guidetti et al. 2022; Müller 2014; OECD 2021). As most posts rely on short-term, project based funding, career plans can be derailed at any time by funding changes or cuts (Sills et al. 2020). This can induce fear over career prospects and livelihoods (Jones and Oakley 2018).

Supervision represents another cause for concern in the extant literature. Supervisors play an important role supporting and preparing postdocs for future careers but evidence indicates that most rely on postdocs to be agentic seeking such support (Chen, McAlpine, and Amundsen 2015). Furthermore, power dynamics and the fragility of relationships between supervisors and postdocs (Müller 2014) can result in irreparable reputational damage for the post doctorate if relationships break down as academic structures support supervisors better than students (Fetzer 2008). There are few mechanisms through which postdocs can express their dissatisfaction (Camacho and Rhoads 2015; Miller and Feldman 2015) since they are neither students nor regular employees they occupy a fragile position on the periphery of the academic hierarchy (Camacho and Rhoads 2015, 307). Marginalization is detrimental to career success (Müller 2014), associated as it is with social isolation, lack of support, burnout and depression, which when combined with financial insecurity has significant implications for a person's wellbeing (Ålund et al. 2020). Evidence of the

adverse effects of precarity includes stress (Teelken and van der Weijden 2020), and severe psychological distress (Pitt, Alp, and Shell 2021). This disproportionately affects groups already disadvantaged in postdoctoral research, such as women, and people with caring responsibilities due to pressures they already experience combining multiple roles (Jones and Oakley 2018).

The scale of discontent surrounding post doctorate precarity is strongly evidenced in recent research, with a survey of 7,670 postdocs from 93 nations highlighting dissatisfaction with workplace culture and career prospects. This has been worsened by the global Covid-19 pandemic (Woolston 2020b; 2020a), further impacting on postdocs mental health and perceptions of the job market (Morin et al. 2022). It is against this background that Grinstein and Treister (2017, 1) refer to a discourse of a 'broken' post doctorate system.

Female postdocs

Higher education systems are rooted in patriarchy, resulting in unequal power relations, cultural sexism and discrimination (Fletcher et al. 2007; Savigny 2019a) that adversely affects females as a group, compared to males, at every career stage (Mott 2022). There is, for example, plentiful evidence that females are underrepresented in research and academic leadership (Jones et al. 2018; Morley 2011; 2013; Morley and Crossouard 2016), are less likely to be invited to speak at conferences or be on panels (Ford et al. 2018; Schroeder et al. 2013), to be cited (Maliniak, Powers, and Walter 2013), or win a Nobel Prize – in all disciplines (Lunnemann, Jensen, and Jauffred 2019), but females are more likely to experience abuse in social media (Savigny 2019b), to be ranked lower in peer review processes when author identities are known (Goues et al. 2018), to receive negative evaluations from students, even in experiments that artificially manipulate the instructor's sex (Mitchell and Martin 2018), and experience discrimination and bias in recruitment and promotion processes (Savigny 2019a). Added to which, females as a group suffer from adverse pay gaps and discretionary payments (Mott 2022). Fletcher et al. (2007) argue that neoliberalism further adds to women's marginalization in research production processes by fostering competitive rather than collegial behavior.

Compounding matters, another major factor affecting women's careers is whether they have a child (Ackers and Oliver 2007). Career breaks for maternity and family commitments are often followed by lower status, part-time work, or not returning to employment (Arntz, Dlugosz, and Wilke 2017). Work-family conflict, especially when accompanied by an inflexible and hostile work climate is the biggest cause of women opting out of an academic career (Quinn and Litzler 2009), often more so in male dominated fields such as science, engineering, mathematics, and technology (Ysseldyk et al. 2019). The most common time to opt-out is during the transition from early to mid-career (OECD 2021), with most women leaving at the postdoc to principal investigator transition point (Martinez et al. 2007). As principal investigator roles have been linked to career success, this has longer-term implications for women's careers (Lu et al. 2022).

Many of the above mentioned challenges appear to be more critical for women in the postdoctoral phase (OECD 2021). Research indicates that in comparison with males, female postdocs are more likely to experience discrimination, isolation and exclusion from professional networks, and they are less likely to be mentored or championed (Briscoe-Palmer and Mattocks 2021). The lock-step career model of long hours, hard work and a continuous employment record favored in academia (Mavriplis et al. 2010), does not fit with women's biological clock (Martinez et al. 2007; Santos 2016). The motherhood penalty appears greater at postdoctoral stage since women who take maternity related career breaks within five years of completing a doctorate are less likely to gain permanent academic positions, compared to men (Resmini 2016). The impact of a career break at postdoctoral stage can also be greater because networks, research and publication records are underdeveloped, adding to the significant obstacles that already exist on the path back to a career in academia (Mavriplis et al. 2010). As noted, females are less internationally mobile and less likely to occupy tenure track positions than males, thus

the probability of gaining a permanent academic position is strongly gendered (Nokkala et al. 2020).

It can be concluded that while the extant literature implies that career breaks contribute to precarity in the postdoctoral career phase, little focused attention has been given to career breaks in empirical research. This study addresses that gap and, with consideration to the secondary dataset, examines the experiences of postdocs that have had a career break, while investigating if there are gender differences. Further, it is argued that regardless of whether postdocs have experienced a career break, these pose a threat, thus contribute to the precarity phenomenon. Therefore, giving attention to perceptions of career breaks across different groups of postdocs who have/not experience a career break and the reasons why postdocs maybe deterred from taking a career break allows for nuances to be explored. Thus, the research questions guiding this study and the presentation of the findings are:

(1) What are postdocs' experiences of career breaks, and is there an association with gender?
(2) How do female and male postdocs who have experienced a career break describe its impact?
(3) Is the impact of a career break perceived significantly differently across postdoc groups, and between genders?
(4) What deters postdocs from taking a career break, and is there a significant association with gender?

Materials and methods

This study is innovative in its use of secondary analysis, particularly in post-doctoral precarity research where secondary data has been limited in the past. By exploiting existing data, the study not only saves time and cost, it benefits from variables of higher quality and a larger sample than could be achieved by a single researcher using primary methods (Johnston 2017). The sample of 950 postdocs was drawn from a larger sample of 5035 academics who took part in an international online survey on 'Academic Career Breaks' – defined as – a period of time when a person has stopped working with the intention of returning later, e.g. due to redundancy, the end of a fixed-term contract, maternity leave, caring responsibilities, health issues, for travel, a sabbatical or other reasons. All research protocols were led by a Principal Investigator from the former organization Pirrus.ac.uk with the assistance of a researcher. The online survey was launched by Pirrus.ac.uk with jobs.ac.uk and supported by *Research Media* in 2016. This partnership enabled the survey to reach a wide audience.

The researcher and author of this paper responded to a call for secondary analysis of the data and met with the Principal Investigator and the original researcher to learn as much as possible about why and how data were collected and to evaluate it for quality assurance purposes (Johnston 2017). Following recommended criteria for evaluating secondary data (Boslaugh 2007; Johnston 2017; Tripathy 2013) the purpose of the study was evaluated along with its methodology and the code book was inspected. Consequently, the author learnt about the type of variables, measures and routing applied, the timeframe and protocols for data collection, response rates, what happened after the data were collected, in terms of procedures to screen, clean and analyse the data. Postdocs were the largest group of respondents, and due to gaps in the extant literature, this dataset was deemed worthy of further exploration. Agreement was given in writing for the data to be shared for the purposes of this study and one other study. Secondary analysis was funded by The University of Reading Undergraduate Research Opportunities Programme (UROP). The anonymised data was stored in line with research ethics and GDPR.

The survey included single response, closed multiple-choice questions and free text questions. Questions utilized for the analysis were demographic and career related and focused on experiences and perceptions of career breaks. Descriptive statistics were used to examine the characteristics of the sample (Table 1) and whether they had experienced a career break (Table 2).

Table 1. Sample characteristics.

Variable	N (%)
Gender	
Female	609 (64.6)
Male	332 (35.2)
Other	1 (.1)
Age	
25–34	448 (47.4)
35–44	342 (36.2)
45–54	107 (11.3)
55 & over	38 (4.0)
Prefer not to say	10 (1.1)
Country of residence	
UK	668 (70.3)
Europe (excluding UK)	181(19.1)
North America and Caribbean	38 (4.0)
Australasia	23 (2.4)
Asia	22 (2.3)
Middle East	8 (.8)
Africa	6 (.6)
South America	4 (.4)
Current/Previous Role	
Research role	737 (77.7)
Teaching and research role	138 (14.5)
Other (e.g. administration, research support)	48 (5.1)
Teaching role	26 (2.7)

Thereafter, data analysis was undertaken as follows:

- As shown in Table 2. 449 postdocs had experience of a career break. Questions routed to this group asked how many career breaks they had taken, and focusing on the most recent career break, the reasons for that, along with questions about employer support, the duration of the career break and the return to work. The data were analysed using descriptive statistics to produce frequencies and percentages (Tables 3–5). Chi-squared tests for independence with Yates continuity correction examined the association with gender (i.e. and the reason for taking a career break, etc.) Pearson Chi-Square tests (with continuity correction) were used for 2 by 2 tables. For tables larger than 2 by 2, Cramer's V was used to account for degrees of freedom.
- Open text questions were included in the survey to invite further comment on closed questions. Qualitative data were analysed thematically using an established six step process developed by Braun and Clarke (2006), which began with data familiarization, followed by first cycle coding, then second stage coding, and the development of themes which were checked and compared with the quantitative results, using data triangulation, where possible, to answer the research questions (Heale and Forbes 2013).
- The sample of 950 postdocs were categorized into groups (Gp): Gp1 ($n = 179$) were currently on a career break, Gp2 ($n = 270$) had previously taken a career break, Gp3 ($n = 497$) had never taken a career break. A question in the survey, tailored and routed to each of these groups, produced data on their perceptions of the impact of a career break on different aspects of professional and

Table 2. Career break status.

Taken a career break?	N (%)
Currently on a career break	179 (18.8)
Taken a career break but not currently on one	270 (28.4)
Sub-total	449 (47.2)
Considered a career break but have not taken one	251 (26.4)
Not considered a career break	246 (25.8)
Sub-total	497 (52.5)

Table 3. EFA Pattern matrix.

	Factor	
Items	1	2
Perceptions of CB – ability to run funded projects	.863	
Perceptions of CB – ability to bid for funding	.839	
Ability to supervise students	.838	
Ability to teach	.759	
Ability to publish	.747	
Ability to attend conferences	.739	
Ability to keep up with field	.659	
Future employment, salary and promotion opportunities	.620	
Colleagues' perceptions of them	.571	
Mental health and wellbeing		.895
Work/life balance		.876
Confidence in own abilities		.674

Extraction method: Principal Component Analysis.
Rotation method: Oblimin with Kaiser Normalization.

Table 4. Main reason for most recent career break.

	N (%)
Maternity leave	157 (35.0)
End of fixed term contract/redundancy	127 (28.3)
Carer responsibilities (for children, partner, parent, or other family)	46 (10.2)
Family reasons (for example, partner's job moving location)	32 (7.1)
Other	25 (5.6)
Health reasons	21 (4.7)
Personal development	16 (3.6)
Travel	13 (2.9)
Paternity leave	8 (1.8)
Voluntary work	4 (.9)

Table 5. Employer support before and after career break.

Support prior to career break	N (%)
Very/satisfied	122 (27)
Neutral	168 (38)
Very/dissatisfied	157 (35)
Support surrounding return to work	
Very/satisfied	126 (47)
Neutral	103 (38)
Very/dissatisfied	39 (15)

personal life. This question had 12 multi-choice response items, which were subjected to Exploratory Factor Analysis (EFA). EFA is a technique used to identify the underlying relationships between a set of variables. If the data proves to be suited to EFA it can be reduced to a smaller number of subscales (i.e. composite variables), that are more meaningful and easier to interpret. Prior to performing EFA, the data were assessed for its suitability to factor analysis. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above so the data for all three groups were combined. The Kaiser Meyer-Olkin test value was .886, exceeding the recommended value of .6 (Kaiser 1970; Kaiser and John 1974) and Bartlett's Test of Sphericity (Bartlett 1954), which checks that data reduction can compress the data in a meaningful way, reached statistical significance ($p < .0001$), supporting the factorability of the correlation matrix. EFA revealed three components with eigenvalues exceeding 1, explaining 46%, 14%, 9% of the variance respectively. The number of factors to be retained was guided by the Kaiser's criterion (Eigenvalues above 1), inspection of the scree plot, and pattern matrix (Table 3), which led to a clear two-factor solution, with 9 items in Factor 1 and 3 items in Factor 2,

explaining 60% of the variance. Put simply, the nine items in Factor 1 capture the *career* implications of a career break, and Factor 2 which comprises of 3 variables – mental health and well-being, confidence, and work-life balance captures the *personal* implications of a career break (see Table 3). The reliability of these two Factors was assessed using Cronbach alpha coefficients. The results of .899 for Factor 1 and .789 for Factor 2 exceed the recommended value of .7, indicating good internal consistency (Pallant 2016).

- Factor 1 and Factor 2 scores across the 3 postdoc groups were examined and compared using one-way Analysis of Variance (ANOVA) tests to determine if there were any statistically significant differences between the means of two or more of the groups. Tests for normality, indicated the data were normally distributed. However, Levene's F test revealed that the homogeneity of variance assumption was not met ($p = <.001$). As such, Welch's F test was used, followed by the Games-Howell post-hoc test to see where in the 3 postdoc groups the difference lay. An alpha level of .05 was used. As Welch's F test was used, omega squared was used to calculate the effect size and interpreted following Cohen (1992) as follows: < 0.02 = very small, < .013 = small, < .26 = medium, > .26 = large effect.
- T tests were used to compare female and male postdocs' Factor 1 and Factor 2 scores (as obtained through EFA) and to establish where differences lay in each postdoc group (i.e. Gp1, Gp2, Gp3). Bonferroni adjustments were made to the alpha levels to correspond with multiple tests. Cohen's *d* was used to calculate the effect size and interpreted as follows: .2 = small, .5 = medium, and .8 = large effect (Cohen 1988).
- 251 postdocs indicated they had considered taking a career break but not taken one. A question exploring the reasons why they had not taken a career break were analysed to build a deeper picture of postdoc experiences and perceptions of career breaks. Steps described above were followed to produce descriptive statistics and triangulated with qualitative data. Chi-squared tests examined the association with gender.

Results

What are postdoc experiences of career breaks, and is there an association with gender?

Number and reason for most recent career break

449 (47%) of the 950 respondents had experienced a career break. A chi square test for independence (with Yates' Continuity Correction) revealed a significant association with gender, with a higher proportion of females ($n = 327$; 54%) than males ($n = 119$; 36%) experiencing a career break, X^2 (1, $n = 938$) = 26.86, $p < .001$, $phi = -17$.

Table 6. Duration of career break and return to work.

Duration of career break	N (%)
1–3 months	28 (10)
4–6 months	49 (18)
7–11 months	72 (27)
1–2 years	68 (25)
3–4 years	17 (6)
5–10 years	30 (11)
Over 10 years	6 (2)
Returned to work with	
Different employer	142 (53)
Same employer	127 (47)
Returned	
Full time	149 (56)
Part time	119 (44)

Of those experiencing a career break, 33% ($n = 147$) had experienced more than one. A higher proportion of males ($n = 43$; 36%) compared to females ($n = 104$; 32%), had experienced more than one career break, but the association with gender was not significant, X^2 (1, $n = 446$) = .56, $p = .46$, *phi* = .04.

Table 4 shows the main reason for postdocs' most recent career break. Maternity leave stands out as the most common reason overall (35%), and it was the most common reason for females (48%). This is in stark contrast to 6.7% of males who cited paternity leave, although due to paternity leave being of a relatively short duration some respondents may not have recognized it as a career break. Moreover, combined maternity/paternity, family and caring responsibilities were given by a higher proportion of females ($n = 220$; 67%) than males ($n = 22$; 18%), X^2 (1, $n = 446$) = 81.73, $p < .001$, *phi* = 0.2, confirming the association with gender.

The second most common reason given for career breaks for both females and males were the end of a contract/redundancy, but males (45%) were significantly more likely to give this reason than females (22%), X^2 (1, $n = 446$) = 23.49, $p < .01$. *phi* = .23. It is important to note this does not mean that males are more likely than females to have their contract ended or be made redundant, rather the statistics reflect that this is the main reason why men experienced a career break, whereas maternity was the main reason for females. In addition to the reasons listed in Table 4, 'other' explanations for career breaks included health issues and burnout, professional development (e.g. training, industry placement), and career changes, as well as personal development. One person cited war in their country. Open text responses indicate that combinations of push and pull factors often prompted career breaks:

> It was a combination of both personal development AND end of fixed term contract/redundancy AND a bereavement in the family (Male, UK).

> Career break due to fixed term contract ending while on maternity leave and subsequent caring responsibilities and health reasons (Female, UK).

Employer support with career break

Table 5 indicates that postdocs' experiences of support from employers was mixed prior to the career break and upon the return to employment, although somewhat better at the latter point. No association with gender and satisfaction with employer support was found prior to the career break, X^2 (2, $n = 444$) = 1.175, $p < .56$. *phi* = .05, or after it, X^2 (2, $n = 226$) = .82, $p < .66$. *phi* = .06.

Answers to the open questions produced qualitative data that corresponds with the quantitative results by giving a similarly mixed picture of employer support, ranging from very positive to inconsistent and negative experiences, and very few gender differences.

Positive experiences of support

Those who had positive experiences referred primarily to supervisors: *my supervisors were very helpful and lobbied for the institution to treat me well (female, UK)*. Some referred to employer support: *The employer kept in touch with me about opportunities (male, UK)*. Some postdocs valued support offered but were pragmatic about their employment prospects: *My research lab was very supportive during my unemployment but couldn't offer jobs that didn't exist* (male, Africa). *P*ay and benefit entitlements also featured in responses, especially in relation to redundancy and maternity pay. Positive examples include: *They were in complete support and kept in touch with me during the break. They also continued my pension contributions (Female, UK)*.

Only 14% ($N = 37$) of postdocs experienced formal support, such as re-entry fellowships and the majority were females. When used, such schemes were highly valued. The Daphne Jackson Trust – a UK charity that helps researchers return to their careers, was most prominent. Those that benefited from this scheme said it provided an *invaluable steppingstone (Female, UK)* back to a research career and an *invaluable source of support and guidance (Female, UK)*. Interestingly, in such cases respondents also appeared to have good support at their institution: *My new employer […] and my funder Daphne Jackson trust could not have been more supportive before my return and also for the*

last 1.5 years (Female, UK.) However, not everyone met the criteria for returner fellowships due to the duration of their career break or because they worked in Countries that did not offer re-entry schemes or they did *not know they existed* (female, UK).

Inconsistent support

Inconsistent support emerged as another theme. For example, referring to a maternity related career break, this female from Asia said: *My immediate supervisor was very supportive, but the institution seemed to pretty much ignore my existence*. Similarly, this female from Australasia said: *the university I work with has great benefits for maternity leave which helped. Otherwise, there was no other support*. Another female in Africa said: *The employing institution was fine, but my manager (principal investigator on a project I was involved in) was not very understanding*. Some women taking maternity breaks reported stigma and backlash, for example, one referred to a *boycott/mobbing* by colleagues (female, Europe). Support was similarly inconsistent in many end-of-contract or redundancy situations, regardless of gender:

> Employer helped me to apply for unemployment insurance, but nothing more. No help with finding another job, or even temporary teaching positions at the same institution. (male, Europe)

No support

Thirty-eight open text responses explicitly referred to 'no support' with many more indicating that support was poor. This was by far the most prominent theme among females and males internationally. For example: *No support, just thrown out* (female, UK), and *Zero, I got a ciao and a card* (male, UK). Those that elaborated referred most to limited institutional support and pay/entitlements, which in several cases were owed, for example:

> … my redundancy pay is now 2 months overdue. And, HR said they would inform me of suitable posts in the same institution, but they gave no help or advice. (female, UK)

> I wasn't offered support. There was a process to "help" re-deployment in the same institution, but it seemed to be a tick box exercise because of the legislation. I applied for several roles and did not get them. (female, UK)

While overall the data revealed few differences in males and females' experiences of support, females taking maternity related career breaks were more likely to report this as a 'stressful' time (Females, Europe; North America and Caribbean; UK), and some experienced additional setbacks:

> I was on a fixed term contract and had worked for my employer for four years. HR and my Department made my maternity arrangements very stressful which was unnecessary. I was made redundant a month after giving birth, which was fine as that was what I expected from being on a fixed term contract. (female, UK)

> One funding body (… science fellowship) withdrew support as they felt the length of my maternity leave represented a lack of passion for my work. (female, UK)

Regardless of gender or the reason for the career break, most postdocs clearly felt let down and frustrated:

> No support available. Degree, post doc and 6 years of post doc experience wasted. Crap, crap, crap. (male, UK)

> No support, it was end of contract = end of pot of money, maybe we will find more, maybe we won't, but will you still do a load of unpaid work for us? (Female, Australasia)

A few postdocs appeared to accept lack of support uncritically and a few blamed themselves. For example, this female from the UK said: *At the time, I was not given any career guidance or support by my supervisor, however, I was not dynamic in seeking whether this was available elsewhere in my institution.* More commonly, these postdocs appeared to be habituated to the conditions of the postdoctoral career phase:

> As someone who had worked on short contracts for about a decade there was no support. In the end I relied too much on the goodwill of my personal network. There was no career support for short contract people. Being part of a Trade Union offered no benefit either in terms of advancing employment conditions. I had to make my own way and find my own route to more security which lost me time and income … . Having been on limited contracts for so long meant I came to expect nothing and I got nothing to help me find the next contract. (male, UK)

As alluded to in the previous excerpt, the most common reason for not expecting support was the casualised nature of academia: *The nature of fixed-term contracts in research meant that my employer could not offer me any support (male, UK).*

Returning to work

Table 6 shows the duration of the most recent career break taken. Over half (55%) of career breaks lasted up to eleven months, and overall, most lasted no more than two years (80%). A higher proportion of males (64%) had a career break of up to 11 months, than females (53%). Females were more likely to have longer career breaks of five years or more than males (15% compared to 8% respectively). However, these differences were not significant.

Over half of the respondents that returned to employment did so with a different employer, with a greater proportion of those being male (68%) compared to female (32%). A Chi-square test for independence shows this relationship is statistically significant, X^2 (1, $n = 268$) = 8.90, p .003. *phi* .19. Over half the respondents returned to work full-time. A Chi-square test for independence shows a much greater proportion of males (79%) compared to females (48%) returned to employment full-time as opposed to part-time, X^2 (1, $n = 266$) = 17.50, $p < .001$. *phi* .26.

How do female and male postdocs that have experienced a career break describe its impact?

Career breaks were predominantly described by both females and males as having a *huge* or *negative* impact (females, Africa; Asia; Europe; UK; males, Europe; UK), and some respondents said it *ruined* or *ended* their career (females, UK; males, UK). However, a common problem noted most by women taking career breaks to have children was *Difficulty explaining [the] career break on [a] CV* (females, Asia; UK), which could lead to a downward career trend:

> I didn't realise that a break in CV would result in such dis-interest from would be employers and eroded confidence on my part. I started applying to get back after 2 years of break. During that period, I would get invited for interviews here and there. I performed well, sometimes being told that if the person offered didn't accept offer, they would offer it to me. But as time went on without a job, interviews became sparse until none came my way at all. They were now sighting the gap in CV. (female, UK)

Some women were unable to pick up the threads of their career in academia so took other work, for which they were overqualified:

> If you're on a funded project of limited duration (which most post-doctoral research roles are) a career break = unemployment. I've found it impossible to return to academia as my research is two years out of date, and impossible to work in a related non-academic role (as competition is too high and by now I'm late 30s). I retrained (…) and am now working in an admin/publishing role for which I am both massively over and under qualified. (female, Europe)

> I found it hard to get back to research position as a scientist. Instead, I had to work from home as a personal tutor. (female, UK)

Other women made career compromises by taking lower-paid work:

> … I have returned after maternity leave to a part-time, lower-paid role … This is a reasonable compromise for me as I did not feel that a research career was a sustainable or even very attractive option, but it is frustrating that this is very much the norm … . (female, UK)

Women who returned to academia after a maternity/family related career break reported common issues feeling *very rusty and embarrassed*, most often when needing to ask for help, and more so when asking younger colleagues (female, UK). Other common issues included: *lagged behind the innovations taking place in my specialization* (female, Africa) and struggling to meet *publication metrics* (females, Asia; Europe; UK). In addition, upon resuming work after career breaks some women felt they were no longer supported or championed: *my line manager lost interest in me and my work* (female UK).

While such issues were more widespread among women that had taken a career break to have children, some men also reported similar issues. For example, some males changed career direction because of the career break:

> My enforced career break totally ruined my career, and I am now in a role that still allows me to be science based, but no longer in research. (male, UK)

Like females, some males reported that it took time, often years, to catch up after a career break:

> I feel that my progress has really stalled. This hasn't been helped by just having temporary research posts. You can't really get involved in things like supervision when you know you may be leaving in 12 months! I feel as if I am about 10 years behind my contemporaries. (male, UK)

Loss of confidence was also a common theme among males:

> The long-term effect on confidence has been truly devastating. I know of no other man who has done this, no one who has done it for the terminally ill, and all the support is directed at women with children. (male, UK)

Notwithstanding the difficulties, many respondents, regardless of gender, felt the career break had been in their best interest, for example for health reasons or to spend time with family, but they still expressed frustration or sadness with employment practice and working conditions in academia, indicating that *There needs to be more support for post docs, actually not just those who've had a career break, but especially those [that have]* (Female, Asia).

Is the impact of a career break perceived significantly differently across postdoc groups, and between genders?

As explained, EFA produced a two-factor solution to understanding postdocs' perceptions of the impact of a career break. Factor 1 represents professional aspects comprising of career related variables, and Factor 2 represents personal aspects and comprises of mental health and wellbeing, confidence, and work-life balance variables (see Table 3). Table 7 shows one-way ANOVA test results. Statistically significant differences in Factor 1 and Factor 2 means across the postdoc groups were found. For Factor 1, Welch's F (2, 319.39) = 16.11, $p = <.001$, est. $\omega^2 = .047$, indicating a large effect. In relation to Factor 2, Welch's F (2, 379.80) = 48.44, $p = <.001$, est. $\omega^2 = 0.97$, indicating a large effect. Post hoc comparisons, using Games-Howell post hoc procedure, were conducted to determine which pairs of postdoc groups differed (Table 8). Mean scores show Gp2, who had previously experienced a career break, had a more positive view of its impact on career variables (Factor 1) compared with Gp1 and Gp3. By contrast, Factor 2 scores for Gp3, who had never had a career break,

Table 7. One-way ANOVA means and standard deviations across postdoc groups.

	Postdoc Groups (Gp)	n	Mean	SD
Factor 1	Gp1. Currently had CB	151	32.81	7.32
	Gp2. Previously had CB	209	29.11	7.31
	Gp3. Never had CB	403	32.15	5.45
Factor 2	Gp1. Currently had CB	176	8.33	2.96
	Gp2. Previously had CB	268	8.43	3.07
	Gp3. Never had CB	455	6.67	2.09

*Lower means indicate more positive view.

Table 8. Post hoc comparisons between postdoc groups.

	Postdoc groups (Gp)	Mean difference	SE	*P*
Factor 1	Gp1 v Gp2	3.69*	.78	<.001
	Gp2 v Gp3	−3.04*	.57	<.001
	Gp3 v Gp1	.66	.65	.576
Factor 2	Gp1 v Gp2	.10	.29	.942
	Gp2 v Gp3	1.75*	.21	<.001
	Gp3 v Gp1	1.65*	.24	<.001

indicate a more positive view of its personal impact (i.e. on mental health and confidence, wellbeing and work-life balance), compared with Gp1 and Gp2.

An independent-samples t-test was conducted to compare Factor 1 and Factor 2 scores for males and females. No significant difference was found in Factor 1 scores for females ($M = 31.63$, SD = 6.25) and males ($M = 31.07$, SD = 7.04); t (755) = 1.15, $p = .27$. However, a significant difference was found in Factor 2 scores for females ($M = 7.76$, SD = 2.72) and males ($M = 7.04$, SD = 2.67); t (893) = 3.81, $p =$ <.001, two-tailed, although the magnitude in differences in the means (mean difference = 1.57–3.50) was small (Cohen's $d = 0.27$).

To establish which postdoc group exhibited gender differences in Factor 2 scores, t-tests were repeated in each postdoc group. Bonferroni adjustments were made to the alpha levels to correspond with multiple tests. In Gp2 (who previously had a career break) a significant difference was found in Factor 2 scores of females ($M = 8.66$, SD = 2.99) and males ($M = 7.56$, SD = 3.13), t (262) = 2.54, $p = .03$. Cohen's $d = 0.36$, indicating a small effect (Cohen 1988). No significant difference was found between females and males in the remaining two postdoc groups: Gp1 females ($M = 8.34$, SD 2.80), males ($M = 8.34$, SD = 3.36), t (84.75) = .01, $p = 2.97$, (mean difference = 1.05–1.04, Cohen's $d =$ < .001); Gp3: females (M = 6.80, SD = 2.08), males ($M = 6.52$, SD = 2.09), t (454) = 1.43, $p = .45$, (mean difference = 67–11, Cohen's $d = 0.13$).

What deters postdocs from taking a career break, and is there a significant association with gender?

A chi square test for independence (with Yates' Continuity Correction) indicated a greater proportion of females (57%) compared to males (41%) had considered taking a career break, but not done so. The association with gender was statistically significant: X^2 (1, $n = 492$) = .11.88, p < .001, *phi* = –.160.

Table 9 shows factors that deterred respondents ($n = 251$) who had considered taking a career break from doing so. It shows that most did not deem a career break to be financially viable and were deterred by concerns for their career and employability. No significant differences were found between the reasons given by males and females.

Qualitative data indicates that some of the postdocs who had considered taking a career break but not done so felt it was *not the right time in my career – too early* (females, UK), but they planned to take one in the future, primarily to have a family. While some postdocs were deterred from taking a career break because they were worried about the *break in service* or were

Table 9. Reasons for not taking a career break.

Variable	N (%)
Not financially viable	156 (62)
Concerned about how it would look to future employers	148 (59)
Don't feel confident about being able to return to same job	135 (54)
Would limit ability to carry out research, publish, supervise	128 (51)
Worried about losing touch with colleagues and peers	64 (25)
Concerned about how it would look to colleagues	60 (24)
No sufficiently attractive opportunity	55 (22)

nervous about returning to a similar salary (female, UK), most gave reasons related employment precarity:

> Do not feel confident having a job after the career break. (female, Europe)

> When the majority of work available for researchers is casual, short-term contract, or zero hours, you can't take a career break - you're just unemployed which is dangerous both in terms of building & maintaining your career and also financially. (female, UK)

> It's near-impossible to get a permanent job in the humanities -as contract research staff it seems career suicide to take any time out. (female, UK)

Discussion

This paper responds to OECD (2021) calls for research into postdoc careers and the precarity phenomenon, and Bologna Process goals to improve post-PhD employability. Results from this study with 950 postdocs provide a deeper understanding of career breaks and the different ways that career breaks are experienced and perceived by females and males. Corresponding to literature on the leaky pipeline (Ysseldyk et al. 2019), nearly half of the career breaks for women were for maternity leave, and when combined with family and caring responsibilities accounted for 67% of career breaks for females. This is in stark contrast with males, since only 18% of males took a career break for comparable reasons (paternity, family/caring). The end of a contract or redundancy was the second most common reason for career breaks overall, and the main reason for males who were significantly more likely to give this reason than females. One possible explanation is that women experience combinations of push and pull factors, such as the end of a contract or redundancy with maternity leave/caring responsibilities. This was found in the qualitative data and corresponds with prior research (Mavriplis et al. 2010). Compared to males, significantly more females returned to work for the same employer. A plausible explanation is that their positions were safeguarded by maternity legislation, but disparities in geographic mobility are also known to exist for women (Vohlídalová 2017; Ysseldyk et al. 2019). Corresponding with research by Arntz, Dlugosz, and Wilke (2017), women in this study appeared to make more career concessions by taking lower-status jobs and significantly more females returned to employment part-time, perhaps due to unequal divisions of domestic labor (Jones and Oakley 2018).

It has been suggested that men's greater involvement in the home situation will reduce work-family conflict for women (Williams 2000), but this study serves to caution that institutions are deeply wedded the unencumbered ideal worker (Quinn and Litzler 2009) as the findings show institutions have a poor understanding of how to support men who participate in the domestic sphere. These findings are indicative of a need to change the systemic culture so that employers are proactive supporting postdocs, as Lu et al. (2022) have argued.

This study addresses research gaps identified by St Clair et al. (2017) into how support is perceived and what types of support exist for postdocs. Results from this study show that support provided by employers was mixed, both prior to taking a career break and upon returning to employment, and most commonly a result of the working relationship between the post doctorate and their supervisor, rather than formal institution-wide support. As such, Human Resources appear to be designed for staff with regular hours and workstyles, not postdoctoral researchers, aligning with literature around lack of support structures for postdocs (Camacho and Rhoads 2015; Fetzer 2008; Miller and Feldman 2015).

The study highlights support valued by postdocs. Returner schemes or fellowships were held in high esteem by those who accessed them, but not everyone qualified for them, knew about them, or had access to schemes, especially males, who compared to females rarely benefited from such schemes. As found in research by Teelken and van der Weijden (2018), postdocs in this study particularly needed guidance and support to find a new position when leaving a position, such as in end of contract/redundancy situations. The findings reveal postdocs valued empathetic supervisors

who lobbied for them, opportunities to keep in touch with employers, information, and guidance about jobs, especially redeployment opportunities, provision of a reference, as well as pay that was owed and benefit entitlements. Such support should be a basic condition of employment and be spelt out in training for supervisors and evaluation of supervisory arrangements.

Extending theoretical discussions on the precarity phenomenon, the results suggests that the discourse of precarity is more complex than previously understood. Significant results indicate postdocs that had not had a career break perceived career breaks as good for the soul (i.e. mental health and wellbeing, confidence, and work-life balance), but bad for the career. However, empirical findings suggest a different reality as postdocs that had previously experienced a career break indicate it was not as bad for their career or as good for their 'soul' as the other postdocs believed. While males and females did not differ significantly in their perceptions of the career implications arising from a career break, significant results indicate females had a less positive view of its personal impact on mental health and wellbeing, confidence, and work-life balance than males, and this was found to be significant in the group that had previously taken a career break. Furthermore, postdocs that had never experienced a career break held an aversion to taking one linked to fears for their career and livelihood, which resonate with prior research into postdoc precarity (Jones and Oakley 2018).

Also in keeping with prior research (Nicholson 2015), career breaks were difficult to account for on a CV and other difficulties that are indicative of the subjective complexity of precarious work (van der Weijden et al. 2016) expressed in respondents own words included its impact on their confidence and mental health. Some chose to escape precariousness by changing career direction, but more appeared habituated to the conditions of the neoliberal university, even if they did lament the gradual proletarianization of the academic workforce (Hall 2018). The data supports the view that postdocs, located as they are at the lower strata of the academic profession, act as a contingent workforce of knowledge workers and a reserve army of labor (Neilson 2015; Standing 2011). As such, under neoliberalism, they are a growing lumpen proletariat in the academic workforce. This is not to degrade postdocs but to highlight that they are often treated in a way that resembles the Marxist theory of the underclass, exploited for gain through capital-labor relations (Marx 1867/1976). While some commentators argue that intense competition for academic positions enables universities to recruit the most talented academics (Henningsson and Geschwind 2022), such a view eclipses gender disparities in the postdoc population and the issue of gender bias, moreover HEIs have a duty of care to postdocs and there is a strong social justice case for providing more meaningful employment.

Conclusions

The duty falls on HEIs to address shortfalls in the sector, but these issues should not be neglected by European Research Area (ERA) Bologna Process partners who underwrote employability in the Bologna Declaration of June 1999, and for whom employability is an ambitious and shared goal (Sin and Neave 2016) with influential stakeholders such as the OECD, research councils/funders, and nation states. Findings from this study show that more strategic action is needed to improve the working conditions of postdocs and boost their chances of meaningful employment. As a starting point, enhanced training for postdoctoral supervisors, academic career services and Human Resources is needed and family policy should be extended to postdocs with caring and family responsibilities (Ackers and Oliver 2007). To boost employability, more progressive solutions include apprentice academic posts, along the lines proposed by Coates and Goedegebuure (2012), to provide training and experience across academic function areas. Networking with 'versatile experts' would provide opportunities for exploring and forging alternative career paths (Sarrico 2022, 1311) or as Mills and James (2020) suggest, collaborations such as placements, internships, partnerships and knowledge exchange.

Further research is needed to examine themes in this paper. Notwithstanding its important contributions, limitations include that some details of the sample (e.g. ethnicity) and postdoc experiences could not be examined (e.g. contractual arrangements, training, career advice), as the secondary data source did not contain such variables. The study raises further questions, such as what enabled postdocs who had not experienced a career break to maintain employment? Who played a role in that and how did they help? Did these postdocs accrue and deploy different types of career capital? Did they plan and strategize their careers in a particular way? Further in-depth exploration is needed to explore these questions and other themes in this paper, such as factors that deterred postdocs from taking a career break. While open text data provided additional contextual insights that illuminated the quantitative results, qualitative interviews would elicit deeper insights into themes in this paper. Gender analysis needs to be extended with intersectional analysis, for example with ethnicity. Postdocs have been a neglected group in research and there is a lack of comparable data on postdocs internationally. Future research should include nations underrepresented in this study, such as the Gulf countries. This would be aided by more consistent methods of data collection on post-PhD's, in terms of demographic and employment data. A larger international sample would enable comparisons of the way that precarity manifests in different institutional and national contexts and large-scale longitudinal research is needed to track postdocs' career experiences and trajectories over time.

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