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Shifting Perspectives in Polar Research: Global Lessons on the Barriers and Drivers for Securing Academic Careers in Natural Sciences

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The polar regions provide valuable insights into the functioning of the Earth's regulating systems. Conducting field research in such harsh and remote environments requires strong international cooperation, extended planning horizons, sizable budgets and long-term investment. Consequently, polar research is particularly vulnerable to societal and economic pressures during periods of austerity. The global financial crisis of 2008, and the ensuing decade of economic slowdown, have already adversely affected polar research, and the current COVID-19 pandemic has added further pressure. In this article we present the outcomes of a community survey that aimed to assess the main barriers and success factors identified by academic researchers at all career stages in response to these global crises. The survey results indicate that the primary barriers faced by polar early and mid-career researchers (EMCRs) act at institutional level, while mitigating factors are developed at individual and group levels. Later career scientists

report pressure toward taking early retirement as a means of institutions saving money, reducing both academic leadership and the often unrecognized but vital mentor roles that many play. Gender and social inequalities are also perceived as important barriers. Reorganization of institutional operations and more effective strategies for long-term capacity building and retaining of talent, along with reduction in non-research duties shouldered by EMCRs, would make important contributions toward ensuring continued vitality and innovation in the polar research community.

Keywords: austerity, COVID-19, diversity and inclusion, interdisciplinarity, mentoring, post-doctoral researchers

INTRODUCTION

The polar regions are unique in multiple contexts. They hold some of the longest cryospheric global climate records in their ice sheets and, hence, make a significant contribution toward our knowledge of global biotic and abiotic regulating systems and changes. Because of their comparatively recent human discovery and settlement – post-Pleistocene for the Arctic, and last one to two centuries for Antarctic with even now no permanent human population - both "discovery" and "Earth monitoring" science are equally important (Chapin et al., 2005; Meredith et al., 2019). At the same time, they are currently experiencing some of the most rapid environmental changes globally (Hansen et al., 2014; Convey and Peck, 2019; Meredith et al., 2019).

Research in the polar regions is particularly susceptible to rapid fluctuations in funding due to national and global economic pressures. The 2008 global financial crisis led to adverse impacts on polar research, with the consequences of several years of austerity becoming increasingly evident (e.g., Schiermeier, 2009; Brady, 2011; Osipov et al., 2017). Conducting polar research requires international cooperation and extended planning horizons, as well as a sizeable budget to enable logistic support and long-term investment in specialized training and capacity building (National Research Council, 2011; **Figure 1**). Since early 2020, the COVID-19 pandemic has further challenged the tenuous balance between meeting ambitious polar research goals and support from limited budgets and drastically reduced deployment of field staff. The pandemic has caused the cancelation or severe reduction of annual field campaigns in both Arctic (summers of 2020 and 2021) and Antarctic (summers of 2020/21 and 2021/22) by national polar programs, research institutions and individual researchers (Frame and Hemmings, 2020; Hughes and Convey, 2020; Uryupova, 2021). The extent of these impacts is not yet fully known as the pandemic continues to heavily affect scientific research and operations to the present day, and probably will continue to do so over the next decade (Frame and Hemmings, 2020). Polar research, and the careers that underpin it, need to develop greater resilience in order to prosper over the longer term and to ensure the maintenance of long-term data series and the careers of researchers and field support staff that are now at risk of being discontinued. Polar research serves both as a sentinel for the challenges ahead and in identifying the coping mechanisms required to safeguard natural science careers as we tentatively take the first steps of moving into the post-pandemic world (Petrov et al., 2020).

The long-term time horizons inherently associated with work in the polar regions, together with the premium requirement and value of practical experience gained over time, are at odds with the short-term funding mechanisms and career insecurity that increasingly characterize academic research globally (Brasier et al., 2020). These opposing forces present a key challenge to polar research. Early and mid-career researchers (EMCRs), in particular, face strong psychological pressures and often have to make considerable personal sacrifices (e.g., delaying or not starting a family, staying away from family/partner for considerable periods) in order to pursue their career goals (Evans et al., 2018). Furthermore, gender and socio-economic inequalities and the dominance of established and more wealthy nations tend to become accentuated in periods of austerity. At the extreme, the next generation of polar researchers may decide to abandon polar research in favor of other areas, or leave research completely in favor of other more secure career options. The research community, consequentially, may be deprived of new and promising scientists and, at the same time, waste the considerable investment already made in their education and training (Milojević et al., 2018). At the other end of the career spectrum, more senior researchers are prone to be targeted for early retirement, a measure that is often used to achieve cost savings, damaging both academic leadership and the often unseen/unrewarded but vital mentor roles that many senior scholars play (Lalloo, 2017).

Against this background, this study examines the vulnerabilities of polar research career pathways and identifies viable means of responding to the challenges faced, in order to secure the careers of future generations of polar scientists and the research they undertake. In particular, drawing on data from the polar early-career research community (as represented by the international Association of Polar Early Career Scientists – APECS[1]) (Hindshaw et al., 2018), we identify and rank the main barriers faced by EMCRs in developing careers in polar research as well as the supportive measures this community perceives to be key to overcoming these barriers. The current study focuses on the challenges and success factors associated with progression in the "standard" academic career trajectory, but it is recognized that this is by no means the only valid way of measuring personal or professional fulfillment subsequent to obtaining graduate degrees.

[1]www.apecs.is

FIGURE 1 | Examples of activities by polar EMCRs and senior researchers in the Arctic and the Antarctic: **(A)** Monitoring eDNA and greenhouse gases in Bayelva catchment, near Ny-Alesund, Svalbard; **(B)** Sampling microbial mats from Gypsum Hill (Axel Heiberg Island, Nunavut, Canada), a unique sulfur-rich, cold spring system analog to Early Mars environments; **(C)** Sampling by scuba diving at –1°C to assess the composition and structure of benthic communities in the caldera of Deception Island, Antarctica; **(D)** Assembling an epibenthic sledge for deployment in the Weddell sea; **(E)** Internationally coordinated eradication act of an alien grass species in Cierva Point, Antarctica; **(F)** Collecting fossil bivalves from 45 million years old rocks in Seymour Island to study paleoenvironment and past climate changes; **(G)** Collecting microalgae samples from small meltwater areas to assess their diversity and distribution along latitudinal gradient at Casey Station, Antarctica; **(H)** Sampling of air microorganisms to understand microbial dispersal patterns in the polar atmosphere; **(I)** Examining vegetation zonation around areas of intense geothermal heating on Bellingshausen Island, South Sandwich Islands, in a study combining bryophyte ecophysiology and biogeography; **(J)** Download of penguin breeding pictures taken by automatic-cameras to monitor phenology, breeding success and population changes in chinstrap penguin of Deception Island, Antarctica. Credits: A. Popp, B. O'Connor, E. Ballesté, I. Peeken, P. Escribano, F. Podestá, R. A. Rahim, A. Justel, P. Bucktrout, A.L. Machado.

METHODS

Challenges faced in pursuing polar research careers were analyzed following the "barriers and career drivers" framework, developed for the identification and promotion of effective sustainable practices in academic institutions (Blanco-Portela et al., 2017). In this study, polar EMCR and senior researchers were invited to participate in a survey that aimed at analyzing the state of polar careers, drawing on a preliminary list of career barriers and success factors that had been previously identified (e.g., Brasier et al., 2020) and which was refined here in an iterative process of pre-screening and filtering. The refined survey was launched online in Google Forms and advertised through various polar organizations and social media in the period between 1 December 2020 and 31 January 2021 (**Supplementary Material 1**). The introduction to the survey provided participants with detailed information about the purpose of the survey and the confidentiality of their data. The participants specifically permitted the use of their responses *via* a yes/no question (**Supplementary Material 1**). The study was approved by the ethics committee of the Consejo Superior de Investigaciones Científicas (CSIC).

The survey consisted of three sections: (1) demographic information about the survey participant, including age, gender, nationality, discipline, geographical study region and unemployment-to-employment ratio in terms of time; (2) 4-point Likert-scale questions on perceived barriers to career development, with the option to provide context or further detail *via* free text entry; and (3) 4-point Likert-scale questions on perceived success factors that contribute positively to career advancement, again with options for free text entry (**Supplementary Material 1**). In (2) and (3), participants were able to select a "not applicable" response if appropriate. Detailed descriptions of the barriers and success factors are included in **Supplementary Material 2**.

Each barrier or success factor was classified according to the nature of the experience: emotional (subconscious attitudes toward achieving satisfaction in life experiences), behavioral (attitudes dependent on strategy prioritization), informational (attitudes dependent on situational awareness), or systemic (rigid institutional operating systems that generate passive attitudes in the inability to change the system) (**Supplementary Material 2**; Lozano, 2008). The metadata supporting the findings of this study have been deposited in the repository Centro Nacional de Datos Polares (CNDP). The data collected cannot be shared for ethical reasons.

Survey participants were asked to share their personal experiences throughout their careers and, in particular, during previous crises (e.g., the 2008 global financial crisis) (Cruz-Castro and Sanz-Menéndez, 2016). Post-doctoral researchers up to 10 years since their Ph.D. defense were also asked to report on their employment ratio (contracted months/total months) as a means of assessing the proportion of their time experienced as not employed in research. Post-doctoral fellows who left the research community in this period are not included here, so these numbers do not represent a general success ratio.

Recognizing the potential for redundancies amongst barrier and success factors, we tested the structural aggregation of responses and discarded those overlapping terms that were less relevant on their own (e.g., limited mobility as a barrier and little competition as a success factor) to enable more parsimonious interpretation (**Supplementary Materials 3, 4**).

Survey results are presented at three structural levels of impediment or benefit, representing individual, group and institutional levels. This allowed us to identify the main challenges across different hierarchical levels (Lozano, 2008). When considering these different levels, we also identified various experiential factors that influenced the perception of barriers with regard to a job/employment itself or to personal circumstances. Five experiential categories describing barriers to career development or success factors contributing to career advancement were identified and examined in greater detail: (i) native language (non-English speaking or English speaking, which relates to communication barriers), (ii) career stage (post-graduate, fixed-term post-doctoral researchers or tenured/open-ended/permanent position), (iii) gender (which may impact on career opportunities and personal pressures), (iv) discipline (the majority of survey participants were biological or physical scientists, and we consequently considered only these two broad categories), and (v) study region (Antarctic, Arctic/Alpine or both, which may influence structural employment opportunities). To determine statistical differences among categories and perceived barriers and success factors, Kruskal–Wallis and Wilcoxon signed-rank tests were performed to test for significance at a threshold of $p < 0.05$. All analyses were performed using R software version 4.0.3 (R Core Team, 2019) and the "Likert" package (Bryer et al., 2016).

RESULTS

General Perceptions

A total of 114 polar researchers ranging in age from 23 to 74 years, from 22 different countries, responded to the survey. Of these, 25.4% ($n = 29$) were pre-doctoral researchers, 54.4% ($n = 62$) were EMCRs and 20.2% ($n = 23$) tenured researchers. Respondents were given an open question regarding their gender, with 60% ($n = 69$) identifying as female, 35.7% ($n = 41$) as male and 4.3% ($n = 5$) as non-binary, transgender or other. Due to the low response from non-binary, transgender or other these results could not be analyzed independently but are included in the overall analyses. Free text responses led to identification of 16 barriers and 16 success factors (**Supplementary Materials 3, 6**). Those that overlapped sufficiently to be considered redundant were removed, resulting in a final list of 11 barriers and 11 success factors (**Figure 2**; the full list of barriers is included in **Supplementary Material 4**).

Survey responses indicated that the strongest barriers participants perceived in relation to developing a successful career in polar science were systematic barriers at the institutional level. These included job insecurity (68%), limited employment opportunities (67%) and "bureaucracy," referring to the often complex and time-consuming requirements for administrative

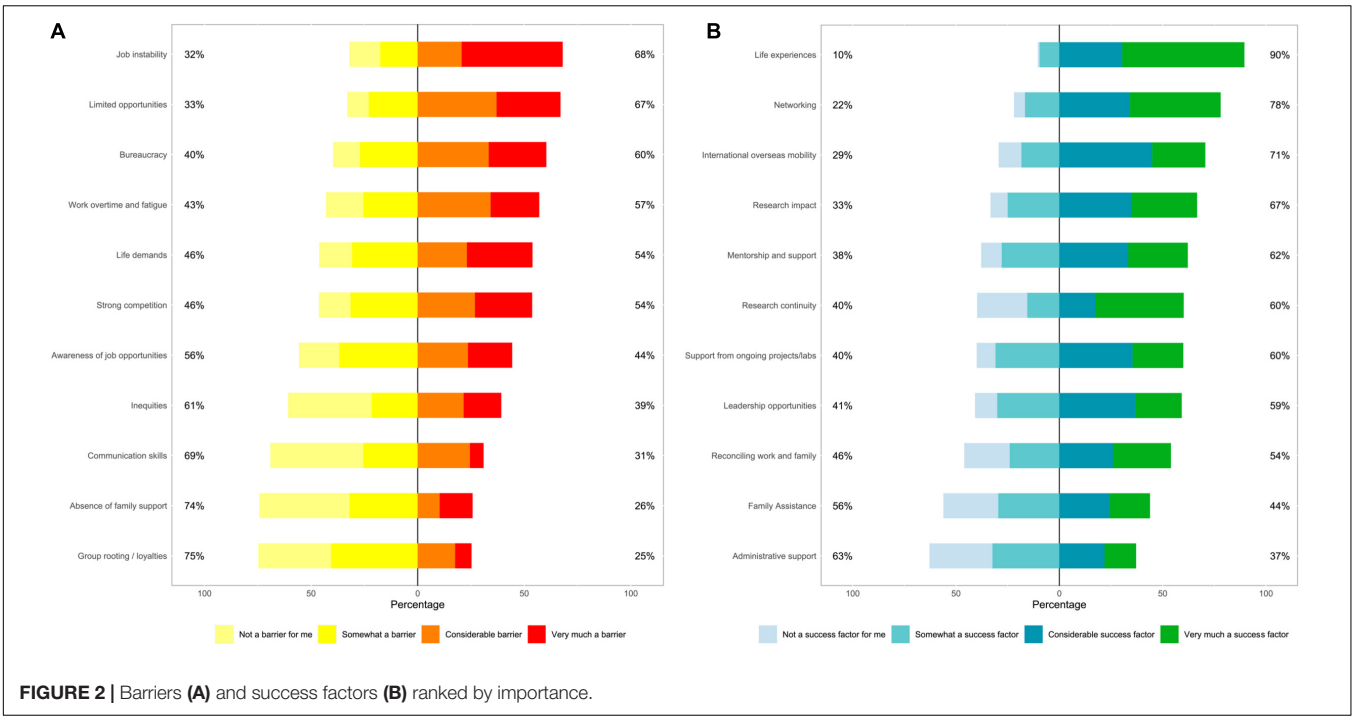

FIGURE 2 | Barriers **(A)** and success factors **(B)** ranked by importance.

activities (60%) (**Figure 2A**). EMCRs reported an average unemployment-to-employment ratio varying from 4% (Q25) to 46% (Q75) (**Supplementary Material 7**). The remaining barriers were ranked lower and comprised (poor) awareness of employment opportunities (44%), gender and socio-economic inequities (39%), insufficient communication skills (31%), absence of family support (26%), and tied group loyalties (**Supplementary Material 2**) (25%).

At institutional and group levels, the success factors identified by study participants as positively contributing to career advancement included institutional support and/or mentoring (62%), support from ongoing projects and research continuity (60%), leadership opportunities (59%), and administrative support (37%). However, survey participants felt that the most important success factors were found at group and individual levels and were related to life experiences – emotional well-being and support (90%), networking – behavioral (78%), international mobility – behavioral (71%), and research impact – informational (67%) (**Figure 2B**).

Coparticipant EMRCs took from 3 to 6 years to complete their Ph.D. studies. A substantial number of EMCRs pursuing careers in polar sciences have not obtained a semi-permanent position at academia or other scientific institutions, with less than 25% of the coparticipants consolidated after 3 years, and less than 50% after 10 years of post-doctoral research. Extrapolations suggest that nearly 100% of coparticipants would be consolidated at a minimum of 11+ years, but the estimates are data deficient and should be only taken as case studies.

Variation Between Levels

At the institutional level, survey responses indicated that limited employment opportunities and the requirement to devote significant time to administrative duties (bureaucracy) are perceived as stronger barriers to researchers from the biological sciences than to those in the physical sciences (**Supplementary Material 5**).

Post-graduate researchers perceived poor awareness of employment opportunities as a greater barrier than did tenured researchers. In addition, a gender bias was apparent in the responses, with women perceiving greater gender and socio-economic inequalities than men.

Considering the perceived success factors at group level, networking was considered a stronger success factor by first-language English speakers than non-English speakers, and by tenured than post-graduate and post-doctoral researchers (**Supplementary Material 5**). Tenured researchers perceived research impact as a greater success factor than did post-doctoral researchers, indicating different drivers of career progress at each stage. The existence of leadership opportunities was perceived as a stronger success factor by researchers working in both polar regions than those working in only one.

At the individual level, long working hours and fatigue were perceived as greater barriers by post-graduate students compared to tenured researchers, and by researchers working in one polar region compared to those working in both, as well as by women than men. Life demands were identified as a more significant barrier by physical than biological sciences researchers. Female researchers considered insufficient communication skills to be a greater barrier than did male.

At the individual level, life experiences were perceived as a greater success factor by post-doctoral and tenured researchers than by post-graduate researchers, and more so by biological than physical sciences researchers, suggesting that more rewarding experiences are accumulated with age and career stage.

DISCUSSION

Barriers to Pursuing a Career in Polar Research

The strong barriers to academic career progression perceived by many survey respondents suggest a disconnect between the top-down controlled opportunities and resources provided at the institutional level and the requirements at individual and group levels. Short- and fixed-term contracts often do not allow EMCRs to lead projects themselves or to establish their own research groups. Conflicting with this, progression in the research system often requires demonstrated experience and leadership (e.g., acting as principal investigator for several projects) (Herschberg et al., 2018). Consequently, short- or fixed-term contracts often result in a semi-permanent status of "hypermobility," impacting multiple areas of researchers' personal lives (Fochler et al., 2016). The research and personal development achieved in such contracts is often further compromised by factors such as limited time available to learn and gain experience in new techniques or skills, to establish strong long-term collaborations, or to complete projects and outputs. The high pre-doctoral offers to post-doctoral contracts ratio, the limited window of time in which applications for most post-doctoral positions are viewed as acceptable after Ph.D. completion and the general scarcity of alternative employment opportunities (e.g., globally, few employers consider a Ph.D. as training for high-level positions in non-academic careers) further fuels insecurity in EMCRs (Cyranoski et al., 2011; Schillebeeckx et al., 2013; Gould, 2015; Hayter and Parker, 2019).

Complex, and sometimes excessive, bureaucracy and administrative requirements can divert considerable working time from primary research activities (Martin, 2016). Alternatively, it can result in considerably extended and non-accounted/recorded working hours. Study participants ranked administration/bureaucracy as one of the strongest barriers to career development, and it has also been recognized as translating into lower scientific productivity and quality (Moss, 2005; Coccia, 2009).

Limited awareness of employment opportunities was ranked lower but still seen as a significant barrier by 44% of survey respondents (**Figure 2A**). For instance, many EMCRs have limited awareness of the full spectrum of academic and non-academic career and employment opportunities (Hayter and Parker, 2019). In addition, the ongoing imposition of strict international border and travel restrictions during the COVID-19 pandemic has limited or complicated access to overseas opportunities that would otherwise help to alleviate this barrier (Hughes and Convey, 2020).

Language and communication barriers can also adversely affect not only the prospects of a job applicant and the career pathways of EMCRs but also the personal lives of researchers and their families challenged by movement to a different country and/or culture. This was perceived as a barrier by survey participants originating from non-English speaking countries. Such barriers are particularly important to overcome in polar research given the inherently international nature of the community that needs to interact and collaborate in these regions, and also the stated aims of the Scientific Committee on Antarctic Research (SCAR) to support the development of Antarctic research capacity and programmes in countries that have no long-standing political or scholarly Antarctic involvement (e.g., SCAR, 2017). Stereotyping and preconceptions about individual capabilities and skill sets (e.g., inferiority perception and exclusion from departmental networks) may also arise from gender and other differences in communication (Bystydzienski and Bird, 2006; Merchant, 2012). Female survey respondents perceived language difficulties to be a barrier to career progression to a greater extent than male respondents.

We identified considerable emotional and behavioral barriers acting at the individual level, including long working hours, fatigue, and competing demands on time (**Figure 2A**). Several survey participants, in free text responses, expressed that it was impossible to reconcile work with private life and future planning, such as starting a family. Globally, researchers at all stages often work beyond their contracted hours in order to increase outputs (Wang et al., 2012) and take partially paid or fully voluntary roles (fieldwork, scientific committee members, editors, reviewers, etc.) to bolster their resumés (Fernández-Bellon and Kane, 2020) or serve the research community. Such demands on researchers' time, that often go above and beyond the call of duty, pose significant pressures on the mental and physical well-being of these individuals, as is evidenced by the higher risk of experiencing mental health issues in graduate students than in the general population (Evans et al., 2018). While our survey results indicate that most researchers find their job stressful, there is a specific lack of knowledge about how such stressors are perceived by and impact on EMCRs (Guthrie et al., 2018). In the context of polar research, parenthood can be particularly challenging (Nash et al., 2019) as extended and repeated periods of polar fieldwork (often at least 2 months and in some instances much longer) conflict with their parental-care responsibilities.

Family-related barriers were perceived as stronger by female polar researchers than male. Combining a scientific career with maternity is challenging in relation to scientific competitiveness and can lead to pressure to choose between career and family [e.g., in the United States nearly half of women scientists leave full-time science after having their first child (Else, 2019)]. Globally, women take on a greater share of household tasks and care duties (Bianchi et al., 2012) and are more likely than men to work flexible hours or extra-long hours to facilitate these family demands (Singley and Hynes, 2005; Weston et al., 2019). Caring responsibilities often interfere with the dedication, time commitments and personal sacrifice required to achieve career demands, in turn affecting the commitment, promotion and career growth of female researchers (Gjerdingen et al., 2001). Recent research confirms that female scientists with children are likely to publish fewer papers than male parents (Morgan et al., 2021).

Measures currently taken by institutions are insufficient to prevent gender biases, with very few countries having strong policies that adequately address gender inequality in science (Lerchenmueller and Sorenson, 2018; Treviño et al., 2018). For instance, globally, 43% of doctoral graduates are

female but only 28% of research positions are occupied by women (UNESCO, 2015), and, in the United States, 12.8 million scientists and engineers employed full-time were male versus 10.1 million female in 2017 (National Science Foundation, 2019). This dichotomy has been reinforced during the pandemic (Cardel et al., 2020; Staniscuaski et al., 2021) where, after the early months of COVID-19 lockdown, a significant gender disparity was observed in research productivity (see, e.g., the rise of the twitter hashtag #coronapublicationgap) (Oleschuk, 2020). Balancing the demands of unpaid care-giving work and paid work is difficult and affects the well-being of female researchers (Fathima et al., 2020). While the polar research community tends to be gender equal from undergraduate to Ph.D. level, a sharp gender inequality is clear in decision-making positions. A better understanding of how these inequalities play out across all senior positions, however, is still required in order to take appropriate action (García-González et al., 2019).

The academic sector is also typified by hyper-competitiveness, which might promote excellence but is also damaging to science as evidenced by, for instance, increases in low-quality publications and unethical practices (Grimes et al., 2018). Recent generations of researchers are increasingly aware of such difficulties and decide to leave science earlier (Dorenkamp and Weiß, 2018), resulting in an overall loss of promising scientists.

Absence of family support was ranked lower in survey responses than other barriers (26%). However, it is likely that many survey respondents who are current Ph.D. students or post-doctoral researchers could only afford to enroll for their Ph.D. due to pre-existing family support (Jairam and Kahl, 2012). Most EMCRs participating in the survey had held multiple short-term post-doctoral positions, with an unemployment-to-employment ratio varying from 4 to 46%. This applied even for those who had won one or more competitive fellowships or had been project principal investigators, resulting in the transition into tenured/permanent academic positions happening much later in life, if at all.

Drivers of Successful Polar Research Careers

Strikingly, the bottom-up hierarchical perception of success factors contrasts with the top-down perception of barriers. Whereas the main barriers to career advancement are systemic and informational, mainly at the institutional level, success factors in academic careers were recognized at the individual and group levels. This could be a result of the rigidity of institutional systems, with a large part of a researcher's success arising as a result of them adapting at the individual and group level. Interestingly, no respondents reported significant differences in institutional support regardless of their discipline or region of study.

Life experiences, including good relationships with peers and managers or opportunities for skill development, are perceived as important emotional indicators for personal satisfaction, counteracting negative emotional factors such as insecurity, excessive working hours and fatigue (**Figure 2B**). Post-doctoral and tenured researchers perceived life experiences as greater success factors than post-graduate students, likely a result of having more opportunities over time to expand their scientific skills and grow their research networks and experience. Respondents highlighted that networking and international mobility are two key behavioral factors that increase their chances of success in academic careers. These allow better access to remote research locations and to more sophisticated equipment and infrastructure (e.g., research stations and specialized vessels/expeditions). They also catalyze the development of additional expertise and communication skills which, in turn, increase the impact and visibility of the research carried out. This combination of rewarding experiences and strategic career planning ultimately results in skills development and career progression. However, tenured researchers perceived networking as a stronger success factor than did developing researchers, who initially face practical challenges in building professional relationships in international contexts. A recent survey reported that the cost of attendance prevented nearly 75% of polar researchers from participating in at least one career-relevant event (scientific meetings, conferences, workshops) that could have provided essential networking, particularly for EMCRs, in the preceding 2 years (Bradley et al., 2020). While the COVID-19 pandemic has increased online conference/workshop attendance (e.g., the SCAR 2020 Open Science Conference), these virtual events make it hard to network (e.g., Blackman et al., 2020). Notably, a researcher's native language influences the perceived importance assigned to networking, with English speakers considering it more important success factor than do non-English speakers, highlighting language barriers resulting from the mainstream language of science being English.

Other success factors perceived as important for career success included institutional support and mentoring, support from ongoing projects, research continuity, leadership opportunities and effective administrative support. Mentors and managers are key in providing support in the long-term development and career planning of EMCRs (Scaffidi and Berman, 2011; van der Weijden et al., 2016; Maestre, 2019). Institutions can provide mentoring programs and training for mentors. Leadership opportunities, for example through existing long-term post-doctoral contracts with a return option (e.g., Marie Curie International Fellowships[2]), assist in the successful transition from EMCR to established scientist. Having academic vacancies more widely advertised by institutions may increase the visibility of job opportunities by providing greater transparency, thereby resulting in a greater number of skilled and high-quality applicants for these positions. APECS serves an important role as a hub for information on early career vacancies and other opportunities in the polar research sector (Hindshaw et al., 2018).

In summary, our survey results highlight the need for greater institutional support to promote opportunities for leadership (e.g., through contracts as principal investigators), networking, international mobility and awareness of employment opportunities for EMCRs. The survey also highlights the need for reduction of administrative duties, and for steps to be

[2]https://ec.europa.eu/research/mariecurieactions/actions/post-doctoral-fellowships

taken to overcome economic disadvantages by, for instance the organization of hybrid conferences in the eventual post-pandemic era, and reduce language barriers (e.g., through language courses). Finally, they increase awareness about existing inequalities and the need for taking measures to tackle these (e.g., affordable childcare facilities in close proximity to laboratories and institutions) (**Supplementary Material 8**).

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the metadata supporting the findings of this study have been deposited in the repository Centro Nacional de Datos Polares (CNDP). The data collected cannot be shared for ethical reasons. Requests to access the datasets should be directed to corresponding author BF, bfiguerola@gmail.com.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics committee of the Consejo Superior de Investigaciones Científicas (CSIC). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LRP created an outline of the manuscript. BF and LRP led manuscript production including coordination, the designation of co-authors, and editing. BF, LRP, PC, HJG, and DL wrote the first draft of the manuscript and edited the final version. NV performed the statistical analyses. BF and NV made the figures. RC-C and BF wrote the research proposal for ethics review. Additional text in the section "Barriers to Pursuing a Career in Polar Research" was written by NV, AB, MB, RC-C, MF-M, SG, SJ, FM, DN, JP, and FQ. All authors were involved in discussion regarding the aims and content of the manuscript, provided comments and suggestions, and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fevo.2021.777009/full#supplementary-material

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