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COMMENTARY

A lost generation? The impact of the COVID-19 pandemic on early career ASD researchers

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Abstract

The COVID-19 pandemic has disrupted autism research and services. Early career researchers (ECRs) are particularly vulnerable to the impact of the pandemic on job security and career development. The goal of this study was to capture the challenges ECRs are facing during the pandemic and the supports that are needed for career development and research. ECRs were invited to complete an online survey that focused on four major areas; the impact of COVID-19 on their research; changes in productivity due to COVID-19; changes to training due to COVID-19; and current mental health. 150 ECRs were eligible and provided sufficient data for inclusion. All but one ECRs reported their research had been negatively impacted by the pandemic. Reductions in productivity were reported by 85% of ECRs. The biggest impacts included recruitment of participants, increased needs at home and personal mental health. ECRs reported a 3-fold increase in burnout, as well as increased anxiety. ECR supports, such as funding, flexibility, and tenure extensions, are required to ensure ASD research does not suffer from a "lost generation" of researchers.

Lay Summary: The COVID-19 pandemic has had negative impacts on research around the world. Loss of productivity impedes autism research discoveries. However, researchers in the earliest phases of their career, specifically postdoctoral fellows through individuals in assistant professor (or equivalent) positions, are particularly vulnerable to long-lasting effects of pandemic-related disruptions which may limit their ability to continue as autism researchers. This survey highlights the needs of this group and identifies mechanisms by which these early career researchers may be supported in this time. This is critical to ensure the next generation of ASD researchers and clinician scientists continue on the path to advancing understanding of autism in the decades to come.

KEYWORDS
autism research, COVID-19, early career researchers

INTRODUCTION

The COVID-19 pandemic has left autism families and care providers scrambling for solutions but has also significantly disrupted scientific research. Social distancing guidelines shut down research institutions for months and some universities have still not fully re-opened as we enter 2021. The impact of the COVID-19 pandemic has been well-documented on research productivity, particularly for early career researchers, female academics and scholars with caregiving responsibilities (Andersen et al., 2020; Krukowski et al., 2021; Myers et al., 2020; Viglione, 2020).

There is evidence that the pandemic is disproportionately impacting researchers in the earliest phases of their career, defined as "early career researchers" (ECRs) (Krukowski et al., 2021; Myers et al., 2020; Viglione, 2020). While different organizations vary in their definitions and parameters designating ECRs (Health Research Alliance, personal communication), typically the early career phase encompasses the period of time that spans the end of specialized training

through the transition to more independent research and funding.

Several factors contribute to the differential impact of the COVID-19 pandemic on ECRs. Many ECRs have experienced increased teaching demands and administrative obligations, particularly with the shift to remote instruction. Moreover, many clinical ECRs face significant increases in time allotted to providing clinical services and supports. During non-pandemic times, ECRs frequently experience substantial caregiving challenges (e.g., being responsible for various aspects of child or elder care; (Hartmann et al., 2018) and have been referred to as the *sandwich generation* (Amercian Psychological Association, 2008). These responsibilities have drastically expanded with the widespread closure of schools and childcare facilities. Myers et al. (2020) reported unequal effects of the pandemic based on career stage, discipline, and sex/gender, concluding that female scientists with young dependents had the most pronounced impact of COVID-19 on their ability to devote time to research (Krukowski et al., 2021). An analysis of preprint servers indicated that ECRs, particularly women, are producing fewer research outputs (Andersen et al., 2020; Viglione, 2020) – outputs required for appointments and promotions. Further, ECRs have been less likely to actively pursue new lines of research than their senior colleagues (Viglione, 2020).

Networking and training opportunities that help establish career advancement and collaboration have also been upended (Amaral & de Vries, 2020; Taylor et al., 2020; Tchieu et al., 2020). In addition to the impact on the careers of ECRs, this lack of hands on training impacts the training of research staff and students who provide essential support to their scientific projects (Termini & Traver, 2020). Finally, due to university closures and hiring freezes, recruitment into different positions is at a standstill. Each of these has immense effects on ECRs' ability to establish independent research programs that are critical foundation to advancement and job security.

While the impact of COVID-19 on academics has been a focus of many recent articles, the particular impact on the ASD ECR community has yet to be described. A number of unique features of the ASD research community make ECRs in this field particularly vulnerable to the impact of the pandemic. Clinical research labs have been hindered by months of being unable to conduct in-person research. Even when able to return, PPE and social distancing protocols make many research assessments invalid, particularly those considered both a gold-standard and pre-requisite in the majority of ASD research (e.g., ADOS). ASD research may be disproportionately affected by telehealth or PPE may pose greater barriers for research participation with individuals with significant cognitive or sensory impairments. Basic science labs have also been crippled by a lack of access to laboratories, supplies and research tools, sometimes resulting in culling of animal colonies due to limitations to animal care staff and facilities (Grimm, 2020; Servick et al., 2020). Across disciplines, precious time and resources have been diverted to developing new research protocols and learning to navigate telehealth and remote data collection platforms (Lord, Holbrook, Dow, Kim, Toolan, & Byrne, 2020; Marshall, 2020). Families have also not been able to obtain diagnostic assessments, which are often required for research eligibility, nor have they been able to access clinical services or participate in in-person research collection, such as in early intervention studies (Amaral & de Vries, 2020). Despite major changes in the way research is being conducted, the core issues for supporting families and advancing ASD research remain and, in many cases, are exacerbated as autistic individuals and their families navigate the challenges of the pandemic. Thus, it is more critical than ever to support autism research scientists to ensure that they can guide families during the pandemic and provide scientific data to help them for years to come. However, there have been no quantitative analyses to date of the challenges facing researchers during this time.

A major goal of many organizations, including funding organizations and research societies such as the International Society for Autism Research (INSAR), is the retention of ECRs in autism research to ensure the next generation of scientists continue to focus research efforts on autism and other neurodevelopmental disorders and pursue scientific inquiries into questions that are important to autistic individuals and their families. For this reason, Autism Science Foundation (ASF) and Autism Speaks (AS) created and disseminated a survey to autism focused ECRs in order to better understand the challenges of ECRs during the pandemic. The survey was designed for the purposes of strategic planning. The findings of this survey will help guide potential changes in funding priorities and drive collective advocacy efforts, if necessary.

METHODS

For the purposes of this study, ECRs are defined as scientists at the postdoctoral or post-graduate training (such as medical residency) level through the first 7 years of a faculty (tenure or non-tenure track) position at a university. The inclusion criteria for the ASF/AS survey included either (a) currently employed in a postdoctoral position or residency or (b) within the first 7 years of a faculty (or equivalent such as staff scientists or research associate) position. Additionally, respondents had to be actively involved in research projects within ASD or neurodevelopmental disorders when the pandemic started.

ECRs were invited to complete an online survey, via a SurveyMonkey platform, via email listservs, direct email, and social media. This included channels for ECRs

in ASD and ECR ASF and AS grantees. The survey, which comprised 39 questions, was developed in collaboration with the Health Research Alliance (www.healthra.org); a group of 90 biomedical research organizations representing a wide range of diseases and disorders. The ASF developed the initial survey in collaboration with the HRA and then worked directly with a subcommittee of ECRs in ASD research (spanning behavioral, intervention, neuroscience and basic science in both the US and UK) to finalize the questions. The survey is meant to be disseminated to others who would like to use it or customize it. All responses were anonymous and no personal information (such as DOB, email or name) was collected. Original survey questions are available in Supporting Information.

Questions focused on four major areas: (a) the impact of COVID-19 on their research; (b) changes in productivity (if any) due to COVID-19; (c) changes to training due to COVID-19 and (d) current mental health. Additional questions regarding mentor and institutional support and responses for ECRs were also included. Demographic information was also collected from each participant. No identifying information was collected. Average completion time was ~8 min. IP addresses were checked for duplicates to ensure participants only completed the survey once.

Descriptive statistics were used to understand general trends in these areas. Open field responses are presented where applicable. Differences in pre- and pandemic-levels of burnout were analyzed using t-tests.

RESULTS

Response rate and sample demographics

Two hundred and eight respondents answered at least one question. Twenty respondents were removed due to not being in a postdoctoral or early career position. A further 38 respondents were removed due to not proceeding past the first question ("Are you a post-doc or 7 years or less from your last training experience?" One respondent who was previously employed as in an ECR position but lost their position due to COVID-related job cuts was retained. Two ABD (All But Dissertation) respondents were also retained in the sample as they indicated they were currently working in postdoctoral positions, leaving a final sample of 150 respondents.

As reported in Table 1, the majority (73%) of the respondents identified as female. The mean age was 35.15 years (SD = 4.95) and ranged from 26 to 56 years. Further, the majority of respondents (66%) were white or Caucasian, and non-Hispanic, and located in North America (75%).

The most common professional degree was a PhD (93%). Respondents were equally split between postdoctoral (47%) and faculty/other early career positions (53%) representing a range of research areas (Table 1). Of the "other" areas listed, these included adult services and research, language development, and early/familial risk research.

TABLE 1 Sample characteristics

	N
Total Respondents	150
Mean Age (SD)	35.15 (4.95)
Gender: F/M/Missing	110/20/20
Race	
White	99
Black/African American	1
Asian	18
Two or more	6
Missing	24
Ethnicity	
Hispanic	8
Professional degree	
PhD	139
Other	11
Position	
1st Year Postdoc	9
2nd Year Postdoc	21
3rd Year Postdoc	18
4th Year Postdoc	6
5th Year + Postdoc	10
Other Role (Faculty or Research Scientist)	81
Missing	7
Research areas	
Neuroscience	44
Intervention	24
Diagnosis	19
Services	13
Etiology	9
Epidemiology	6
Public health	4
Data analysis	3
Other	24

Impact of the COVID-19 pandemic on research and training

All but one respondent reported their research had been negatively impacted by the COVID-19 pandemic (99%). The biggest impact on research during the pandemic was collecting data (N = 124). Respondents also reported difficulties managing a research team remotely (N = 32), decreased training opportunities (N = 34), and difficulties writing papers (N = 31) and grants (N = 23).

When asked how their research had specifically been impacted, issues recruiting participants, increased needs at home, and lab closures were the most commonly reported factors impacting ECRs' ability to conduct research during the pandemic (Figure 1). Perhaps most concerning, over one third of respondents (N = 56) reported that their mental health was impacting their ability to conduct research. One respondent reported the incompatibility between parenthood and academia being exacerbated by the pandemic:

> My experience has been that being a tenure track academic and PI at a tier 1 institution is barely compatible with motherhood on the best of days. The strains of the pandemic……have made that conflict insurmountable. The feeling that nags so many parents—that despite exhausting yourself and trying your hardest- you are falling short in both the spheres of work and home is magnified as a result of this crisis.

What has been lost due to the COVID-19 pandemic and what resources are needed to resume research?

When asked what had been lost due to the institutional shutdowns caused by COVID-19, 139 respondents indicated time. Many also reported the loss of staff (N = 52), expertise (N = 34), and funding (N = 43). With regards to the resources that would help ECR's restart their research, funding for salary (N = 84), staff (N = 76), supplies (N = 32), and support for collaborations (N = 58) were identified. Help navigating career development during the time of COVID-19 (N = 87) and advocating for institutional changes (N = 47) were also selected. "Other" responses (N = 12) included changes to No Cost Extension policies, guidance for resuming face to face research and support for childcare. The majority of respondents reported needing between $10,000 to $50,000 ($N$ = 66) and $50,001 to $200,000 ($N$ = 41) to return to "research as normal."

When asked to report what policies (national and institutional) were in place to support ECRs during this time, there were surprisingly few respondents indicating positive supports (N = 25). Extensions to tenure clocks and start up extensions (N = 8), increased flexibility around working hours (N = 5) and childcare or emergency funds (N = 5) were amongst the types reported. With regards to what policies would be appreciated to support ECRs during and following the pandemic, funding emerged as a strong theme, including funding to support childcare (N = 13), extending grants to accommodate the time lost due to the pandemic (N = 4), funding to retain research staff (N = 5), and boost/bridge funding (N = 6). Changes to promotion and tenure were also desired (N = 10) as well as extensions to Early Stage Investigator status (N = 6). Support to more effectively work at home (N = 6), to move studies online (N = 4) and to facilitate safe in-person research (N = 7) was also reported. Over one-third of ECRs reported wanting more career development mentorship as they navigated the pandemic and next steps (N = 59).

Impact on productivity and concerns for future research

Most ECRs (N = 127) reported a loss of productivity compared to "normal", with the majority of respondents

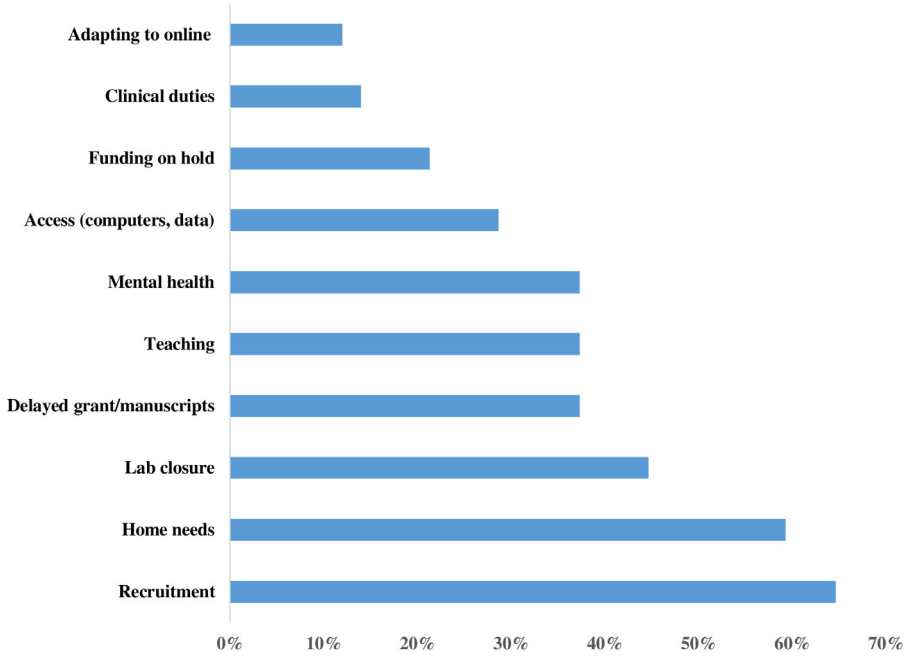

FIGURE 1 Proportion of respondents indicating ways in which research has been affected

reporting they were currently working between 41–60% (N = 50) or 61–80% (N = 57) productivity. The greatest impacts on productivity were stress and anxiety (N = 94) and lack of childcare (N = 67). Stopping of experiments/projects (N = 55), lack of access to facilities (N = 37) and the time taken to convert studies to remote (N = 8) were also reported as impacting their productivity. Health issues (COVID-19 and non COVID-19) for respondents and/or their families members were also reported (N = 11). ECRs also reported racial and social justice issues impacting their productivity during this time.

When asked about their concerns for their future research, ECRs were most concerned about completing ongoing research and grant possibilities moving forward (N = 52), future funding N = 25), and hiring and promotion prospects (N = 25). A third of ECRs reported changing their research direction within ASD research (N = 50) as well as outside of ASD research (N = 46) during the pandemic. One ECR reported the feeling vulnerable about their future in academia as a result of the pandemic:

> I have always loved my job and truly could not be more passionate about advancing autism research and mentoring the next generation of clinician-scientists, but at the same time am incredibly concerned about my future in academia as the pandemic persists. As an early stage investigator, I feel especially vulnerable to the effects of covid19, and can only imagine that others are likely experiencing similar degrees of stress and uncertainty.

Burnout and mental health

As shown in Figure 2, pre-pandemic, the majority (N = 103) of ECRs reported either no symptoms of burnout or occasional stress, but not burnout. Current (pandemic) levels of burnout shifted to one or more symptoms (N = 65), persistent burnout (N = 17) and complete burnout to the point where the individual is considering making changes to their life or seeking help (N = 17; Figure 2). This is equivalent to an over 3-fold increase in the number of respondents reporting burnout (t[127] = 10.87, $p < 0.0001$). One female ECR reported the major burnout due to lack of childcare:

> I am the primary caregiver for 2 young children. I get 2–3 hours a day and the weekends which means zero breaks and major burnout for a fraction of the productivity of my childfree colleagues. I have had to prioritize all my time to writing grants because without them, I have no job.

Similar trends were observed for anxiety and depression, with the majority of ECRs reporting more anxiety (N = 104, 80% of respondents) and over one third of ECRs reporting more depression (N = 66) during the pandemic. Current symptoms were high, with moderate-to-severe levels of anxiety reported for 43%, depression 20% and sleep issues 31%.

DISCUSSION

The goal of this commentary was to characterize the impact of the COVID-19 pandemic on ECRs specializing in ASD-focused research. Overwhelmingly, ECRs' programs of research and training have been impacted by the pandemic, with data collection on hold for over 80% of respondents to this survey and recruitment of human subjects paused or significantly reduced for two-thirds. Respondents overwhelmingly reported that time was the most valuable commodity lost during the pandemic and indicated the need for additional mentorship to navigate

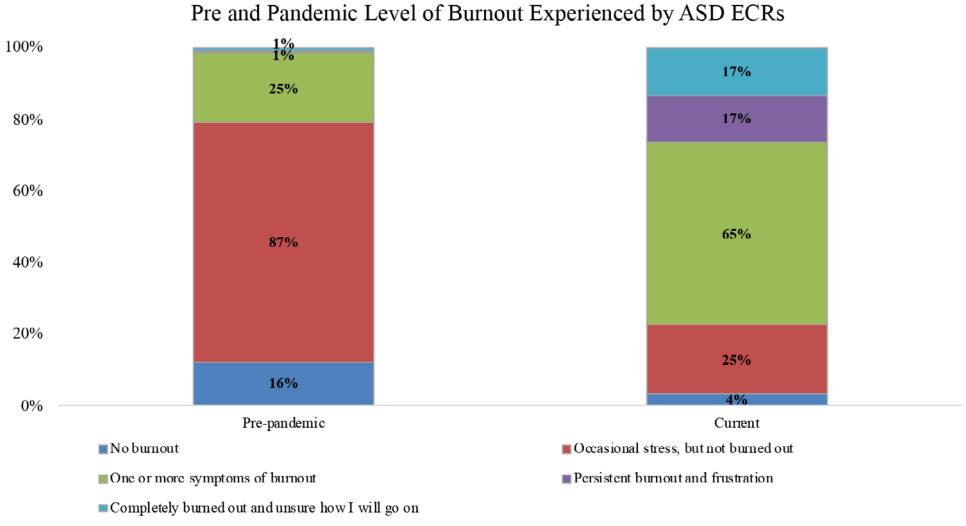

FIGURE 2 Pre-pandemic and current levels of respondent burnout

career development during this time and support for salary, staff, and to foster collaborations.

Losses to productivity were widely reported. Close to half of the respondents stated that lack of childcare was impacting their productivity and nearly a third reported spending their time caring for family members. Nearly two thirds of ECRs reported that stress and anxiety were directly impacting their productivity during the pandemic. A three-fold increase in burnout was reported relative to pre-pandemic levels. An alarming 17% reported persistent burnout and frustration, while another 17% reported feeling so burned out that they were unsure how they would continue. While nearly everyone is experiencing challenges during the pandemic, it may be that the combination of early career pressures and the responsibilities of the so-called sandwich generation are being exacerbated by the pandemic.

The majority of our data was from ECRs who identified as female. While this ratio aligns somewhat with the gender ratio of ECRs in ASD research (70% of ECRs funded by ASF are female; 60% of ECRs contacted by AS were female), fewer than 15% of our sample was male. However our data align with those reported for academic mothers and females in academia (Alon et al., 2020; Johnston et al., 2020; Staniscuaski et al., 2020). Emerging data suggests that males are also feeling the impact of the pandemic (Cleveland Clinic, 2021) and working fathers also report significant stress related to COVID-19, albeit at lower rates than working mothers (Catalyst, 2020). A recent report stated that 41% of mothers felt they had to hide their caregiving responsibilities from colleagues, compared to 36% of fathers (Catalyst, 2021). Therefore, working fathers, and males in general, may not report the same degree of COVID related stress to females. Further, data suggests that female faculty are more likely to respond to online surveys (Smith, 2008), thus it could be that female ECRs, particularly mothers, were more motivated to complete the survey based on the challenges they are facing.

Females, in general, have been reported to have been hit harder by the pandemic-linked recession (job losses, reduced hours) and its consequences, such as childcare demands (Alon et al., 2020). Both males and females in our sample reported increased caregiving responsibilities and demands at home. Given such a small percentage of male respondents, it could be that those who responded were motivated to do so – i.e. they are personally experiencing the impact of childcare closures – compared to females who are generally more motivated to complete research. While we are not able to compare gender differences, our data are in line with the impact of the pandemic on working parents that has been reported across other fields and wider society (Collins et al., 2020; Guatimosim, 2020; Johnston et al., 2020; Myers et al., 2020; Staniscuaski et al., 2020).

Of note, we did not specifically ask about child-caring responsibilities, rather we asked about the impact of caregiving in general, which was intended to include child-care, as well as taking care of elderly parents, other family members, or other similar responsibilities. Thus, while we cannot assume that all respondents to this question were parents, several respondents' open-ended responses are highly indicative that the impact of being a working parent, particularly a working mother, was a major factor in our findings. Such differences were reported in academia prior to the pandemic (Cech & Blair-Loy, 2019; Holman et al., 2018; Larivière et al., 2013; Ley & Hamilton, 2008; Mason et al., 2013; Shen, 2013). It is important to recognize that female academics without caregiving responsibilities also reported the impact of the pandemic on their research and productivity, reinforcing the well-known gender inequities in academia that manifest in greater work-related stress, pay gaps, and fewer opportunities for career advancement (Raj et al., 2016; Rosenthal et al., 2016; Thoreson et al., 1990). These inequities have been further exacerbated by the pandemic and will likely continue to grow if active measures are not taken to address them.

This survey was conducted in the late summer and fall of 2020, with the backdrop not only of the pandemic, but high-profile cases of Black men and women who were lost to police violence and racism, as well as the Black Lives Matter movement. Therefore, it is understandable that many ECRs reported their productivity being impact by racial and social justice issues in addition to the pandemic. The lack and need for diversity within ASD research has been eloquently summarized by Jones and Mandell (2020) and our sample solidified this lack of diversity. Very few respondents were people of color and no autistic ECRs responded to the survey.

It is worth noting that our respondents were mostly from North America and some of the questions may not be applicable outside of the United States, where a more balanced mix of research, administration and teaching is common. Many ECRs reported increased administrative duties and teaching, including preparing for remote instruction. Therefore, our survey did not fully consider the impact of teaching on research productivity. Furthermore, we also acknowledge that the impact of research restrictions have varied across different countries, ranging from minimal restrictions and lockdowns (e.g., Sweden), to a slow lifting of restrictions as seen in the United States (with variations by state and institutions), to the complete halting of research in other regions (e.g., UK). Nonetheless, there is evidence that, at minimum, European ECRs have been similarly impacted, and perhaps may be at even greater risk due to significant reductions in funding for ECRs in these regions (Eurodoc, 2020; Servick et al., 2020).

It also worth noting that a smaller number of respondents provided in-depth responses to the open-ended questions, thus warranting caution in interpretation and overgeneralization as these responses may represent "extremes" in our data. Data suggests that the format of

questions (open vs. closed) has an impact on the completeness of data and who responds (Andrews, 2005; Denscombe, 2009; Griffith et al., 1999). It is also possible that respondents did not provide in-depth examples because of the difficulty inherent in offering solutions to challenges of this magnitude and scope across different areas of their life and scholarship. For example, asking for childcare support might not seem obvious for many, given the additional challenges of finding trustworthy and reliable childcare during a pandemic. Similarly, while COVID-related funds may be beneficial, the additional work of assembling an application or fast submission turnaround might not be feasible given the additional challenges ECRs are facing.

How can ASD ECR researchers be supported?

The most common response from ECRs with regards to what is needed to help them resume their research was funding, whether for their own salary, funding to retain staff, or to develop collaborations. A number of respondents stated that childcare support grants would be beneficial. However, a number of funding agencies and institutions do not allow childcare costs. Therefore, funds directly to individuals would likely be most beneficial. ECRs also reported the need for targeted bridge or boost funding. Such examples include Yale's School of Medicine COVID-gap funding, targeted at Assistant Professors forced to pause their research (https://medicine.yale.edu/about/deanoffice/covid-gap-funding/). Reducing the administrative costs associated with smaller, non-federal grants as well as indirects for these smaller funds could help ECRs navigate funding during the pandemic and develop a much-needed funding portfolio for larger, federal funding. One possibility is to offer COVID-related funds as awards directly to the ECR (rather than as grants to institutions), which may reduce the administrative burden and offer more flexibility for use of funds. Coupled with longer turnarounds and shorter applications, these opportunities may become more appealing for ECRs.

The National Institutes of Health has allowed applicants to submit pilot data at a later date to supplement proposals. However, with the pandemic now stretching into 2021, it is likely that many researchers have not been able to collect new pilot data during shutdowns. Therefore, funding agencies should consider the impact of the pandemic on the availability of preliminary data, while also supporting extensions to Early Stage Investigator Status for postdoctoral fellowships, career development awards and investigator funding. Funding agencies and foundations should take the opportunity to think outside of the box to support ECRs; for example, establishing grant mechanisms that pair established researchers with ECRs to explore existing data in new and innovative ways. Such an approach would help the ECR to build their funding track records, as well as provide mentoring and publishing opportunities.

Adjustments to tenure and promotion requirements (including specific adjustments for COVID-19 related disruptions, such as reduced productivity expectations) could reduce the stress/anxiety/worry about the future and have little to no tangible cost to institutions. We acknowledge, however, that while schemes such as tenure extensions and extension of early career status as a result of COVID are well-meaning, data suggests that such *gender-neutral* schemes actually often work to the disadvantage for female academics (Antecol et al., 2018) and this may be further exacerbated by the pandemic. These policies also do not benefit Fixed-Term or Non Tenure-Track ECRs.

Thirty percent of ECRs reported changing their research direction outside of ASD as a result of the pandemic. This represents a great loss to the field. Supports for mentorship to navigate career development during this time could help reduce the loss of promising ECRs from the field. Formal mentorship programs through ASF, Autism Speaks, SFARI and INSAR could help reduce this attrition. Further, reentry grants for ECRs who are forced to leave ASD research, take on additional teaching or clinical duties, or leave academia completely should be prioritized. In short, funding agencies need to recognize the specific needs of ECRs and provide specialized funding for them, including support specifically earmarked for ECRs to build their independent lines of research not related to COVID. In addition to ASD-funding organizations providing special funding opportunities for ECR's, we are encouraged to see that funding organizations are already banding together in support of this goal as part of the Health Research Alliance. The Health Research Alliance is not limited to ASD, but includes funding agencies across biomedical research, and meets regularly to discuss issues like online networking, mentoring, the tenure clock, special considerations when it comes to publications of data that were collected pre/post COVID, support for childcare difficulties, gender issues, teaching responsibilities, and diversity and equity issues across science.

In addition to increased institutional and funding agency support for ECRs, there is a critical role of more senior autism researchers and faculty in supporting ECRs during this particularly tenuous time. Institutions and mentors should strive to "give a little grace" and take the opportunity to view the pandemic as a "paradigm shift" in academia; for example, requiring staff to take "mental health" days, considering departmental scheduling that will allow ECRs to block a day free from meetings, limiting early morning and late afternoon meetings, and allowing for flexible work schedules to continue post-pandemic. Such changes will also help recruit and retain female and underrepresented groups in academia beyond the current pandemic.

ECRs reported the need for support to reopen and safely conduct research, especially given the pressing need for preliminary data. More open-science and sharing of best practices within the ASD research community is required to enable ECRs to safely relaunch their studies. However, we recognize that the ability to conduct research varies widely by institution, state, and country and the availability of funding for PPE. Additionally, support to manage teams and conduct research remotely would allow some ECRs to continue data collection during this time and potentially explore new methods.

It is also worth recognizing that data and publications during the era of COVID may not meet some of the standards we have come to expect with ASD research. This may be a prompt to more flexibly consider what criteria are needed for different types of studies to promote confidence in findings and replicability across samples (e.g., Bal & Taylor, 2019). For example, accepting a community clinical diagnosis of ASD and samples characterized by parent-report interviews or questionnaires of autism symptoms, adaptive skills, emotional behavioral challenges or other characteristics relevant to the study aims when in-person assessments were not possible. Additionally, there should be the expectation and acceptance of the fact that there may be a mixture of ASD assessments across samples depending on when data collection occurred. Growing recognition for telehealth diagnoses or parent-led assessments, using tools such as the BOSA (Lord et al., 2020) or TELE-ASD-PEDS (Juárez et al., 2018; Wagner et al., 2020), will be needed. However, given the rapid shift to online data collection, appropriate justification for other forms of characterization (e.g., for studies occurring earlier in the pandemic) should be allowable. We believe that these changes will not only serve ECRs at this time, but that they also have implications for addressing disparities that have existed well before the pandemic. Indeed, this transition may catalyze the entire field to be more flexible with the metrics and expectations that have put non-Western based researchers at a disadvantage, thus helping to increase diversity in ASD research.

Supporting ECRs during and post pandemic, however, will warrant more radical shifts in thinking; that is, a "reset" rather than a return to pre-pandemic times (Gibson et al., 2020). An alarming 34% of ECRs in the present survey reported persistent or complete burnout (completed between 5 and 7 months in). This number will surely rise as the pandemic persists into 2021 and in most countries, at the time of writing, entering a dangerous peak of cases. Yet very few respondents indicated institutional supports. It remains to be seen if more institutions will begin to offer protections or continued flexibility in support of ensuring that an entire generation of ECRs are not lost to burnout. Particularly as approval of vaccines for emergency use begins to provide a "light at the end of the tunnel," institutions may be more inclined now to consider "short-term" solutions over changes that will impact the longer-term good. Rather than providing new grant opportunities for ECRs to apply to, departments might consider providing course releases or reduction of clinical responsibilities to ECRs or offering research "maintenance packages" (similar to startup packages) or formal salary support (without additional requirements) for those in "soft money" positions facing grant reductions or gaps. Just as we suggest considering our requirements for studies, this may be a reminder to reconsider expectations of ECR productivity (e.g., number of publications and grants) required for promotion and tenure.

Finally, some of the practices required due to the pandemic, such as flexible and remote working, telehealth, and remote research, also can increase accessibility of ASD research and the diversity of the next generation of researchers entering the field. While clinical psychology PhD programs across the US have reported 50–100% increases in the number of applicants (Prinstein, 2020), the removal of GRE requirements and in-person interviews can help to diversify our field.

CONCLUSIONS

While the current study focused on early career researchers, the profound loss of productivity is likely seen across different career stages and ASD research. However, these data suggest the combination of life (e.g., having young families) and career stage may exacerbate the pandemic's effects and put this group at high risk for burnout. That over 30% expressed an interest in expanding their research beyond ASD at this pivotal point in their careers puts the autism field at risk for losing talent that has already received a high level of specialized training. Such a loss could leave a gap in researchers dedicated to autism research in the next decade, further limiting future scientific discovery in our field. The results of this study call for both institutional and funding accommodations to help retain ECRs overall, and in ASD-related research specifically. This includes targeted funding mechanisms, continued flexibility and support for career development, innovative networking opportunities, support for child care, extension of tenure clocks and other stop-gap supports for non-tenure track faculty, as well as understanding of reviewers when considering manuscripts or grant applications. These changes need to be made in order to prevent a "lost generation" of researchers who would otherwise have gone on make important discoveries that would have significant impact on the individuals and families affected with ASD.

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AUTHOR CONTRIBUTIONS

Alycia Halladay created the survey and initiated the idea for and design of the study and managed the data. Clare Harrop, Kimberly Carpenter, and Vanessa Bal analyzed the data. Clare Harrop wrote the manuscript, with edits and contributions from all other authors. All authors read and approved the final manuscript with young children at home and supervising online school.

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