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Stress and Quits Among Intimidated Scientists: Management Failures and Paradoxes of Support[**]

Abstract

Through a major international survey of scientists, we investigated the stress effects on scientists who experience work-related intimidation and harassment, from whom they sought support, how useful support was, and whose support mattered for stress and quits. Using a theoretical framework that was an adaptation of the job demands-resources model, we found that different forms of intimidation affected stress and quits in different ways. Intimidated scientists sought support from both internal and external sources. The most supportive groups they consulted were often outsiders. Support had a major impact on stress and quitting. While stress itself increased quits, support was much more important, especially from senior management. Internal and external support worked very differently on quits. We finish with observations about management and HR functions within universities and other research organisations.

Keywords: intimidation, harassment, stress, science, scientists, support
            (JEL: I2, I23)

Introduction

The harassment and intimidation of scientists have been a growing concern in recent years. On the one hand, extensive research literature has developed about workplace harassment and 'bullying' of employees (e.g. Branch et al., 2012; McDonald, 2012). The old, unreflexive norm of the white-male-god-scientist (Burke et al., 2017) is meeting the #Metoo movement head-on. On the other hand, far less attention has been directed to the intimidation of specialist occupations such as scientists. Yet intimidation, for example, from lobbyists, interest groups or corporations, has implications for both the scientist and science. It has global implications for the progress of knowledge: advances can be ignored, hidden, or not made in the first place. This can lead to bad public policy nationally and has global

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ramifications. Participation in scientific careers is already a major problem (Lyons & Quinn, 2015), and intimidation of scientists (Dunlap & McCright, 2015; Halpern & Mann, 2015) exacerbates this. Scientists may avoid research areas that are highly sensitive (Miller, 2003; Wolfson et al., 2015). This is all of concern, not just because of the public interest in having an effective, vocal scientific workforce (Hardert, 2001; Miller, 2003), which might just help in saving the planet, but also because of evidence of harassment in the sector (Strachan et al., 2012; Penner, 2015; Clancy et al., 2014; Skinner et al., 2015).

While estimates of the prevalence of what is often called harassment vary in a range of 5–20%, it is potentially destructive and miserable for affected workers (Rittenmeyer et al., 2012), adversely influencing retention, burnout, and job satisfaction (Deery et al., 2011), diversity and performance (Hunt et al., 2015), including scientific performance (Corrales et al, 2015). We cannot ignore what intimidation may mean for the progression of science (Kozlowski et al., 2022).

In this paper, we look broadly at issues of intimidation, going beyond sexual harassment — which is not to downplay its importance (Aji et al., 2024; Burke et al., 2017) — to all forms of intimidation affecting scientists, taking into account the relevance of some ideas that emerge from the study of personal harassment and bullying (Branch at al., 2013) to the scientific community at large. Our core research question is this: for scientists, what are the relationships between intimidation, stress, and job quits? This encompasses a series of sub-questions:

1. What are the effects, in terms of stress and quits, on scientists who experience work-related intimidation and harassment?

2. From whom do intimidated scientists seek support?

3. How useful is support?

4. Whose support matters for stress and quits?

We investigate this through a major global survey of scientists specifically designed to interrogate the experiences of harassment for scientists. The analysis tells us a lot about management in research organisations, particularly its failures in some key areas, and about the paradoxes of support. Some types of support, we will see, have very different effects on what might intuitively be thought of as closely related outcome variables.

Relevant Literature

Before detailing our methodology, we outline the relevant literature, starting with the distinction between intimidation (the term we use) and harassment (the term more commonly appearing in the literature). We then briefly touch on some studies on the effects of intimidation before considering the relevant theoretical studies relating to social support theory, social capital theory and job demand-resources

(JD-R) theory, and finally outlining our specific theoretical perspective, which in effect integrates those various theories but also adds some matters specific to this study.

Intimidation vs Harassment

In this study, we use the term 'intimidation' rather than 'harassment' for two reasons. First, harassment is usually defined in the literature as something that needs to be repeated (Dollard et al., 2009; Brodsky, 1976). We are also interested in 'one-off' incidents, which may still be stressful for the target (Grimes at al., 2020), because a one-off incident of sufficient strength may be enough to change the behaviour of a target in the way intended by the perpetrator. Second, harassment implies conscious agency on the part of the perpetrator, which we do not assume: although intent will frequently be there, sometimes a target may feel intimidated even if that is not the objective of the perpetrator. Most surveys (of which this is one) cannot read the mind of the perpetrator, but the key thing is how the target feels.

The Internal/External Distinction

It could be considered that the type of abuse we are looking at comes down to two sources of intimidation: external (perhaps a lobby group wanting to suppress particular ideas or an individual trying to force a change in scientists' behaviour) or internal (a colleague, supervisor or student) who seeks the elimination of competition or sexual gratification. Typically, studies (Marsh at al., 2004) have treated internal and external intimidation as conceptually unrelated phenomena that have been considered from different perspectives.

However, several European studies (Giaccone & Nunzio, 2015 identified twelve) applied an internal/external perpetrator distinction to surveys of workplace harassment, sometimes (but only in a minority of cases) restricted to consideration of violence or, at the other extreme, hassling and teasing. It is a very useful distinction for thinking about not only the sources of intimidation but also the factors that ameliorate its effects.

That said, for a broader analysis of intimidation, the neat internal/external conceptual distinction may not be quite so simple. Intimidation from within the organisation may be in response to, or even in anticipation of, the needs of outside interests, real or perceived. It may be perceived by the target as the 'organisation' against the scientist (even if the perpetrator is not acting consistent with policy), as opposed to an individual who might be harassing them.

So, it is probably better to conceive of three types of intimidation: external organisational intimidation (where the immediate perpetrator is outside the organisation), internal organisational intimidation (where the immediate perpetrator is inside and

may be doing it in anticipation of or in response to external factors, or entirely for internal purposes); and personal harassment (predominantly, but not exclusively, internal). A common thread is the likely effects on targets, ranging from defiance to ignoring and retreat, which might include states of fear or silence (e.g. Rittenmeyer et al. 2012) and stress. Similarities also include the potential effects on science: diminishing its capacity to develop and grow and contribute to public debate, something research organisations are meant to be concerned about.

In this paper, the internal/external distinction is also important in terms of the nature and effects of support. That is, we take into account whether support available to an intimidated scientist is internal or external to the organisation and explain the significance in terms of job demands and resources (JD-R) theory, which we discuss in more detail below. We also take into account the extent to which the outcome variable relates to the scientist's internal vs. external positioning. The two outcome variables under discussion here are: first, stress responses (largely involuntary and not measured by reference to whether the scientist is inside or outside the organisation) and second, exit behaviour, that is, whether the scientist remains in or leaves their job. These last are measured by various internal/external indicators (are the scientists still inside or now outside their former job with the organisation?). We will return to this matter later.

Effects of Intimidation

Job quitting may be a response to intimidation of scientists, one that concerns the organisations for which they work — that is, the universities, government agencies or other research organisations. There is evidence that women who self-report harassment are more likely to leave their jobs for a lower-paying one elsewhere (Folke & Rickne, 2022). A study by the Australian Human Rights Commission found that 17 per cent of victims of sexual harassment who made a formal complaint ended up quitting their jobs (Australian Human Rights Commission, 2020). In the US, 'over time, fully 52% of highly qualified females working for SET companies quit their jobs, driven out by hostile work environments and extreme job pressures' (Hewlett et al., 2008). Such responses reflect the low power of workers in the capitalist workplace (Jessop, 2010), and particularly the low power of women (Federici, 2020), such that exit for many is the only viable option. According to some analyses, 'the objective of sexual harassment is not necessarily the pursuit of sex, but rather intimidation and the satisfaction of power needs' (de Haas & Timmerman, 2010; Pryor et al., 1995). While many theories of power at work (such as the Marxist theories cited above) are built around businesses with profit as the goal, a similar argument (about intimidation and power) might be applied to research organisations with the goal of monetisable research outcomes and where many scientists work.

Theoretical approaches

What might influence this stress and quitting behaviour? The literature suggests that the impact of intimidation can be lessened by the power of support networks that benefit the affected employees (Ashida & Heaney, 2008, 872; Heaney & Isreal, 2002, 199). People without networks have low resources and, hence, low power. Using Social Support Theory (as discussed by Sarason & Sarason 1985), support is the key theoretical concept when trying to explain what influences an individual to undertake bad or even criminal behaviour. This means that the more social support an individual has, or the stronger the individual's social network is, the less likely that this person will engage in crime or other harmful behaviours. In general, social networks and social support are beneficial to health, including in male-dominated workplaces (which many scientific workplaces are) (Lee et al., 2014; Battams et al., 2014), and various interventions are proposed to strengthen these support networks (Isreal 1982; McLeroy et al., 2001) or are favoured by corporations (Scully, 2009). Baumeister & Leary (1995) argued that people can be partly protected from stress and have improved coping skills through the presence of others who provide support and assistance. Underlying this is an intrinsic drive for connections and social relationships. From limited studies, support networks appear relevant to the impact of personal harassment (Mueller et al., 2001; Chamberlain et al., 2008).

Related to social support theory is *social capital theory*, which explains the importance of using social connections and social relations to achieve (or not be able to achieve) goals. As social integration within organisations affects sexual harassment, and supportive co-workers provide some protection against some (milder) forms of sexual harassment; we would expect networks to play an important role in whether intimidation occurs (Mueller et al., 2001; Chamberlain et al., 2008). *Organisational support theory* suggests employees form a general perception concerning the extent to which their organisation values their contributions and cares about their well-being. This involves the critical role of bystanders (not just people who witness harassment but also those with whom the victim may subsequently discuss the issue, whether or not through their regular social networks). This is analysed in detail by several authors (e.g. D'Cruz & Noronha, 2011; Omari & Paull, 2012; McDonald, 2012) and points to the importance of support, not only from the abused target's colleagues, family and friends but also the institutional support that is potentially provided by the supervisor, senior management and HR. The role of management is potentially important, not just because of where scientists might fit in the managed hierarchy but also because of their role in providing (or not providing) support.

JD-R Theory, as suggested by Bakker & Demerouti (2007), is another theoretical angle showing how "job demands and resources have unique and multiplicative effects on job stress and motivation". The theory also proposes to reverse causal effects, whereby associated stresses mean that "burned-out employees may create

more job demands overtime for themselves, [whereas] engaged workers… mobilise their job resources to stay engaged". This theory could be popular with management looking to get better long-term benefits from their employees.

Crucially for our analysis, JD-R theory allows for social support to be one of the resources that employees can draw upon to reduce stress as the demands of the job intensify. High job demands, such as pressures with a physical, psychological, or organisational origin, may run down employees' resources (mental and physical) and thereby lead to health problems (Demerouti et al., 2001). The adverse effects of high job demands can, in turn, be ameliorated by support from colleagues and supervisors, which is seen as a job resource (Bakker et al., 2003b). This may have consequences in employment behaviour: for example, a study of return-to-work outcomes after injury found that social connectedness was higher amongst employees who had returned to work than it was amongst those who had not (Watt et al., 2015).

A Theoretical Model

Our approach is to locate the processes investigated here within an expanded JD-R framework that incorporates ideas from social support theory. We treat intimidation as a job 'demand' in that it is something that arises in the process of a scientist doing their work and would not have occurred if they had not been working in that organisation. The more intensive that intimidation is, the more demanding it is. Feeling stressed is a physiological and psychological response to the stressor that is intimidation, with high-level demands causing bodily reactions manifest in stress (Bakker et al., 2006). So, the more intensive intimidation is, the greater the stress response will be, if other things are equal.

Other things are not equal, however. The 'support' that the scientist can access is a 'resource', but the extent to which it is a useful resource for the purpose of dealing with the 'demand' caused by intimidation will depend on several factors. The first is whether that support is perceived as beneficial: whether the worker feels that it has helped them or not. That may seem, on the surface, to be self-evident, but it needs to be explicitly stated here.

The second factor is whether that support comes from within or outside the organization. If the problem comes from the scientist's engagement with the organization (employment), then the beneficial impact of support may be shaped by whether support also comes from internal or external sources. If support comes from within the organization, it might help resolve the problem, and ease the adverse response.

Yet, we cannot assume that the effect would work the same for all types of responses. Physiological or psychological responses, which may be relatively involuntary, may vary less than discretionary responses, such as whether the scientist remains working in the organisation, which has a direct link to the organisation itself.

This, then, is the third factor in determining the impact of a support resource: the outcome variable itself.

Indeed, it is plausible that the location of support could interact very differently with the perceived degree of support when explanations are sought for different types of outcomes. With involuntary outcomes, such as perceptions of stress, external support might just be weaker than internal support in reducing adverse effects. Thus, perceived stress might be lower when the scientist receives good support from either internal or external sources. With discretionary employment decisions, however, the sign of the effect could feasibly disappear or even change. This is because external support is not a resource for a beneficial behavioural response that deals with a problem internal to the organisation (i.e. work). Indeed, good external support combined with poor internal support could persuade a scientist that they are better off leaving the organisation. Thus, exit rates could conceivably be even higher where the scientist received high external support than if they received low external support, even though the reverse would be expected (that is, exit rates would be lower) where internal support was higher than where it was low.

In short, we propose five factors that will determine the relationship between intimidation and adverse outcomes for the scientists themselves. Two concerns are the intimidation itself (the 'job demand'), the intensity of the intimidation, and the source (internal or external). Two concerns are the support (the 'job resource'), how beneficial it is perceived to be (a variant of the 'intensity' concept), and the source (internal or external). The final factor concerns the outcome itself, in particular, the extent to which it is involuntary or discretionary and relates to the internal/external positioning of the scientist.

Methodology

The main data were collected through an anonymous online survey of international scientists. We focused on three main fields of science, recruited and categorised as either high or low risk in terms of the nature of their disciplinary topic, the potential risk to a scientist's reputation and the extent to which they could be viewed as politically sensitive or non-sensitive. They were Climate Science (high risk, being politically controversial, with attacks coming from the 'right'), Food and Plant Science, e.g., agronomists, biologists, genomics, etc. (also high risk, due to being politically controversial, but with attacks coming from some 'left' and 'green' groups) and scientists in astronomy (low risk, as it is politically non-controversial, outside of fringe religious groups).

The project was funded by the Australian Research Council and designed with the assistance of an international advisory board. Potential participants were recruited through a search of the ISI Web of Science database, a method previously used successfully by Cook et al. (2013). We applied keyword phrases in either the title, author keywords or abstract of the paper to identify the specific science cohorts

published between 2012-2018. This method obtained 90467 unique author emails. Survey invitations were distributed from August to December 2020. Several problems arose using this method. We obtained what looked like automatic replies from over 20% (n=20190) stating that the invitation email had been blocked or was not received. We targeted specific disciplinary groups through our search terms, but it turned out that half of the respondents self-identified as being from other STEMM disciplines or HASS researchers, emphasising the cross-disciplinary nature of the target topics. This meant the potential survey population who received the survey invitation and two reminders was 70277, though they were not exclusively employed in the three areas mentioned above — rather, they had *published* in one of those three areas. In total, 2675 scientists responded to the survey, but 589 (22%) did not answer the focal questions about intimidation and were dropped for this analysis. The remaining 2086 (78%) who responded to the focal questions designed to elicit intimidation or intimidation incidents and their consequences are the sample for this paper.

Among these 2086 international scientists, 1403 (67.3 %) were males, 499 were females (23.9%), and 184 (8.8%) did not provide their gender. Some 41% had experienced intimidation in the past five years. The sample represented a response rate of 2.9% of our potential international scientific community. To date, it is the largest study of international scientists on the topic of intimidation or harassment. It included 118 Climate scientists (6%), 401 (19%) in food and plant science, and 448 (21%) in astronomy research. As mentioned, despite using search terms to target specific cohorts, a considerable proportion of the scientists who participated self-identified from other disciplines; 1114 (54%) were from other STEMM or humanities and social sciences disciplines.

We examined nine forms of intimidation. The online survey was designed specifically for the study, taking about 30-60 minutes to complete depending on the length of responses given. It was administered using Lime software. The invitation emails were not linked to responses to ensure respondent anonymity and confidentiality and were consistent with ethical standards for human participants as required by the funding body.

Challenges in Estimating Intimidation

Studies in this area typically measure harassment either by asking respondents to say whether they were harassed ('self-labelling') or to confirm various incidents on a list that the researchers subsequently define as harassment (a 'behavioural experience inventory') (Nielsen et al., 2016). We used the latter. We did not consider the self-labelling approach to be useful for this project, as words like 'intimidation' convey different meanings to different people, whereas descriptions of specific events have more commonly shared meanings. Nine items were developed specifically for the context of scientific knowledge production and communication of evidence and

concerning aspects of bullying related to the science sector, with one item being more general to allow responders to provide information on any other relevant incidents. Respondents could check all items they had experienced in the past five years since 2015. A series of questions tapped the nature of the incident (or the one most significant for them) designed to identify who was involved, the motives (if known), how long the intimidation lasted, what the consequences were to the scientists in terms of their research work including perceptions of career and health and wellbeing consequences. In the tables and figures below, the potential responses to the behavioural experience inventory are abbreviated; the full wording is shown in Table 1.

Table 1. Short Form and Full Wording of Response Options Regarding Form of Intimidation

Short form	Full form
Complaint	[Q24_1 A complaint about you to someone in the organization]
Adverse information	[Q24_2 Dissemination or publication of adverse information about you]
Online abuse	[Q24_3 Online abuse]
Property damage	[Q24_4 Damage to property relating to you or your work]
Pressure to redirect	[Q24_6 Unwelcome pressure to redirect your work in ways that you did not feel were appropriate]
Instructed not to talk	[Q24_7 Being instructed to talk about, or not to talk about, your work or the work of others in your area in a way that could hide, obscure or mislead about that work]
Budget or contract cuts	[Q24_8 Actual or threatened cuts to budgets or termination or non-renewal of budgets or contracts for reasons not arising from scientific merit]
General other unwelcome behaviour	[Q24_9 Unwelcome behaviour with the intention or effect of making you feel intimidated or harassed]
Sexual harassment	[Q24_5 Unwelcome or inappropriate behaviour of a sexual nature]

Question wording: The next set of questions asks about situations and events in connection with your work. Please indicate which, if any, of the following have occurred to you in connection with your work since 1 January 2015, regardless of whether you were working for a different organization at the time *(multiple responses possible)*

In our sample, some 850 respondents — about two-fifths of our sample — reported having experienced an intimidation event. We do not claim that this represents the incidence of intimidation in the population of scientists as a whole, as the survey method could have encouraged those who had experienced one more than those who had not completed the survey, especially given the high workload of the target audience. However, bearing this bias in mind and the fact that there was nothing in the sampling process to encourage particular types of intimidated scientists to respond differentially, we do treat the sample as being sufficiently representative of *intimidated scientists* and large enough to warrant statistical analysis.

After identifying the main incident that was most serious for them, respondents were asked about the extent, if any, to which they experienced a range of concerns relating to career health and well-being (one of which was stress).

Dependent Variables

Our two main dependent variables were stress and job exit. To measure job exit, the numerator in the labour turnover equation, we asked respondents whether the incident had led to them leaving their jobs. To measure stress, we used an item from a series that assessed respondents' worry and concerns relating to work, personal and mental health aspects following intimidation. The lead question asked, 'To what extent, if any, did the event make you…' and one of the items was 'feel stressed'. Response options comprised a 5-point scale (1=never, 2=rarely, 3=some of the time, 4=often, 5=a lot of the time). In reporting the results in the text below, we treat "often" and "a lot of the time" as a single category. Our analyses were performed in SPSS version 27.

We also considered using more extensive multi-item indexes based on all nine of the items in that series and undertook various tests. However, an extensive recent study by Matthews et al. (2022) found that many single-item indexes performed as well as, or better than, equivalent multi-item indexes and listed 'subjective stress' as a single-item measure that had 'very good validity'. The particular item they tested was a general measure ('Do you find your job stressful?'), whereas we used one referring to a specific incident (did the event make you…feel stressed?). Nonetheless, after undertaking various tests, we opted for our simple single-item index measuring stress over a multi-item alternative due to its ease of understanding, the fact it did not perform any worse in relation to the variables we examined than the main multi-item index we tested, and that in comparisons with one variable (gender), the single-item index actually showed more variation against gender than the multi-item index.

In examining the effects of various intimidation events, we are conscious of the fact that this is a cross-sectional study and so cannot incontrovertibly prove cause and effect over time. Thus, while we can compare such measures as whether respondents who have been intimidated show lower or higher career satisfaction than those who have not been intimidated, we place more reliance on self-reporting of the effects of events on people ('Did the event make you feel…more stressed?' or '…worry about your future career?'). Self-reporting is not without limitations, and we point in the conclusions to ways of addressing this weakness.

Forms and Relationships of Intimidation

Amongst intimidated scientists, the most common form of intimidation was a type of personal intimidation, 'other unwelcome behaviour that was intimidating or harassing'. (Responses to our follow-up questions confirmed that this was mostly

internal intimidation that would be classed as 'personal'.) This was the last option of the nine presented to respondents. Some 46 per cent of intimidated scientists reported this, about 1½ times the next most common form. For 26 per cent, it was the most serious incident (Figure 1). No single form of intimidation dominated this category, but the most common, in order, were 'persistent criticism', 'verbal abuse', 'gossip or false or malicious rumours', 'exclusion from workplace activities', 'ridicule', 'exclusion from other work-related networks', 'offensive messages' and 'sabotage'.

Behind this general 'other unwelcome behaviour' category, the next most common forms of intimidation were, in order, actual or threatened cuts to budgets or contracts, a complaint to someone in the organization, pressure to redirect work, dissemination of adverse information, online abuse, being instructed not to talk about research, property damage, and unwelcome behaviour of a sexual nature.

Figure 1. Forms of Harassment Experienced
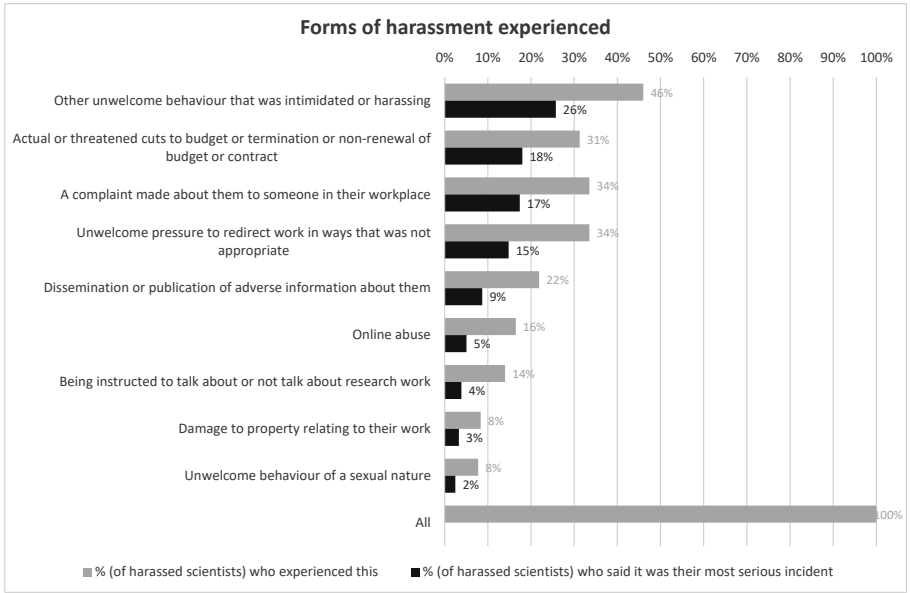
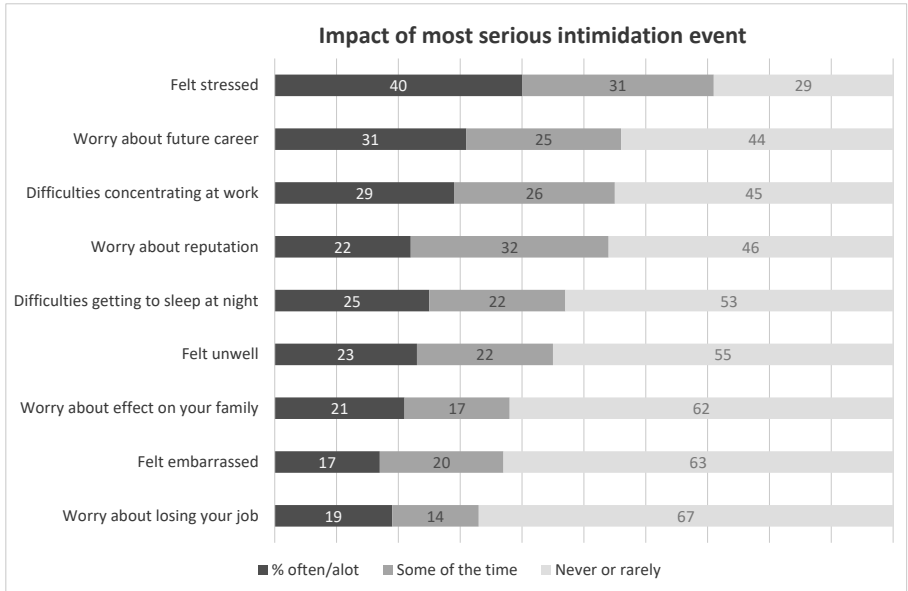
Population: Intimidated scientists

Stress and Other Effects

Amongst scientists who had experienced an incident, over seven-tenths felt some stress as a result of the incident (Figure 2), including four-tenths who stated they were stressed often. Nearly a third had been unable to concentrate at work often, and nearly a half sometimes or often had difficulty getting to sleep. Almost a third

of the scientists were often concerned about their future careers, and a third had some concerns about losing their jobs following the intimidation.

Figure 2. Impact of Most Serious Intimidation Events

Impact of most serious intimidation event

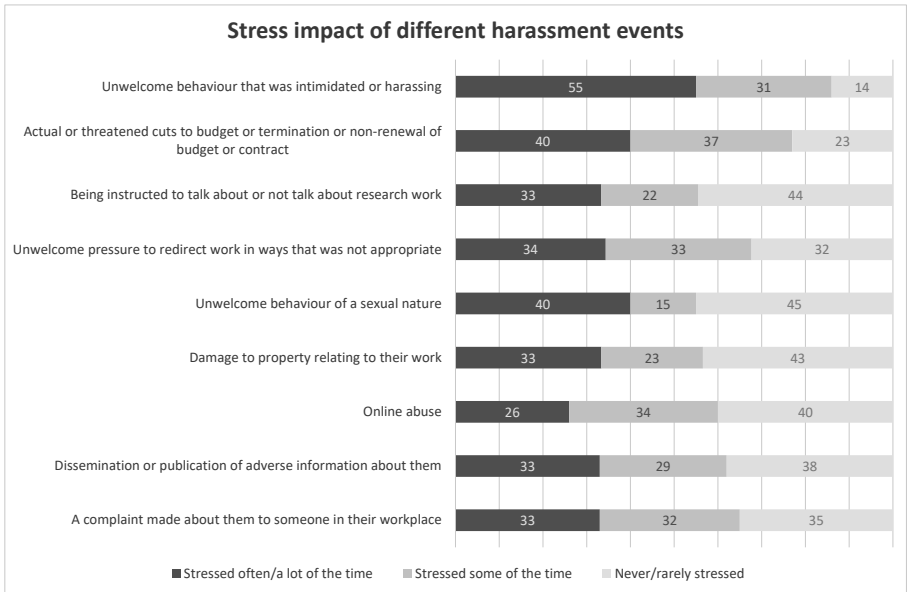|	% often/alot	Some of the time	Never or rarely
Felt stressed	40	31	29
Worry about future career	31	25	44
Difficulties concentrating at work	29	26	45
Worry about reputation	22	32	46
Difficulties getting to sleep at night	25	22	53
Felt unwell	23	22	55
Worry about effect on your family	21	17	62
Felt embarrassed	17	20	63
Worry about losing your job	19	14	67

Population: Intimidated scientists

Consistent with our adaptation of JD-R theory, stress was greater for those who reported that intimidating actions were perpetrated by persons within the workplace than external to their workplace. For example, half of scientists who experienced internal intimidation were stressed often by this experience, compared to a third of scientists whose main incident was motivated by an external perpetrator.

Different events led to different stress responses (Figure 3). On this, the worst event was, again, general 'other' unwelcome behaviour that was intimidating or harassing. Amongst those who nominated this as the most serious event, well over half said that they were often stressed as a result. In total, six-sevenths of people who nominated this said they were sometimes or often stressed by it.

The items with the next most frequent 'often stressed' responses were budget or contract cuts and sexual harassment. Interestingly, sexual harassment also had the least frequent 'sometimes stressed' response and the most common 'not at all stressed' response. The number of such approaches — in terms of our model, its intensity — mattered a lot. If there was only one category of sexual harassment, then stress was lower than if there were more. The impact of online abuse on stress appeared the weakest, at least if it was on its own.

Figure 3. Stress Impact of Different Harassment Events

Stress impact of different harassment events

Event	Stressed often/a lot of the time	Stressed some of the time	Never/rarely stressed
Unwelcome behaviour that was intimidated or harassing	55	31	14
Actual or threatened cuts to budget or termination or non-renewal of budget or contract	40	37	23
Being instructed to talk about or not talk about research work	33	22	44
Unwelcome pressure to redirect work in ways that was not appropriate	34	33	32
Unwelcome behaviour of a sexual nature	40	15	45
Damage to property relating to their work	33	23	43
Online abuse	26	34	40
Dissemination or publication of adverse information about them	33	29	38
A complaint made about them to someone in their workplace	33	32	35

■ Stressed often/a lot of the time　■ Stressed some of the time　Never/rarely stressed

While the form of intimidation mattered, what appeared stronger was the cumulative breadth of it. When a respondent indicated only one form of intimidation, just 26 per cent said they were often stressed as a result of that incident. However, when they recorded two forms of intimidation, 42 per cent said they were often stressed by the most serious incident, and when they recorded three or more forms, 60 per cent said they were often stressed. When we look within the general 'other' category, the proportion often stressed when they experienced one category (say, verbal abuse or ridicule) was 31 per cent, but the proportion often stressed with two categories was 56 per cent, with three or four, it was 65 per cent, while 85 per cent of those unfortunate individuals who recorded five or more categories (n=72) said they were often stressed. Likewise, 48 per cent of people who recorded one category of sexual harassment were often stressed by their most serious incident, but 80 per cent of people who recorded three or more categories of sexual harassment were often stressed. If intimidation was intended to put the targets under stress, then the more forms it took, and hence the more cumulative and reinforcing it was, the more effective it also was.

Sources of Support

Following Organizational Support Theory (Murry et al., 2001; Alrawadieh et al., 2023), the literature tells us that support is important in explaining the targets' experience of, and even exposure to, intimidation. Just over half of the intimidated

scientists in the sample sought some help, or at least spoke to someone, about their most serious incident. Figure 4 tells us from which 'groups' they sought support or spoke with regarding the most serious incident.

The group most commonly consulted was inside the organization: it was the scientist's colleagues, who were consulted by over half intimidated respondents. The two next most commonly consulted groups, though, were both outside the organisation: family and friends. After that came several others within the organisation: the respondents' supervisors, senior management (both being consulted by about a third of intimidated respondents), then the human resource (HR) department (one in five), and another (unspecified) part of the organisation (one in six). The least commonly consulted were two externals: a lawyer and a doctor or a counsellor (about one in eight in each case).

Some 38 per cent consulted or sought support from no one. Less than a third (28 per cent) did nothing (even on their own) following the incident. Only 17 per cent took formal action (that is, reported the incident or made a complaint).

Figure 4. Entities Who Were Told or From Whom Support Was Sought
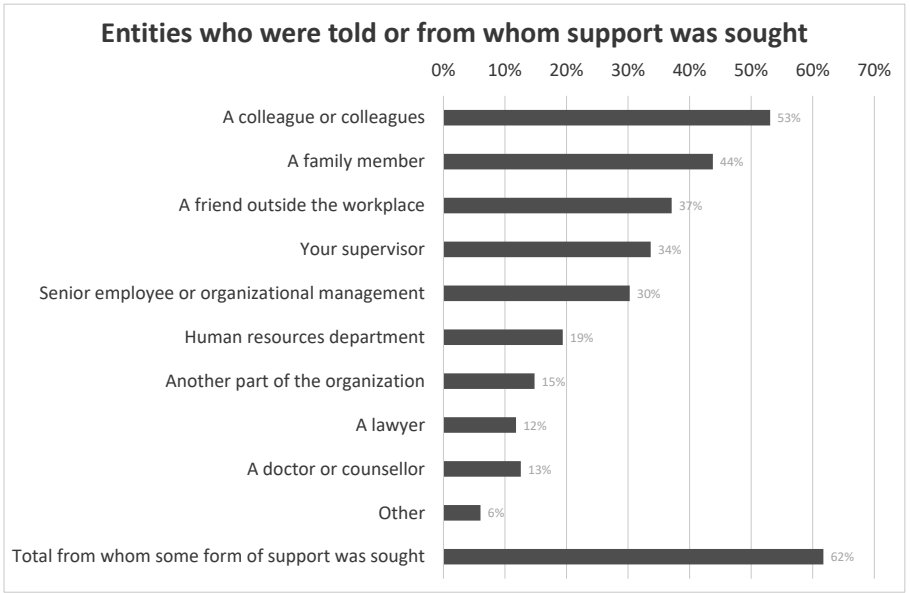
The more stressed a scientist was, the more likely they were to seek support. Amongst those who said that they were never or rarely stressed by the most serious incident, only 48 per cent sought support from anyone, but the proportion who sought support was 58 per cent amongst those who were sometimes stressed and 77 per cent amongst those who were often stressed. Those who were stressed often or a lot tended to reach out to a broader support network (on average, about four

groups or individuals), whereas those who were rarely stressed from their incident reached out to only 1.5 groups on average.

We found that the more stressed (single item) a scientist was, the more likely they sought support from management (54 per cent who were stressed often or a lot of the time sought support from management, compared to 43 per cent who were stressed some of the time and only 29 per cent who were not that stressed at all about the incident). However, among those who sought support from management, the scientists who were highly stressed and worried about job loss were the least satisfied with the support they received. Only 33 per cent were satisfied, with two-thirds stating that management was not supportive, useless or made things worse.

The level of stress was also related to the entity from whom support was sought. Amongst those who sought support from a doctor or counsellor, 77 per cent were often stressed. In addition, 65 per cent of those who sought support from a lawyer were often stressed. So, the two entities sought out disproportionately by the most stressed were two external entities. But these professionals were least commonly sought by anyone. (To put it colloquially, you had to be pretty desperate to talk to a doctor, a counsellor or a lawyer.) Within the organisation, the entity associated with the most stressed scientists was the HR department, but now we start to bump into questions of reverse causality: to what extent was this because people only sought HR out because they were more stressed, and to what extent were they more stressed because they had spoken to HR? Although we cannot answer that definitively, it is plausible that both are true, as the data below suggest.

The Usefulness of Support

We asked about how supportive the various entities intimidated scientists who were consulted. There were very large differences in the efficacy of support from different groups (Figure 5). At the top was a group which was mostly, but not entirely, outside the workplace: a friend (91 per cent were rated as 'supportive' or 'very supportive'), family (88 per cent), doctor or counsellor (80 per cent), colleague (79 per cent), and, somewhat below those, lawyer (64 per cent). In the middle was the respondent's supervisor (50 per cent).

Figure 5: The Source Rated 'Supportive' or 'Very Supportive'
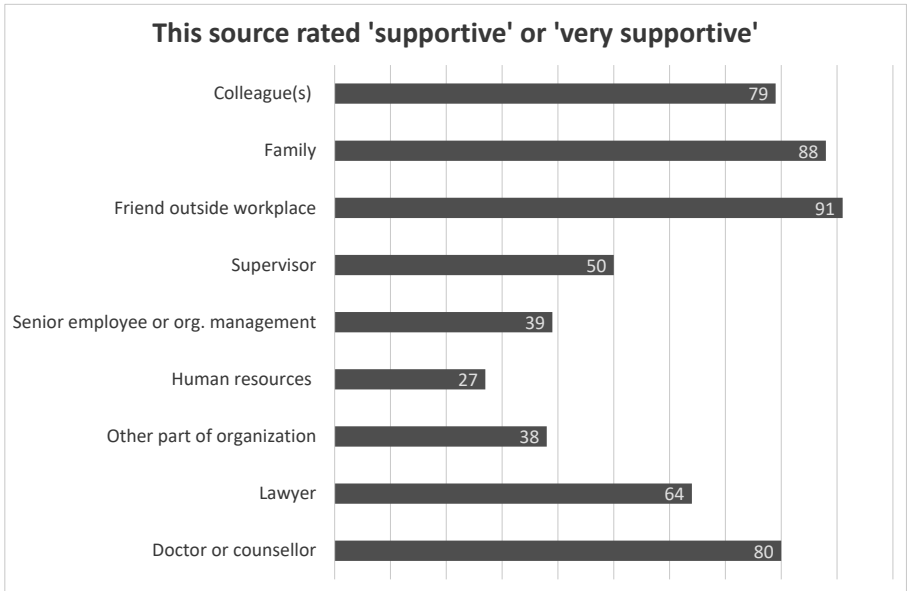
The worst performance was shown by the HR department (something also noted elsewhere, e.g. Gutek & Koss (1993)). Only 27 per cent of those who consulted them found them supportive. We add that 39 per cent found HR 'useless' and 19 per cent said they 'actively made things worse'. This was almost twice as many as the next-ranked entity for 'actively made things worse', which was the respondent's supervisor (10 per cent), followed by senior management (8 per cent).

The more complex the intimidation, the worse the performance by HR. When respondents recorded only one form of intimidation, 40 per cent rated HR as supportive concerning the most serious incident, 40 per cent as useless, and 7 per cent said it actively made things worse. However, when respondents recorded three or more forms of intimidation, a mere 21 per cent found HR supportive concerning the most serious incident, 41 per cent useless, and 32 per cent said it actively made things worse.

Aside from HR, the two other worst performers in terms of the proportion rated 'supportive' or 'very supportive' were another part of the organisation (38 per cent) and senior management (39 per cent). The latter, however, were consulted twice as often as the former (Figure 4), so the poor performance of senior management was much more important than the poor performance of other parts of the organisation.

Like with HR, the more complex things were, the less helpful senior management was. When respondents recorded only one form of intimidation, 51 per cent rated

senior management as supportive, 29 per cent as useless, and 7 per cent said it actively made things worse. However, when respondents recorded three or more forms of intimidation, a mere 11 per cent found senior management supportive, 28 per cent useless, and 30 per cent said it actively made things worse.

Broadly speaking, we found three clusters of support sources. One group comprised entities who were not consulted often and who did not perform well when their support was sought. These were all entities that had a formal role within the organisation: senior management, HR, and 'other' parts of the organisation. A second group comprised entities who were consulted often after intimidation occurred and whose support was mostly considered very positively. These were mostly external entities with 'informal' roles: friends, family and colleagues. While colleagues were normally employed by the organisation, they had no presumed formal role in terms of the management of intimidation, and targeted scientists would presumably choose to consult those whom they considered their closest friends within the organisation. The third cluster comprised those entities that were demonstrably outside the organisation but had a formal role: lawyers, doctors, and counsellors. They were consulted relatively infrequently and by those often most stressed but were nonetheless generally given high ratings for supportiveness.

One group, supervisors, sat in a unique intermediate position, both in terms of the frequency with which they were consulted (more often than other formal parts of the organisation, but less than informal external or collegial sources of support) and the quality of support they were seen to offer (better than the rest of the organisation, and again less supportive than informal external or collegial sources of support).

The Effectiveness of Support and the Relationship to Stress and Quits

How much did it matter whether an entity was supportive or not? And did it matter whether they were internal or external to the organisation?
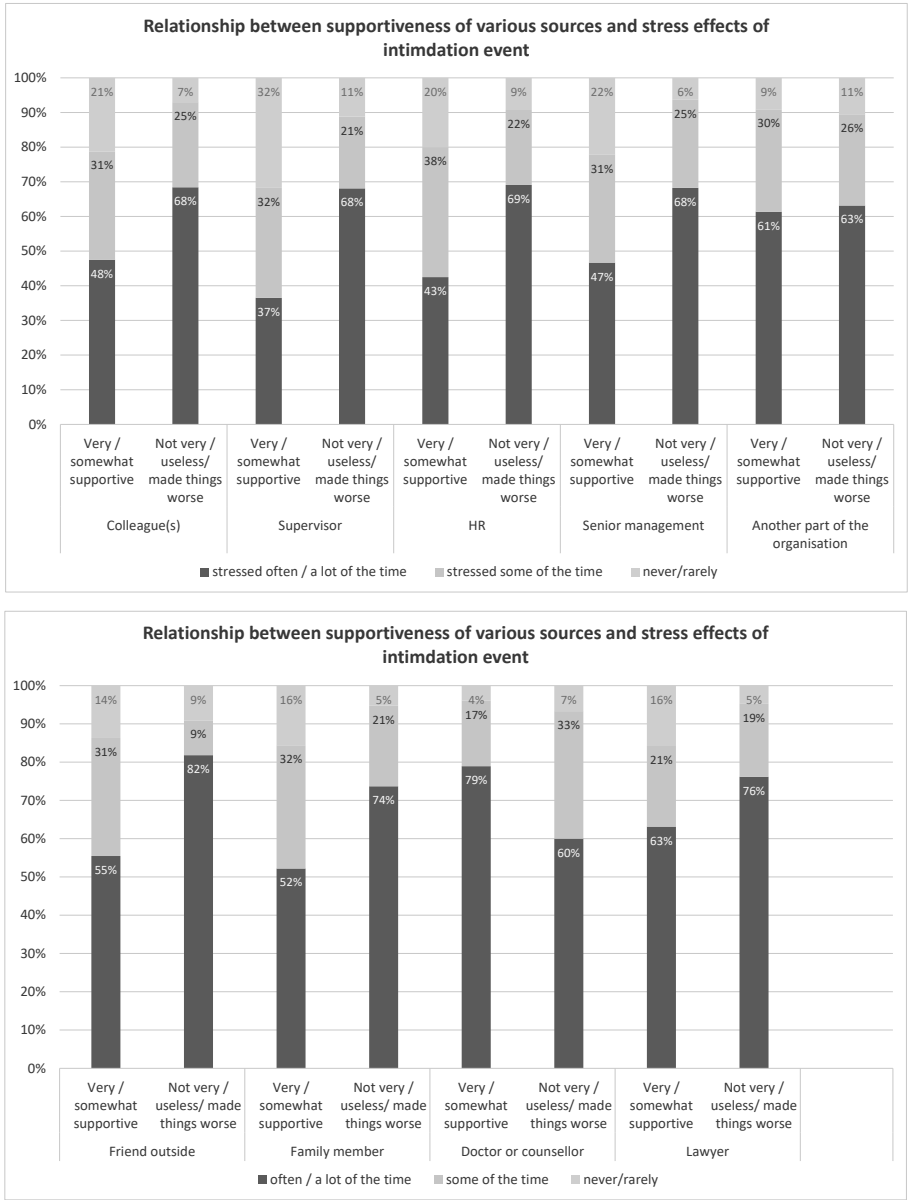
Support and Stress

There were several entities whose support made a real difference to the stress experienced by intimidated scientists (Figure 6). If senior management was supportive, just 47 per cent of intimidated scientists were often stressed. But if senior management was unsupportive ('not very supportive', 'useless' or 'actively made things worse'), some 68 per cent of intimidated scientists were stressed, a difference of 20 percentage points. Broadly similar effects were apparent for most of the other frequently consulted groups: a 22-percentage point difference for support from family members, a 20-percentage point difference for colleagues, a 26-percentage point difference for HR, a 27-percentage point difference for external friends, and a substantial 31 percentage point difference for the scientist's supervisor. For the

remaining support groups, who were the least frequently consulted, the differences were smaller.

For the more commonly consulted support groups — the ones that mattered — greater support meant less stress. The most important finding was that regarding senior management, as senior management was frequently consulted but infrequently supportive. HR had a bigger impact on those who consulted it, and it performed much worse than senior management, but fewer consulted HR than consulted senior management, so its poor performance was not as important as senior management's.

What helped intimidated scientists' stress levels more, though, was that they often consulted external supports like family and friends. Those groups were normally very supportive, and support from those groups was linked to a substantial difference in the stress those scientists experienced. Similarly, within the organisation, scientists' colleagues were most frequently consulted; they were normally supportive, and their support was associated with lower stress among targets.

Figure 6. Relationship Between Supportiveness of Various Sources and Stress Effects of Intimidation Events
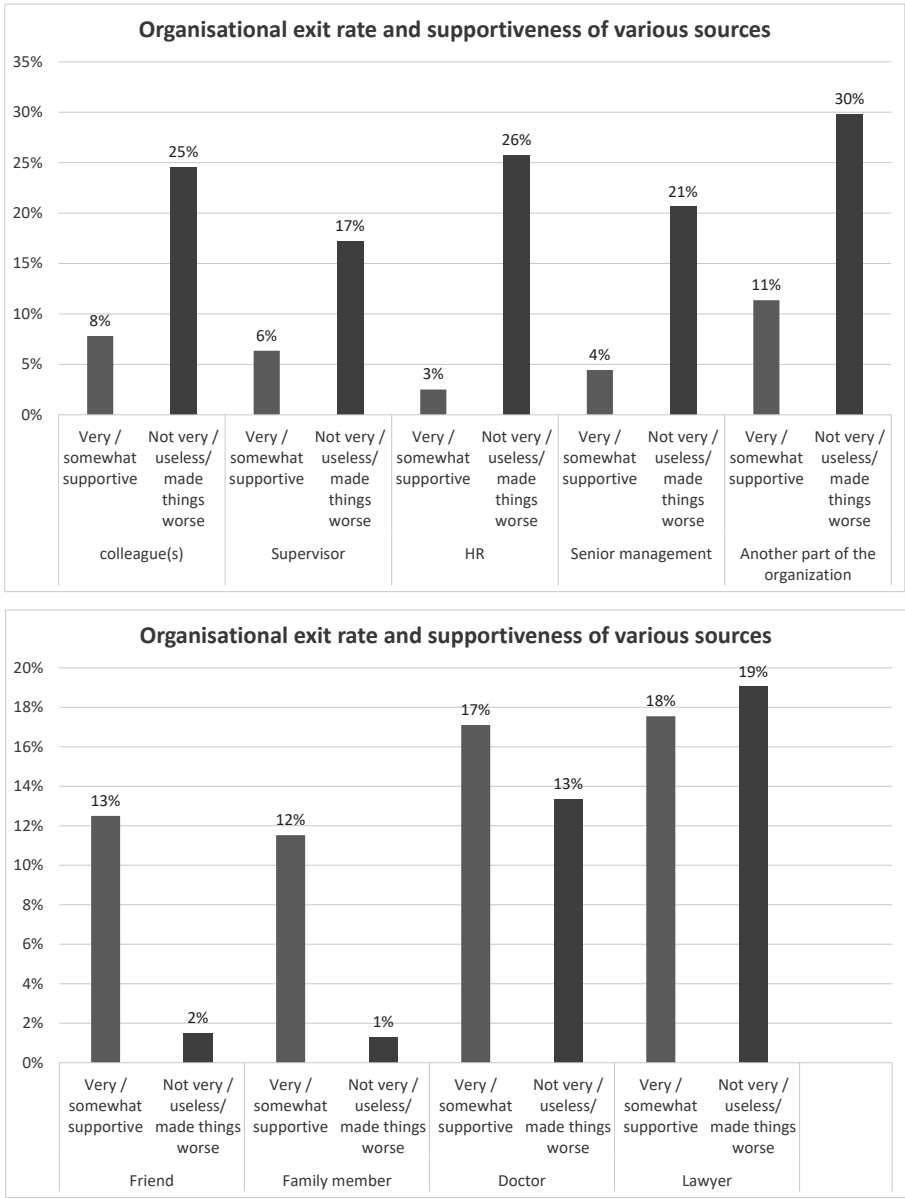
Support and Quits

Did the same patterns exist between support and quits? It would be reasonable to expect one, as there was a strong relationship between stress and quitting. Only 4 per cent of intimidated scientists who rarely or never felt stress as a result of their most serious incident quit their job because of it. Yet 18 per cent of intimidated scientists who often felt stress did quit.

Some of the relationships we saw previously with stress also applied to quits. The quit rate was 8 per cent among those who experienced one form of intimidation, 10 per cent among those who experienced two and 15 per cent among those who experienced three. However, the relationship with forms of intimidation was a bit different. Quits were highest, not amongst those who experienced personal intimidation, but amongst those who experienced some forms of organisational intimidation: instructions not to talk (20 per cent), budget or contract cuts (18 per cent) and pressure to redirect (16 per cent) all had higher quit rates than sexual harassment (11 per cent) and general other unwelcome behaviour (14 per cent).

Figure 7 replicates Figure 6 but with the exit rate in place of stress. We can see the major effects of support on quit rates. Support from senior management, HR, the supervisor, another part of the organization and colleagues all have a substantial lowering effect on the quit rate, cutting it by between 62 per cent (another part of the organization) and 90 per cent (HR). Indeed, the effect of support from within the organisation on the quit rate is greater than the impact on stress.

Moreover, the effect of managerial support appears considerably greater than the impact of stress. If management was supportive (N=90), the exit rate was at 4-5 per cent regardless of whether stress was frequent or not. If management was unsupportive (that is, 'not very supportive', 'useless' or 'actively made things worse') (N=126), the exit rate was 18 to 22 per cent, depending on whether stress was frequent or not. If these key functions of senior management and HR are failing scientists, then that is a key resource that they are unable to access in the face of the demands placed on them by intimidation events.

Figure 7. Organisational Exit Rate and Supportiveness of Various Sources

Organisational exit rate and supportiveness of various sources

(Bar chart data: colleague(s): Very / somewhat supportive 8%, Not very / useless / made things worse 25%; Supervisor: Very / somewhat supportive 6%, Not very / useless / made things worse 17%; HR: Very / somewhat supportive 3%, Not very / useless / made things worse 26%; Senior management: Very / somewhat supportive 4%, Not very / useless / made things worse 21%; Another part of the organization: Very / somewhat supportive 11%, Not very / useless / made things worse 30%)

Organisational exit rate and supportiveness of various sources

(Bar chart data: Friend: Very / somewhat supportive 13%, Not very / useless / made things worse 2%; Family member: Very / somewhat supportive 12%, Not very / useless / made things worse 1%; Doctor: Very / somewhat supportive 17%, Not very / useless / made things worse 13%; Lawyer: Very / somewhat supportive 18%, Not very / useless / made things worse 19%)

But it is a very different story for external sources of support. If the intimidated scientist has a supportive friend, their probability of quitting is 7 times *greater* than if the friend is not supportive. If a family member is supportive, they are 8 times

more likely to leave. If a doctor or counsellor is supportive, they are 28 per cent more likely to leave. Only if the lawyer is supportive are they less likely to leave, and that is by a tiny (and non-significant) 8 per cent.

To an intimidated scientist, support from external colleagues, friends or family tells them that they are right and that the grass is indeed greener on the outside. Realising that there is a viable alternative to staying in a negative environment reduces their stress and increases their incentive to leave. Support from outside the organisation might be a resource intimidated scientists can draw upon, but the mere fact of it alerting them to the existence of a viable alternative seems pretty important.

The incentive is even stronger when the intimidated scientist faces unsupportive management but a supportive outside network. Amongst scientists who reported both a very supportive external friend and unsupportive senior management (N=56), the exit rate was as high as 30 per cent. With a very supportive friend and an unsupportive HR (N=37), the exit rate was 38 per cent.

Discussion

The findings of this study provide important insights into the complex power dynamics of intimidation and harassment experienced by scientists and how various theoretical perspectives can help explain the actions of employees and managers. We found that common forms of intimidation could be personal harassment or internal or external organisational intimidation. Experiencing intimidation led to significant stress for the affected scientists. Responses of the people affected targeted range from defiance to ignoring – or retreat, which might include states of fear or silence and stress. Those who experienced intimidation "often" or "a lot of the time" reported higher levels of stress. Intimidated scientists sought support from various sources, including colleagues, supervisors, and management. However, the support they received was not always seen as useful in mitigating the negative impacts of the intimidation. The study found that the source of support mattered – support from supervisors and management was more effective at reducing stress and preventing job quits compared to support from colleagues or other sources. We explained how various theoretical frameworks can help explain the dynamics of intimidation, stress, and job quits among scientists. These explanations provide pathways for management action and insights for those affected.

Second, when scientists are intimidated, they may seek support from both internal and external sources. They commonly speak to friends, family and colleagues, as well as to their supervisor. For intimidated scientists, the most supportive groups they consulted were often outsiders: families and friends. Colleagues were also seen as supporters. Senior management was not.

These findings align well with social capital theory in explaining the importance of social connections and social relations for support (Mueller et al., 2001; Chamberlain et al., 2008). However, the type of social capital matters. If there is an increased risk of workplace bullying when organisations fail at developing social capital (Pihl et al., 2017), social support from outside the organisation may compensate for that yet draw people away.

Third, the findings on stress and quits can be explained in the context of organisational support theory and our adaptation of the JD-R model (D'Cruz & Noronha, 2011) Bakker & Demerouti, 2007). Support from within the organisation, particularly from senior management, played a critical role in mitigating the negative impacts of intimidation on scientists. However, lack of support from these internal sources was associated with higher levels of stress and increased likelihood of job quits among the affected scientists. On a substantial minority of occasions, victims sought support from HR or other parts of the organisation to little avail. This underscores the importance of organisations providing adequate upper management support and resources to help scientists cope with intimidation – particularly in light of HR not being much use to victims. Different forms of intimidation affect stress and quits in different ways, but the more a scientist experiences these incidents, the greater the stress effect and the greater the quit effect. While stress itself increased quits, support was much more important. If management was supportive and intimidated, scientists would mostly stay in their jobs. If management was unsupportive, a much higher proportion of them would leave. These findings highlight the critical role of organisational support from senior management and HR in mitigating the negative impacts of intimidation and reinforce the responsibility of scientific institutions to create and maintain a supportive institutional environment.

Good support empowers individual scientists within the organisation, reduces stress and subsequently reduces quits. However, external support works very differently. This reduces stress and increases quits, presumably because it shows the benefits to scientists of leaving the organisation. If a scientist's friends and family are supportive and senior management is unsupportive, the temptation to leave becomes immense. The failure of internal management support is reinforced by the paradox of external support that reduces stress but increases the likelihood of exit. If internal support increases the power of intimidated scientists to mobilise resources within the organisation in their favour, external support increases the external resources that can draw them to leave.

We can say that the old saying rings true in this data: 'HR is not your friend'. HR was the least supportive of all the groups that intimidated scientists turned to and often made things worse rather than better for them. The only positive thing that could be said about senior management in this regard is that they were not HR and were, therefore, better than HR in providing support. Senior managers behave as if they have no idea how to provide support and fail to provide direction to HR on

how they should support their scientific workers. Until they do, these organisations will encounter increasing difficulties with a distressed and departing workforce.

This is happening in the context of the management of universities and other research organisations failing in their duties to reduce the incidence or effects of harassment and intimidation. We agree with the argument that the neoliberal reforms serve to restrict the ability of individual academics to maintain the traditional public good mission of universities and erode the traditional values of academic freedom and independence (Hil and Lyons, 2017).

Conclusion

Overall, the findings support our adaptation of the JD-R theory, implying that there are five factors that determine the relationship between intimidation and adverse outcomes for the scientists themselves. Two concern the intimidation itself (the 'job demand'): the intensity of the intimidation; and the source (internal or external). Of those, the intensity of intimidation appeared more important than the form of it. More intense intimidation led to more stress.

Two other factors concern the support (the 'job resource'): how beneficial it is perceived to be (a variant of the 'intensity' concept) and the source (internal or external). When those from whom the intimidated scientists sought support actually gave good support, stress was lower. This occurred regardless of whether the source of support was internal or external, though the size of the effect varied.

However, when looking at exits, the pattern was more complex. If internal sources were highly supportive, exit rates were low. However, if external sources were highly supportive, exit rates would be higher. So, the outcome variable itself mattered; it was the fifth factor influencing outcomes. Stress is a largely involuntary outcome of a difficult situation. Leaving an organisation is a discretionary act, and if external sources are offering support that internal sources are not, then it makes sense for many intimidated scientists to leave.

Future research on the analysis of intimidation could make use of longitudinal techniques to overcome the limitations of the cross-sectional used here. Research on the policy side could consider how organisations could do better in creating an environment less likely to promote intimidation, better able to support scientists who experience intimidation, and crucially with better equipped and trained supervisors capable of effectively dealing with these problems when they are not the source of them themselves. Just as HR is not the scientists' friend, neither is their supervisor likely to be, but they at least know the person, have some sort of personal relationship with them, and have some level of power within the organisation. Can they be equipped to represent the scientist's interests to senior management rather than represent senior management's interests to the scientist?

Meanwhile, the implications of this research are profound. What organisations do about the intimidation of scientists is crucial, and clearly, many are not doing enough. It is reasonable to conclude that significant numbers of researchers experience intimidation, in many cases as pressure to redirect their research or reduce their efforts to communicate findings. In an era where scientific research is often the basis of public policy, we should be concerned about the extent of intimidation of scientists and the consequences of less informed policy choices. Further research on this problem could usefully include a more detailed exploration of the impacts of intimidation in areas of science critical to current policy debates, such as climate research and studies of alternative responses to pandemics. While some populist politicians have accused scientists of exaggerating the risks of climate change, this research shows it is much more likely that intimidation has led to scientists being reluctant to speak out or even to abandon science entirely.

Acknowledgement

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APPENDIX A:
SINGLE-ITEM MEASURES VERSUS A MULTI-ITEM INDEX MEASURING STRESS

Our two main dependent variables are stress and job exit. Job exit, the numerator in the labour turnover equation, was simple to measure: we asked respondents whether the incident had led to them leaving their jobs.

Stress was more complex, and we faced a choice of using a single-item measure specifically framed in terms of stress or a multi-item index. To assess the negative personal effects of the most serious incident, scientists were asked nine questions

that assessed their worry and concerns relating to work, personal and mental health aspects following intimidation. The leader question asked, 'To what extent, if any, did the event make you': 'worry about your reputation', 'worry about your future career', 'worry about losing your job', 'worry about the effect on your family', 'have difficulty concentrating at work', 'have difficulty sleeping at night', 'feel stressed', 'feel unwell', 'feel embarrassed'. The response options for each item comprised a 5-point scale (1=never, 2=rarely, 3=some of the time, 4=often, 5=a lot of the time). Our analyses were performed in SPSS version 27. A preliminary analysis using the original scoring (1 to 5) showed the nine items were all significantly correlated (table A1). Feeling stressed was more closely correlated with concentration, sleep, and unwell (r=.75,.75,.72 respectively), as is typical of stress instruments. By contrast, the stress item with the worry about future career or job loss items were not as strongly correlated (.58,.49) but correlated higher together (.67), as might be expected, but also suggesting distinct aspects across the 9 items.

Table A1. Correlations Between Single Item Stress and Worry Items

	Mean	1	2	3	4	5	6	7	8
1. Worry about reputation	2.54								
2. Worry about future career	2.69	.60							
3. Worry about losing your job	2.09	.49	.67						
4. Effect on family	2.22	.46	.60	.67					
5. Difficulty concentrating	2.67	.55	.59	.51	.57				
6. Difficulty sleeping	2.44	.51	.54	.53	.58	.78			
7. Feeling embarrassed	2.17	.54	.43	.37	.40	.54	.53		
8. Feeling stressed	3.15	.51	.58	.49	.55	.76	.75	.54	
9. Feeling unwell	2.40	.48	.55	.47	.56	.70	.71	.56	.72

To capture the variance of the stress and worry items into a smaller set of variables, a principal component analysis (PCA), an exploratory technique, was used to examine the structure of these items. Our criteria to assess the suitability of the nine items for PCA were reached: the sample size to item ratio was high (720 responses for nine items). Skew and kurtosis did not exceed.20 for any of the items. A KMO measuring sampling adequacy was high (.915), and Bartlett's test of sphericity suggested the correlation matrix was appropriate for analysis (chi-square = 4371.99, p=.000). An oblimin rotation due to correlation between items and along with a graphical scree test the output suggested two factors explaining 71 per cent of the variance in total. For the first factor, which we called 'psychological injury' (62.1 per cent), items were feeling embarrassed, stressed, unwell, difficulty concentrating, difficulty sleeping, feeling embarrassed and worry about reputation (loadings.874,.841,.831,.800,.792, 562, respectively). The second factor, which we named 'vulnerability', explained that 9.7% of the items were worrying about job loss, the effect on family, and worry about future careers with loadings.968,.770,.737, respectively.

However, face validity for a multi-item index is difficult to interpret. A lot of the details contained in the components get lost. A single-item construct is easy to understand as its meaning is self-explanatory; the weakness with a single-item measure arises in people's tendency to answer questions erratically. One hopes that, with a multi-item index, that erraticism will wash out.

So, we compared the analytic usefulness of the multi-item index ('psychological injury') with the single-item measure ('stress'), which at heart are meant to measure the same thing. They showed similar patterns across relationships with several other variables that we looked at. However, we found that the single-item index was more powerful for undertaking gender comparisons. We wanted to see if either could detect gender differences in the effects of certain intimidation events on stress/psychological injury. So, we used a t-test to compare the average gender difference in scores on the 5-point scale of the single-item stress measure and on the 30-point scale of the multi-item index for each of the nine main types of intimidation events. At the conventional 5 per cent level of significance, the single-item stress index showed gender differences (women being more affected than men) in the impact of online abuse and being instructed not to talk. The multi-item index did not detect these differences. At the 10 per cent level, the single-item index also detected a gender difference in the effect of property damage, which the multi-item index did not. For six of the nine forms of intimidation, the t-score on the single-item index was higher than that on the multi-item index. In light of this, and in the absence of contrary results with other variables suggesting significantly better performance for the multi-item index, we use the easier-to-understand, single-item measure of stress throughout the rest of this paper.