

## Are We Ignoring a Serious, Preventable Occupational Health Risk Among Life Scientists in Academia?<sup>1</sup>

Malcolm L. McCallum<sup>2</sup>

**Abstract:** Academic burnout is an occupational health syndrome with both psychological and physiological symptoms. It manifests as a debilitating and sometimes life-threatening condition when the extremely educated are under excessive social and occupational stress. Recent studies demonstrate that societal and economic changes have induced metamorphosis of the professoriate from a low-stress to a high-stress occupation. Our knowledge about the nature and incidence of burnout among professors in the United States comes largely from studies confined to specific institutions, medical schools, and research universities. Publication is probably the most obvious and obtainable signal of reduced research productivity, and it is closely connected with academic burnout. I shed light on the potential incidence of academic burnout in university faculty by examining the productivity of 612 tenured life science faculty members from non-doctoral granting departments at 76 regional state universities and liberal arts colleges distributed among 13 randomly selected states. Anything claimed to be a publication on a faculty member's CV or webpage, or via a Google Scholar query was accepted. This definition inflated publication counts making unpublished faculty more difficult to identify. Despite this, about 37% of tenured faculty went unpublished from 2008 - 2012. State jurisdictions averaged from 19% to 52% of faculty without publications. Departments awarding masters degrees had more published faculty than non-masters awarding departments. The large numbers of unpublished faculty during this five-year window constitutes a smoking gun suggesting that academic burnout (a.k.a., adrenal exhaustion) may be a widespread problem in American regional state universities and public liberal arts colleges. However, supporting psychological and physiological tests are needed to rule out or support definitively the role of academic burnout in the revealed publication patterns of faculty at these mid-tier schools. Institutions with low faculty publication rates should screen faculty to evaluate the degree to which burnout is present, regardless of teaching load. These results beg to question if immediate need exists for strategic implementation of college-wide, self-help programs to reduce the occurrence of stress-related disorders like academic burnout which may threaten the stature of American higher education.

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<sup>2</sup> Department of Environmental Studies, University of Illinois at Springfield, Springfield, Illinois 62703 USA. E-mail: [malcolm.mccallum.tamut@gmail.com](mailto:malcolm.mccallum.tamut@gmail.com) . Current address: School of Agriculture and Applied Sciences, Langston University, Langston, Oklahoma 73050 USA.

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*“She burnt with love, as straw with the fire flameth. She burnt out love, as soon as straw outburneth” - The Passionate Pilgrim (Shakespeare 1599).*

### Introduction

According to the National Institute of Environmental Health Sciences (NIEHS 2013), occupational health refers to the “identification and control of the risks arising from physical, chemical, and other workplace hazards to establish and maintain a safe and healthy working environment.” Essentially, occupational health asks, “how does one’s work activity affect their quality of life?” (Viscusi 1979). Karl Marx (1867) considered these hazards to be an integral part of the exploitation of labor; whereas Smith (1863) considered these conditions competitive market outcomes leading to increased compensation for workers (Viscusi 1979) that today we term hazard pay. However, modern consideration of occupational hazards focuses on management and elimination of their impacts to provide a healthy work environment (Harms-Ringdahl 2004). Even the earliest studies of occupational health note as problems workers’ ignorance of hazards, and inadequate insurance compensation for injuries (Engels 1845).

*Work hazards and stress in academia.* Academia is traditionally thought of as a low stress occupation (Fisher 1994), and this perception continues to be spread by the popular media (e.g., Adams 2013, Kim 2013), including the life sciences (Kay 2012). However, expansion of faculty roles, expectation to incorporate new educational technologies into classes, pressure to engage and be universally available for students, colleagues and the surrounding communities, mandates to search out funding, requirements to teach an increasingly diverse (in preparation and potential) body of students (Gappa et al. 2007), combined with reduction of tenure-track positions, a growing army of low-paid, temporary, adjunct faculty members with no or minimal benefits (Anonymous 2010; Wilhelm 2013, Lengermann and Niebrugge 2015), and the addition of responsibilities for most college governance and service at many institutions, imparts undue stress (Wimsatt et al. 2009). University faculty require significant open time to develop and revise high-quality courses (Palmer and Cho 2012, Graber et al. 2012, Stiff-Williams 2010), learn new technology (Howard et al. 2011, McAndrew and Johnston 2012, Freeman 2012), perform scholarly research (Rowe and Okell 2009, Sorinola and Thistlethwaite 2013), and evaluate emerging ideas (Zimpher 1974, Hardy 1991, Holt and Anderson 2012), all of which directly influence the quality of the courses they teach and contribute to an individual’s creativity (Sternberg 2006). During the last decade, these new responsibilities have lengthened the work week sufficiently that the percentage of faculty members who work > 55 hr/wk skyrocketed from 13% in 1972 to 47% in 2003 (U. S. Department of Education 2004). Most still lack enough time

to remain current in their fields (Bayer 1973, U. S. Department of Education 2004). In fact, higher education employees in the United Kingdom are dissatisfied with their jobs/careers (Edwards et al. 2009). Generally, excess hours of work translate to declining health, increased stress, fatigue and work-family interference (Sparks 1997, Golden and Wiens-Tuers 2006, Fontinha et al. 2017). Despite the transformation of a non-research university into a high-stress, heavy workload workplace, declining performance of a professor lead to labeling him/her as lazy, incompetent, or selfish, rather than over-worked (personal observation). In twenty years of employment in higher education, I have never observed one mention, warning, or piece of advice for faculty members to manage stressors to avoid burnout. Even the AAUP (2006a) seems ignorant of the syndrome when it states, "...incentives, monetary rewards or penalties, promotion, and grant reviews are sufficient to encourage accommodation to institutional standards and professional values." Not once in their response on post-tenure review (AAUP 2006a), statement on academic freedom and tenure (AAUP 2006b), outline of procedural standards in faculty dismissal proceedings (AAUP 2006c), or recommended institutional regulations on academic freedom and tenure (AAUP 2006d) is burnout or stress mentioned, nor do they anywhere in these documents recommend faculty members be monitored or screened for symptoms of burnout during these procedures or at any other time. In fact, most in academia are unaware that burnout is a serious debilitating, life-threatening condition (Bornstein 2009, Melamed et al. 2006a) resulting from significant occupational hazards leading to adrenal dysfunction and for which there is no insurance coverage or workers compensation; despite its identification long ago by Engels (1863, see also Viscusi 1979).

The hazards in the academic environment for which life scientists are probably most familiar are those in the laboratory (DiBerardinis 2013) and in the field (Gentile et al. 1992, Leemon and Schimelpfenig 2003) settings, including chemical (Robinson and Sorensen 1980, Axelsson et al. 1984), radiation (Beckhoff et al. 2007), and pathogen exposure (Dominici et al. 2001, Collins 1988), sharp instruments (Weltman et al. 1995, Smith and Leggat 2005), animal attacks (Langley and Hunter 2001), student aggression (McKinney 1990, Morrissette 2001, Bray and Favero 2004), susceptibility to criminal activity in remote field sites/natural areas (Pendleton 1996, Smith 2012), and violent protesters (Jasper and Poulsen 1993, Monaghan 1997, Leader and Probst 2003). However, faculty members face many other less-obvious occupational stressors (Winefield et al. 2003; Michailidis 2008; Gillespie et al. 2001) that can lead to significant occupational stress-loads.

Early studies suggested the top three potential occupational stressors for university faculty members were high self-expectations, excessive time constraints, and inadequate resources (Clark 1974, Gmelch et al. 1983). Other previously identified stressors included self-doubt (Shull 1972, Hunter et al. 1980), general absence of clear and standardized guidelines for judging faculty

performance, and inadequate or lacking reward structures (Wilke 1983). More recent studies (Leung et al. 2000, Gillespie et al. 2001) added financial inadequacy, perceived organizational practices, home-work conflicts/interface, work overload, poor management practices, and job insecurity as important stressors. Financial inadequacy, recognition, and perceived organizational practices were the best predictors of job satisfaction, and perceived organizational practices and home-work conflicts were the best predictors of psychological distress; whereas, locus of control had a moderating effect on the stressor-strain relationship (Leung et al. 2000). The sum of these occupational stressors can lead to negative emotional states such as depression, frustration, anxiety, and worry (Kyriaco 2001, Gmelch et al. 1986).

There is evidence that occupational stress levels of university faculty have risen dramatically in recent years (Winefield et al. 2003, Gillespie et al. 2001), especially in respect to increased administrative responsibilities and pressure to publish (Tijdink et al. 2013), and to obtain external funds (Gumport 1997, Santos 2007, Wimsatt et al. 2009). These stress-loads can culminate as burnout (Sullivan and Bhagat 1992, Taris et al. 2010), which is highly correlated with large teaching loads and classroom size, excessive multiple demands on limited time, and near total reliance on numerical student evaluations (Bauer et al. 2006, Lackritz 2004).

*Burnout and stress.* Burnout is traditionally defined as a three-dimensional syndrome characterized by excessive exhaustion, cynicism, and poor professional efficacy (Taris et al. 2010); or a chronic state of extreme psychophysical and emotional exhaustion (Pšeničy 2006). Although burnout is strongly correlated with (Toker and Biron 2012, Dyrbye et al. 2006) and traditionally believed to lead to (de Jesus and Santos 2006) depression, recent evidence suggests burnout is a much different disorder (Pšeničy 2006, Pranjić et al. 2012, Toker and Biron 2012), with similar physiological groundings to chronic fatigue syndrome (van Houdenhove et al. 2009, Tomas et al. 2017). It develops gradually under prolonged, long-term exposure to occupational stressors (Toker and Biron 2012) and depends on the quality of the social environment at work (Schaufeli and Enzmann 1998). This differs from major depression, which is a multisystem disorder with affective, cognitive and physiological manifestations (Insel and Charney 2003, Lebowitz et al. 1997) not directly related to working conditions (Toker and Biron 2012). The similarities between depression and burnout make them difficult to discern, sometimes leading to improper treatment (Toker and Biron 2012, Pšeničy 2006).

Burnout progresses through three stages: (1) exhaustion, (2) captivity, and (3) adrenal burnout syndrome (Pšeničy 2006). This final stage leads to a functional blockade of the hypothalamic-pituitary-adrenal axis, which causes secondary cortisol insufficiency (Pšeničy 2006) and elevated salivary cortisol levels (Melamed et al. 1999). This final stage of adrenal insufficiency is a life-threatening condition (Bornstein 2009). Burnout increases risk for respiratory

and gastrointestinal illnesses (Felton 1998), heart disease (Toker et al. 2012), and other cardiovascular diseases (Melamed et al. 2006a), headaches (Felton 1998), type II diabetes (Melamed et al. 2006b), muscle pain (Felton 1998), and premature mortality (Ahola et al. 2010). Also, burnout sometimes leads to physical and behavioral changes, and even chemical abuse (Felton 1998, Sarmiento et al. 2004). Burnout in workers is costly because it manifests in decreased worker effectiveness and productivity (Pines and Maslach 1978, Sarmiento et al. 2004) including such symptoms as depersonalization of people served, disillusionment with work, increased frequency of mistakes, impaired ability to concentrate, increased tardiness and absenteeism, lack of motivation, increased frustration, and disinterest in the outcomes and quality of their work (Felton 1998). Stress cost US employers an estimated annual \$150 billion dollars in 1996 (Cooper et al. 1996).

*The professoriate compared to other high-stress professions.* Faculty positions in the life sciences at regional state universities and public liberal arts colleges share many characteristics in common with occupations that have high susceptibility to burnout. As an employee in an occupation that deals with the public and/or special populations they are at distinct risk of burnout (Felton 1998). Further, their position involves extreme responsibility, potentially hazardous conditions (particularly in field or laboratory settings), precision work and considerable concentration, severe consequences, shift work (see below), all of which are known to raise an employee's risk of burnout (Felton 1998). The quantitative demands of faculty positions are in line with high-risk professions because the workload often exceeds the available time leading to bringing work home or working long hours (Maslach et al. 2001). Grant deadlines, institutional deadlines, and sudden unpredictable deadlines are classic examples of stimuli that could lead to burnout (Maslach et al. 2001). Finally, the constant budget cuts regularly reduce available resources necessary for performance (Hons 2006).

The earliest mention of burnout in the context of occupational health targeted probation officers working with juvenile delinquents (Bradley 1969), but it was first identified as a syndrome only five years later in a study of volunteers at a drug addiction clinic in New York (Freudenberger 1974). The classic recent example and most researched area of employment in this regard is the health care profession (e.g., physicians, nurses, social workers); however, university life sciences faculty members also exemplify Felton's (1998) characteristics of employees susceptible to burnout (Lackritz 2004). Like health professionals, university faculty members work regularly with the public and special populations (Bleske-Rechek et al. 2004). Where health professionals must work with patients and patients' families, educators work closely with students and often interact with students' families and friends (Moore 2001, Chickering et al. 1987), all of whom can be equally as demanding and difficult. Healthcare workers and college educators rarely receive compliments or thanks

(Lackritz 2004), and when they do it is often overwhelmed by counter opinions. Further, where health care workers increasingly are concerned with malpractice suits, faculty members must deal with nuisance accusations of sexual harassment (Patai 2000, Biaggio and Brownell 1996, Robertson et al. 1988), favoritism (Weis 1985, Aydogan 2008, Blase 1988), sabotage of student evaluations (Haskell 1998), or incompetence (Copeland and Murry 1996, Haskell 1998) that, like medical professionals, make protective insurance a warranted investment in case of a lawsuit (Emerson and Haber 1963, Smith 1992, Babcock 2009), and can place untenured faculty at risk of release (Hendrickson 1988, Haskell 1997, Copeland and Murry 1996). Health professionals and educators have extreme responsibility for information and actions that can have long-term effects on a person's future (Amstutz and Whitson 1998, Weeks and Haglund 2002). Whereas misdiagnosis of a health condition can directly threaten a patient's life, misevaluation of a student's performance and ability can threaten that student's employability, future job success, and indirectly health outcomes from the stress of unemployment (Cloninger and Hodgkin 1986, Krueger 1947). Even providing a positive reference that provides a person with a position that sets him/her up for failure is a consideration for faculty when evaluating students.

The high-risk similarities between life sciences faculty members and health professionals do not end there. The precision required for both occupational areas is immense and in the case of life sciences faculty, many hazardous conditions are similar or of similar risk to those of healthcare professionals. Scalpels, for example, cut as effectively whether used to cut into a patient or a specimen and biocontamination from wild or captive specimens can be as dangerous as from humans. Professional demands increasingly impose on available time and energy in both fields. Regular cuts to higher education have eliminated support structures on which faculty once depended in the same way cuts have dissipated supporting resources for physicians and other medical staff (Chrisman et al. 1995, Kerlin and Dunlap 1993, Sallee 2011). Even the pressure to remain current is comparable among these fields (Bozeman and Gaughan 2011, Rhem 2010), as is the preponderance of interruptions and last-minute appointments at the office that compromise the time and energy available (Westbrook et al. 2010). Many healthcare workers must deal with patients for 8-12 hour shifts each day; whereas, life sciences faculty members at regional universities spend similar time (>55 hr/wk, Cataldi et al. 2005, Conley 2002) with students when we consider time in classes, office hours, private appointments, and club advising (Shanafelt et al. 2009a, 2009b; Bentley and Kyvik 2012; Olds and Clarke 2010). Both faculty and health care workers deal with split shifts of sorts, which are known to increase likelihood of burnout (Felton 1998). It is rare for a professor to have two classes back to back. But, it is common for classes to be separated by down time insufficient for productive activities, or to have an early morning and late evening class on the same day with meetings scattered in-between (personal observation).

Health care workers are continuously exposed to illness, death, dying and cases with little hope; whereas, faculty members are continuously dealing with student failure, inability to perform, apathy, students with failure syndrome, and students who simply are beyond hope or face formidable challenges due to mistakes or ignorance (Brophy 1996, Covington and Omelich 1985, Chemers et al. 2001). Dealing with students who fail when they could have succeeded is a very stressful to some and frequent affair, and regularly helping severely deficient students can be a significant source of stress (Billingsley and Cross 1992, Blair 1999, Sass and Feng 2012). In fact, far more students fail in life science classes than excel (Freeman et al. 2007) and many underachieve. This sometimes contributes to needless student-faculty conflicts (Gamson 1967, Bray and del Favero 2004). Whenever a job involves close, working relationships with large numbers of people; the opportunity for overload from associated stressors is increased (Coverman 1989, Härenstam and MOA Research Group 2005, Bacharach et al. 1990). Both careers in the health professions (Gaba and Howard 2002, Veasey et al. 2002, Ruggiero 2003) and higher education (Blackburn et al. 1986, Sorcinelli 1988, Sorcinelli and Near 1989) culminate in genuine fatigue simply because the amount of work can be so arduous. Both health care and academia are regularly attacked on all fronts (Blackburn and Lawrence 1995, Rothman et al. 2005, Millenson 1997), although the individuals in these professions tend to be their own harshest critics (Aasland and Førde 2005, Brewin and Firth-Cozens 1997, Dunn et al. 2006, Miller et al. 2011), a classic characteristic of burnout patients (Maslach et al. 2001). The tenure system is often a subject of attack by governing boards, unsympathetic politicians and politically motivated individuals (Cameron 2010, Hutcheson 1996, Tepker 1993). Further, both occupations are often looked down upon (Fairweather 1996, Meyer 1998, Bérubé 1996) as exemplified, in the case of the professoriate, by regular derogatory references during the 2008 presidential election to Barack Obama's previous employment as a Lecturer at the University of Chicago. Pundits frequently referred to him as the professor, and criticized that experience as not part of the real world (personal observations). The lack of respect for academics is steeped in the regular quoting "He who can, does; he who cannot, teaches" (Shaw 1903, Snyder 2005). As they do for physicians, reformers commonly imply professors are somehow dishonorable, wasteful, and/or receiving credit for only the "good results," or results for which others deserve credit (e.g. Hacker and Dreifus 2010, Darcy and Ryan 2013, Anonymous 2013). They absurdly promote the academic's "cushy job" as a position from which they cannot be fired or disciplined (Hutcheson 1996, Allen 2000, Beam 2010). These kinds of attacks and criticisms lead to both academics and health professionals feeling misunderstood and unappreciated.

Health care (Maben et al. 2007, Massey 1976) and academia (Bartlett 1994, Stier 2004) tend to attract idealists who want to help others or work for the greater good, but when resources are strained this can impact their job

satisfaction (Leung et al. 2000, Locke et al. 1983, Pfeffer and Langton 1993). Both require extensive educations, placing them at higher risk of burnout than uneducated people (Maslach et al. 2001). At least at the beginning of their careers, both academics (Baldwin and Blackburn 1981) and health professionals (Maben et al. 2007) tend to be driven by nonmonetary factors more so, or at the cost of financial wealth. They also tend to be perfectionists (Dunn et al. 2006; Austin and Pilat 1990, Burt 2008). Both perfectionists and idealists are particularly vulnerable burnout (Cloninger et al. 2011, Taris et al. 2010), although those who are easy-going tend to be less negatively affected (Cloninger et al. 2011). Finally, outside of their respective workplaces/disciplines, professors and healthcare workers occupy a small portion of authoritarian positions in the greater community. They may serve as advisors to politicians, or community groups, but decisions are typically made by others.

Organizations, like universities and hospitals, have abundant issues involving hierarchies; operating rules, resources, and space distribution making them hotbeds for burnout inducing occupational stressors (see Maslach et al. 2001). The university is shaped by larger social, cultural and economic forces (Scott 1995) that control organizational processes, structures, and management environments conducive to workplace stress and burnout (Maslach et al. 2001). In fact, these features cause organizations to undergo widespread changes (Maslach et al. 2001) including the proliferation of lay-offs and cancelled searches that occurred over the past decade in higher education (Auxter 2012, Hilton and Jacobson 2012, Washington 2012). Such activities are the most basic changes in the psychological contract that induce occupational stress on the professoriate (Maslach et al. 2001). From an organizational standpoint, the university is the perfect environment to foster burnout (Minter 2009), especially when the hierarchical structures are paired with forms of harassment (Amienne 2017). Clearly, the similarities in burnout-risk associated-characteristics shared between healthcare professionals and life science professors are remarkable.

*Burnout, creativity, and publishing.* Creativity is especially subject to burnout inducing stressors (Berg et al. 2008). It is also a strong predictor of productivity (Heinze and Bauer 2006, Schwartz and Walden 2006). Creativity requires intellectual skills including synthetic skill to “think outside the box,” analytic skill to recognize the worth or lack thereof in pursuing an idea, and the practical-contextual skill to persuade others of an idea’s value (Sternberg 2006). Creativity is hampered by excessive occupational stress (Berg et al. 2008, Eckert et al. 1999), although this effect is tempered by organizational support (Asad and Khan 2003, Eckert et al. 1999). In fact, there is a tendency for supervisors in all fields to give many additional tasks to the most productive individuals, which reduces their available time for creativity (Eckert et al. 1999). Therefore, anything that reduces creativity should directly impact productivity. Lackluster productivity resulting from burnout is a threat to academic freedom because it

fuels the perception that tenured faculty are lazy and untouchable. Further, faculty stress in general has a demonstrated negative influence on student learning (Stevenson and Harper 2006). Consequently, one must ask how prevalent faculty burnout is among life sciences professors. I approached this question from the perspective of faculty productivity. Tenured faculty members have societal responsibilities to teaching, research and service even if not directly outlined in their institutional job description (Medawar 1978). It is difficult if not impossible to assess how/if an individual professor contributes to quality teaching and service from outside his/her home institution. However, analysis of publications can provide one reasonably obtainable indication of research productivity, which strongly impacts faculty prestige (Jacobs 2001, Budd and Seavey 1996, Pouris 1989), positively affects faculty satisfaction (Husemann et al. 2017), provides some evidence of faculty motivation (Lechuga and Lechuga 2012), constitutes a very important non-teaching activity (AAUP 2013, Medawar 1979), and has a known pattern of growth in the life sciences from graduation through retirement (Diamond 1984, Gingras et al. 2008, McCallum 2010). Further, previous research demonstrates that reduced motivation to conduct research activities like publishing is related to burnout (Singh et al. 1998).

Herein, I provide an analysis of tenured faculty publishing in the life sciences at 76 regional state universities and public liberal arts colleges from among 13 randomly-selected states of the United States. I hypothesized that burnout may be an immediate, serious problem among tenured life sciences faculty at regional state universities and public liberal arts colleges that placed at risk student learning, academic freedom, and the faculty member's personal health. I predicted that if tenured faculty (>10%) went unpublished since 2008 then burnout may be much more widespread than previously known, thus warranting further investigation; but, if faculty members who were unpublished since 2008 comprise a small fraction (< 10%) of the tenured professoriate, then it is probably not a major issue other than for the individuals involved.

### Methods

*Approach.* I obtained the names of 612 tenured faculty members from the websites of life sciences programs without doctoral programs at each of 76 regional state universities and public liberal arts colleges from among 17 randomly selected states. Four of these States did not have programs described in this study or did not have sufficient available information to analyze. This resulted in 13 total States in this analysis. I tabulated the publications by each tenured faculty member and then calculated means and SE for all faculty and faculty by state. Tenure was defined as anyone with a rank of Associate Professor or above because most institutions did not identify tenure status of faculty. I defined a publication as anything either peer reviewed or non-peer reviewed that the professor listed as such on his/her CV or webpage, or anything

that I retrieved via a query of Google Scholar. Google Scholar results were verified by examining the home institution of the author as listed on the manuscript and cross-checking that against the home institution of the faculty member at the time of publication. Results from the Google Scholar query were excluded from the faculty member's portfolio only when clear evidence (e.g. matter-of-fact) revealed the paper was erroneous (e.g. unrealistic publication date [e.g. before he/she was born, during his/her childhood], subject matter tangent to usual scope [e.g. physics, astrology], content of CV, faculty website, or other available resources). No attempt was made to evaluate the quality of manuscripts or to challenge an author's presentation of questionable literature as a valid publication. This was done to reduce subjectivity on my part, bias the results against a finding of widespread burnout, and because what constitutes a publication can vary somewhat among subfields and disciplines. Although the order of authorship is often valued differently at different institutions, we did not consider this factor in this analysis. If multiple faculty members coauthored the same paper, all authors were given full credit for the publication. Department Chairs/Directors, Deans and other administrators listed among the departmental faculty were excluded because research is commonly excluded from their activities while in these roles. Names of faculty members, institutions, and states are excluded to protect the privacy of faculty who may be suffering from this occupational health issue and to avoid perceptions of "ranking" or otherwise "evaluating" faculty performance.

*Use of a five-year window and rationale.* Faculty members were assumed unpublished, hence possibly burned out, if I could find no publications released within the past five years (publication date since 2008). The rationale for the five-year window was that numerous studies demonstrated the average publication rate of faculty members ranged from 0.26 (Zivney and Bertin 1992) to three publications (Gaughan and Ponomariov 2008, Symonds et al. 2006) per year, and a dated study suggested that in some fields only 5% of faculty members manage one publication per year (Zivney and Bertin 1992). On average, natural sciences faculty members published 4.09 (SE = 0.162) papers every 2 years (Fairweather 2002). In a two-year window, average publication counts for natural sciences faculty members was 5.78 (SE = 0.07) publications at research universities, 3.84 (SE = 0.13) publications at doctoral universities, 2.06 (SE = 0.072) at comprehensive universities, and 1.74 (SE = 0.162) at liberal arts colleges (Fairweather 2002). Professors in ecology and evolution publish between 0.75 and 3.0 publications per year (Symonds et al. 2006), and herpetologists publish a mean of 2.1 and median of 1.1 publications per year (McCallum 2010). By using the metric "one publication in the last five-years," I hoped to reduce the possibility that temporary administrative assignments, institutional problems, delays in publication release, or occasional life events such as illnesses or family difficulties confound the results. Additionally, I am aware that some departments (Pepperdine University 2006) and accrediting

organizations (AACSB 2009) use a five-year window to rate research productivity. Finally, five years is a significant portion (17%) of a 30-year academic career, suggesting a substantial loss in lifetime productivity regardless of the causation. Although there are other products of research (e.g. conference presentations, conference abstracts, &c.), these are generally not viewed as the end-point of research as is a publication. In general, conference presentations were excluded from these totals, but I did not remove abstracts or proceedings publications if listed as publications on a faculty member's website or CV for earlier discussed reasons. This methodology was used to provide a best-case scenario of faculty publishing that grossly exaggerated the number of publications a given professor acquired during the study period to avoid.

*Rationale for excluding non-tenure track and untenured faculty.* Most of the above cited studies included non-tenure track and untenured faculty members. Tenure-track faculty members are typically under pressure for minimum tenure-mandated benchmarks for publication counts (Medawar 1979, Seldin et al. 2010). Faculty members seeking tenure have more incentive to publish proficiently at a departmentally designated level and often have significant start-up resources available to fulfill this goal. Many also have competing tenure requirements for grantsmanship. Consequently, tenure-track faculty members have complex assemblages of incentives, resources, and demands on their time that are not comparable to tenured professors and would probably confound the results of our study (Catano et al. 2017). Non-tenure track faculty members are often temporary faculty not under pressure to publish, usually have meager to no resources for research, and receive little or no reward for doing so. They may even be punished for devoting time to research. Inclusion of them would inflate the number of faculty designated as burned out because many permanent non-tenure track faculty members do not regularly publish.

*Rationale for selecting and targeting departments that do not award doctorates at regional state universities and public liberal arts colleges.* There is no rule that states a faculty member with burnout will limit reduced productivity to research activities. In fact, declines could be isolated to teaching, service, research, or they could be distributed proportionally in unending combinations of these three primary roles of a faculty member (Sahibzada and Bano 2012). It seems obvious that much variance exists in teaching, research, and service obligations among the academic institutions. Research universities and departments with doctoral programs tend to have better resources and support for research, and the use of doctoral students and nontenure track faculty to support research and teaching is difficult to assess. There are far fewer research universities than other kinds, and more faculty work at regional state universities than at either small liberal arts colleges or research universities (Fleet et al. 2006). It is also hard to support that the atmosphere of a research university or a department with a doctoral program represents the typical

resources and expectations present at non-doctoral institutions of higher education. Likewise, there is much variation among private liberal arts colleges in number of courses taught, service mandates, and research expectations and resources. Further, these differences are very difficult to account for in this kind of study. I also excluded military academies and HBCUs because these kinds of schools have many unique funding sources (e.g. 1890 land grants, HBCU-specific funding) and resultant expectations compared to other institutions of higher learning.

Although some programs at regional state universities that do not award doctoral degrees may have more in common with research schools or private small liberal arts colleges, all are philosophically positioned somewhere between these two extremes in higher education. Most faculty members at these schools have workloads dominated by teaching (between 9-18 contact hours per semester in the classroom plus office hours and other student advisement), research obligations tend to be moderate (less than that at a research university or a doctoral degree granting department), as do service obligations (personal observation).

Faculty at these schools tend not to have postdoctoral advisees, continuous major grant support, or budgets comparable to those in doctoral programs and research universities. Further, in many states regional universities are part of university systems in which they are subject to many decisions of the system as opposed to having the independence enjoyed by most research universities or small liberal arts colleges.

## **Results**

This study encompassed 17 different states. Of these, four states had no qualifying institutions. Some schools were excluded because their online resources lacked the necessary information to assess faculty rank. The remaining 13 states were distributed among the Northeastern (1), Northwestern (1), Midwestern (5), Southeastern (5), and Southwestern (1) regions of the United States. In 2013, there were 954 faculty members employed at the 76 regional state universities and public liberal arts colleges sampled in this study. Of these faculty members, 612 (64%) were tenured and ~37% of tenured faculty members had not published a paper since 2008.

Tenured faculty members averaged 3.19 papers during the time or period; however, published tenured faculty members averaged 4.87 publications (Table 1). The median publication level was one publication since 2008, with the middle 50% of faculty ranging from 0-4. The maximum number of publications by one professor was 38. Since 2008, the top 20% of faculty members had > 5, top 10% had > 10, and the top 1% had > 20 manuscripts published since 2008 (Figure 1).

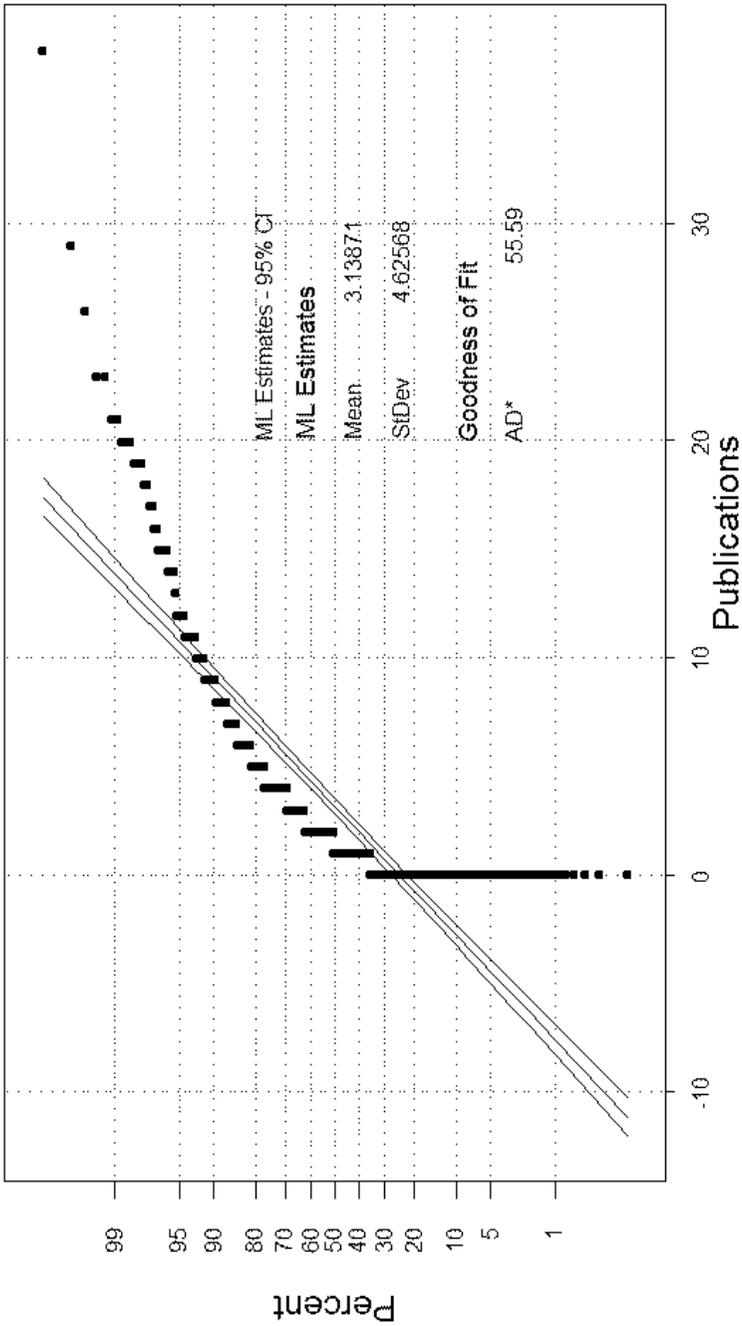


Figure 1. Probability plot for the percent of tenured faculty members from regional state universities and public liberal arts colleges who published at various levels from 2008 - 2012.

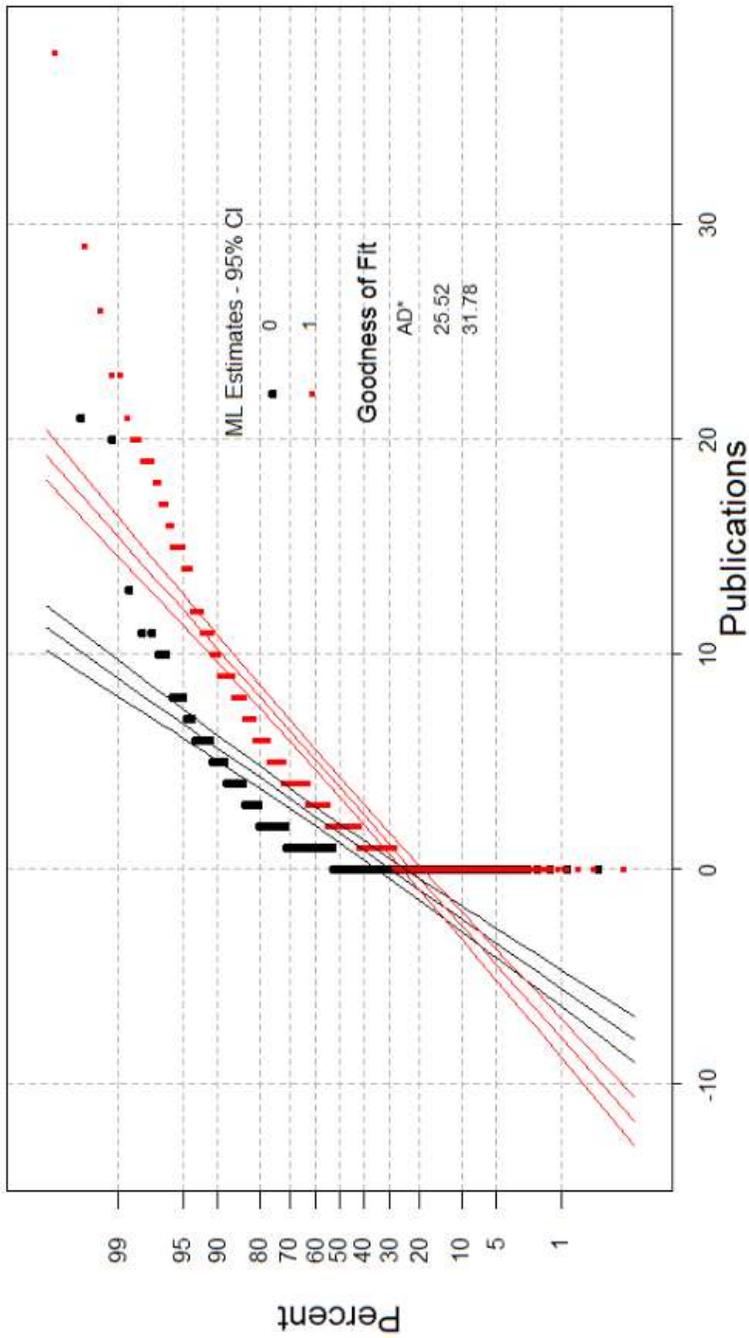


Figure 2. Probability plot for the percent of tenured faculty members who published at various levels from 2008 - 2012 while teaching at life sciences programs at regional state universities and public liberal arts colleges that award (black) and do not award (red) master degrees.

The presence of a Master degree program had a dramatic effect on faculty publishing (ANOVA:  $F_{1,619} = 29.53$ ,  $P < 0.001$ ). Faculty in departments awarding masters degrees ( $n = 430$ ) published 3.8 (SE = 0.242) publications (maximum = 38 publications); whereas, those in baccalaureate-only programs ( $n = 190$ ) published 1.6 (SE = 0.226; maximum = 21 publications) manuscripts in five years. However, in both cases, the lower bound of the middle 50% of tenured faculty members was zero publications. The upper bound was two publications for baccalaureate program faculty members and five publications for master program faculty members. Productivity of faculty members from master degree granting departments were in the top 20% with  $\geq 6$ , top 10% with  $\geq 10$ , and the top 1% with  $\geq 21$  manuscripts published since 2008. Faculty members from departments offering only baccalaureate degrees were among the top 20% with  $\geq 3$ , the top 10%  $\geq 5$ , and the top 1%  $\geq 12$  publications since 2008 (Figure 2).

There was no significant difference between faculty in right-to-work states and those from union states (ANOVA:  $F_{1,618} = 1.09$ ,  $P = 0.297$ ). Residing in a larger department had a very small positive effect on publication counts for individual faculty ([publication numbers] = [1.31] + [0.119 (the number of faculty members in the department)]);  $r^2 = 0.036$ ;  $P < 0.001$ ).

State averages for the fraction of the faculty who were unpublished ranged from 19% to 52%. State averages ranged from 1.63 to 6.18 publications for tenured faculty members, and from 3.35 to 8.82 for published tenured faculty members (Table 1). There were significant differences in faculty publishing among states (ANOVA:  $F_{12,607} = 2.46$ ,  $P = 0.004$ ); the most productive state (State 13, Table 1) was significantly different from the least productive state (State 5, Table 1; Tukey: 0.665 - 6.741).

### Discussion

Publication of research is only one part of a professor's job, but it is a dominant and (hopefully) usually enjoyable component. The evidence presented is only one indicator, but a very important signal that alerts burnout might be a wide-spread, nation-wide problem among tenured faculty in regional state universities and public liberal arts colleges. Still, the proportion of faculty at regional state universities and public liberal arts colleges is reasonably like observed high rates of stress-related physical health symptoms and psychological strain in Canadian universities (Catano et al. 2017). This cannot continue to be ignored.

One may speculate that among the various elements in a professor's activities, research is most susceptible to the impacts of burnout and the easiest to observe. The reason I make this speculation is that when an individual makes tenure, the never-ending process of perfecting the primary structure an outline of lectures and other teaching and learning activities has probably plateaued, leaving updating as a primary preparation. This individual could slack off on

preparation without himself/herself or others noticing changes in student performance early on. Sustaining motivation to teach well can be difficult without the influences of burnout (Lechuga and Lechuga 2012). By the time the notes become significantly out of date, or student performance on standardized tests or courses requiring his/her class as a prerequisite noticeably declines, the tenured faculty member could realistically be approaching retirement. Withdrawal from service activities might occur without notice in many departments as new faculty members, anxious to participate, take over the roles once occupied by the afflicted faculty member. However, most research activities cannot be filled in by other people. If the funds are available, technicians or students can do much of the time-consuming data collection/analysis work (Anonymous 2006), but this requires sustained proposal writing that must fall on the professor. Even occasional complimentary co-authorships are probably insufficient to affect sustained research output.

Writing is a creative outlet that requires serious, dedicated concentration and consideration of syntax, context, and content before it is ready for submission (Rowe and Okell 2009, Sorinola and Thistlethwaite 2013). The symptoms of burnout should make doing these things even more difficult than they are already. Further, if a scientist loses a collaborator to burnout (or other reasons), it affects his/her own productivity. In fact, the loss of a single former coauthor of average quality reduces the productivity of a scientist of average quality by 12.5% in physics and 16.5% in chemistry (Waldinger 2008). Logically, if the burned-out professor was a scientist of exceptional quality the impact must be far more extreme. When faculty members suddenly stop working with previous collaborators it can cause various negative emotional reactions likely to harm these relationships (especially if they walk off in the middle of a study) and reduce the likelihood of inclusion in future publications and research. Consequently, one of the first and most obvious symptoms of academic burnout among faculty members should be a declining or failing research program. The separation from those with whom a burned-out faculty once associated might reduce the likelihood that behaviors characteristic of stress are detected by his/her comrades, delaying treatment. This can also cause difficult relationships that even manifest into forms of psychological terrorism and harassment such as bullying (Vickers 2013) and mobbing (Lane 2013) of the stressed-out faculty member (Duffy and Sperry 2007, Savicki et al. 2003). More study on these interactions is needed involving life sciences faculty.

Mobbing (= bullying of an individual by a group) is also a serious social stressor (Zapf 1999) often present (and fostered) in the academic environment (Celep and Konakli 2013) that can fuel stress and burnout (Duffy and Sperry 2007, Tigrel and Kokalan 2009). From 3.5-65% of faculty members receive bullying and/or mobbing (Ozturk et al. 2008, Tigrel and Kokalan 2009), with up to 80% of this originating from superiors (Tigrel and Kokalan 2009). In fact,

institutional pressure-to-publish can be a significant contributor to burnout (Tijdink et al. 2013) and it seems logical that pressure from co-workers and superiors to work on non-research activities should be equally damaging. Mobbing need not be isolated to the faculty and can functionally come by way of retaliatory student evaluations and baseless complaints that sometimes arise in cliquish student cultures (Duffy and Sperry 2007, Frazier 2011, Keim and McDermott 2010). Mobbing elicits an unhealthy work environment for all involved and should be eliminated whenever possible. Mobbing in the face of numerous other stressors surely places faculty members at serious risk of burnout.

It is very concerning that such large proportions of tenured faculty had not published a paper since 2008. My ground-rules for what constituted a publication were extremely permissive; essentially anything so long as you say it is one. Further, if I encountered a paper published in early 2013 (when I did the tabulations), I gave the individual credit for it because most of the work involved took place before 2012 and would confound our study because clearly these individuals were doing research. So, the publication levels I reported are significantly biased against a finding of burnout and probably inflated productivity figures providing a best-case scenario and maximum estimates of publication. Attempts to more accurately identify publications would drive publication/faculty member down significantly. In fact, the current number publications produced by tenured faculty at regional universities and public liberal arts colleges is much lower than the data in this paper suggests, but the maximum number of publications by a single professor would not change. In this case, the best-case scenario for faculty productivity is far worse than I expected, making the possible extent of burnout so widespread further investigation of the publication rates is just belaboring the point. The need for follow-up psychological and physiological investigations of the extent of burnout in these institutions is imperative.

Some might believe unpublished faculty lost interest in the discipline and academia in general. However, about 50% of faculty members at regional universities indicated publication numbers were important in the hiring process, and they ranked this factor comparably to, but slightly lower than teaching experience and evaluations (Fleet et al. 2006). In fact, 65% of respondents from regional universities expected a candidate to have 1-3 publications; and, 30% expected 4-6, 2% expected 7-9, and 1% expected > 10 publications before getting interviewed (Fleet et al. 2006). In other words, 1/3 of faculty members expect more publications from a job candidate, despite probably fewer than 5 years of experience submitting manuscripts, than is usually produced by the average tenured associate/full professor in a similar time frame. Further, 98% expect better productivity from a candidate than what > 50% of tenured faculty accomplish. This supports the notion that these faculty members think research is important and that they are still interested in academia; in fact, they tend to

hire new faculty who upgrade the research environment of their departments. Would faculty who no longer have interest or see value in research do this? If they still value and have interest, then there must be a different reason for their own reduced research productivity.

In fact, graduate student support, strong leadership, and a good atmosphere are cited as stimulating influences on faculty productivity (Anonymous 2012) and things that are sometimes cut or lacking at regional universities. Further, publication rates source from an array of factors including gender, age, academic position and rank, availability of funds, teaching loads, equipment, availability of research assistants, workload policies, department culture, working conditions, size of the department, and organizational context (Dundar and Lewis 1998, Kyvik 1993, Ramesh and Singh 1998, Heinze and Bauer 2006). These factors can lead to conditions that mask or mimic burnout, hence the need for further psychological and physiological investigations to support the current study. Individual factors affecting productivity include research motivation, creativity, abilities and IQ, and academic background (Anonymous 2012, Heinze and Bauer 2006, Asad and Khan 2003). These individual factors, particularly motivation and creativity, happen to be central components of decay in burned out faculty (Anderson and Iwanicki 1984, Skaalvik and Skaalvik 2010).

The 37% of life sciences faculty who went unpublished from 2008 to 2012 runs counter to what we expect prior to retirement. Historically, the portfolio of publications for life science faculty continues to grow from graduation through retirement and beyond (Gingras et al. 2008, McCallum 2010), although it peaks in mid-career and gradually slows with time (Diamond 1984, Gingras et al. 2008, McCallum 2010), it does not normally cease long before retirement. This pattern also exists in other fields (Horner et al. 1986). However, a study published after my investigation was completed, demonstrated publication rates of 1,000 surveyed life scientists fell with age (Husemann et al. 2017) suggesting that publication patterns are now different. This is especially confusing because faculty members are largely driven by, and their job satisfaction related to, the desire to achieve (Castillo and Cano 2004, Husemann et al. 2017). Publication is generally considered crucial to faculty achievement (Lechuga and Lechuga 2012, Minter 2009, Manjunath et al. 2008). This previously published evidence is counter to some speculation that faculty at these institutions simply shift their emphasis away from research due to job demands because surely such shifts were necessary in the past, but growth in publication portfolio continued to rise on average. This incidence of ceased publishing is in line with the incidence of burnout in multiple disciplines, and other explanations are largely inadequate to explain these recent changes in light of current events.

University faculty from strong market-driven countries have high stress; whereas, those in most European countries have high satisfaction, suggesting market factors are significant stressors (Shin and Jung 2013). Previous studies

found employees with advanced stages of burnout comprised over 20% (range 1-25%) of workers in North America, 28% (range = 12-69%) in Asia and Eastern Europe, and 48-69% of workers in Japan and Taiwan (Golembiewski et al. 1996). In Australia, 53% of English academic staff had signs of psychological illness (Winefield et al. 2003) reminiscent of, but not defined by the investigators as burnout. Another Australian study observed 67% of the general university faculty population report psychological health problems associated with occupational stress (Gillespie et al. 2001). In one South Australian university, the overall level of psychological distress was 'very high' among faculty (Winfield 1995). In a Victorian-based university, stress was a major problem for ~25% of faculty who had more anxiety, absenteeism, doctors' visits, injuries, accidents and illnesses, and over all lowered physical health (Sharpley et al. 1996). Almost identical results were observed in a New South Wales university (Dua 1994).

Of 130 research, teaching and extension faculty respondents with 10 years of service at the University of Agricultural Sciences (Dharwad, India), all had moderate stress levels (Manjunath et al. 2008) emulating other studies with Indian faculty (Jhansi 1985, Veeraswamy et al. 1999). Despite qualifying as 'good' fits according to the Person-Environment Fit model, 2/3 of tenure-track faculty reported feeling stressed at work at least 50% of the time, and many of these reported burnout or stress-related health problems (Blix et al. 1994). A report surveying medical faculty at the Mayo Clinic (Rochester, Minnesota, USA) identified 34% of faculty as burned out (Shanafelt et al. 2009b). In another study focused on nursing faculty, 39.7% demonstrated high to moderate emotional exhaustion and 73% scored low on personal accomplishment, two of the three key dimensions of burnout (Talbot 2000). Online instructors at US universities had average emotional exhaustion, high depersonalization and low personal accomplishment, (Hogan and McKnight 2007), thus resembling burned out faculty. Their level of emotional exhaustion was like that of K-12 and postsecondary teachers, but personal accomplishment measures were much lower (Maslach et al. 1996, Hogan and McKnight 2007). In fact, faculty stress levels during the school year can be so dramatic that poorly timed and orchestrated intervention strategies can increase distress. For example, in one attempt to implement stress reduction for university faculty, occupational stress inventory pre- and post-test results demonstrated increased stress from occupational roles, personal strain, and personal resources from Fall 2002 to Spring 2003 (Wood and Budden 2006).

After major budget cuts and reorganization in the face of enrollment growth in the University of California System, the faculty was surveyed to determine how members were personally and professionally effected (Orfield et al. 2011). Almost 80% of faculty indicated they were experiencing stress from multiple institutional changes and issues. Institutional budget cuts were identified by 96% of faculty members as major sources of stress. Loss of teaching and

research resources strongly impacted faculty. Fewer classroom materials (51% of respondents), fewer technical materials and less related support (50%), reduced clerical support (50%), cancelled library materials (33%), fewer travel funds (50%), and loss of research assistance (35%) were major stressors. Many were accruing stress due to personal finances (88%) related to furloughs (effectively a 10% pay cut) and other issues, and an abnormally large proportion were concerned about job security (68%). The implications of these cuts paired with continued unrestricted growth resulted in heavier teaching loads ([number of courses + number of students]; 77% of respondents), larger classes (80% of respondents), more courses taught (20%). Further, 85% said working with underprepared students was a major source of stress. In fact, 33% were spending more time on prep than they used to, and unfortunately 35% reported lower expectations than they used to have for student improvement after revision of papers. Almost 43% of the faculty in the system reported decreased research and scholarly writing due to these problems and 86% complained that they lacked personal time. Most faculty members reported feeling overwhelmed by increased class sizes, decreased support, both of which they felt harmed their teaching effectiveness. These factors caused 59% to worry about the review and promotion process, and the recent events led 63% of faculty members to consider leaving their institution and 48% to consider leaving academia altogether.

In the 1990s, Australian universities underwent large-scale organizational change including restructuring, downsizing, and budget cuts (Gillespie et al. 2001). A longitudinal investigation on occupational stress was initiated involving 178 faculty and staff from 15 universities. This revealed a dramatic increase in stress over the previous five years, with faculty experiencing more stress than staff. They reported that stress was sourced from lack of funding, resources and support services (100% of faculty), task overload (100%), poor leadership and management (67%), job insecurity (33%), and lack of promotion, reward and recognition (67%). Most faculty members surveyed reported occupational stress was deleteriously impacting their professional and personal welfare. Poor job performance was reported by 33% of faculty. Other professional consequences of stress they reported included poor work relationships (83%), reduced commitment (33%), and withdrawal from their faculty roles (67%). Personal consequences among faculty were also evident including physical health problems (67%), psychological problems (67%), strained personal relationships (50%), and substandard quality of life (50%). Aspects of the work environment that improved stress levels included support from coworkers and management (50% of faculty), high morale [50%], flexible working conditions [33%] and personal coping strategies (stress management techniques [33%], work/life balance [50%], tight role boundaries [50%], personal social support [33%], and lower faculty performance standards [66%]).

Occupational stress among Canadian universities also appears to be a problem consistent with that in the United Kingdom and Australia (Catano et al. 2007). Of faculty surveyed, reported results on seven of ten indicators that were consistent with high stress levels. These included large work load (85%), role conflicts (82%), work-life balance (76%), scheduling problems (73%), role ambiguity (71%), fairness in administration (55%), fairness in awards (51%). However, Job control (14%), skill use (3%), and fairness of the chairperson (20%) was less important. They identified several demographic factors related to stress including: 1) female, 2) age 30 - 59 years, 3) low faculty rank, 4) tenure status, 5) first language is not native (English or French).

Some degree of stress is normal and inevitable in any normal working environment (Costa and McCrae 1992). The results of these two reports (Gillespie et al. 2001, Orfield et al. 2011) provide evidence that recent times of economic stress and budgetary concern resulted in significant maladaptive stress in faculty members that is more severe than previous observations in other occupations (Gillespie et al. 2001). Both cases demonstrate very similar faculty responses despite nearly a decade and half the globe separating them. This emphasizes how little progress was made at educating faculty and administrators about the symptoms, signs, causes and implications of stress in the academic workplace, and fostering awareness about the dangers of burnout. Further, it warrants that investigations into faculty stress and burnout in American universities be conducted so that stressors can be managed at both the individual and institutional levels during these current stressful times. Institutional leaders and community members must consider the academic environment and the stress it might be creating before implementing new initiatives, changing policies, and making other major decisions during times of unrest.

If the 37% of tenured faculty members who went unpublished reflects the incidence of burnout among the professoriate at regional state universities and public liberal arts colleges, what can be done to manage the occupational stressors that lead to burnout syndrome?

Burnout should be expected at some level during times of institutional strain, restructuring, or generally poor economic conditions outside the university (Figure 3, see page 100). There are numerous strategies an institution can take to reduce the incidences of burnout. First, faculty members and administrators should monitor teaching performance, service participation, faculty productivity, and personal behavior of the faculty in light of burnout risks. This is of special importance during times when individuals and/or institutions are facing difficult issues.

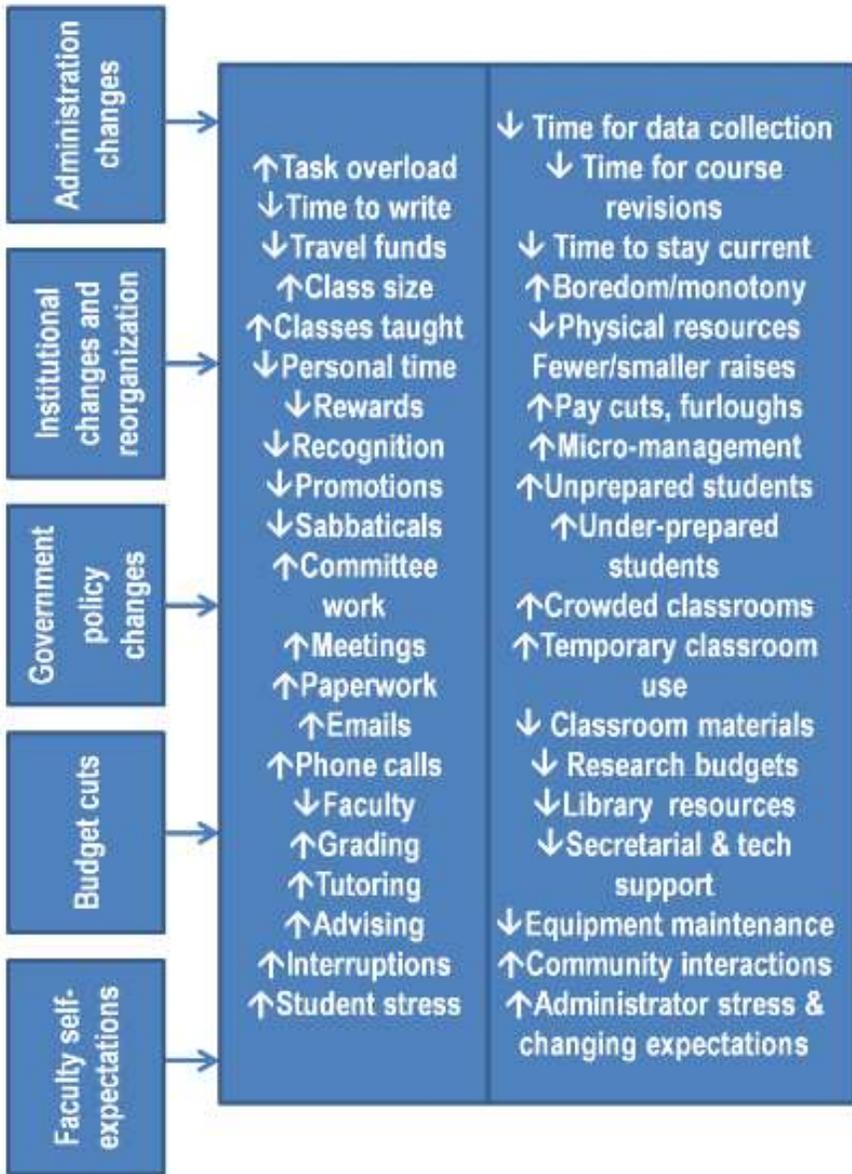
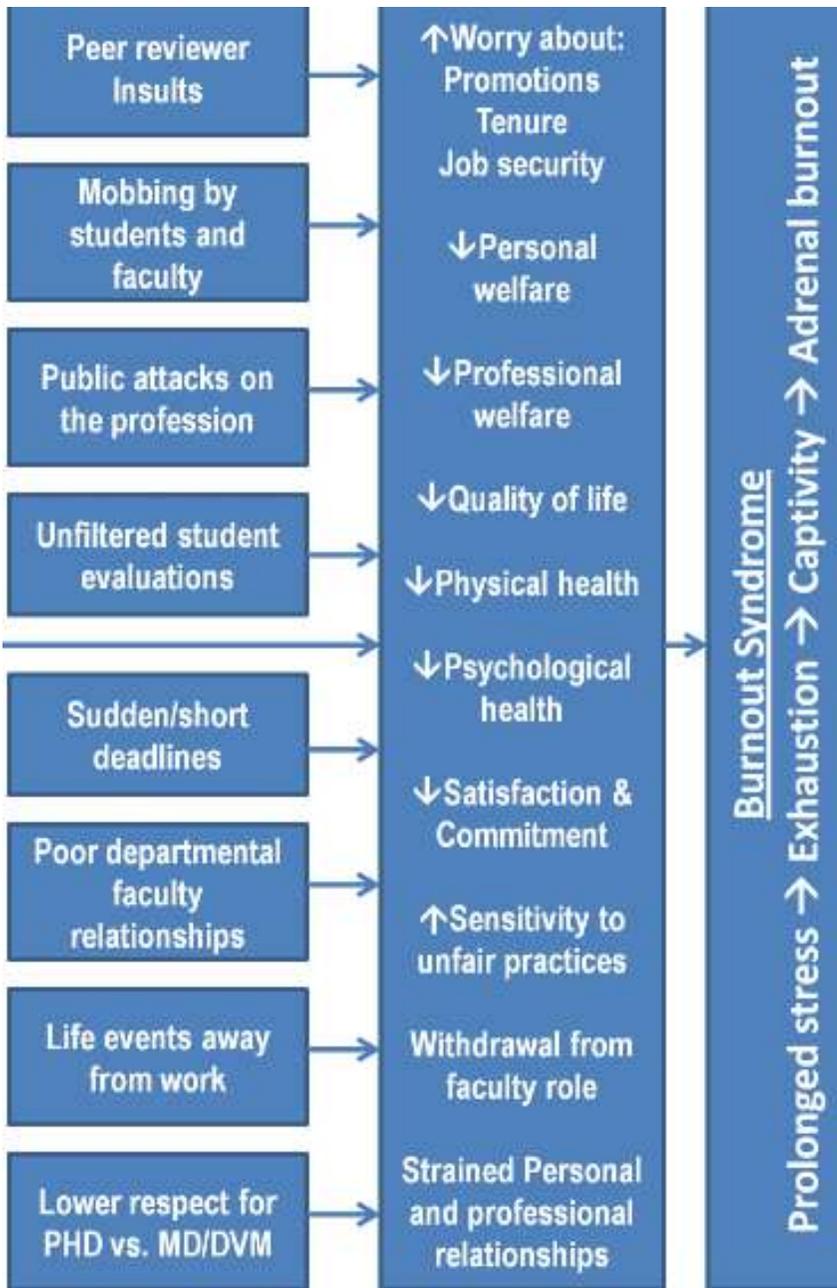


Figure 3. Conceptual model summarizing influences on faculty burnout that



were consolidated and assembled from the published literature.

Departmental leaders and members should be attentive to one another throughout the year, and be understanding about life events that can cause stress (Clark and Oswald 2002). Strategic stress intervention policies and programs might help prevent problems proactively (Wood and Budden 2006). Departments should strategically foster faculty self-efficacy (Skaalvik and Skaalvik 2010), social support (Ilyas and Hussain 2011), and job satisfaction (Castillo and Cano 2004), provide counseling for faculty who are experiencing stressful life or professional issues, and ensure all administrators and faculty members know the risks of burnout and understand how to manage stress via programmatic or self-care strategies (Länge 2003, Kravits et al. 2010).

Managers should monitor for and guard against bullying and mobbing (Ozturk et al. 2008). Preserving sabbaticals and using them to relieve stress is a critical factor, there is strong evidence that this helps reduce stress (Davidson et al. 2010). Finally, managing faculty as independent professionals instead of as general employees might be a critical tactic to consider. As has been discussed, faculty members are already driven, and their curiosity, insight, attention, and integrity are very important for their success. Managing them like one does unskilled labor is not effective.

To some degree, managing faculty is much like herding cats (Virginia Simons pers. Comm.). Threatening faculty may be counter-productive because there is evidence that harm avoidance is negatively correlated with resilience (Eley et al. 2013, Tjldink et al. 2013). Resilience happens to be further positively correlated with cooperativeness, and persistence (Eley et al. 2013). Micromanaging faculty activity creates stress, erodes effectiveness, and usually leads to poor job satisfaction and performance, whereas self-directedness is strongly correlated with resilience, persistence, and cooperativeness (Eley et al. 2013). Hogan and McKnight (2007) provide an outline of key stress-reducing strategies to alleviate stress and possibly eliminate burnout. They suggest consulting with faculty on matters directly impacting their learning environment, creating and maintaining clear lines of communication and chain of command as some key managerial strategies useful for minimizing stress. Further, providing adequate resources (i.e. technology support, &c.), constructive performance feedback to improve outcomes, detailed job descriptions and evaluation mechanisms to reduce role ambiguity, and professional development activities (i.e., mentoring, advanced training with technology, teaching, or other university activities), and reducing the number of students/courses taught and/or over-all responsibilities is often effective. Anything that reduces boredom, lack of autonomy, or monotony may have significant positive effects on stress (Vermunt and Steensma 2005).

Additionally, ensuring decisions regarding tenure, promotion, raises, and assignments are made with the utmost application of justice and fairness helps reduce faculty stress-loads (Vermunt and Steensma 2005). Sometimes simply changing the work environment to remove stressors by asking a faculty member to take on a different committee or responsibility can be very effective (Spinetta et al. 2000,

Minimura and Griffiths 2003). If faculty stress is managed in a strategic, proactive fashion; it is possible to minimize its effects and reduce the progression of stress-related (or stress related) syndromes including academic burnout.

This study is not unequivocal proof of wide-spread burnout because there have been no psychological or physiological tests performed. It does provide evidence that further study of is warranted. Regardless, anyone reading this manuscript must ask what is more likely. That (1) a person who survived staunch criticism and created sufficient new knowledge to earn inclusion among the 1% of the population who earns a PHD (Petersons 2013); *then* became one of the ~ 55% of science graduates (0.55% of the general population) who find tenure-track positions within 5 years of graduation (Mangematin 2000, Ginther and Kahn 2006); *then* maintained productivity and job performance sufficient for inclusion among the ~52% of tenure-track faculty (0.29% of the general population) who earn tenure within 11 years of their PHD (Ginther and Kahn 2006); *only* to abandon their devotion to research and publishing for half a decade; *or* (2) while in a work environment dominated by known occupational stressors unique to academia, but intrinsically similar to those commonly encountered in high-stress professions, this person developed a significant, life-threatening, almost universally ignored, preventable and treatable, occupational health syndrome called academic burnout?

### **A self-help guide to managing academic stress levels...**

*“You've got to accentuate the positive  
Eliminate the negative  
Latch on to the affirmative  
Don't mess with Mister In-Between.  
You've got to spread joy up to the maximum  
Bring gloom down to the minimum  
Have faith or pandemonium  
Liable to walk upon the scene”*

–Johnny Mercer and Harold Arlen  
(1946, Ac-cent-tchu-ate the Positive)

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