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Teacher burnout and physical health: A systematic review

Daniel J. Madigan [a,*], Lisa E. Kim [b], Hanna L. Glandorf [a], Owen Kavanagh [a]

[a] School of Science, Technology, and Health, York St John University, UK
[b] Department of Education, University of York, UK

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ABSTRACT

Teachers are at risk of many negative physical health consequences. The high levels of burnout in the teaching profession may be one of the reasons why this is the case. We tested this idea by providing the first systematic review of the association between teacher burnout and physical health. We found 21 relevant studies including 5267 teachers. The findings showed that teacher burnout was consistently associated with somatic complaints (e.g., headaches), illnesses (e.g., gastroenteritis), voice disorders, and biomarkers of hypothalamic-pituitary-adrenal-axis dysregulation (cortisol) and inflammation (cytokines). Future work in this area would benefit from a greater focus on integrating and testing theory. Nevertheless, the findings suggest that burnout may be a factor underpinning the development of physical ill-health in teachers.

1. Introduction

Teaching is renowned for its demanding working conditions (e.g., Hakanen et al. 2006). Such conditions likely have far-reaching consequences. Perhaps the most worrying of these are the potential negative effects on teachers' physical health. These effects may help explain why work absences and attrition are so apparent in the teaching profession (e.g., Buchanan et al. 2013). For these reasons, many researchers have sought to understand the factors that may underpin teachers' physical ill-health (Bowers, 2001). In the current study, our aim is to examine the role of a particularly common experience for teachers — burnout — in this relationship. To do so, we extend previous work (e.g., Ghanizadeh and Jahedizadeh 2015) by providing the first systematic review of research examining teacher burnout and physical health consequences.

1.1. Teacher health

Research suggests that work can have adverse effects on employee health across a range of occupations (e.g., Burgard and Lin 2013). Similarly, this may be the case for the teaching profession, as studies indicate that teachers are susceptible to many health consequences. This includes the development of mental health conditions (e.g., depression; Gray et al. 2017), but also notable and negative effects on their physical health. For example, work in this area has shown an increased incidence of somatic symptoms (e.g., headaches) and also cardiovascular diseases (Scheuch et al., 2015). Worryingly, there is also evidence that teacher health is worsening (e.g., Yang et al. 2019), and it is wholly likely that the COVID-19 pandemic has only exacerbated these issues even further (e.g., Kim et al., 2022; Swigonski et al. 2021).

There are many reasons why understanding and maintaining teacher health is so important. At its broadest, teacher ill-health likely

* Corresponding author.
E-mail address: d.madigan@yorksj.ac.uk (D.J. Madigan).

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has a large economic burden on schools, the educational system, and thereby society as a whole (Bowers, 2001). This includes directly on school systems with increased classroom absences, presenteeism (e.g., working while sick), and contributions to teacher dropout (where rates exceed those typical to most professions; Carlsen 2012). For teachers themselves, the effects are potentially disastrous too — not only in the short-term (with reduced work capacity, motivation, and wellbeing; Aloe et al. 2014, Yorulmaz et al. 2017) but also over time in terms of chronic illness (e.g., Wilhelm et al. 2000).

Recent research has sought to understand why teachers' health is at risk. In an attempt to unpick this relationship, research has examined a range of personal and organisational factors (De Simone et al., 2016). Although it is likely a complex interplay between many factors, research has identified stress, personality, and organizational conditions as possible predictors of worse physical health (e.g., Benevene et al. 2018, Coledam and de Silva 2020, Phillips et al. 2008). Given mixed evidence for these aspects overall, in the present study we focus on one factor that has historically been linked with teaching and may help to explain this relationship — burnout.

1.2. Teacher burnout

Burnout is a psychosocial syndrome that develops in response to chronic work-related stress (Maslach et al., 2001). In a professional context, it is defined by its three symptoms: emotional exhaustion (feelings of emotional overextension and exhaustion associated with work), cynicism (impersonal and dispassionate response to recipients of one's instruction), and reduced professional efficacy (feelings of reduced competence and achievement at work; Maslach et al. 1986). As teaching is considered to be a stressful profession, it is unsurprising that researchers have highlighted teachers to be at risk to burnout (e.g., García-Carmona et al. 2019, Pyhältö et al. 2021). Consequently, it is a phenomenon that has been empirically examined now for many decades (Chang, 2009).

The implications of burnout for teachers are wide-ranging. This includes interpersonal consequences such as conflict, irritability, and reduced communication (e.g., Ghanizadeh and Jahedizadeh 2015, Van Droogenbroeck et al. 2014). It also includes broad consequences for teachers' mood, wellbeing, and mental health, including links with depression, anxiety, and lower life and work satisfaction (e.g., Capone et al. 2019, Hakanen et al. 2006). In addition, there is evidence that teacher burnout affects student outcomes, with studies finding reductions in academic achievement and quality of student motivation (Madigan & Kim, 2021a). Ultimately, these consequences can contribute to teachers' intentions to leave the profession (Billingsley & Bettini, 2019; Madigan & Kim, 2021b).

1.3. Teacher burnout and physical health

Burnout may also have consequences for teachers' physical health. In this regard, Shirom et al. (2005) forwarded several theoretical pathways through which burnout may affect physical health. It is possible to use these ideas to construct a theoretical framework that applies to the teaching profession. In doing so, we posit three main ways burnout will likely inhibit teachers' physical health. First, teachers who experience frequent burnout symptoms may be likely to engage in unhealthy behaviours. This may be while at work (e.g., smoking), at home (e.g., alcohol consumption), or both (lack of exercise/physical activity). Such behaviours are well-known risk factors for various physical ill-health consequences (e.g., cardiovascular disease). Second, burnout may modulate teachers' biophysiological responses to stress (*via* the hypothalamic-pituitary-adrenal axis). For example, when presented with stressful situations (e.g., disruptive classroom behaviours), as is very common in teaching, teachers experiencing frequent burnout symptoms are less able to respond to these situations biologically (e.g., blunted cortisol responses [hypocortisolism]). Over time, these processes have implications for disease susceptibility, especially in context of autoimmune disorders and chronic pain. Finally, burnout may compromise teachers' immune systems (including immunoglobulin antibody secretion). When combined with aspects common for teachers (e.g., close proximity to others [classroom teaching]), it is possible that teachers who experience frequent burnout symptoms are more susceptible to infectious disease and associated symptoms. While these are unlikely to be discrete pathways, and instead act in an integrative manner, they do provide a useful basis to begin to understand the link between teacher burnout and physical health.

There is empirical evidence to support an association between burnout and physical health outside of teaching. For example, early research in this area linked burnout to specific conditions such as cardiovascular disease (see Melamed et al. 2006 for a review). Other work identified links between burnout and musculoskeletal disorders (e.g., Honkonen et al. 2006) and respiratory problems (e.g., Kim et al. 2011). More recently, reviewing the large body of prospective work that has accrued in this area, Salvagioni et al. (2017) found that burnout predicted, amongst others, hypercholesterolemia, type 2 diabetes, and musculoskeletal pain over time. Most notable, however, was the link between burnout and mortality below 45 years of age. Salvagioni et al. (2017) found these findings to generalize to a range of professions, including dentists, nurses, and human services workers.

What is less clear is the extent to which burnout affects teachers' physical health. Again, early work in this area suggested a potential link, especially in relation to an increased incidence of somatic symptoms (Burke & Greenglass, 1995). Other work has built on these findings to suggest other, more serious consequences may also be relevant (e.g., cardiovascular disorders; Daniel and Schuller 2000). Unlike in other occupations, though, this link is not well established. For these reasons, an up-to-date review of this literature would provide an understanding of whether burnout is indeed linked to teachers' physical ill-health, and in what ways it manifests (e.g., which particular conditions and consequences).

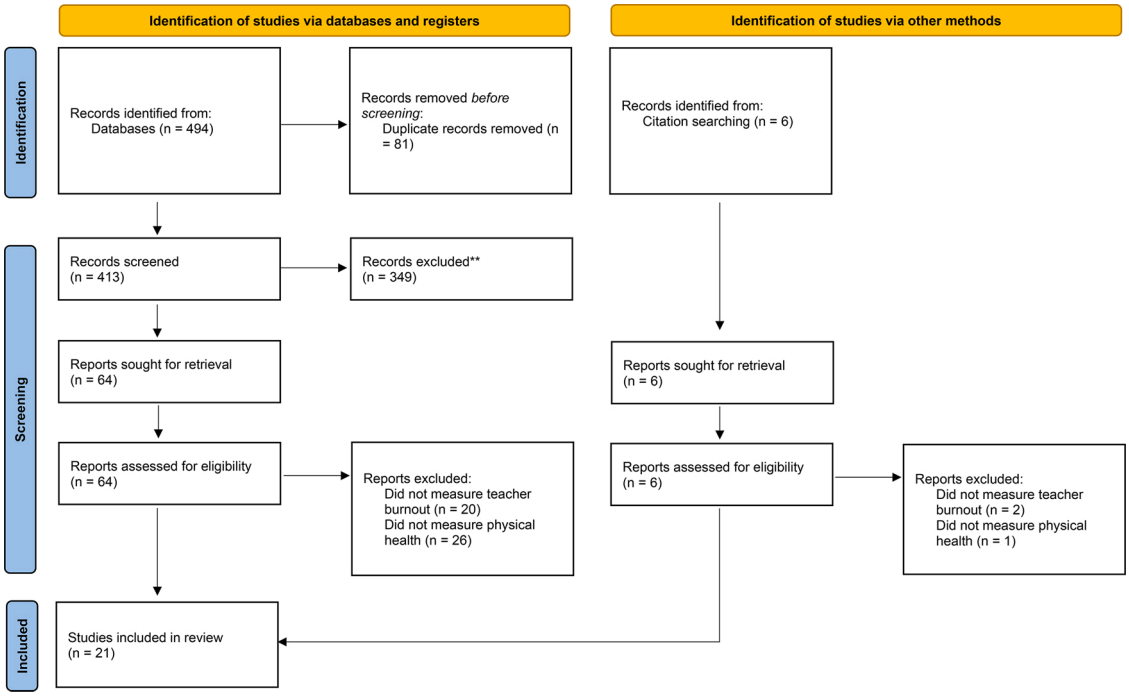

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram illustrating study selection process.

1.4. The present study

Against this background, we aim to provide the first systematic review of research examining teacher burnout and physical health consequences. Based on the aforementioned theoretical framework, we expected that burnout would be associated with physical ill-health in teachers, but did not have any specific hypotheses in terms of specific conditions and consequences.

2. Method

We first preregistered our review with PROSPERO (ID: CRD42022367418). In conducting and reporting the findings of our review, we also followed the most recent PRISMA guidelines (Page et al., 2021).

2.1. Literature search

We began our review with a literature search of the following databases: PsycINFO, PsycArticles, Education Abstracts, Educational Administration Abstracts, MEDLINE, PubMed, Web of Science, and ProQuest Dissertations and Theses. We used the following search terms: "teacher or educator or lecturer or instructor" and "burnout or exhaustion or cynicism or depersonalization or reduced efficacy" and "disease or illness or biomarker or health or cardiovascular or diabetes or hypertension or heart disease endocrine or immune or pain or mortality or injury or headache or insomnia or physiological or cortisol or saliva or blood". We supplemented our database search with an exploratory search on GoogleScholar and by scanning the reference lists of reviews, book chapters, and journal articles that were relevant to our study.

We conducted our search on 21 October 2022, which returned 494 studies. We then removed duplicates and screened abstracts for relevance. The remaining studies were then assessed in relation to the inclusion criteria below.

2.2. Inclusion criteria

We included studies in our systematic review if they: (a) measured teacher burnout, (b) measured a physical health outcome, (c) were published in English, and (d) were a published journal article, dissertation/thesis, or conference presentation. Based on these criteria, studies were excluded if they did not measure teacher burnout ($n = 20$) or did not measure a physical health outcome ($n = 26$). This process resulted in the final inclusion of 21 studies. We have included a detailed overview of this process in Fig. 1.

2.3. Data extraction

We then extracted the following data from these studies: (a) publication information (authors and year), (b) teacher demographics,

Table 1
Studies examining teacher burnout and physical health.

Study	*N* teachers	Country	Level	Burnout Measure	Design	Analyses	Criterion Variables	Main Findings
Baka (2015)	316 (79% female, M_{age} = 40.67, *SD* = 9.49; M_{exp} = 14.42, *SD* = 9.86)	Poland	Primary (142) Secondary (171)	OLBI	C/S	Regression	1. Somatic symptoms (Physical Symptoms Inventory; Spector and Jex (1998))	Total burnout positively associated with somatic symptoms ($r = 0.42$, $p < .001$).
Barkhuizen et al. (2014)	595 (50.1% female)	South Africa	Tertiary	MBI-GS	C/S	Correlations	1. Somatic symptoms (an Organizational Stress Screening Tool; Cartwright and Cooper (2002))	Exhaustion ($r = 0.43$, $p < 0.01$) and cynicism ($r = 0.24$, $p < 0.01$) positively associated with somatic symptoms.
Bartholomew et al. (2014)	364 (34% female, M_{age} = 40.47, *SD* = 9.06, M_{exp} = 14.56, *SD* = 9.67)	Spain	Secondary	MBI-GS	C/S	SEM	1. Somatic symptoms (Teacher Stress Inventory; Fimian and Fastenau (1990))	Total burnout positively associated with somatic symptoms ($r = 0.48$, $p < 0.01$).
Belcastro (1982)	181	USA	Secondary	MBI	C/S	Chi-square	1. Illness (Teachers' Somatic Complaints and Illnesses Inventory; Castro, 1982)	Teachers classified into burned out (n=27) or not (n=154) based on total burnout scores. Gall bladder disorders ($\chi^2 = 12.18$, $df = 2$, p =0.002) and cardiovascular disorders (χ^2 = 12.84, $df = 2$, $p = .001$) occurred with greater frequency in burned out teachers.
Belcastro et al. (1982)	102 (25% female)	USA	Secondary	MBI	C/S	Chi-square	1. Illness (Teachers' Somatic Complaints and Illnesses Inventory; Castro, 1982)	Teachers classified into burned out (n=17) or not (n=85) based on total burnout scores. Gastroenteritis ($\chi^2 = 14.0$, $df = 2$, $p = 0.000$) and migraine headaches ($\chi^2 = 11.8$, $df = 2$, p = 0.002) occurred with greater frequency in burned out teachers.
Belcastro and Gold (1983)	286	USA	Secondary	MBI	C/S	Chi-square	1. Illness (Teachers' Somatic Complaints and Illnesses Inventory; Castro, 1982)	Teachers classified into burned out (n=40) or not (n=246) based on total burnout scores. No group differences were found for 12 illnesses.
Bellingrath et al. (2008)	135 (70% female, M_{age} = 46.1, *SD* = 9.20)	Germany, Luxembourg	Secondary	MBI	Prospective	RMANOVA	1. Cortisol (saliva immunoassay) a) Across three days (two work and one leisure day). b Dexamethasone suppression test	No association between burnout and basal cortisol levels across three days. Exhaustion (F [1,116] = 3.9, $p = 0.05$, $h^2 = 0.03$) and reduced efficacy (F6,696 = 3.4, $p = 0.02$, h^2 = 0.03) associated with dexamethasone-suppressed cortisol levels
Burke and Greenglass (1995)	362	Canada	Secondary	MBI	2-wave longitudinal (1 year)	Regression	1. Somatic symptoms 2. Self-reported illness	Baseline exhaustion and reduced efficacy predicted time 2 somatic symptoms. No association between burnout and illness.
Daniel and Schuller (2000)	445	Slovakia	Primary (46%) and Secondary (54%)	MBI	C/S	Correlations	1. Digestive disorders (Standard Shiftwork Index; Costa, 1992) 2. Cardiovascular disorders (Standard Shiftwork Index; Costa, 1992)	All burnout dimensions were positively associated with digestive disorders (E $r = 0.29$, D $r = 0.12$, RE $r = 0.14$). Exhaustion and devaluation were positively associated with cardiovascular disorders (E $r = 0.30$, D r = 0.12).
de Brito Mota et al. (2019)	208 (76.9% female, M_{age} =	Brazil	Primary	CESQT	C/S	Regression	1. Voice disorders (Screening Index for Voice Disorder; Ghirardi et al. 2013)	Exhaustion (high scores) associated with greater risk of voice disorders ($OR = 3.07$, p = 0.007).

(*continued on next page*)

Table 1 (*continued*)

Study	*N* teachers	Country	Level	Burnout Measure	Design	Analyses	Criterion Variables	Main Findings
	40, 8.8; M_{exp} = 16.1, SD = 9.3)							
Kalynychenko et al. (2021)	427 (100% female)	Ukraine	Secondary	DEBL	C/S	Correlations	1. Heart rate variability a) Relative sympathetic activity b) Relative parasympathetic activity	Total burnout positively associated with relative sympathetic activity ($r = 0.34$, $p < 0.05$) and negatively associated with relative parasympathetic activity ($r = -0.32$, $p < 0.05$).
Katz et al. (2016)	64 (88% female, M_{exp} = 14 years, SD = 9)	USA	Secondary	MBI-ES	C/S	Correlations	1. Cortisol (saliva assay) a) Waking cortisol b) Cortisol awakening response 2. Salivary alpha amylase (waking, and awakening response)	Exhaustion was positively associated with cortisol at waking ($r = 0.26$, $p < 0.05$). Depersonalization was negatively associated with cortisol awakening response ($r = -0.28$, $p < 0.05$). No significant associations were found with salivary alpha amylase.
Moya-Albiol et al. (2010)	64 (80% female, M_{age} = 42.83, SD = 9.21)	Spain	Secondary	MBI	C/S	Correlations	1. Cortisol (saliva assay) a) Awakening b) 30 min after c) Cortisol awakening response (CAR)	No significant associations between burnout subscales and cortisol measures.
Moya-Albiol et al. (2010)	64 (80% female, M_{age} = 42.83, SD = 9.21)	Spain	Secondary	MBI	Prospective (one day, 3 time points)	ANOVA	1. Cortisol (saliva assay) 2. Heart rate 3. Blood pressure	Total burnout and all subscales were associated with lower cortisol levels and higher heart rate at the end of the work day compared to the beginning or the middle. Total burnout was positively associated with systolic blood pressure at the beginning of the work day.
Righi, De Godoi, Venezian, Degan, & de Menezes, 2021	330 (M_{age} = 43.0, SD = 10.68)	Brazil	Primary and Secondary	CESQT	C/S	Regression	1. Temporomandibular disorder (Diagnostic Criteria for Temporomandibular Disorders; Schiffman et al., 2014)	Total burnout (high scores) associated with greater risk of temporomandibular disorder ($OR = 1.92$, $p = .02$).
Pruessner et al. (1999)	66 (67% female, M_{age} = 43.6, SD = 9.5)	Germany	Secondary	MBI	Prospective (three working days)	ANOVA	1. Cortisol (saliva immunoassay) a) Across three days b) Dexamethasone suppression test (on third day)	Differentiated high and low burnout groups (30 vs 36). High group showed lower cortisol levels on all three days ($f^2 = 0.27$).
Rothmann et al. (2008)	279 (50.7% female)	South Africa	Tertiary	MBI-GS	C/S	Correlations	1. Somatic symptoms (an Organizational Stress Screening Tool; Cartwright and Cooper (2002))	Exhaustion ($r = 0.60$, p <0.01) and cynicism ($r = 0.42$, $p < 0.01$) positively associated with ill-health.
von Känel et al. (2008)	167 (66% female; M_{age} = 48)	Germany, Luxembourg	Primary and Secondary	MBI	C/S	Regression	1. Proinflammatory TNF-alpha 2. Anti-inflammatory IL-4 and IL-10	Total burnout was negatively associated with IL-4 ($r = -0.17$, $p = 0.03$) and positively associated with TNF-alpha/IL-4 ratio ($r = 0.17$, $p = 0.03$). This pattern of associations was found for reduced efficacy but not exhaustion or depersonalisation.
Wang et al. (2015)	523 (85% female, M_{age} = 41.31, SD = 9.68, M_{exp} = 12.92, SD = 8.63)	Canada	Primary and Secondary	MBI	C/S	Correlations	1. Illness symptoms (Hall et al., 2006)	All burnout subscales were positively associated with illness symptoms (E $r = 0.55$, D $r = 0.28$, RE $r = 0.19$; $ps < 0.01$).

(*continued on next page*)

Table 1 (*continued*)

Study	*N* teachers	Country	Level	Burnout Measure	Design	Analyses	Criterion Variables	Main Findings
Wolfram et al. (2013)	53 (58% female)	Germany	Primary and Secondary	MBI	C/S	ANOVAS	1. Synacthen (ACTH1-24) test 2. Plasma cortisol (blood) 3. dexamethasone–corticotropin releasing hormone test (DEX-CRH)	Following ACTH1-24 injection, exhaustion was positively associated with higher plasma cortisol. No associations following DEX-CRH test.
Zhong et al. (2009)	300 (47% female, M_{age} = 47.4, *SD* = 19.3)	China	Tertiary	MBI-GS	C/S	Correlations	1. Somatic symptoms (Short Form Health survey; Ware, 1993)	Total burnout was positively associated with somatic symptoms ($r = 0.24$, $p < 0.01$).

Note. *M*age = Mean age. *M*exp = Mean teaching experience. MBI = Maslach Burnout Inventory. MBI-GS = Maslach Burnout Inventory-General Survey. MBI-ES = Maslach Burnout Inventory-Educators Survey. OLBI = Oldenburg Burnout Inventory. CESQT (Cuestionariopara la Evaluacion del Síndrome de Quemarse por el Trabajo). DEBL = V. Boiko's methodology "Diagnostics of emotional burnout level". C = Cynicism. EE = Emotional exhaustion. RE = Reduced efficacy. C/S = Cross-sectional. ML = Multilevel modeling. ML-SEM = Multilevel structural equation modeling. LPA = Latent profile analysis.

Table 2
Quality assessment of included studies.

Study	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	5.1	5.2
Baka (2015)	++	+	++	+	++	NR	+	++	++	++	NA	NA	NR	++	++	++	+	+
Barkhuizen et al. (2014)	++	+	++	+	++	NR	+	++	++	++	NA	NA	NR	++	++	++	+	+
Bartholomew et al. (2014)	++	+	++	+	++	NR	+	++	++	++	NA	NA	NR	++	++	++	+	+
Belcastro (1982)	+	+	++	+	–	NR	–	++	++	++	NA	NA	NR	+	+	–	+	+
Belcastro et al., 1982	++	+	++	+	–	NR	–	++	++	++	NA	NA	NR	+	+	–	+	+
Belcastro and Gold (1983)	++	+	++	+	–	NR	–	++	++	++	NA	NA	NR	+	+	–	+	+
Bellingrath et al. (2008)	++	+	++	+	++	NR	++	++	++	++	NA	NA	NR	++	++	+	+	+
Burke and Greenglass (1995)	+	+	++	+	–	NR	++	++	++	++	NR	NR	NR	++	++	–	+	+
Daniel and Schuller (2000)	++	+	++	+	–	NR	+	++	++	++	NA	NA	NR	++	+	+	+	+
de Brito Mota et al. (2019)	++	+	++	+	–	NR	+	++	++	++	NA	NA	NR	+	+	++	+	+
Kalynychenko et al. (2021)	+	+	+	+	–	NR	+	++	++	++	NA	NA	NR	+	+	+	+	+
Katz et al. (2016)	++	+	++	+	++	NR	++	++	++	++	NA	NA	NR	+	++	++	+	+
Moya-Albiol et al. (2010a)	++	+	++	+	+	NR	+	++	++	++	NA	NA	NR	+	+	+	+	+
Moya-Albiol et al. (2010b)	++	+	++	+	+	NR	+	++	++	++	NA	NA	NR	+	+	+	+	+
Righi, De Godoi, Venezian, Degan, & de Menezes, 2021	++	+	++	+	–	NR	+	++	++	++	NA	NA	++	++	++	++	+	+
Pruessner et al. (1999)	+	+	++	+	–	NR	++	++	++	++	NA	+	NR	++	+	+	+	+
Rothmann et al. (2008)	++	+	++	+	++	NR	++	++	++	++	NA	NA	NR	++	++	+	+	+
von Känel et al. (2008)	+	+	++	+	–	NR	++	++	++	++	NA	NA	NR	++	++	++	+	+
Wang et al. (2015)	++	+	++	+	++	NR	+	++	++	++	NA	NA	NR	++	+	+	+	+
Wolfram et al. (2013)	++	+	++	+	++	NR	++	++	++	++	NA	NA	NR	++	++	++	+	+
Zhong et al. (2009)	++	+	++	+	–	NR	–	++	++	++	NA	NA	NR	++	++	+	+	+

Note. ++ = minimized risk of bias. + = may not have addressed all sources of bias. - = significant sources of bias may persist. NR = Not reported. NA = Not applicable. [1.1]Population well described. [1.2]Population is representative. [1.3]Selected participants represent eligible population. [2.1]Selection bias minimised. [2.2]Theoretical basis. [2.3]Contamination low. [2.4]Confounding factors identified. [3.1]Outcome measures reliable? [3.2]Outcome measurements complete? [3.3]All important outcomes assessed? [3.4]Similar follow-up time in exposure and comparison group? [3.5]Follow-up time meaningful? [4.1]Power analysis. [4.2]Multiple explanatory variables considered? [4.3]Analytical methods appropriate? [4.4]Precision. [5.1]Are the results valid? [5.2]Are the findings generalisable? [Criteria [2.5](Setting applicable to the UK) was removed from the checklist].

(c) country, (d) instructional environment (primary, secondary, or tertiary), (e) measure of burnout, (f) study design, (g) main analyses employed, (h) outcome variables, and (i) main findings. Data extraction was conducted independently by two authors. We calculated Cohen's Kappa (McHugh, 2012) as a measure of inter-rater reliability, which was excellent (Kappa = 0.91). Disagreements were resolved *via* a consensus among authors with reference to the original studies. We have presented all extracted information in Table 1.

2.4. Risk of bias

We then assessed risk of bias by employing the NICE (National Institute for Health and Care Excellence, 2012) quality appraisal checklist for quantitative studies reporting correlations and associations. Studies were assessed against 18 criteria in this tool (e.g., reliability of outcome measures, appropriate power and analytical methods; see Table 2 for full details). For each criterion, studies are rated as having minimized risk of bias, may not have addressed all sources of bias, and significant sources of bias may persist. This was conducted independently by two authors and again disagreements were resolved *via* a consensus among authors with reference to the original studies (Kappa = 0.93). We have included a summary of this information in Table 2.

3. Results

We now provide a narrative synthesis of the findings from the reviewed studies, and do so based on the recommendations of Campbell et al. (2020). This synthesis is organized around the samples and their demographics, the designs of the studies, the instruments used to measure burnout, and the risk of bias analyses. Studies are then grouped based on the examined outcomes. We also examine the number of studies that support each relationship in addition to an appraisal of the associated risk of bias. We take into consideration how directly the included studies address our research question and where applicable discuss possible moderating factors/major study differences. Table 1 provides a detailed overview of this information for each study.

3.1. Teacher samples

Across the present studies, a total of 5267 teachers participated in the studies. They were on average 43.34 years old ($SD = 10.55$ years), 59.90% female (range 25.00 – 100%), and had 14.40 years of teaching experience ($SD = 9.29$ years). Teachers were from a broad range of countries (Germany [$N = 4$], USA [$N = 4$], Spain [$N = 3$], Brazil [$N = 2$], Canada [$N = 2$], Luxembourg [$N = 2$], South Africa [$N = 2$], China [$N = 1$], Poland [$N = 1$], Slovakia [$N = 1$], Ukraine [$N = 1$]). In terms of level of teaching, one study recruited teachers from a primary school setting, 11 studies from a secondary school setting, six from a combination of primary and secondary settings, and three from a tertiary setting.

3.2. Measurement of burnout

The majority of studies (i.e., 17 of 21 studies) used a version of the Maslach Burnout Inventory. Of these, 12 used the original MBI (Maslach et al., 1986), four used the MBI-General Survey, and one used the MBI-Educator Survey (Maslach et al., 1996). Of the remaining four studies, two used the Cuestionariopara la Evaluacion del Síndrome de Quemarse por el Trabajo (Gil-Monte et al., 2010), one used the Diagnostics of emotional burnout level (Rajgorodskij, 2011), and one used the Oldenburg Burnout Inventory (Demerouti & Bakker, 2008).

3.3. Designs

Seventeen of the studies used a cross-sectional design. The remaining four studies adopted a range of longitudinal designs. Three were prospective studies varying from three measurement points in one day (Moya-Albiol et al., 2010), three measurement points over three working days (Pruessner et al., 1999), and four measurement points over a combination of working and leisure days (Bellingrath et al., 2008). The final study adopted a two-wave longitudinal design over a period of one year (Burke & Greenglass, 1995). The associated analyses employed by these authors can be found in Table 1.

3.4. Risk of bias

Following quality appraisal, for the most part, studies had attempted to minimize sources of bias or may not have addressed all sources of bias across the different parameters. In addition, however, there were a number of areas that were identified as having significant sources of bias. This included in particular a lack of power analyses for a priori sample size calculations and a general lack of theoretical models used to inform study design and hypotheses (see again Table 2).

3.5. Health consequences

3.5.1. Somatic complaints

Six studies examined somatic complaints (Baka, 2015; Barkhuizen et al., 2014; Bartholomew et al., 2014; Burke & Greenglass, 1995; Rothmann et al., 2008; Zhong et al., 2009). Burnout was associated with more frequent somatic complaints across all six studies. This included measures of specific complaints such as headaches, back pain, and skin rash, and groups of complaints such as

cardiovascular and intestinal symptoms. These effects were found cross-sectionally but also over time (Burke & Greenglass, 1995), and across all educational levels. Effect sizes were typically medium-sized. These studies showed minimal to low levels of bias, with a lack of theory the prominent area for biases.

3.5.2. Illnesses

Six studies examined illnesses (Belcastro, 1982; Belcastro & Gold, 1983, 1982; Burke & Greenglass, 1995; Daniel & Schuller, 2000; Wang et al., 2015). Across these studies, burnout was associated with more frequent cases of illness more often than not (in four out of the six studies). This included specific illnesses such as gastroenteritis and migraines, and broader groups of cardiovascular and digestive disorders. All studies that found associations were cross-sectional in nature. The one longitudinal study found no association between burnout and diagnosed illnesses (Burke & Greenglass, 1995). The remaining study that found no association when comparing post hoc groups based on high versus low total burnout scores (Belcastro & Gold, 1983). Effect sizes were typically small-to-medium sized. In terms of bias, the studies by Belcastro and colleagues were identified to have the most risk of potential bias, while others for the most part were at minimal risk.

3.5.3. Voice disorders

Two studies examined outcomes related to voice disorders (Righi, De Godoi, Venezian, Degan, & de Menezes, 2021; de Brito Mota et al., 2019). Both studies found that burnout was associated with greater risk of voice disorders. This was based on broad array of symptoms (e.g., loss of voice) but also specific conditions (temporomandibular disorder). Odds ratios suggested this risk was approximately two-to-three times higher in those individuals with high burnout scores. Aside from lacking theoretical frameworks, both studies were at minimal risk of biases.

3.5.4. Cortisol

Six studies examined cortisol (comprising five unique samples; Bellingrath et al. 2008, Katz et al. 2016, Moya-Albiol et al. 2010, Moya-Albiol et al. 2010, Pruessner et al. 1999, Wolfram et al. 2013; cortisol is an endocrine hormone which mediates the hypothalamus-pituitary-adrenal (HPA) physiological response to stress). In five of the six studies, burnout showed an association with cortisol, in some form or another. This included higher cortisol at waking and less steep cortisol awakening response (Katz et al., 2016), lower cortisol at the end of the work day compared to the beginning and middle (Moya-Albiol et al., 2010), and lower cortisol across three days for a high burnout group compared to a low burnout group (Pruessner et al., 1999). It was also the case following pharmacological intervention to modulate cortisol levels including greater cortisol suppression following dexamethasone intake (Bellingrath et al., 2008; Pruessner et al., 1999) and higher plasma cortisol following synacthen injection (Wolfram et al., 2013). Effects were typically small-to-medium sized. Collectively these findings indicate a complex association with burnout associated with both increased negative feedback activity and higher response sensitivity, in addition to general hypocortisolism. Across the studies, there was a range of areas where risk of bias may not have been adequately addressed, including theory and generalizability.

3.5.5. Cytokines

Two studies examined cytokines (Katz et al. 2016, von Känel et al. 2008; cytokines are receptor-mediated protein signaling molecules that serve as chemical messengers between cells of the immune system). In this regard, burnout was negatively associated with IL-4 and positively associated with TNF-alpha/IL-4 ratio (von Känel et al., 2008). The latter are associated with inflammatory responses and suggest lower anti-inflammatory and higher proinflammatory responses. However, there was no association between burnout and salivary alpha-amylase (a marker of autonomic regulation; Katz et al. 2016). Both studies were cross-sectional and the effects were small-sized. For the most part, both studies were minimally at risk of bias.

3.5.6. Heart function indices

Finally, one study examined heart function indices (Kalynychenko et al., 2021). This study found that burnout was positively associated with sympathetic activity ('fight or flight') and negatively associated with parasympathetic activity ('rest and recovery'), but not related to heart rate variability. Effects were medium-sized and from cross-sectional data. This study may not have addressed all areas of bias (particularly in relation to precision and generalizability of the findings).

4. Discussion

The aim of the present study was to provide the first systematic review of research examining the association between teacher burnout and physical health. Our search of the literature found 21 studies including over 5000 teachers from 11 different countries and examining a range of health outcomes. In line with our theoretical expectations, teacher burnout was related to more frequent somatic complaints, physical illnesses, and voice disorders. We also found evidence for links with blunted cortisol responses, markers of inflammation (cytokines), and indicators of heart function (sympathetic activity). We now discuss the implications of these findings and do so by first highlighting what we think are the key findings before providing some critical considerations and recommendations, and we end by summarizing the implications for policy and practice.

4.1. Key findings

Burnout has long been linked with physical health. This has been the case both theoretically and empirically and across a broad

range of occupations (Salvagioni et al., 2017). For the first time, in collating all published work in this area, we show that this is also the case for teachers. Specifically, we found burnout to be linked with a range of health problems which include specific conditions (e.g., gastroenteritis) and biomarkers of a range of health-related biochemical processes (e.g., cortisol). Akin to work in other stressful professions (e.g., nurses, physicians; Williams et al. 2020), our findings support the notion that teachers who experience burnout may be at risk for worse physical health. These findings therefore contribute to the growing evidence highlighting that burnout has the potential to significantly inhibit not only teachers' work experiences but also their lives more broadly.

Research in this area spans a period of several decades (with work beginning in 1982). However, the majority of this work was cross-sectional in nature. Such designs have limitations for causal inferences, and, in this case, limit the claims that can be made in regard to burnout as a causal factor in ill-health development. There were a couple of notable exceptions in this regard, however, that provide a stronger case for a directional and causal relationship. In particular, Burke and Greenglass (1995) found burnout to predict more frequent somatic symptoms a year later. Also, Pruessner et al. (1999) found lower cortisol responses for a high versus low burnout group over a three-day period. In these instances, then, burnout was temporally linked to worse health. Future studies in this area should therefore ensure that the strongest possible designs are used (e.g., longitudinal, prospective), to enable the evidence base for teachers to be as strong causally as it is in other professions (Salvagioni et al., 2017).

Another notable feature of the present research was an almost entire absence of theory. Theory guides researchers; shining light on expectations and possible explanations. Theoretical explanations for the link between burnout and physical health, including those based on behavioral and biological perspectives, have, however, been offered by others (Shirom et al., 2005). In addition, we articulated a theoretical framework to help understand why teachers' health is at risk from burnout. Specifically, we identified three main ways this could occur; increased engagement in unhealthy behaviours, blunted stress responses, and inhibited immune function. The findings of our review support these ideas for the most part, especially in context of increased illness incidence and blunted cortisol responses. We note, however, that theory development in this area is in an early phase. One way to enhance its development is to incorporate aspects and circumstances unique to teachers. Based on the present work, for example, this could include the addition of factors that increase the incidence of voice disorders. It is possible that factors linked to burnout that potentially increase background noise (such as increased student misbehavior) would necessitate that teachers use higher and louder tones of voice, precipitating voice problems. Future work would benefit from explicit tests of these paths both individually but also in an integrative manner. At their simplest, this could involve measuring multiple pathways concurrently, but more complexly could involve linking pathways together (e.g., exploring the mediating link between burnout and illness *via* HPA dysregulation and immune function suppression). As theory development is an ongoing task, the propositions here require testing, and more than likely will need to be refined as a consequence.

4.2. Critical considerations and recommendations

We found discrepant findings in relation to biomarkers of autonomic function (alpha amylase). This is very similar to the literature as a whole where evidence is particularly mixed for certain biomarkers (e.g., Danhof-Pont et al. 2011). There are many reasons why this may be the case. As alluded to elsewhere (Wolfram et al., 2013), it is possible that methodological differences could help explain these discrepancies (e.g., research designs and timeframes, sampling in blood vs. saliva). Discrepancies are also apparent in context of burnout itself. For example, some studies treat burnout symptoms on a continuum and others treat burnout as a categorical variable (e.g., high versus low burnout). There are arguments for both approaches (see e.g., Messias and Flynn 2019), however, the former approach may be more useful. This is for both conceptual (little evidence for viewing burnout as taxometric) and statistical reasons (dichotomizing variables significantly reduces statistical power; Altman and Royston 2006). Therefore, we call for researchers to adopt standardized methodological approaches when examining this relationship, especially in context of biomarkers and burnout conceptualization and measurement.

While the present studies included a reasonable array of physical health conditions and outcomes, future work may benefit from the inclusion of a wider array of disease states. This has been the case in the literature more broadly (Salvagioni et al., 2017). In context of teacher burnout, however, it appears that perhaps the more serious illnesses, in particular, have been overlooked. Future work looking into type 2 diabetes, cardiovascular disease and events, and mortality would be very useful in this regard. To do so, in addition to ensuring the use of robust designs, it is likely that large, interdisciplinary teams will be necessary (e.g., educational psychologists, health psychologists, biomedical scientists). To move this area forward, then, burnout should be examined as part of a collaborative science so as to enable more complex, difficult, and interesting questions to be addressed (Madigan et al., 2021).

4.3. Implications for policy and practice

Teacher burnout features surprisingly little in educational policy. This is despite its links with highly relevant personal (e.g., mental health), interpersonal (e.g., conflict), and organizational outcomes (e.g., attrition). The present findings, therefore, further highlight the necessity for relevant policy and governmental briefs to consider burnout as an important, concerning, and likely growing problem among teachers, and, given the range of countries the present studies examined, also an international one. To do so, it is recommended that researchers attempt to translate findings to broader audiences, disseminate relevant information widely, and communicate with schools, teachers, and policy makers directly. Viac and Fraser's (2020) work offers a useful framework to support these efforts.

The present findings also reiterate the need for burnout interventions. There are two meta-analyses that could guide practice in this regard (Iancu et al., 2018; Oliveira et al., 2021). Both showed that interventions can be effective in reducing burnout symptoms and they suggest cognitive-behavioral, mindfulness, and social and emotional learning-based interventions may be the most effective approaches. Although no cost-effectiveness analyses have been performed on these interventions, given the potential cost of burnout

for physical health and associated problems, it is likely intervention benefits will be significant, and possibly exceed outlay costs. In addition to such individual- and teacher-focused interventions, there may be need for enhanced organizational engagement and awareness so as to most effectively safeguard teachers' experiences and health.

5. Conclusion

We have provided the first systematic review of research examining the relationship between teacher burnout and physical health. We found reasonably strong evidence to suggest that teacher burnout is indeed implicated in the development of physical ill-health. In future a greater focus on integrating and testing theory, examining a wider range of outcomes, and adopting standardized methodological approaches would benefit our understanding of this important issue.

Refereces

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