

Pathways to health: conceptual clarification and appropriate statistical treatment of mediator, moderator, and indirect effects using examples from burnout research

Tyrone B Pretorius

Abstract

In my role as consulting statistical editor for the *South African Journal of Psychology*, I have witnessed a steady increase in articles that focused on the presumed role of mediator and moderator variables. While straightforward cause–effect studies have an important explanatory role, our task in the helping profession is to identify those factors that ‘intervene’ and make individuals differentially vulnerable in the cause–effect relationship. However, in a significant number of papers I have reviewed, there appeared to be considerable conceptual confusion about these variables with moderator and mediator often used interchangeably. In addition, no single paper I have reviewed considered indirect effects. This article attempts to differentiate between the various roles that a third variable can play in the adverse condition–wellbeing relationship (e.g., the stress–depression relationship). In addition, the appropriate statistical procedures for testing these roles are demonstrated using burnout research data. In this particular research project, 207 secondary school teachers completed a range of research questionnaires designed to assess among others burnout, work environment, social support, personal competence, coping, and problem-solving appraisal. Using this data, the various roles that third variables can play are demonstrated using hierarchical regression analyses.

Keywords

Burnout, direct effects, indirect effects, mediator, moderator

There is an abundance of research that has over the years documented an association between adverse conditions and physical and psychological functioning. For example, stress has been related to a broad range of health problems, including sudden cardiac death (Krexi et al., 2016),

University of the Western Cape, South Africa

Corresponding author:

Tyrone B Pretorius, University of the Western Cape, Private Bag X17, Bellville 7535, South Africa.
Email: tpretorius@uwc.ac.za

myocardial infarction (Xu et al., 2015), pregnancy and birth complications (Staneva et al., 2015), and insomnia (Mazo, 2015). Yaribeygi et al. (2017) provide a comprehensive overview of the impact of stress on brain function as well as the immune, cardiovascular, and endocrinal systems. Psychiatric disorders that have been linked with stress include anorexia nervosa and anxiety (Guarda et al., 2015), as well as schizophrenia (Howes et al., 2017). Similar effects have been noted for lifetime stress in terms of mental and physical health (Toussaint et al., 2016).

Similarly, within the work context, the association between negative aspects of the work environment and physical and psychological strain has been well documented. For example, quantitative workload has been linked to anxiety (Guastello et al., 2015), burnout (Portoghese et al., 2014; Pretorius, 1994b), and general psychological distress (Ilies et al., 2015). Other aspects of the work environment like role conflict and role ambiguity have also been found to be associated with burnout (Huat et al., 2018; Pretorius, 1994b) as well as job dissatisfaction and job-related anxiety (Urien et al., 2017). Other work-related factors linked to negative outcomes such as burnout include job insecurity and lack of opportunity for growth (Das, 2016) as well as lack of control and absence of fairness (Leiter et al., 2014).

However, even though the relationship between adverse environmental conditions and physical and psychological wellbeing has been well documented, from a research point of view the relationship was considered to be overly simplistic. Already in the seventies, Rabkin and Streuning (1976) pointed out that in stress research the magnitude of this relationship was generally very modest, since obtained correlations typically ranged between .10 and .30. This indicates that stress might account for only about 9% of the variance in illness/wellbeing. In addition, while understanding the causes and effects of certain phenomena is certainly important, as a helping profession we need to identify those factors that make individuals differentially vulnerable to adverse conditions.

Thus, from an earlier concern with documenting the effects of negative environmental conditions on physical and psychological functioning, there has been a shift to identifying those variables that might influence this relationship. Examples of such variables include social support (Pretorius, 1996; Racine et al., 2018), locus of control (Carter et al., 2014; Goldzweig et al., 2016), self-esteem (Kong et al., 2013), willingness to use support resources (Pretorius, 1994a), appraisal of problem-solving ability (Abdollahi et al., 2015), organisational commitment and participation in decision-making (Pretorius, 1993b), fortitude (Pretorius et al., 2016), and appraisals of safety (Padmanabhanunni et al., 2017). These variables are conceptualised as making individuals differentially vulnerable in the face of adverse environmental conditions.

These variables are often described as having a moderating function in the sense that they moderate the harmful effects of negative environmental conditions. As a statistical reviewer, I have seen many submissions where this term (moderator) is used interchangeably with mediator, despite the conceptual distinctiveness of the two (see Baron & Kenny, 1986, for a landmark paper on this distinction). In addition, incorrect inferences are often drawn about the supposedly moderating (or mediating) effect of a third variable on the basis of zero-order correlations between the third variable and the independent (or health-outcome) variable, or other inappropriate statistical analyses.

In reality, there are at least four different pathways through which a third variable can influence the relationship between a dependent (adverse environmental condition) and an independent (physical/psychological functioning) variable, namely, direct, moderating, mediating, and indirect.

Direct effects

It has often been found that a variable that is presumed to play a role in protecting the individual from negative environmental conditions has a direct relationship with physical/psychological

outcomes. For example, research has found that social support was directly related to depression (Huang et al., 2014; Pretorius, 1994a); problem-solving appraisal was directly related to depression (Heppner et al., 2019); and participation in decision-making and organisational commitment are directly related to burnout (Basami et al., 2013; Pretorius, 1993b). This direct effect hypothesis is also referred to as the health-sustaining model (Shumaker & Brownell, 1984) which postulates that the effect of the third variable (e.g., social support) on well-being is independent of the level of the negative environmental condition. In an extreme version, the direct effects hypothesis holds that an increase in the levels of the third variable will result in an increase in well-being, irrespective of the level of the adverse condition.

Moderating effect

A moderator is described as a third variable that ‘affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable’ (Baron & Kenny, 1986, p. 1174). In stress research, moderator variables are said to have a stress-reducing function (Shumaker & Brownell, 1984) in the sense that it reduces the impact of stress on physical and psychological functioning. It is also referred to as the buffering hypothesis which postulates that these variables interact with stress in affecting psychological adjustment. For example, with regard to social support, the buffering hypothesis would predict that at low levels of social support, the relationship between stress and psychological well-being should be strong and direct (i.e., high stress levels associated with low levels of psychological well-being), and as social support increases, the relationship should weaken. Under conditions of maximal support, the relationship between stress and well-being should be non-existent. Examples of such moderator variables in the literature have already been referred to above.

Mediating effects

‘Whereas moderator variables specify when certain effects will hold, mediators speak to how or why such effects occur’ (Baron & Kenny, 1986, p. 1176). In general, a third variable operates as a mediator when it transforms the predictor or input variable in some way. In this regard, the third variable is the mechanism through which the adverse environmental condition influences the physical/psychological outcome. Baron and Kenny (1986) refer to perceived control as an example of a mediating construct. Essentially, if perceived control operates as a mediating variable, it functions as the mechanism through which the adverse condition (independent variable) affects the physical/psychological outcome (dependent variable). Other examples of mediating effects in the literature include the following: problem-solving confidence mediating the relationship between approach–avoidance style and psychological distress (Heppner et al., 2002), depression mediating the relationship between parenting stress and infant development (Huang et al., 2014), resilience mediating the relationship between compassion fatigue and burnout (Burnett & Wahl, 2015), and anxiety mediating the relationship between perceived performance and intention to quit (Pelsers-Carstens et al., 2015).

Indirect effects

A third variable may not be directly related to physical/psychological functioning but may have an indirect effect by influencing perceptions of the environment/stressor (Moyle, 1995). In this regard, the adverse condition is said to mediate the impact of the third variable on the dependent variable. In stress literature, this has mostly been studied in respect to personality dispositions. It is argued

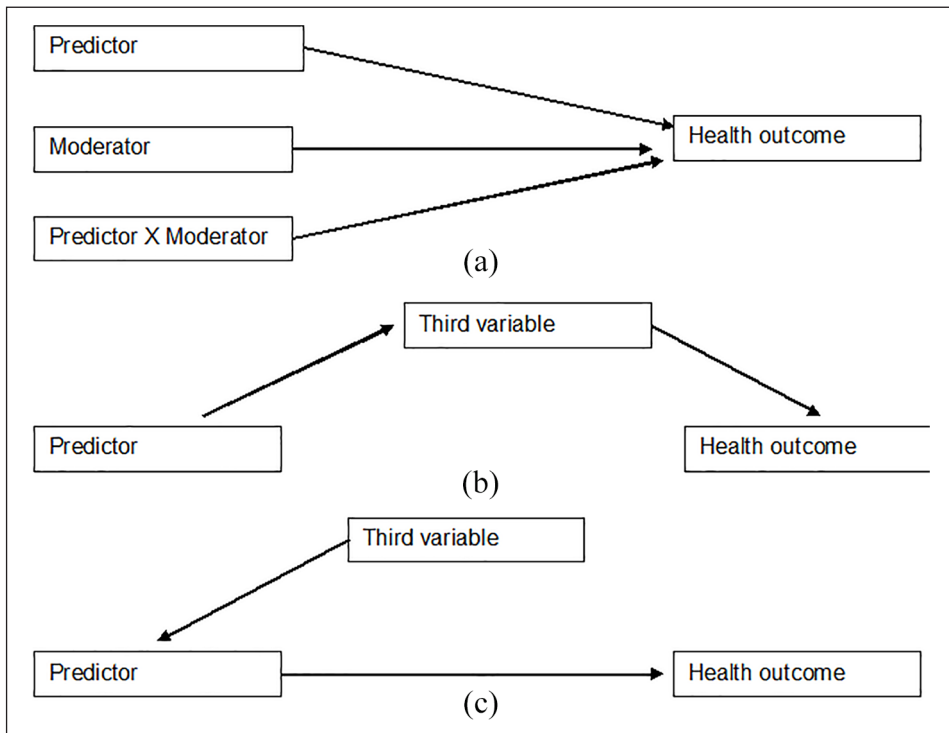


Figure 1. Illustration of moderator, mediator, and indirect effects: (a) moderator effect: the moderator interacts with the predictor in affecting health outcome; (b) mediator effect: the third variable acts as the mechanism through which the predictor affects the outcome; and (c) indirect effects: the third variable leads to the interpretation of the predictor variable in a certain way which in turn affects the outcome variable.

that people bring certain dispositions to, for example, the work setting and tend to interpret the setting in a manner that is consistent with this disposition which in turn results in certain outcomes. For example, Moyle (1995) found that the effect of negative affectivity indirectly affected job satisfaction through perceptions of control in the workplace. Staw et al. (1986) found that the effect of positive affect on job satisfaction was indirectly through the job characteristics. More specifically, they reported that people scoring high on positive affect perceived the characteristics of their jobs more positively and thus experience more job satisfaction. Levin and Stokes (1989) report a similar finding and explain it by speculating that affectivity (negative or positive): ‘may influence how job-related information is translated and stored. As job related information is processed, it may be distorted to be consistent with one’s affective state’ (p. 756).

The difference between moderator, mediator, and indirect effects may be best understood by specifying causality between the various variables. This is done in Figure 1.

As can be seen in Figure 1, the moderator and adverse condition are at the same level with regard to their role as causal variables. However, in the case of mediator variables, the adverse condition is causally antecedent to the third variable, while in the case of indirect effects the third variable is causally antecedent to the adverse condition.

The aims of this article are (a) to briefly report on a study of burnout among secondary school teachers, and (b) to use this data to demonstrate the appropriate statistical analyses to examine the four roles of third variables outlined above.

Method

Participants

The sample consisted of 207 secondary school teachers in the Western Cape. The majority of the sample consisted of women (65.7%). The mean age of the sample was 33.03 ($SD = 6.65$) and the mean number of years in teaching was 10.74 ($SD = 7.42$).

Instruments

Participants completed five different questionnaires, namely, the Occupational Roles Questionnaire (ORQ; Osipow & Spokane, 1998), Maslach Burnout Inventory (MBI; Maslach & Leiter, 2017), State-Trait Anxiety Inventory A-Trait Scale (STAI-T; Spielberger & Sydeman, 1994), Personal Competence Scale (Campbell et al., 1960), and Problem-Solving Inventory (PSI; Heppner et al., 2019). These instruments measure the work environment, psychological outcomes, and variables presumed to play a moderating, mediating, or indirect role in the work environment–psychological outcome relationship.

Aspects of the work environment were assessed by means of the ORQ (Osipow & Spokane, 1998). This scale was designed to measure six different work roles, namely: (a) role overload, which is the extent to which job demands exceeds the resources of the individual; (b) role insufficiency, which is the extent to which skills are inappropriate to job requirements; (c) role ambiguity, which is the extent to which priorities, expectations, and evaluation criteria are clear; (d) role boundaries, which is the extent to which the individual is experiencing conflicting role demands and loyalties; (e) responsibility, which is the extent to which the individual feels responsible for others on the job; and (f) physical environment, which is the extent to which the individual is exposed to high levels of environmental toxins or extreme physical conditions. The ORQ consists of 60 items (i.e., 10 per subscale) which are responded to on a 5-point scale ranging from “rarely” to “most of the time”, and reliability coefficients for the various subscales ranged between .71 and .94. The authors also established the existence of the six independent subscales through confirmatory factor analysis. Comparable internal consistency coefficients were reported for a sample of banking employees in Ghana (Yeboah-Kordee et al., 2018).

Psychological outcomes included burnout and anxiety. Burnout was assessed using the Maslach Burnout Inventory (Maslach & Leiter, 2017). The MBI provides a measure of three components of burnout, namely: (a) Emotional Exhaustion, which is described as the tired and fatigued feelings that develop as emotional energies are drained and teachers are no longer able to give of themselves to students; (b) Depersonalisation, which refers to indifferent and negative attitudes teachers display towards their students and is characterised by feelings of callousness and cynicism; and (c) Low Personal Accomplishment, which refers to the tendency to evaluate oneself negatively, particularly with regard to one’s work with students. The MBI consists of 22 statements scored on a 6-point scale. Persons with higher scores on the Emotional Exhaustion and Depersonalisation Scales and with lower scores on the Personal Accomplishment Scale would be perceiving themselves as burned out. The reliability and validity of the MBI has been well documented. Coefficients of internal consistency typically ranged between .71 and .90 and test–retest reliability ranged between .54 to .80 depending on the test interval. In South Africa, the MBI has been successfully used to assess burnout among rural hospital doctors (Liebenberg et al., 2018) and university teachers (Pretorius, 1994b).

Anxiety was assessed using the STAI-T (Spielberger & Sydeman, 1994). The STAI-T provides a measure of generalised anxiety and consists of 20 items to which subjects respond on a 4-point scale ranging from 1 “almost never” to 4 “almost always”. High scores on the STAI-T indicate high levels of trait anxiety. Test–retest reliability ranged from .73 to .86 and the STAI-T demonstrated

good internal consistency with alpha coefficients ranging from .83 to .92 (Spielberger & Sydeman, 1994). Some studies also provided reliability and validity estimates for the STAI-T as used in Black South African samples (Heppner et al., 2002). The STAI-T has been widely used in South Africa, among other in health studies (e.g., Redinger et al., 2018) and sports science research (e.g., Broodryk et al., 2020).

Third variables that were presumed to influence the relationship between the work environment and psychological outcomes included personal competence and problem-solving appraisal. Personal Competence refers to the feeling of mastery over oneself and one's environment. The Personal Competence Scale was developed by Campbell et al. (1960) and it has largely been applied in political surveys. It consists of eight items scored on a four-point scale ranging from 1 "strongly agree" to 4 "strongly disagree". The responses to all the items are totalled to produce a measure of the degree of personal competence. A high score indicates a high sense of personal competence. Dean (1986) reported acceptable, although not strong, alpha coefficients for the scale (.56–.64) as well as item-total correlations ranging from .35 to .58. In terms of validity, it was found that the scale demonstrated consistent and strong relationships to depression, with correlations ranging from $-.31$ to $-.41$. It was therefore concluded that the scale possesses sufficient strengths in terms of reliability and validity. The reliability of the Personal Competence Scale as used with a South African sample has been reported by Pretorius (1993a).

Appraisal of problem-solving ability was measured with the Problem-Solving Inventory (Heppner et al., 2019). The PSI was developed to assess perceptions of one's problem-solving capabilities rather than actual problem-solving capabilities. It reflects the evaluative awareness of one's problem-solving skills, that is, it provides a global appraisal of oneself as a problem-solver. The PSI consists of 32 items rated on a 6-point scale where low scores are indicative of perceptions of effective problem-solving ability. There are three factors on the PSI: problem-solving confidence (belief and trust in one's problem-solving abilities), approach–avoidance style (general tendency to approach or avoid different problem-solving activities), and personal control (the belief that one is in control of one's emotions and behaviours while solving problems). In addition, a total PSI score is used as a single general index of problem-solving appraisal. Only this total PSI score was used in the current project. The Problem-Solving Inventory appears to be a highly reliable instrument with coefficients of internal consistency ranging between .72 and .92 and coefficients of stability between .83 and .89 (Heppner et al., 2019). In terms of validity, the Problem-Solving Inventory appears to measure constructs that are amenable to change through problem-solving training and that are related to self-perceptions of problem-solving skills. The Problem-Solving Inventory has also been found to be significantly correlated with behavioural observations of actual competence in solving problems (Heppner & Lee, 2009). It has also been found to be a reliable and valid measure for use with Black South African students (Heppner et al., 2002).

Procedure

Teachers at several schools in the Western Cape were invited to participate in the study by completing the questionnaires outside of schooling hours. On a prearranged day, the researcher went around to all the schools to collect the completed questionnaires.

Ethical considerations

The research received ethical approval from the University of the Western Cape. Informed consent was obtained from participants and they completed the questionnaires anonymously. No identifying information was included in the questionnaires.

Table 1. Summary of different steps in hierarchical regression analysis predicting outcome.

Step	Predictor	Result	Conclusion
1	Adverse condition	Significant	Adverse condition has direct effect on outcome
1 (in second regression)	Third variable	Significant	Third variable has direct effect on outcome
2	Adverse condition	Significant	If third variable significant in Step 1 but not significant in Step 2, then indirect effect.
	Third variable	Non-significant	
	Adverse condition	Non-significant	If adverse condition significant in Step 1 but not significant in Step 2, then a mediating effect
	Third variable	Significant	
3	Product of third variable and adverse condition	Significant	Moderating effect

Statistical analyses

The four roles of third variables can be examined using two sets of regression analyses. In the first regression analysis, the physical and/or psychological outcome is used as the dependent variable. The adverse condition is then entered in the first step; the adverse condition and third variable together are entered in the second step; and the product of the adverse condition and third variable (Adverse Condition \times Third Variable) is entered in the third step. To avoid the problem of multicollinearity and to assist with the interpretation of interaction effects, the deviation scores (score minus mean) of the adverse condition and the third variable should be used in the calculation of the product term (Cohen et al., 2013). The second regression analysis only differs from the first in terms of Step 1. Here, the third variable is entered in Step 1 instead of the adverse condition.

A significant effect for the third variable in Step 1 of the alternative regression analysis indicates a direct effect of the third variable on the outcome. This implies that the third variable influences the outcome directly, irrespective of the level of the adverse condition. This would be consistent with the health-sustaining hypothesis.

The second step of the regression analyses indicates whether the third variable has a mediating or indirect effect. If in Step 1 the adverse condition is found to predict the outcome, but in Step 2 is reduced to an insignificant level, this would indicate that the third variable operates as a mediator variable. If, however, it is the third variable that is reduced to an insignificant level in Step 2, the adverse condition is said to be the mediated pathway (i.e., the third variable has an indirect effect on the outcome variable).

The third step of the regression analysis indicates whether the third variable acts as a moderator. If the product of the third variable and the adverse condition is significant in the third step, this is indicative of a moderating effect. The exact nature of such moderating effects is usually examined by comparing those high on the moderator variable with those low on the moderator variable in terms of the relationship between the adverse condition and the physical and/or psychological outcome.

The above analyses are summarised in Table 1.

Results

The means, standard deviations, and reliability coefficients (alpha) for the various scales that will be used in the analyses are reported in Table 2.

The reliability of the various scales appears satisfactory with the exception of the Personal Competence Scale. It is, however, comparable to previously reported reliabilities for this scale (Dean, 1986), as well as other similar competence scales (Husaini et al., 1982).

Table 2. Means, standard deviations, and reliability coefficients of scales.

Scale	Mean	SD	α
ORQ (occupational roles)			
Role overload	29.21	7.42	.77
Role ambiguity	23.04	6.68	.72
MBI (burnout)			
Emotional exhaustion	23.57	12.72	.90
Accomplishment	33.62	7.57	.73
STAI-T (anxiety)	42.00	10.39	.90
Personal Competence Scale	23.04	3.09	.55
PSI (problem-solving appraisal)	84.20	19.56	.85

ORQ: Occupational Roles Questionnaire; MBI: Maslach Burnout Inventory; STAI-T: State-Trait Anxiety Inventory A-Trait Scale; PSI: Problem-Solving Inventory; SD: standard deviation.

Table 3. Intercorrelations between variables.

	1	2	3	4	5	6	7
1. Ambiguity	1.00						
2. Overload	.27**	1.00					
3. Emotional exhaustion	.38**	.44**	1.00				
4. Accomplishment	-.17*	.03	-.19*	1.00			
5. Anxiety	.40**	.26**	.59**	-.39**	1.00		
6. Competence	-.29**	-.02	-.26**	.26**	-.51**	1.00	
7. PSI	.36**	.13	.29**	-.43**	.52**	-.48**	1.00

PSI: Problem-Solving Inventory.

* $p < .05$; ** $p < .01$.

The intercorrelations between those variables that will be used to demonstrate the various models (moderator, mediator, indirect, and direct) are shown in Table 3.

The work environment measures (overload and ambiguity) are significantly related to the health outcome measures (anxiety, emotional exhaustion, and personal accomplishment), with the exception of the relationship between overload and personal accomplishment, which was not significant. Role ambiguity was also significantly related to those variables that are presumed to play a role between an adverse condition and health outcome (competence and problem-solving appraisal). Finally, the health outcomes were all significantly related to these third variables.

To demonstrate the various roles that third variables can play in the adverse condition–health outcome relationship, three different ‘case studies’ were selected, namely: (a) the role of personal competence in the relationship between role ambiguity and emotional exhaustion, (b) the role of personal competence in the relationship between role ambiguity and personal accomplishment, and (c) the role of problem-solving appraisal in the relationship between role overload and anxiety.

The role of personal competence in the relationship between role ambiguity and personal accomplishment

To examine the role of personal competence in the relationship between role ambiguity and personal accomplishment, two separate hierarchical regression analyses were done. In the first regression

Table 4. Hierarchical regression analyses using personal accomplishment as outcome and role ambiguity and personal competence as predictor.

Predictor ^a	df	Cum. R ²	t-value	β
Ambiguity	1,162	.03	-2.40	-.19*
Competence ^b	1,162	.07	3.35	.25**

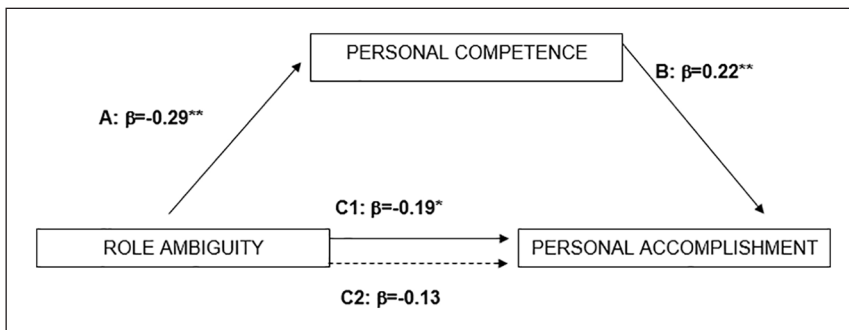
Ambiguity	1,161		-1.63	-.13
Competence	1,161	.08	2.82	.22**

Ambiguity \times Competence	1,160	.08	-0.19	-.02

^aA dashed line represents different steps in the regression analysis.

^bAlternative first step in a separate regression analysis.

* $p < .05$; ** $p < 0.01$.

**Figure 2.** Personal competence mediating the effect of role ambiguity on accomplishment.

* $p < .05$; ** $p < .01$.

analysis, personal accomplishment was used as outcome variable; role ambiguity was entered as Step 1; role ambiguity and personal competence were entered together in Step 2; and the product of role ambiguity and personal competence were entered in Step 3. The second regression analysis only differed from the first in terms of Step 1. Instead of role ambiguity, personal competence was entered in Step 1 of the second regression analysis. The results of these analyses are shown in Table 4.

The product term of personal competence and role ambiguity is non-significant ($\beta = -.02$, $p > .05$), indicating no moderating effects. Although the relationship between ambiguity and personal accomplishment is significant in Step 1 ($\beta = -.19$, $p < .05$), it becomes statistically non-significant in Step 2 ($\beta = -.13$, $p > .05$) when ambiguity is entered simultaneously with personal competence. This is indicative of a mediating effect for personal competence (i.e., that the effect of role ambiguity on personal accomplishment is mediated by personal competence). This is illustrated in Figure 2.

Figure 2 illustrates the various conditions Baron and Kenny (1986) view as necessary to demonstrate a mediating effect for the third variable. First, the independent variable must affect the mediator. This is shown in Path A (established through an additional regression analysis) where there is a significant association between role ambiguity and personal competence ($\beta = -.29$, $p < .05$). Second, the mediator must affect the dependent variable. This is shown in Path B (Step 1 of the second regression analysis) where there is a significant association between personal competence and personal accomplishment ($\beta = .25$, $p < .05$). Third, the independent variable must affect the dependent

Table 5. Hierarchical regression analyses using emotional exhaustion as outcome and role ambiguity and personal competence as predictors.

Predictor ^a	df	Cum. R ²	t-value	β
Ambiguity	1,166	.16	5.56	.40**
Competence ^b	1,166	.06	-3.21	-.24**

Ambiguity	1,165		4.85	.36**
Competence	1,165	.18	-1.94	-.14

Ambiguity × Competence	1,164	.18	-0.19	-.02

^aA dashed line represents different steps in the regression analysis.

^bAlternative first step in a separate regression analysis.

***p* < .01.

variable. This is shown in Path C1 (Step 1 of the regression analysis) where there is a significant association between role ambiguity and personal accomplishment ($\beta = -.19, p < .05$). Finally, when the mediator is controlled for (by entering it simultaneously with the independent variable into the regression equation – Step 2), the effect of the independent variable on the dependent variable should be reduced. When personal competence was controlled for the relationship between role ambiguity and personal accomplishment became non-significant ($\beta = -.13, p > .05$). This is indicated by Path C2 where the dashed line indicates a non-significant association.

The role of personal competence in the relationship between role ambiguity and emotional exhaustion

As before, two separate hierarchical regression analyses were done. In the first regression analysis, emotional exhaustion was used as outcome variable, role ambiguity was entered as Step 1, role ambiguity and personal competence were entered together in Step 2, and the product of role ambiguity and personal competence were entered in Step 3. In the second regression analysis, personal competence was entered in Step 1. The results of these analyses are shown in Table 5.

There are no significant moderating effects as indicated by the fact that the product term is not significant ($\beta = -.02, p > .05$). In the first step, personal competence is a significant predictor of emotional exhaustion ($\beta = -.24, p < .05$), but is not significant ($\beta = -.14, p > .05$) in Step 2 when entered together with role ambiguity. This would indicate an indirect effect for competence on emotional exhaustion (i.e., that the effect of competence on emotional exhaustion is indirectly through perceptions of the work environment, more specifically role ambiguity). This is illustrated in Figure 3.

Figure 3 shows that the relationship between competence and emotional exhaustion is significant ($\beta = -.24, p < .05$) when competence is considered on its own (Path C1). However, when competence and ambiguity were considered together (Step 2 of the regression analysis), the relationship between competence and emotional exhaustion became non-significant ($\beta = -.14, p > .05$) as indicated by Path C2.

The role of problem-solving appraisal in the relationship between role overload and anxiety

Role overload was entered into the first step of the regression analysis, role overload and problem-solving appraisal together in the second step, and the product of role overload and problem-solving

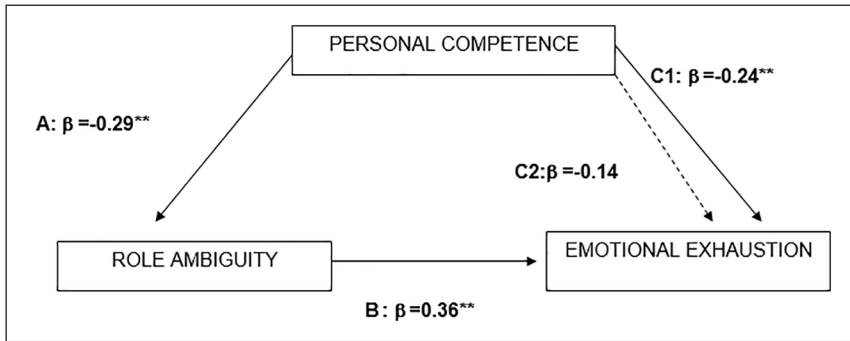


Figure 3. Indirect effects of personal competence – personal competence affects emotional exhaustion indirectly through perceptions of the work environment.

** $p < .01$.

Table 6. Hierarchical regression analyses using anxiety as outcome and role overload and problem-solving appraisal as predictors.

Predictor ^a	df	Cum. R^2	t-value	β
Overload	1,134	.08	3.38	.28**
Problem-solving appraisal ^b	1,134	.27	6.94	.51**
<hr/>				
Overload	1,133		2.86	.21**
Problem-solving appraisal ^b	1,133	.31	6.63	.48**
<hr/>				
Overload \times Problem-Solving Appraisal	1,133	.33	2.22	.16*

^aA dashed line represents different steps in the regression analysis.

^bAlternative first step in a separate regression analysis.

* $p < .05$; ** $p < .01$.

appraisal in the third step. In the separate regression analysis, problem-solving appraisal was entered into the first step. The results of these analyses are reported in Table 6.

In the first step (of the alternate regression analysis), problem-solving appraisal was significantly associated with anxiety ($\beta = .51, p < .05$). This points to the direct effects of problem-solving appraisal on anxiety. This finding is further confirmed by the fact that neither problem-solving appraisal nor role overload was significantly reduced in Step 2 of the analysis. Thus, no mediating or indirect effects are present. However, the product term of problem-solving appraisal and role overload was significant ($\beta = .16, p < .05$). This points to a moderating effect for problem-solving appraisal. Cohen et al. (2013) suggests that the nature of the moderating effect can be established by comparing the regression lines of those high on the moderator variable with those low on the moderator variable.

Following the procedure suggested by Cohen et al. (2013), two different regression lines were calculated – one for those high in problem-solving appraisal (ineffective problem-solvers – at or above the 75th percentile, $N=44$) and one for those low in problem-solving appraisal (effective problem-solvers – at or below the 25th percentile, $N=40$). An alternative to using the 25th and 75th percentiles would be to use 1 standard deviation above and below the mean as cutoff points. The graph for high and low problem-solving appraisal for the relationship between role overload and anxiety is shown in Figure 4.

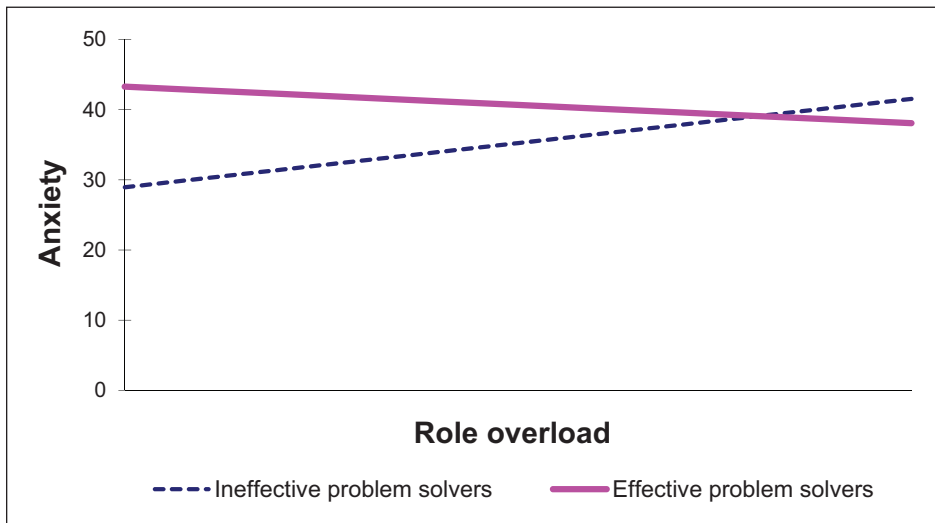


Figure 4. The regression of anxiety on role overload for high and low problem-solving appraisal.

The regression line for those defined as ineffective problem-solvers (high scores on PSI) was much steeper (slope=0.63) than that of the effective problem-solvers (low scores on PSI). In fact, the regression line for the effective problem-solvers shows a slight decline (slope=-0.26). There was also a significant positive relationship between role overload and anxiety for the ineffective problem-solvers ($r = .38, p < .01$), while this relationship was negative (not significant) for the effective problem-solvers ($r = -.18, p > .05$). This indicates that an increase in role overload is significantly associated with an increase in anxiety but only for those who perceive themselves as ineffective problem-solvers. For effective problem solvers, the relationship between role overload and anxiety actually weakens.

Discussion

The purpose of this article was to demonstrate the potential direct, mediating, moderating, and indirect effects that a third variable might play in the adverse condition–health outcome relationship, and to provide an overview of the appropriate statistical analyses for determining these effects. This was done using burnout research conducted among secondary school teachers. Using this data, the direct and moderating effects of problem-solving appraisal on the role overload–anxiety relationship, the mediating effects of personal competence in terms of the role ambiguity–personal accomplishment relationship, and the indirect effects of personal competence on the role ambiguity–emotional exhaustion relationship were illustrated.

A word of caution: in cross-sectional studies of this nature, certain assumptions about causal paths have to be made. These assumptions are made on theoretical rather than strict empirical grounds. For example, role overload is presumed to be causally antecedent to anxiety. However, it could well be that an overanxious individual tends to experience the work environment negatively in terms of role overload. These cross-sectional designs are, however, important in identifying potential causal paths that can be pursued through more sophisticated longitudinal designs and using a triangulation of data sources.

The findings with regard to the three examples used not only make theoretical sense, but are also consistent with previously reported studies. The results pertaining to the direct and buffering roles of

problem-solving appraisal supports those of previous studies (Heppner & Lee, 2009). This indicates, first, a health-sustaining role for problem-solving appraisal in the sense that, irrespective of whether the individual is confronted with an adverse environmental condition, perceiving yourself as an effective problem-solver is beneficial for health. Second, it indicates a stress-buffering role for problem-solving appraisal. In this regard, it was found that at high levels of problem-solving appraisal (ineffective problem-solver), the relationship between role overload and anxiety is very strong. As problem-solving appraisal decreases (towards more effective problem-solving), the relationship between role overload and anxiety weakens. In other words, if a self-perceived effective problem-solver and a self-perceived ineffective problem-solver were exposed to the same level of role overload, the self-perceived ineffective problem-solver would experience higher levels of anxiety.

It was also found that personal competence mediates the relationship between role ambiguity and personal accomplishment. To the extent that personal competence reflects the feeling of control over oneself and one's environment, this finding would link very well to social-psychological research which has long accepted the control mediational model (Baron & Kenny, 1986). A mediational role for personal competence implies that role ambiguity is not directly related to burnout (personal accomplishment), but that personal competence is the mechanism through which ambiguity impacts on burnout. In other words, a work environment characterised by high levels of role ambiguity would indirectly lead to high levels of burnout, depending on the level of personal competence of the individual. In this model, ambiguity is causally antecedent to personal competence. In terms of Baron and Kenny's (1986, p. 178) explanation, personal competence represents 'properties of the person that transforms the . . .' work environment (role ambiguity) in some way.

Personal competence also demonstrated an indirect effect on emotional exhaustion by influencing perceptions of the work environment (role ambiguity). In this model, personal competence is causally antecedent to role ambiguity, whereas in the mediational model it was the other way around. In other words, there is no direct relationship between personal competence and burnout (emotional exhaustion), but personal competence colours the perception of the work environment, which results in burnout. Thus, one can hypothesise that those high in personal competence are more likely to perceive the work environment as manageable (low in ambiguity) resulting in lower levels of burnout. On the contrary, those low in personal competence are more likely to perceive the work environment as unmanageable (high in ambiguity) leading to higher levels of burnout. This is consistent with the argument put forward in the introduction, namely, that people bring certain dispositions to the work setting and tend to interpret the work environment in a manner that is consistent with that disposition.

Conclusion

To understand all the possible mechanisms through which third variables can sustain health and/or reduce the negative effect of adverse conditions, it is important that we examine all the possible pathways mentioned in this article. Failure to do that would not only limit the contribution to science in general that research of this nature can make but also impact on our ability to develop appropriate interventions. It is, however, essential that these pathways be examined with appropriate statistical techniques. Although sophisticated researchers might prefer the use of structural equation modelling, this article attempted to demonstrate, in a very non-technical way, an equally acceptable procedure that would possibly be more accessible to the general researcher or student. Using the three-step hierarchical regression analyses as demonstrated in this article also requires no a-priori formulation of the potential role of a third variable, as all the possible roles are examined at the same time. The purist would probably insist that such an a-priori formulation is correct and proper science. However, for example, only testing the mediational role of a particular variable

and not finding one could lead to an erroneous conclusion that such a variable has no role to play when in fact it might have a moderating or indirect role to play.

This is also not a comprehensive treatise of the moderator/mediator distinction. For example, David Kenny (2018) on his webpage (<http://davidakenny.net/>) discusses the concepts of ‘moderated mediation’ and ‘mediated moderator’, and also provides examples of moderation with different types of variables: categorical and continuous.

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References

- Abdollahi, A., Talib, M. A., Yaacob, S. N., & Ismail, Z. (2015). Problem-solving skills appraisal mediates hardiness and suicidal ideation among Malaysian undergraduate students. *PLOS ONE*, *10*(4), e0122222. <https://doi.org/10.1371/journal.pone.0122222>
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. <https://psycnet.apa.org/1987-13085-001>
- Basami, A., Chizari, M., & Abbasi, E. (2013). Investigating relationship between job burnout and organizational commitment among extension workers in Kurdistan Province, Iran. *International Journal of Humanities and Social Science Invention*, *2*(10), 2319–7722.
- Broodryk, A., Pienaar, C., Edwards, D., & Sparks, M. (2020). Psycho-hormonal effects of aerobic fatigue on collegiate female soccer players. *South African Journal of Science*, *116*(1–2), 1–6. <https://doi.org/10.17159/sajs.2020/6095>
- Burnett, H. J., Jr., & Wahl, K. (2015). The compassion fatigue and resilience connection: A survey of resilience, compassion fatigue, burnout, and compassion satisfaction among trauma responders. *International Journal of Emergency Mental Health and Human Resilience*, *17*, 318–326.
- Campbell, A., Converse, P. E., Miller, W. E., & Stokes, D. E. (1960). *The American voter*. John Wiley.
- Carter, I. I., Larry, W., Mollen, D., & Smith, N. G. (2014). Locus of control, minority stress, and psychological distress among lesbian, gay, and bisexual individuals. *Journal of Counseling Psychology*, *61*(1), 169–175. <https://doi.org/10.1037/a0034593>
- Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). *Applied multiple regression/correlation analysis for the behavioral sciences*. Routledge.
- Das, A. (2016). Causes and effects of stress among working women in banking sector, Bangladesh. *Mediscope*, *3*(1), 1–7. <https://doi.org/10.3329/mediscope.v3i1.29729>
- Dean, A. (1986). Measuring psychological resources. In N. Lin, A. Dean, & W. Ensel (Eds.), *Social support, life events and depression* (pp. 97–111). Academic Press.
- Goldzweig, G., Hasson-Ohayon, I., Alon, S., & Shalit, E. (2016). Perceived threat and depression among patients with cancer: The moderating role of health locus of control. *Psychology, Health & Medicine*, *21*(5), 601–607. <https://doi.org/10.1080/13548506.2016.1140902>
- Guarda, A. S., Schreyer, C. C., Boersma, G. J., Tamashiro, K. L., & Moran, T. H. (2015). Anorexia nervosa as a motivated behavior: Relevance of anxiety, stress, fear and learning. *Physiology & Behavior*, *152*, 466–472. <https://doi.org/10.1016/j.physbeh.2015.04.007>
- Guastello, S. J., Shircel, A., Malon, M., & Timm, P. (2015). Individual differences in the experience of cognitive workload. *Theoretical Issues in Ergonomics Science*, *16*(1), 20–52. <https://doi.org/10.1080/1463922X.2013.869371>
- Heppner, P. P., Heppner, M. J., Wang, Y.-W., & Lee, D.-G. (2019). Creating a positive life: The role of problem-solving appraisal. In M. W. Gallagher & S. J. Lopez (Eds.), *Positive psychological assessment: A handbook of models and measures* (pp. 111–124). American Psychological Association. <https://doi.org/10.1037/0000138-008>
- Heppner, P. P., & Lee, D.-G. (2009). Problem-solving appraisal and psychological adjustment. In S. J. Lopez & C. R. Snyder (Eds.), *Oxford library of psychology. Oxford handbook of positive psychology* (pp. 345–355). Oxford University Press.

- Heppner, P. P., Pretorius, T. B., Wei, M., Lee, D. G., & Wang, Y. W. (2002). Examining the generalizability of problem-solving appraisal in Black South Africans. *Journal of Counseling Psychology, 49*(4), 484–498. <https://doi.org/10.1037/0022-0167.49.4.484>
- Howes, O. D., McCutcheon, R., Owen, M. J., & Murray, R. M. (2017). The role of genes, stress, and dopamine in the development of schizophrenia. *Biological Psychiatry, 81*(1), 9–20. <https://doi.org/10.1016/j.biopsych.2016.07.014>
- Huang, C. Y., Costeines, J., Kaufman, J. S., & Ayala, C. (2014). Parenting stress, social support, and depression for ethnic minority adolescent mothers: Impact on child development. *Journal of Child and Family Studies, 23*(2), 255–262. <https://doi.org/10.1007/s10826-013-9807-1>
- Huat, C. S., Saili, J., & Sabil, S. (2018). The relationship between role conflict and burnout among secondary school counselors in Sarawak. *Global Business & Management Research, 10*(2), 10–22. <https://search.ebscohost.com>
- Husaini, B. A., Neff, J. A., Newbrough, J. R., & Moore, M. C. (1982). The stress-buffering role of social support and personal competence among the rural married. *Journal of Community Psychology, 10*, 409–425. [https://doi.org/10.1002/1520-6629\(198210\)10:4<409::AID-JCOP2290100410>3.0.CO;2-D](https://doi.org/10.1002/1520-6629(198210)10:4<409::AID-JCOP2290100410>3.0.CO;2-D)
- Ilios, R., Huth, M., Ryan, A. M., & Dimotakis, N. (2015). Explaining the links between workload, distress, and work–family conflict among school employees: Physical, cognitive, and emotional fatigue. *Journal of Educational Psychology, 107*(4), 1136–1149. <https://doi.org/10.1037/edu0000029>
- Kenny, D. (2018). <http://davidakenny.net/>
- Kong, F., Zhao, J., & You, X. (2013). Self-esteem as mediator and moderator of the relationship between social support and subjective well-being among Chinese university students. *Social Indicators Research, 112*(1), 151–161. <https://doi.org/10.1007/s11205-012-0044-6>
- Krexli, L., Georgiou, R., Krexli, D., & Sheppard, M. N. (2016). Sudden cardiac death with stress and restraint: The association with sudden adult death syndrome, cardiomyopathy and coronary artery disease. *Medicine, Science and the Law, 56*(2), 85–90. <https://doi.org/10.1177%2F0025802414568483>
- Leiter, M. P., Maslach, C., & Frame, K. (2014). Burnout. In *The encyclopedia of clinical psychology* (pp. 1–7). <https://doi.org/10.1002/9781118625392.wbecp142>
- Levin, I., & Stokes, J. P. (1989). Dispositional approach to job satisfaction: Role of negative affectivity. *Journal of Applied Psychology, 74*, 752–778. <https://doi.org/10.1037/0021-9010.74.5.752>
- Liebenberg, A. R., Coetzee, J. F., Jr., Conradie, H. H., & Coetzee, J. F. (2018). Burnout among rural hospital doctors in the Western Cape: Comparison with previous South African studies. *African Journal of Primary Health Care & Family Medicine, 10*(1), 1–7. <https://doi.org/10.4102/phcfm.v10i1.1568>
- Maslach, C., & Leiter, M. P. (2017). Understanding burnout: New models. In C. L. Cooper & J. C. Quick (Eds.), *The handbook of stress and health: A guide to research and practice* (pp. 36–56). Wiley-Blackwell. <https://doi.org/10.1002/9781118993811.ch3>
- Mazo, G. N. (2015). Causes, effects of stress and the coping mechanism of the bachelor of science in information technology students in a Philippine University. *Journal of Education and Learning, 9*, 71–78. <https://doi.org/10.11591/edulearn.v9i1.1295>
- Moyle, P. (1995). The role of negative affectivity in the stress process: Tests of alternative models. *Journal of Organizational Behavior, 16*, 647–668. <https://doi.org/10.1002/job.4030160705>
- Osipow, S. H., & Spokane, A. R. (1998). *Manual for the Occupational Stress Inventory*. Psychological Assessment Resources.
- Padmanabhanunni, A., Campbell, J., & Pretorius, T. B. (2017). Gendered role of appraisals of safety in psychological outcome in relation to trauma. *Psychological Trauma: Theory, Research, Practice, and Policy, 9*(5), 518–525. <https://doi.org/10.1037/tra0000167>
- Pelser-Carstens, V., Keyser, E., & Surujlal, J. (2015). Relationship between social contract, anxiety, performance, workload and intention to quit among professional sport coaches. *African Journal for Physical, Health Education, Recreation and Dance, 21*(32), 1009–1023. <https://hdl.handle.net/10520/EJC175493>
- Portoghese, I., Galletta, M., Coppola, R. C., Finco, G., & Campagna, M. (2014). Burnout and workload among health care workers: The moderating role of job control. *Safety and Health at Work, 5*(3), 152–157. <https://doi.org/10.1016/j.shaw.2014.05.004>

- Pretorius, T. B. (1993a). Assessing the problem-solving appraisal of Black South African students. *International Journal of Psychology, 28*, 861–870. <https://doi.org/10.1080/00207599308246968>
- Pretorius, T. B. (1993b). Commitment, participation in decision making and social support: Direct and moderating effects on the stress-burnout relationship within an educational setting in South Africa. *South African Journal of Psychology, 23*, 10–14. <https://doi.org/10.1177/008124639302300102>
- Pretorius, T. B. (1994a). Network orientation and social support as moderators of the stress-depression relationship. *Journal of Social Behavior and Personality, 9*, 1–12. <https://search.proquest.com/openview/64fb8ff11070421e9b8167bcb8cdecf1/1?pq-origsite=gscholar&cbl=1819046>
- Pretorius, T. B. (1994b). Using the Maslach Burnout Inventory to assess educator burnout at a university in South Africa. *Psychological Reports, 75*, 771–777. <https://psycnet.apa.org/record/1995-23823-001>
- Pretorius, T. B. (1996). Gender and the health-sustaining and stress-reducing functions of social support. *Journal of Social Behavior and Personality, 11*, 193–208.
- Pretorius, T. B., Padmanabhanunni, A., & Campbell, J. (2016). The role of fortitude in relation to exposure to violence among adolescents living in lower socio-economic areas in South Africa. *Journal of Child & Adolescent Mental Health, 28*(2), 153–162. <https://doi.org/10.2989/17280583.2016.1200587>
- Rabkin, J. G., & Streuning, E. L. (1976). Life events, stress and illness. *Science, 194*, 1013–1020.
- Racine, N., Madigan, S., Plamondon, A., Hetherington, E., McDonald, S., & Tough, S. (2018). Maternal adverse childhood experiences and antepartum risks: The moderating role of social support. *Archives of Women's Mental Health, 21*(6), 663–670. <https://doi.org/10.1007/s00737-018-0826-1>
- Redinger, S., Norris, S. A., Pearson, R. M., Richter, L., & RoCHAT, T. (2018). First trimester antenatal depression and anxiety: Prevalence and associated factors in an urban population in Soweto, South Africa. *Journal of Developmental Origins of Health and Disease, 9*(1), 30–40. <https://doi.org/10.1017/S204017441700071X>
- Shumaker, S. A., & Brownell, A. (1984). Toward a theory of social support: Closing conceptual gaps. *Journal of Social Issues, 40*, 11–36. <https://doi.org/10.1111/j.1540-4560.1984.tb01105.x>
- Spielberger, C. D., & Sydeman, S. (1994). State-Trait Anxiety Inventory and State-Trait Anger Expression Inventory. In M. E. Maruish (Ed.), *The use of psychological testing for treatment planning and outcomes* (pp. 292–321). Lawrence Erlbaum.
- Staneva, A., Bogossian, F., Pritchard, M., & Wittkowski, A. (2015). The effects of maternal depression, anxiety, and perceived stress during pregnancy on preterm birth: A systematic review. *Women and Birth, 28*(3), 179–193. <https://doi.org/10.1016/j.wombi.2015.02.003>
- Staw, B. M., Bell, N. E., & Clausen, J. A. (1986). The dispositional approach to job attitudes: A lifetime longitudinal test. *Administrative Science Quarterly, 31*, 57–77. https://www.jstor.org/stable/2392766?casa_token
- Toussaint, L., Shields, G. S., Dorn, G., & Slavich, G. M. (2016). Effects of lifetime stress exposure on mental and physical health in young adulthood: How stress degrades and forgiveness protects health. *Journal of Health Psychology, 21*(6), 1004–1014. <https://doi.org/10.1177/1359105314544132>
- Urien, B., Osca, A., & García-Salmones, L. (2017). Role ambiguity, group cohesion and job satisfaction: A Demands-Resources Model (JD-R) Study from Mexico and Spain. *Revista Latinoamericana de Psicología, 49*(2), 137–145. <https://doi.org/10.1016/j.rlp.2015.09.014>
- Xu, X., Bao, H., Strait, K., Spertus, J. A., Lichtman, J. H., D'Onofrio, G., Spatz, E., Buchholz, E. M., Geda, M., Lorenze, N. P., Bueno, H., Beltrame, J. F., Harlan, M., & Krumholz, H. M. (2015). Sex differences in perceived stress and early recovery in young and middle-aged patients with acute myocardial infarction. *Circulation, 131*(7), 614–623. <https://doi.org/10.1161/CIRCULATIONAHA.114.012826>
- Yaribeygi, H., Panahi, Y., Sahraei, H., Johnston, T. P., & Sahebkar, A. (2017). The impact of stress on body function: A review. *Experimental and Clinical Sciences Journal, 16*, 1057–1072. <https://doi.org/10.17179/excli2017-480>
- Yeboah-Kordec, N. S., Amponsah-Tawiah, K., Adu, I. N., & Ashie, A. A. (2018). An investigation of the impact of occupational stress on employee performance: Evidence from the Ghanaian banking sector. *International Journal of Academic Research in Business and Social Sciences, 8*(9), 150–169. <https://doi.org/10.6007/IJARBS/v8-i9/4581>