

## **Application of Artificial Neural Networks to assess the effects of incivility on job satisfaction through emotional exhaustion**

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### **Abstract**

**Purpose:** This study articulates contribution to understand effect of workplace incivility experience sourced from supervisor and co-worker through emotional exhaustion on job satisfaction based on COR theory at practical and academic junction.

**Methods:** Linear regression through structural equation modelling and non-linear techniques through artificial neural networks were applied for reliable predictability between relationships in survey sample from healthcare nurses in Pakistan.

**Findings:** The obtained results from the SEM as well as ANN indicated that supervisor and co-worker incivility exhaust the employee emotions that has an overall acts as a negative effect, adding to the detriment of the job satisfaction of nurses in public healthcare hospitals.

**Originality:** Supervisor and co-worker incivility are negative features that reduce the satisfaction in profession nurses through emotional exhaustion. This study develops understanding regarding the effect of incivility on job satisfaction in Asian public work settings context. This paper discusses the implications of urgency to make work settings a better place for workforce at all levels.

**Keywords:** Workplace incivility, Supervisor, Co-worker, Emotional exhaustion, Job satisfaction, Artificial Neural Network, Structural Equation Modelling, Healthcare.

## 1. Introduction

Healthcare organizations are the backbone for development and growth of any nation (Mills, 2014), and incivility is breaking that backbone. Individuals experiencing incivility results in generating tremendous amount of negative psychological and behavioral consequences. Accordingly, incivility is on the increase in workplaces and it is detrimental for the productivity and well-being of the employee, employer, and organizations as well (Pearson & Porath, 2008). Incivility gained attention of several researchers who identified several precursors and its wide range of destructive outcomes (e.g., Andersson & Pearson, 1999; Hershcovis, Reich, Parker, & Bozeman, 2012). This current recent research investigates incivility more from the perspective of the victim perspective to understand and tackle due its negative outcomes at all levels (Schilpzand, Pater, & Erez, 2016).

Workplace incivility is mild discourteous, insulting treatment, ambiguously intent to harm others (Loi, Loh, & Hine, 2015). Literature shows that both the supervisor as well as the co-workers are the two main sources of incivility and about 96% workforce have experienced workplace incivility (Porath & Pearson, 2010). Workplace incivility has been reported for rise by researchers in all work settings (Clark, Landrum, & Nguyen, 2013) and has become an increasing problem (Porath, Gerbasi, & Schorch, 2015). Whereas, literature shows that uncivil behaviour at workplace is more lethal for social settings of the healthcare settings (Ahn & Choi, 2019) in terms of job satisfaction and costly for organization by reducing hospital productivity for USD 1,484\$/nurse (Hutton and Gates, 2008) which ultimately deteriorates quality of healthcare services (Selden & Sowa, 2015).

Accordingly, healthcare sector serves for the development of the economic and social wellbeing specifically in developing countries (Mills, 2014). Where nurses are second most important after doctors (Steve, 2015) to impact the healthcare system by interpreting and improving interpersonal relations among staff and supervisors (Kohn, Corrigan, & Donaldson, 2000). More, specifically, Winstanley and Whittington (2002) reported that nurses were more prone to verbal abuse. Further, Bibi, Karim, and Din (2015) in local context of Pakistan linked workplace incivility with negative work outcomes such as job dissatisfaction (Laeque, *et al.*, 2018), therefore, recommended further investigation for managerial intervention development.

On the contrary, workplace incivility among nurses in the U.S.A, enterprise employees in Turkey and hotel employees in Nigeria were reported had no significant effect on their job satisfaction by Walker (2014); Cingöz and Kaplan (2015), Alola, Olugbade, Avci, and Öztüren (2019) respectively. Despite of the impact, less literature is available about workplace incivility in the non-western context (Pattusamy & Jacob, 2016) and typically in Asian context (Ghosh, 2017). This highlights the need for more investigation and importance of this study to help HR practitioner to understand the workplace incivility phenomenon (Pearson & Porath, 2005) with respect to emotional and job satisfaction.

## 2. Theory and Hypothesis development

The Conservation of resources (COR) theory links stressors with depletion of individual emotional resources (Hobfoll, 2001). Such depletion of resources may arise due to stressors such as supervisor and co-worker incivility into a negative emotional experience resulting in lower nurses' job satisfaction in Pakistani context (Dahri & Ab Hamid, 2018). The research frame is based on theoretical assumptions for conceptualization of supervisor as well as co-worker incivility negative effect on job satisfaction resulting in emotional exhaustion.

## 2.1. Co-workers Incivility and Supervisor Incivility affecting job satisfaction and mediating role of emotional exhaustion

Co-worker incivility refers to impolite behaviors of a co-worker, such as being wary of saying “please” or “thank you”, to stalk or follow co-workers and raising one’s voice to intimidate the co-workers or ignoring some co-workers at the behest of other workers (Pearson et al., 2001). As per the COR theory the general well-being of employee may be reduced by experience of uncivil behaviour (Hobfoll and Shirom, 2001). Such as co-workers’ is unwelcoming and disrespectful may manifest distress (Lim and Lee, 2011), decreased social, mental and emotional energy (Giumetti, Hatfield, Scisco, Schroeder, Muth, & Kowalski, 2013) resulting in emotional exhaustion (Samad, Memon, & Kumar, 2020) which is negatively associated with job satisfaction (Brewer & Clippard, 2002). Drawing upon fundamentals of COR theory, co-worker uncivil behaviour experience will induce emotional exhaustion that reduces job satisfaction.

Supervisor incivility refers to impolite behaviour instigated by the supervisor. This type of incivility may include hurtful remarks, racism, gossip, and shunning (Reio, 2011). For example if the supervisor publicly embarrasses or makes fun of, curses and/ or ostracize results in the decline in the productivity of the worker (Pearson & Porath, 2005). These uncivil acts, according to COR theory, may exhaust one’s emotional resources (Hobfoll & Shirom, 2001).

The emotional exhaustion is feeling of stress, depleted, drained, or exhaustion of emotional energy arrived due to contention with workplace factors such as repeated interpersonal interactions or negative factors that accumulate negative individual feelings. These feelings leave employee hapless and they lose their self-esteem, and feel apathy and a general lack of accomplishment (Dahri, Hameed, Nawaz, Sami, & Bux Shah, 2019). This grows a sense of frustration disappointing individual to display interest in their job. Accordingly, emotionally exhausted employs develop a negative attitude towards work, customers, organizational tasks, and even one’s own self (Deci, Olafsen, & Ryan, 2017). This educates us to understand as to why emotionally exhausted employees become dissatisfied with their job. These theoretical argument lead to develop following hypothesis:

**Hypothesis 1:** Co-worker incivility and Supervisor incivility is positively related to emotional exhaustion.

**Hypothesis 2:** Emotional exhaustion is negatively related to job satisfaction.

**Hypothesis 3:** Co-worker incivility and Supervisor incivility negatively related to job satisfaction.

Literature shows that emotional exhaustion plays central role to bridge the negative effect towards job satisfaction. In a recent study, Brewer and Clippard (2002) utilized surveys from about 166 service personnel of the U.S student support and observed a clear and lucid substantial negative relationship between emotional exhaustion and job satisfaction. These facts narrow down to chronic evidences of emotional exhaustion in public hospital nurses in Pakistan (Khokhar, Chaudhry, Bakht, Alvi, & Mohyuddin, 2016) which dismantles their job satisfaction. Similarly, Sun and Pan (2008); Khamisa, Oldenburg, Peltzer, and Ilic (2015); and Rhee, Hur, and Kim (2017) linked work stressors with emotive exhaustion and overall decreased job satisfaction among nurses.

However, incomplete findings in past literature point to many questions regarding mediating role of emotional exhaustion. Such as, Halbesleben and Bowler (2007) have reported a lesser tendency of emotional exhaustion on the performance and job satisfaction. Khokhar *et al.* (2016) found various negative factors were not significantly related to emotional exhaustion.

These unclear arguments on mediating role of emotional exhaustion are underpinned by COR theory assumption to develop the following hypothesis,

**Hypothesis 3:** Emotional exhaustion will mediate the relationship between supervisor and co-worker incivility and job satisfaction.

### 3. Artificial Neural Network (ANN) Rationale

A majority of researcher are using PLS regression prediction function using methods such as regression for causal relationships (Zhao & Xia, 2017). Regardless of wide acceptability of ANN methods there is a reported limitation of oversimplifying the intricacies involved in decision making process (Abubakar et al., 2017). ANN as AI tool has gained momentum as it outperformed these traditional methods such as CB-SEM, PLS SEM, regression and linear modelling,. This is simply due to a lesser ability to predict linear as well as non-linear relationships to a great extent (Abubakar, 2018). ANN has high validity prediction matched with a high predictive accuracy a fast learning algorithm and quite accurate predictions. ANN is able to aquire new learning methods and store past data and memory and it exerts dominance in reliability over regression (CB-SEM and PLS SEM). ANN is flexible in terms of factor loadings, normality assumptions, linearity, homoscedasity, sample and size (Abubakar, Karadal, Bayighomog, & Merdan, 2018), can accommodate sample with great differences and has good generalizability capabilities i-e robust for missing or noisy data or information (Göçken et al., 2016).

ANN features out of the box regression techniques in prediction that a superior (de la Paz-Marín et al., 2012). far insulated from statistical flaws, this study addresses the urge of scholars to capitalize ANN capability to model complex hidden relationships among variables (Taneja & Arora, 2019). ANN utilizes a certain number of neurons which act as the central processing units of that include metathetical functions. These neurons are connected by directed weighted links (Strohmeier & Piazza, 2015). These units are organized in layers, they may have one input layer, one or more hidden layers for data processing through neural networks, and an output layer providing the necessary results (Abubakar, 2018).

ANN can forecast both asymmetric as well as symmetric relationships with total accuracy and it does not make any assumptions of multivariate homoscedastic, linearity and normality mandates (Abubakar, 2018). ANN is an AI method that overcomes common bias methods error and simulates tests for accuracy directing to use PLS package in combination in R to predict job satisfaction behaviour among healthcare workers.

### 4. Methods and Materials

Ensuring confidentiality of respondents, data was collected from a population of 736 registered nurses of in Karachi and Hyderabad district public hospital of Sindh province, through self-reporting method. A total of 330 questionnaires were administered among registered nurses in public hospitals from Sindh province in Pakistan. Where, 301 responses were returned making 78% rate of return and after initial data screening 291 were left usable for final analyses.

#### 4.1. Instruments:

**Co-worker incivility** - measured with 4 items borrowed from (Sliter et al., 2012) on response choice ranging on a likert scale of five (*frequent or very often*) to one (*never*). The high high scores indicated a

higher co-worker incivility. The factor loadings of items in this study were as follows: (0.66,0.81,0.69,0.77,0.83); CR= 0.87; AVE= 0.611

**Supervisor incivility** – measured with 4 items borrowed from (Sliter et al., 2012) on a response choice ranging on a likert scale of five (*frequent or very often*) to one (*never*). In this study the high scores indicated higher supervisor incivility. The factor loadings of items in this study were as follows: (0.72,0.61,0.68,0.73,0.67); CR= 0.83; AVE= 0.601

**Emotional Exhaustion** – measured with 9-items borrowed from (Maslach & Jackson, 1981,) on response choices on a likert scale ranging from 1 (never) to 7 (very often) with the increasing scores indicating greater emotional exhaustion. The low factor loading items were dropped and items included in this study were as follows: (0.69,0.59,0.87,0.77,0.59); CR= 0.79; AVE= 0.610

**Job satisfaction** was measured with 5-items scale developed by Andrews and Whitey (1976) global job satisfaction scale on response choices of ranging from 1 (completely dissatisfied) to 7 (completely satisfied) with higher scores showing greater emotional exhaustion. The factor loadings of items in this study were as follows: (0.75,0.68,0.75,0.71,0.79); CR= 0.81; AVE= 0.604.

#### 4.2. Demographics of respondents:

Among respondents, 60% were female and the rest were male nurses. 50% were between 31 and 45 years of age, while, 35% were between 21 and 30 and the rest were more than 50 years old. 69% were married and rest were single. 54% had graduated, 6% were had master's degree and rest were undergraduates by qualification, with majority having (70%) having experience between 31 to 40 years of experience and 20% had 20 to 30 years and rest had less than 10 years of job experience.

#### 5. Research findings

Self-reporting method is approached in this study which involves certain common bias. To address this issue, this study adopts the technique of structural equation modelling (SEM) to test the applied statistical remedies. Anonymity of respondents was ensured by means of Harman single factor testing in the steps of Podsakoff, MacKenzie, and Podsakoff, (2012) suggestions. The structural equation model of this study was measured through AMOS program and model predictiveness was analysed through neural network in R package. Following (Hair, Hult, Ringle, & Sarstedt 2014) suggestions the measurement model fit was evident from factor loading for each item of the measurement scales ranging from 0.57 to 0.91, Chi-square ( $X^2$ ) value was 1211, goodness of fit (GFI) was 0.82, normed fit index (NFI) was 0.90 and root mean square error approximation (RMSEA) was 0.072. In addition to loadings, for convergent and discriminant validity deemed adequate under Hair, Anderson, Tatham, and Black (1998) guidelines as composite reliability (CR) with values of co-worker incivility (0.87), supervisor incivility (0.83), emotional exhaustion (0.79) and job satisfaction (0.81), average variance extracted (AVE) with values of co-worker incivility (0.661), supervisor incivility (0.601), emotional exhaustion (0.610) and job satisfaction (0.604).

Whereas, convergent and discriminant validity were also analysed and found ( $\beta=0.301$ ,  $t= 4.36$ ,  $p=0.01$ ) for co-worker incivility showing effect on emotional exhaustion (H1 supported); values of ( $\beta=0.31$ ,  $t=5.63$ ,  $p=0.01$ ) showing effect of supervisor incivility on emotional exhaustion (H2 supported); values for co-worker incivility were ( $\beta=-0.281$ ,  $t=5.58$ ,  $p=0.01$ ) showing effect on job satisfaction (H3 supported); values for supervisor incivility were ( $\beta=-0.293$ ,  $t=3.61$ ,  $p=0.01$ ) showing effect on job satisfaction (H4 supported). Finally, emotional exhaustion with values ( $\beta=-0.203$ ,  $t=6.15$ ,  $p=0.01$ ) showed effect on job satisfaction (H5 supported).

An indirect effect of co-worker and supervisor incivility on job satisfaction through emotional exhaustion was analyzed using AMOS. Following Preacher & Hayes (2004) bootstrapping was run at 5000 samples for bias-corrected model. The resulting outcomes showed indirect effect of co-worker incivility on job satisfaction through emotional exhaustion was ( $\beta=-0.109$ ,  $t=1.47$ ,  $p=0.05$ ). Similarly, supervisor incivility indirect effect on job satisfaction through emotional exhaustion was ( $\beta=-0.216$ ,  $t=2.22$ ,  $p=0.01$ ). Thus, indirect effect results show support for indirect hypothesis (H6, H7) see table 1.

The effect size ( $f^2$ ) under the Cohen (1988) guidelines support the hypothesis with effect of c-W.Inc on E.Ex was 0.091, Sup.Inc on E.Ex was 0.035, c-W.Inc on J.sat was 0.039, sup.Inc on J.sat was 0.258, E.Ex on J.sat was 0.311, whereas effect of c-W.inc on J.Sat through mediating of E.Ex was 0.041, and similarly, the effect of size of sup-Inc on J.Sat through mediation of E.Ex was observed as 0.094.

Path	Beta	St.Dev	t	$f^2$	P Values
H1: C-W.Inc ->E.Exh	0.301	0.069	4.36	0.091	0.001
H2: Sup.Inc ->E.Exh	0.31	0.055	5.63	0.035	0.010
H3: C-W.Inc ->J.Sat	-0.281	0.048	5.58	0.039	0.001
H4: Sup-Inc ->J.Sat	-0.293	0.081	3.61	0.258	0.002
H5: E.Exh->J.Sat	-0.203	0.033	6.15	0.311	0.001
H6: C-W.IncI->E.Exh->J.Sat	-0.109	0.074	1.47	0.041	0.05
H7: Sup.IncI->E.Exh->J.Sat	-0.216	0.097	2.22	0.094	0.021

**Table 1:** Break down of total standardized effect of the research model (n = 291).

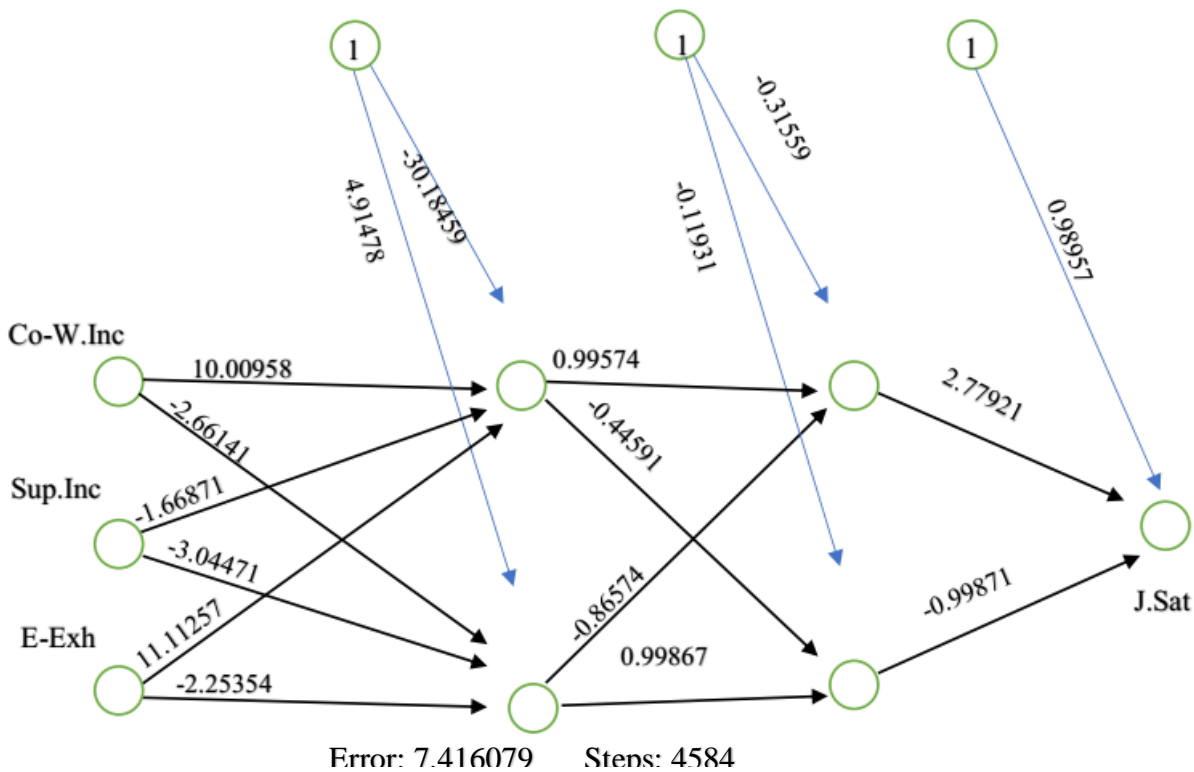
ANN is quite a sound technique for predictive analytics with estimation aspects more effectively. It is a mathematical and human cognition model meant for

- (1) information processing of many simple units called neurons,
- (2) each connection link is associated with a weight that is utilized to multiply the signal transmitted,
- (3) all neurons utilize a nonlinear function for its net input (sum of weighted input signals) to determine its output signal,
- (4) ANN are usually are modelled into one input layer, one or more hidden layers and one output layer Simpson (1990) and Fausett (1994),
- (5) ANN networks relate variables directly and indirectly by determining weights between units among layer which is distinctive in regression which relate variables directly (Abubakar, 2018), and
- (6) The hidden layer along with weights comprise the internal structure of input data (Rumelhart, Hinton, & Williams, 1986) which may produce better estimates.

Therefore, ANN can be utilized to identify non-linear and linear relationships (Sim, Tan, Wong, Ooi, & Hew, 2014) and superior predictive power that outperforms traditional SEM and regression as complex interactions can be modelled by ANN giving highly accurate and flexible response values of nonlinear inputs (Olden & Jackson, 2002). Moreover, ANN does not like any data distribution assumption and had

high predictive accuracy (Leong, Hew, Lee, & Ooi, 2015). Thus, use of SEM as well as ANN together in this study makes a complementing reference.

As ANN multi-layer perceptron with resilient backpropagation and employing weight back tracking algorithm was utilized in this study as given in the R-neural network package. The activation of hidden as well as output layers was through logistic function. The sum square error (SSE) method was utilized as a differentiable error function in this work. The hidden nodes utilized were (2,2) and a generalized linear model (GLM) function was utilized for predicting model accuracy. Using prediction function in neural-net GLM predicted a Root Mean Square of Error (RMSE) equal to 1.07 while neural network predicted the model better with RMSE of 0.08. the synaptic weights on the input, hidden and output layer of ANN are shown in figure 1.



**Figure 1: The ANN utilized for this study**

This training process required 2083 steps till the absolute partial derivatives of the given error function became smaller than 0.01. The results of the estimated weights show that co-worker incivility and supervisor incivility had significant effect on emotional exhaustion that mediated nonlinear effect on job satisfaction.

Significant effects in the job satisfaction also validate the SEM findings. The generalized weights are given for all the covariates within the same range. Further, to potential bias issue of model over fitting was addressed by 10-fold cross validation test with ratio 70:15 data for training and testing, also 10 networks were used for model accuracy. The RMSEs are presented in Table 2, overall the results shows that model predictions are is reliable.





<b>Neural networks</b>	<b>Training</b>	<b>Testing</b>
1	0.048	0.041
2	0.051	0.039
3	0.049	0.051
4	0.055	0.047
5	0.068	0.038
6	0.052	0.045
7	0.061	0.054
8	0.053	0.042
9	0.067	0.044
10	0.062	0.05
Mean RMSE	0.057	0.049

*Notes:* Neural-net in R, *Input nodes –co-worker (C-W.Inc) and supervisor (S-Inc) incivility; Output nodes – Job satisfaction (J-Sat)*

Table 2: Neural Network Model Prediction for 10 Models

### Discussion, Theoretical and Managerial Implication

Earlier research mostly focused on workplace incivility focused mainly on turnover, withdrawal intention, cynicism and negative organizational outcomes. Less attention was focused on negative emotional energy accumulation that preys over job satisfaction. Theoretically, the article links workplace incivility experienced by nurses from co-workers and supervisor resulting in reduced job satisfaction. Similarly, the empirical association endorse the hypothesised relations extends the COR theory postulations. This is study in among very few that addressed critical healthcare behavioural issues with the help of Artificial Neural Network ANN due to its predictive accuracy, validity, dominance over progression, and less data restrictive nature such as normality, linearity and sample assumptions. Though, limitations can be criticized by future researchers and to test this model in western cultures and self-reporting biasness.

Based on COR theory assumptions, this study essentially links experiencing incivility at workplace from supervisor and co-workers with emotional exhaustion which eventually lowers job satisfaction among nurses serving in healthcare sector. Research frame built on these foundations was interacted through ANN as well as SEM to examine the impact of the given proposed variables. Accordingly, co-worker and supervisor ignited emotional exhaustion that further mediated between co-worker, supervisor incivility and job satisfaction supporting the proposed hypotheses.

Chen, Sparrow, and Cooper (2016) observed job satisfaction as an expression of an individual’s thoughts, the attitude of an individual at the workplace, feelings of an employee during performing the allocated task. Where, incivility experience from co-worker and supervisor serves as stressor (Cortina, Magley, Williams, & Langhout, 2001). Thus, according to COR theory assumptions, incivility being low intent and ambiguous at nature, drains more employee efforts (resources) for better assessment and to cope with stressor such as

uncivil behaviour, leading to emotional exhaustion (Zohar, Tzischinski, & Epstein, 2003) which consequently, reduces job satisfaction among nurses (Baeriswyl, Krause, & Schwaninger, 2016). Importantly, this study also addressed the unclear mediating role played by emotional exhaustion between negative variables and their outcomes in urges by scholars in past literature (e.g., Halbesleben & Bowler, 2007) as well as in local context (e.g., Khokhar *et al.*, 2016). Therefore, findings establish vivid role of emotional exhaustion between negative experience of co-worker and supervisor incivility on job satisfaction.

Besides theoretical relevance, job satisfaction is a major challenge for healthcare sector in Asian developing countries. In this regard, findings of this study reveal that job satisfaction is mainly affected by incivility that translates into emotional exhaustion which damages job satisfaction among public hospital nurses. Nurses are front line staff, operating in filed and are faced with emotionally charged events from patient's families or being in the middle of life and death situations which often pushes for emotionally exhaustive pressure typical in developing countries.

Accordingly, this study directs support for HR managers and policy makers for feasible interventional practices at workplace that buffer or eliminate the direct or indirect negative impact of incivility on job satisfaction among nurses. Thus, it is critical for healthcare stake holders to pay attention towards factors that foster better conduct, communication, culture and supportive practice in healthcare workplaces. Therefore, this study directs proper policy development towards workplace incivility such as Zero-tolerance (Scott, Zagenczyk, Schippers, Purvis, & Cruz, 2014) and training activities (Abubakar, 2018) in every sector specially healthcare should be mandatory. And same should be dialogued in meetings to remind employees to act civil. Further, organization should adopt policies of counselling and conflict management.

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