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Working Hours, Burnout and Musculoskeletal Discomfort in Middle and Senior Management of Mexican Industrial Sector

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ABSTRACT Work-related stress is one of the ten most frequent occupational health problems worldwide and precedes a variety of serious mental disorders. It occurs when employees' capabilities fail to meet job demands or when their knowledge and skills are insufficient to comply with company expectations. The aim of this research was to evaluate the impact of working hours and burnout syndrome (BS) on the appearance of musculoskeletal discomfort (MSD) through three dimensions. A cross-sectional study was conducted on 472 middle and senior management staff in the industrial sector in Mexico. Structural Equation Modeling was used to evaluate the relationship between variables. The results showed that 54% of participants reported to be working a maximum of 48 hours a week, the four most frequent MSD occurring in the low back, upper back, neck and eyes. Regarding BS, 59.6% of the participants experienced it at levels ranging from medium to extreme. These findings showed that working hours have a direct impact on emotional exhaustion and indirectly affect MSD and the dimensions of professional efficacy and cynicism. In addition, discomfort in the upper back is directly associated to ailments in the low back and neck and indirectly, to discomfort in the eyes. This points to the need for a greater focus on developing specific measures to reduce or prevent musculoskeletal discomfort symptoms which result from employees' long working hours and emotional exhaustion.

INDEX TERMS Burnout syndrome, musculoskeletal discomfort, structural equation modeling, working hours.

I. INTRODUCTION

There are factors associated with the work environment that can affect a worker's mental health, for example, an inappropriate interaction between the type of work and the skills and competencies of the person. Such aspects can also influence, for instance, the environment's level of organization and the advantages a company may offer to carry out the work [1]. When workers experience mental health problems, they become more susceptible to the negative effects of stress due to lower psychological resistance, lack of social support, and difficulties in the environment when facing the problems.

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Health systems across the world are still unable to respond adequately to the burden of mental disorders. It has been estimated that more than 40 million people suffer from some type of mental disorder, and of these, 4-5 million people are considered seriously mentally ill [2]. Furthermore, when compared to adults between the ages of 26-49 years (22.2%) and to those over 50 (13.8%), adolescents aged 18-25 feature a higher incidence of mental illness (25.8%) [2]. Additionally, in low and middle-income countries, between 76% and 85% of people with severe mental disorders do not receive treatment; this figure is also high in high-income countries, between 35% and 50% [3]. The above statistics translate into significant figures of the world population, which have motivated international organizations such as the World Health

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Organization and the National Institute of Mental Health to focus their efforts on reducing and controlling this problem.

Work stress, in particular, has been recognized as a background for mental disorders and as one of the ten main work-related health problems [4]. It occurs when the demands of the job do not align with the employee's capabilities or when a worker's knowledge and skills do not match the expectations of a company [5]; either scenario can result in a worker's physical and/or mental saturation, thus creating an imbalance between his/her work and personal life [6].

Worker stress is a growing concern worldwide; not only in developed economies such as those in Europe or North America, but also in developing countries which are undergoing rapid industrialization [4].

In the United States, studies report that work stress is the main source of stress in the daily lives of adults and is progressively increasing [7]. Currently, 26% of American workers claim to have experienced work stress, while 29% report having presented some kind of stress at some level [7]. Regarding the Mexican context, the percentage of stressed workers is 75%, surpassing countries such as China and the United States [6].

Although stress is not a disease, it is the first sign of a larger problem that can result in long-term damages [8]. Among the long-term consequences of work stress are; reduced productivity, lower quality of life, heart diseases, asthma, headaches, depression, anxiety [9], risk of addictions [6], musculoskeletal discomfort (MSD), exhaustion at work [4], and the onset of Burnout Syndrome (BS) [10], to name a few.

In the industrial sector, specifically, the trend over the past 20 years has shown that both MSD and BS have adverse effects on worker's health [11], [12].

Standing out among the risk factors identified in the development of MSD are certain psychosocial stressors such as high mental loads, low job recognition levels, and a lack of social support [13]. In the United States, the occurrence of visual symptoms and MSD in upper extremities has increased dramatically from 40% to 80% in the last 20 years, while broader surveys worldwide have shown a prevalence of discomfort in the upper extremities and neck among office workers that ranges from 24% to 44% over a year [14].

On the other hand, in the automotive industry, the type of organization has been shown to influence discomfort problems; for example, Lean Production/Just In Time has been identified as a main cause of the development of MSD in the upper extremities, fatigue, tension, and stress [11]. Although MSD could be directly associated with forced postures or deadlift loads, the risk of MSD has also been found in static routines [15] which affect tendons, tendon sheaths, muscles, nerves, bursae, and blood vessels in the body [13].

This research work was carried out in the border state of Baja California, Mexico, which is meaningful, among other things, because it occupies first place in the number of manufacturing establishments in the country with 17.7% [16] and second place in the category of total employed personnel with 14.9% [16].

This work zeros in on the personnel of the manufacturing, maquiladora, and export services industry in Mexico (IMMEX), as this sector contributes to the Mexican economy by strengthening Mexico's export competitiveness, as well as by reducing logistics costs, both of which encourage investment attraction and retention in the country [17]. In the last quarter of 2019 alone, $10,621,936 USD was generated in merchandise exports, highlighting the importance of this activity in the country's economic development [18].

Research from an academic perspective provides state-of-the-art contributions by considering issues of global interest in terms of the impact that the BS, the working hours, and the MSD have in the middle and upper management population in the IMMEX, in order to enrich the scarce existing literature regarding the Mexican population [19]. The main objective of this research was to propose and validate a model that associates the duration of the working day through working hours with the presence of the most frequent BS and MSD in the particular population under study.

Unlike the other models proposed in the literature, the originality of this research lies, on the one hand, in the explored geographical area, namely, the state of Baja California, Mexico. A second novel aspect is the population under study, that is, the middle and upper management of the IMMEX, a little-explored work group, which, due to time constraints and/or company policies, often falls outside of the scope of research. Finally, a third aspect is that it considers the proposal of a new model with specific relationships between working hours, BS, and MSD, which are theoretically supported.

Just as there are psychosocial risk factors in every workplace, the IMMEX middle and senior managers also feature these indicators, which invites them to pay due attention to the phenomenon. Usually, these workers remain in the same position for long periods of time [19], becoming sedentary workers with long working hours. It is important to focus this research on such personnel because of the constant tension they undergo as a result of their decision-making in situations of uncertainty. The activities they carry out are aimed at increasing organizational effectiveness, often at the expense of human well-being.

With a pertinent theoretical basis, specific hypotheses for the population were developed, which are presented in the next section. Such hypotheses were tested through modeling of structural equations.

II. HYPHOTESIS DEVELOPMENT

Over the course of more than 30 years, copious research on burnout has improved the understanding of this phenomenon [20]. In the industrial context, the role of psychosocial factors in the development and persistence of musculoskeletal symptoms has been widely recognized [21]. Studies have found that all dimensions of the BS are directly and positively associated with risk factors for musculoskeletal pain [12], [22]. Likewise, occupational stress direct risks on health are associated with MSD, specifically with: back,

neck and shoulder problems [23] even in apparently healthy workers [12].

In general, MSD occurs in staff who perform jobs that entail considerable physical and psychological demands [24], for example, surgeons [25], nurses [24], [13], dentists [27], packing workers [28] and construction project managers [29], to name a few. Nurses undertake an average of 40 working hours per week, with a standard deviation of 6.7; thus, they are reported to suffer from low back, neck and knee pains, which worsen in older-aged nurses and in nurses with greater emotional exhaustion. Additionally, 67% also reported being under time pressure to meet work day objectives [15]. However, other studies concerning personnel with lower physical demands, such as office workers [30], have examined the occurrence of and risks associated with shoulders, low back and neck pains caused by computer work and prolonged sitting hours [21]. Musculoskeletal symptoms and visual discomfort are common among this working age population [14]. Similar predictors associated with MSD, such as gender [30] and psychosocial factors, were found in Malaysia and Australia, where it was also found that more than half of the participants (52%) exceeded their working hours in a range of 40 to 54 hours per week [31]. For this sample of workers, MSD increased as the hours on the computer lengthened [32].

Another job involving a similar position to that of an office worker is that of professional drivers [33], where MSD are also present in the neck, shoulders, wrists [34], and back [33].

The relationship between BS and MSD was examined in seven occupational groups: lawyers, physiotherapists, nurses, teachers, priests, bus drivers, and technology transfer employees. The exhaustion dimension of BS was positively associated with discomfort in the head, neck, shoulders, upper back, and low back in all groups. The cynicism dimension of burnout was negatively associated with discomfort in the head, neck, shoulders, upper back, and low back in five groups. Finally, professional efficacy was slightly weaker and inconsistently (i.e., both positively and negatively) associated with discomfort in the head, neck, shoulders, upper back, and low back in four of the groups [35]. Langballe *et al.* [35] reported that exhaustion could cause physical tension and musculoskeletal pain regardless of the worker's gender or profession.

In apparently healthy employees, it was noticed that the increase in burnout levels as a whole (without breaking it down into its dimensions) was associated with the risk of developing neck pain, shoulder pain and low back pain [12].

In Finland, employees ages 30–64 years were studied, and in this population, the prevalence of MSD, which included chronic low back syndrome, chronic neck syndrome, hip osteoarthritis, and knee osteoarthritis, increased with the severity of all three burnout dimensions -exhaustion, cynicism, and professional efficacy [22].

Results found by Valadez *et al.* [19] among industrial sector employees showed the emotional exhaustion dimension of the BS to be the most representative one, causing discomfort in the low back and neck. On the other hand, no evidence of a relationship between cynicism and professional efficacy and MSD was found. In this population in particular, a positive relationship was found between emotional exhaustion and cynicism; a negative relationship, between emotional exhaustion and professional efficacy; and finally, a negative one between cynicism and professional efficacy. In addition, this study mentioned that employees with high job demands felt emotionally exhausted; however, it also mentioned that the social support they received from their colleagues lowered the feeling of job demand and exhaustion, which led them to positively face the situations to which they were exposed. Lastly, 56.5% of workers featured a range of 48 to 56 or more working hours. Similar relationships have been found in medical students [36], teaching members [37], and home care organizations [38].

Both BS and MSD are thought to be reactions to perceived stressors at work [35], resulting from the large number of working hours to which a worker is exposed [23]. A situation of flexibility where workers can have a degree of control over the scheduling and duration of their work hours and the location of their work is identified as an important resource to improve employees' well-being [31].

Understanding the relationships among these variables could provide useful information to improve staff performance and prevent work-related illnesses.

The relationships between working hours, BS, and MSD, as common problems, have been scarcely explored in the area of middle and senior management staff in the IMMEX sector of Baja California, Mexico. Therefore, a hypothetical model was developed from the relationships established between the variables shown in Fig. 1:

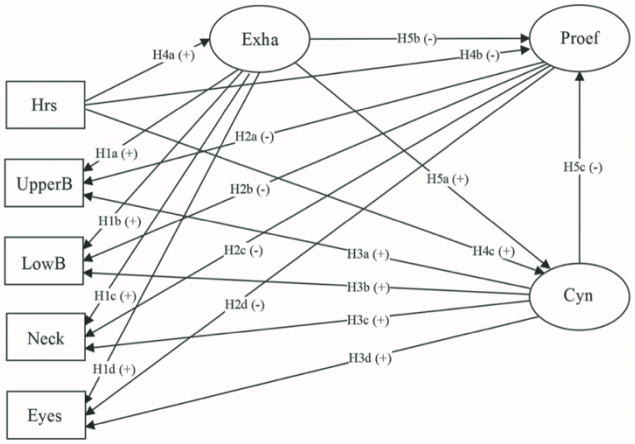

FIGURE 1. Initially proposed structure model, where Hrs: working hours, UpperB: high back, LowB: low back, Exha: BS exhaustion dimension, Proef: BS professional efficiency dimension and Cyn: BS cynicism dimension.

Where hypotheses are defined as follows:

Hypothesis 1 (a, b, c, d). The exhaustion dimension of BS has a direct and positive effect on upper back, low back, neck and eyes musculoskeletal discomfort respectively.

Hypothesis 2 (a, b, c, d). The professional efficacy dimension of BS has a direct and negative effect on upper back, low back, neck and eyes musculoskeletal discomfort respectively.

Hypothesis 3 (a, b, c, d). The cynicism dimension of BS has a direct and positive effect on upper back, low back, neck and eyes musculoskeletal discomfort respectively.

Hypothesis 4a. The working hours have a direct and positive effect on the dimension exhaustion of BS.

Hypothesis 4b. The working hours have a direct and negative effect on the professional efficacy dimension of BS.

Hypothesis 4c. The working hours have a direct and positive effect on the cynicism dimension of BS.

Hypothesis 5a. The exhaustion dimension has a direct and positive effect on the dimension cynicism of BS.

Hypothesis 5b. The exhaustion dimension has a direct and negative effect on the professional efficacy dimension of BS.

Hypothesis 5c. The cynicism dimension has a direct and negative effect on the professional efficacy dimension of BS.

III. MATERIALS AND METHODS

This study was conducted to assess the relationship between working hours, BS and MSD in middle and senior management staff in the manufacturing, maquila, and export service industry (IMMEX) of Baja California, Mexico. The following describes the materials and methods that were used for this research.

A. QUESTIONNAIRES

For data collection from workers, a questionnaire divided into three sections was used. The first part gathered demographic data such as age, gender, working hours and the level of education, as well as each worker's informed consent. The second section consisted of the Maslach Burnout Inventory General Survey instrument used to measure the Burnout Syndrome. Finally, the third section consisted of Marley and Kumar's body map.

1) MASLASCH BURNOUT INVENTORY GENERAL SURVEY (MBI-GS)

Burnout is a psychological syndrome resulting as a prolonged response to chronic interpersonal stressors on the job [39]. Initially, studies focused on professions oriented to education and health care services. The service relationships that providers develop with their customers require a continuous and intense level of personal and emotional contact. Although such relationships can be rewarding and attractive, they can also be very stressful [39].

Burnout cannot be measured directly; therefore, it must be considered as a latent variable to be analyzed by means of appropriate instruments that will allow for the knowledge of its true nature.

The scale that has had the strongest psychometric properties and that continues to be most widely used by researchers is the Maslach Burnout Inventory (MBI), developed by Maslach and Jackson [40]. The MBI was originally designed for use in human service occupations. However, in response to teachers and other professionals' interest in burnout, a second and third version of the MBI was soon developed.

TABLE 1. Codes of the MBI-GS instrument.

Item Code	Dimention	Meaning of score	Feeling that represents
Exha 1	Exha	The higher the score, the more exhausted	Exhausted emotionally
Exha 2			Finishing at the end of day
Exha 3			Fatigued at dawn
Exha 4			Work is stressful
Exha 6			Exhausted by my work
Proef 5			Able to solve problems
Proef 7			Make a contribution to work
Proef 10	Proef	The higher the score, the more the professional efficacy	I'm good at doing my job
Proef 11			I feel fulfilled
Proef 12			Realized worthwhile things
Proef 16			Effective in doing my job
Cyn 8			Loss of interest
Cyn 9			Loss of enthusiasm
Cyn 13			Do not bother me
Cyn 14	Cyn	The higher the score, the more cynicism	I have become indifferent
Cyn 15			I doubt the value of my work

To measure workers' Burnout Syndrome, the Spanish-translated version of the MBI-GS (see Table 1), proposed by Moreno [41], was administered. Its general scope allows it to be answered by any type of professional, however, it was validated for the study population in the present investigation [42].

The MBI-GS defines burnout as a crisis in one's relationship with work, not necessarily as a crisis in one's relationship with the people at work; it measures respondents' relationship with work on a continuum from engagement to burnout [43]. It consists of 16 items grouped in three dimensions: The exhaustion (Exha) items include references to both emotional and physical fatigue but do not make direct reference to people as the source of those feelings. The cynicism (Cyn) items reflect indifference or a distant attitude toward work, but still refer to the work itself, not to interpersonal relationships at work. The professional efficacy (Proef) factor focuses more directly on expectations (e.g., "At my work, I am confident that I am effective at getting things done"). Although it includes satisfaction with past and present accomplishments, it explicitly assesses an individual's expectations of continued effectiveness at work [43].

The survey features a 7-point Likert scale answer for each question, where 0 = on no occasion over the course of the year; 1 = very rarely over the course of the year; 2 = on some occasions over the course of the year; 3 = on many occasions over the course of the year; 4 = frequently over the course of the year; 5 = almost every day; and, 6 = every day.

A high degree of burnout is reflected in high scores on exhaustion and cynicism and low scores on professional efficacy [43].

2) BODY MAP ASSESSMENT OF MUSCULOSKELETAL DISCOMFORT

In order to measure MSD and eye discomfort, Marley and Kumar's body map [44] was used, the development and validation of which was carried out in a large industrial population. To develop the instrument, a pilot test was used with employees of a company; in the end, it was determined

that using just 18 regions of the body was not sufficient in the assessment of the discomfort experienced; thus, more parts of the body were added to arrive at a final version encompassing 25 body regions [44], a version which was used in the present investigation. Of special interest was the case of the eyes, which were included in the final stage of the instrument's development after a prevalence of discomfort in this region of the body was found [44]. Marley and Kumar's body map consists of a pictogram of the human body that signals 25 parts where the worker evaluates the frequency and degree of the discomfort. For the frequency, a scale of 0 to 3 is used (never, rarely, frequently or constantly), and for the degree of discomfort, a scale of 0 to 10 is used (ranging from no discomfort to extremely uncomfortable). Based on Marley and Kumar's model, and considering the worker's responses to the frequency and degree of the discomfort, it is possible to achieve an evaluation of the worker categorized according to the following: ''very likely to seek treatment'' (red zone), ''somewhat likely to seek treatment'' (yellow zone), or ''not likely to seek treatment'' (green zone).

Several studies have used instruments that include the evaluation of MSD as well as a visual evaluation, and among them are the following sectors: middle and senior managers [19], university students [45], workers in highway construction [46], operator teams [47], and workers in general [48], with the objective of obtaining a comprehensive evaluation.

Body maps in general are used in groups of professions as an instrument of proactive surveillance and easy administration to help in the early identification of ergonomic problems or to identify the need for immediate medical attention [35].

B. WORKING HOURS

The instrument included the working day as a variable; such data were obtained through the question: ''How many hours do you work per week?'' with 5 response options: 32, 42, 45, 48 and 56 hours or more.

C. DATA COLLETION

Data collection was carried out in companies affiliated to the IMMEX of the cities of Ensenada, Tijuana and Mexicali, in the state of Baja California, Mexico.

The samples were taken in person at the companies, by means of a printed questionnaire; whose group of interest was middle and senior managers alone. Middle managers included supervisors, group leaders, and technicians from the production, engineering, and finance departments. On the other hand, the senior managers interviewed were the heads of the same departments and director.

Before administering the questionnaires, emails were sent to the different companies through the Ministry of Labor and Social Welfare (STPS) to publicize the project. Next, an appointment was set up with the interested companies to present the project to the board of directors or to the departments interested in participating; There were a total of 11 companies interested in the project, and in the end, 8 companies from the cities of Ensenada, Tijuana and Mexicali participated.

The administration of the questionnaires was carried out face-to-face. The interested companies were visited, and the purpose of the study, the selection criteria, and the directions to answer each section of the questionnaire was explained to a maximum of 15 workers through an introductory talk. At all stages of data collection, emphasis was made for the staff that participation was voluntary, anonymous and confidential and that they were free to withdraw from participating in the investigation if they so wished.

The criteria for exclusion from the sample were: pregnant women, staff who did not belong to middle and senior management, and partially or incompletely answered questionnaires.

All participants gave informed consent, and the study was conducted in accordance with the Declaration of Helsinki [49].

D. STATISTICAL ANALYSIS

The database was analyzed using the IBM ®SPSS ®Statistics software version 23 (IBM company, Chicago, IL, USA), 64 bits edition and with the Amos™ (analysis of moment structures) complementary package.

As initial phase, the preparation and debugging [50] of the original database was carried out to comply with the assumptions of univariate and multivariate normality.

Based on the correlation matrix, a confirmatory factor analysis (AFC) was decided upon, and the principal components method was used for factor extraction. The initial matrix rotation was developed by means of the Varimax orthogonal method; which, although it is not the simplest analytical solution for the existing methods, it is the one showing a clearer separation between factors [51], and because it is independent from the distribution assumptions, it is less likely to produce inadequate solutions.

Sampling adequacy was evaluated through the Kaiser-Meyer-Olkin (KMO) tests, the Bartlett's test and the determinant of the correlation matrix. To measure the degree of intercorrelations along the variables, the measure of sampling adequacy test (MSA) was used. The reliability estimate was calculated using Cronbach's alpha coefficient [52].

Convergent validity was obtained through the average variance extracted (AVE) [51] calculated as the median of the variance extracted from the standardized loads of the items for each construct. The discriminant validity was tested by means of the AVE test [53].

With the valid instrument, a theory-based model was proposed to know the existing relationship between the duration of the working day, the BS, and the MSD. The focus of Structural Equation Modeling (SEM) was to evaluate the relationship between variables with maximum likelihood (ML) estimator.

Once the parameters were obtained, a model test was conducted in order to assess how well the proposed model fit the

sample data. Both, global model fit and parameter fit indices were used. For the first criterion, the relative Chi-square (Chi-square / degree of freedom, CMIN / DF) was calculated to judge the discrepancy of the model when the sample size is large. Additional indices were, the root mean square error of approximation (RMSEA) and the goodness of fit index (GFI) as absolute fit indices. Moreover, the relative fit index (RFI), normed fit index (NFI), Tucker-Lewis index (TLI) and comparative fit index (CFI) of incremental fit indices and last parsimony ratio (PRATIO), parsimony normed fit index (PNFI) and adjusted goodness of fit index (AGFI) of Parsimony were fit indices as well. Further, based on the sample size in SEM, Hoelter's [54] Critical N (CN) was calculated, providing a reasonable estimate that the data fit the theoretical model in addition to being useful in parameter estimation [53].

A second criterion involved the evaluation of the variables magnitude and direction to find significant relationships. The proposed hypotheses were validated through the analysis of the direct, indirect and total effects among the variables.

IV. RESULTS

This section presents the study's results, which are divided into the following subsections.

A. DESCRIPTIVE STATISTICS SAMPLE

The total sample consisted of 472 workers, 91.1% of whom belong to middle management, while 8.9% of them are senior managers. Regarding working hours per week, 54% of subjects reported spending approximately 48 hours in the office; 18.4% reported a total of 45 hours; 16.5% reported 56 or more hours; 7.2% reported 42 hours; and, 3.8 % reported spending a minimum of 32 hours a week working. Out of those interviewed, 65.9% were male and 34.1% were female. From the total sample, 26.6% did not feature BS, while 13.8 of both the low and medium levels did feature it, 20.8% featuring a high level and 25%, an extreme level. The average age and standard deviation (SD) of the test group was (Mean $\pm$ SD) 34.10 $\pm$ 9.22 with 5.5 years of work experience.

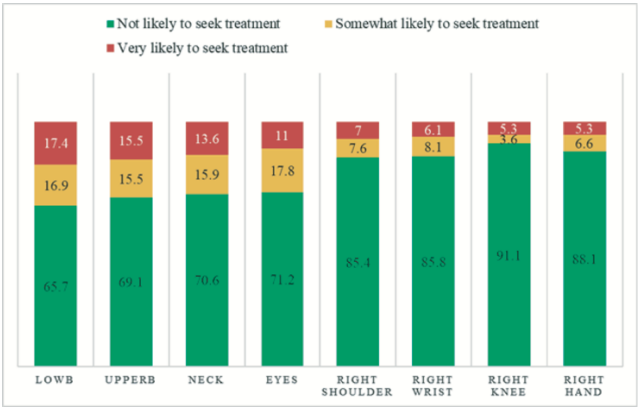

FIGURE 2. Percentage in treatment zone by body part.

The MSD were monitored through Marley and Kumar's body map. Fig. 2 shows the results of each body part in the red zone classification sample, ''very likely to seek treatment.'' Although the instrument measured 25 body parts, the graph only shows the 8 most representative parts for the red zone; the other parts presented values below 5.3% in that zone.

For the purposes of this research, the 4 types of discomfort which together represent 57.5% of the ''very likely to seek treatment'' zone, that is the low back (LowB), upper back (UpperB), neck, and eyes, which were more frequent among middle and higher management.

B. VALIDATION OF VARIABLES

The database was properly screened; no missing values were found, and 104 outliers were removed, which was considered a conservative level of statistical significance with a value of p <0.001. There was univariate normality for leptokurtic frequency distributions with values ranging from 0.0140 to 3.139. Regarding the platykurtic frequency distributions, the values ranged from −0.091 to −0.780, and no cases of extreme kurtosis were found [50].

For the multivariate normality, the Mardia coefficient was used [55], whose calculated value was of 288. With a resulting coefficient of 52,853, a lower value than the one estimated, it is possible to assume that the data set complies with the assumption.

The multicollinearity of the variables was corroborated by obtaining the squared multiple correlation R_smc^2 [50] between variables. The values obtained from the data set for R_smc^2 lay between 0.332 and 0.900; values greater than these would have suggested multicollinearity problems [50].

The adequacy of applying the AFC and expecting a correlation to exist between the population variables was verified through the following results: the determinant of the correlation matrix was different from zero, with a value of 2.901E-5, this indicating that there are variables with very high intercorrelations, which makes the analysis feasible. As for the Bartlett test, the null hypothesis with a statistically significant p-value=0.000 and an approximate X^2 of 4856.444 with 120 degrees of freedom was rejected. The value of 0.888, obtained using the Kaiser-Mayer-Olkin (KMO) test, showed an adequate relationship between the variables [56].

The range of values for the sampling adequacy measure was between 0.838 and 0.944, exceeding the 0.5 threshold value [51].

In the extraction procedure, 3 factors were obtained with eigenvalues of 6.283 for the first dimension, 3.275 for the second dimension and 1.306 for the last dimension with a total explained variance percentage of 67.902%.

The results of this first stage verify and satisfactorily exceed the types of analysis on the relevance and validity of the data matrix.

The response consistency for the total instrument was very good [50], with a value of 0.801. For the case of the Exha dimensions, an excellent value [50] of 0.900 was obtained; for Proef and Cyn, the values were also quite good [50], with 0.873 and 0.838 respectively.

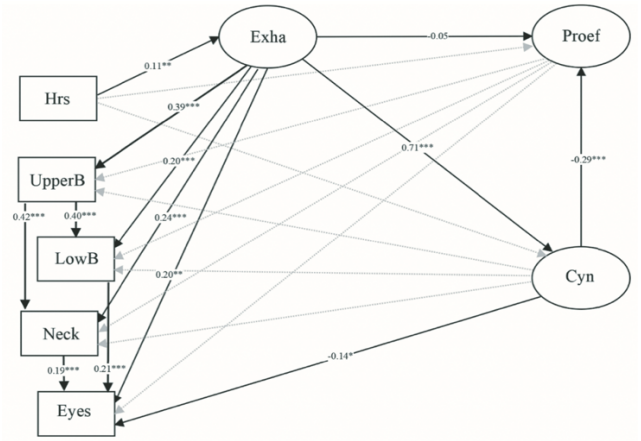

FIGURE 3. Final structural model tested. Numbers are standardized estimates. Dashed lines indicate nonsignificant loadings, while solid lines indicate statistical significance at ∗p<0.1, ∗∗p<0.05 and ∗ ∗ ∗p<0.01.

TABLE 2. Correlations among the constructs.

	Exha	ProEf	Cyn
Exha	*0.791*[a]		
ProEf	0.207	*0.728*[a]	
Cyn	0.716	0.325	*0.762*[a]

Note: [a] Square root of the AVE

The AVE values for each dimension showed an adequate convergence [51] for Exha, Proef and Cyn, with values of 0.625, 0.529 and 0.581 respectively.

The results of the AVE test shown in Table 2 indicate that the values of the AVE square root found on the diagonal are greater than the estimated correlations, which provides evidence that each MBI-GS construct is unique, and which allows for the analysis of the phenomenon supporting the discriminant validity.

C. STRUCTURAL EQUATIONS MODEL

The two-step approach was used to examine the hypothetical relationships raised along the latent variables [51]. First, the fit and construct validity were tested; the results of testing the structural theory on the obtained sample will be shown later in this section.

Fig. 3 represents the SEM results for the relationships between the duration of working hours (Hrs), the three dimensions of burnout (Exha, Proef, Cyn), and the most representative musculoskeletal discomfort. Each path in the figure indicates the association between the variables and constructs established in the hypotheses, as well as the estimates of standardized regression weights with $*p < 0.1$, $**p < 0.05$ and $***p < 0.01$ significance levels.

The initially proposed model suggested that the duration of the working hours impacted BS through its 3 dimensions and that these in turn were directly related to musculoskeletal discomfort. However, the results indicated that there were also relationships which were not significant, yet in order to publicize a proposed model that would describe

TABLE 3. Summary of the adjustment indices to the measurement models.

	Measure	Acceptable level	First Model	Proposed Model
Model fit	Chi-square (X^2) Degrees of freedom (*df*) X^2/df	Less than < 3	X^2=910.824 *df*= 175 *p*=.000 *CMIN/df*= 5.205	X^2=432.924 *df*= 175 *p*=.000 *CMIN/df*= 2.446
Absolute fit indices	Root mean square error of approximation (RMSEA)	Less than ≤ 0.08	0.094	0.055
	Goodness of fit index (GFI)	Close or > 0.90	0.836	0.924
Incremental fit indices	Normed fit index (NFI)	Close or > 0.90	0.835	0.922
	Tucker-Lewis index (TLI)	Close or > 0.90	0.834	0.943
	Comparative fit index (CFI)	Greater than > 0.95	0.862	0.952
Parsimony fit indices	Parsimony ratio (PRATIO),	Of 0.5 to 1	0.833	0.843
	Parsimony normed fit index (PNFI)	Of 0.5 to 1	0.696	0.777
	Adjusted goodness of fit index (AGFI)	Of 0.5 to 1	0.784	0.901

the situation of workers in Baja California, Mexico, such nonsignificant relationships were removed from the initial model. Table 3 shows the adjustment rates for both the initial and the final models proposed by this research.

The adjustment indicators for this model were as follows: the minimum discrepancy (CMIN) in the $\chi 2$ value divided by its degrees of freedom (df) yielded a value of 2.446, which is notably lower than 3 [57] and was thus considered an acceptable indicator. For the absolute fit indices, the root mean square error of approximation (RMSEA) was used to measure the discrepancy per degree of freedom; for 90% of the highly significant confidence interval, the value of the RMSEA index was 0.055, which lies between 0.049 and 0.062, thus signaling a close fit of the model [58]. Regarding the GFI, values higher than 0.90 are normally considered adequate [51]; the proposed model featured a value of 0.924. In terms of the incremental fit, the most widely used index, the CFI, was of 0.952, exceeding the 0.95 threshold [59]. Also, a Tucker-Lewis index (TLI) value of 0.943 places it within the recommended by Schumacker and Lomax [53]. The NFI is another fit index, for which a value of 0.922 accounts for a good fit [51]. The third group, the parsimony fit indices, was designed specifically to provide information about which model among a set of competing models is best. Because such group considers fit in relation to complexity, it results in values which are considerably lower than other goodness of fit indices [46]. According to Muliak *et al.* [60], it is possible to obtain parsimony of fit indices within the region of 0.50–1, such as those obtained in this study. The minimum CN calculated for the present research was a sample of 244 individuals for an $\alpha = 0.01$.

Fig. 3 shows the final proposed model that contains the direct relationships that were significant for the middle and

TABLE 4. Effects decomposition for the proposed model.

	Hrs		Exha		Cyn	
	Unst.	St.	Unst.	St.	Unst.	St.
Exha						
Direct effects	0.138**	0.108	--	--	--	--
Indirect effects	--	--	--	--	--	--
Total effects	0.138**	0.108	--	--	--	--
Proef						
Direct effects	--	--	-0.035	-0.048	-0.286***	-0.290
Indirect effects	-0.025**	-0.028	-0.148***	-0.207	--	--
Total effect	-0.025**	-0.028	-0.182***	-0.256	-0.286***	-0.290
Cyn						
Direct effects	--	--	0.516***	0.714	--	--
Indirect effects	0.071**	0.077	--	--	--	--
Total effect	0.071**	0.077	0.516***	0.714	--	--
UpperB						
Direct effects	--	--	0.240***	0.389	--	--
Indirect effects	0.033**	0.042	--	--	--	--
Total effect	0.033**	0.042	0.240***	0.389	--	--
LowB						
Direct effects	--	--	0.126***	0.197	--	--
Indirect effects	0.031**	0.038	0.099***	0.155	--	--
Total effect	0.031**	0.038	0.225***	0.352	--	--
Neck						
Direct effects	--	--	0.145***	0.244	--	--
Indirect effects	0.033**	0.044	0.097***	0.164	--	--
Total effect	0.033**	0.044	0.242***	0.408	--	--
Eyes						
Direct effects	--	--	0.109**	0.196	-0.109*	-0.141
Indirect effects	0.019**	0.026	0.027	0.049	--	--
Total effect	0.019**	0.026	0.137***	0.245	-0.109*	-0.141

Note. Unst., unstandardized; St., Standardized.
With statistical significance at *p<0.1, **p<0.05 and ***p<0.01

TABLE 5. Conclusion of hypotheses for the final model.

Hypothesis	P value	Conclusion	Decision
H1a	p<0.01	There is enough statistical evidence to declare that exhaustion of BS has a positive direct impact on upper back discomfort.	Accepted
H1b	p<0.01	There is enough statistical evidence to declare that exhaustion of BS has a positive direct impact on low back discomfort.	Accepted
H1c	p<0.01	There is enough statistical evidence to declare that exhaustion of BS has a positive direct impact on neck discomfort.	Accepted
H1d	p=0.006	There is enough statistical evidence to declare that exhaustion of BS has a positive direct impact on eyes discomfort.	Accepted
H2a	p>0.05	There is not enough statistical evidence to affirm that professional efficacy of BS is associated with upper back discomfort.	Rejected
H2b	p>0.05	There is not enough statistical evidence to affirm that professional efficacy of BS is associated with low back discomfort.	Rejected
H2c	p>0.05	There is not enough statistical evidence to affirm that professional efficacy of BS is associated with neck discomfort.	Rejected
H2d	p>0.05	There is not enough statistical evidence to affirm that professional efficacy of BS is associated with eyes discomfort.	Rejected
H3a	p>0.05	There is not enough statistical evidence to affirm that cynicism of BS is associated with upper back discomfort.	Rejected
H3b	p>0.05	There is not enough statistical evidence to affirm that cynicism of BS is associated with low back discomfort.	Rejected
H3c	p>0.05	There is not enough statistical evidence to affirm that cynicism of BS is associated with neck discomfort.	Rejected
H3d	p=0.036	There is enough statistical evidence to declare that cynicism of BS has a negative direct impact on eyes discomfort.	Accepted
H4a	p=0.024	There is enough statistical evidence to declare that work-hours has a positive direct impact on exhaustion of BS.	Accepted
H4b	p>0.05	There is not enough statistical evidence to affirm that work-hours is associated with professional efficacy of BS.	Rejected
H4c	p>0.05	There is not enough statistical evidence to affirm that work-hours is associated with cynicism of BS.	Rejected
H5a	p<0.01	There is enough statistical evidence to declare that exhaustion of BS has a positive direct impact with cynicism of BS.	Accepted
H5b	p>0.05	There is not enough statistical evidence to affirm that exhaustion is associated with professional efficacy of BS.	Rejected
H5c	p<0.01	There is enough statistical evidence to affirm that cynicism of BS has a negative direct impact on the dimension professional efficacy of BS.	Accepted

senior population; however, variables and constructs were also represented by indirect effects. The direct, indirect and total effects found for the proposed final model as shown in Table 4 are described below.

The duration of the working hours had a positive direct effect only on the BS dimension of emotional exhaustion, supporting the H4a. In turn, this dimension showed direct and positive relationships with the 4 types of musculoskeletal discomfort (UpperB, LowB, neck, eyes) considered for this research, thus supporting the H1a, H1b, H1c and H1d hypotheses. Additionally, emotional exhaustion also bore a direct and positive relationship to the cynicism dimension, thus supporting H5a. Regarding cynicism, the direct relationship between that dimension and professional efficacy was negative, which supports H5c. Cynicism also exerted an impact on eye discomfort, with a direct negative relationship contrary to that posed by H3d. It is nevertheless shown in the diagram as being significant. Finally, the relationship between the exha and proef dimensions has already been defined by Maslach [43]; however, for the present sample it was not a significant one, thus rejecting H5b.

On the other hand, the duration of the working hours had indirect effects on both Proef and Cyn, in addition to the four most representative types de MDS. Although Exha, along with the Proef dimension, did not have a significant direct effect, it did have an indirect impact, also causing indirect effects on the LowB and neck.

Additionally, Exha featured a total variance explained of $R^2 = 0.012$; for Proef there was an $R^2 = 0.107$, for Cyn it was $R^2 = 0.510$; for the MSD UpperB, LowB, neck and eyes the values of the explained variance were: $R^2 = 0.151, 0.260, 0.317$ and 0.149 respectively.

Other important findings of the Regards model are those direct and positive relationships for: UpperB affecting LowB and neck; as well as LowB and neck affecting eyes. The relationships found characterize the working population of IMMEX in the state of Baja California, Mexico.

The SEM results presented the quantitative evaluation of the proposed theoretical model presented as a set of variables and constructs.

Finally, the objective of the research was to analyze how the three dimensions characterizing the BS, the MSD and working hours are related in the middle and upper management of the IMMEX in Baja California, Mexico. It began with an 18-hypothesis approach for workers in Baja California. Table 5 shows the conclusions for each of them.

V. DISCUSSION

The results of this research work provide the effects of working hours, the appearance of BS and also the presence of MSD in the IMMEX middle and upper management population. Of the population surveyed, 54% reported to be

working between 48 to 56 hours, while 16.5% mentioned to be working more than 56 hours per week. These figures clearly show the surplus of hours that staff invest in their work according to the Federal Labor Law [61]. This is because the responsibility of making decisions that will impact the entire organization comes to demand a greater number of working hours. In addition, it is known that work under pressure is a characteristic antecedent of fatigue in many industries [62].

Research has shown that afternoon, evening and weekend work shifts can have negative effects on health such as a reduction in the quality and quantity of sleep as well as the appearance of fatigue, anxiety, depression and cardiovascular diseases to name a few [10].

The importance given to the term ''Burnout'' (or work exhaustion) has been increasing to the point that it has now already been included in the international classification of diseases [63], which will allow doctors, health centers, and even insurers to help treat symptoms as of 2022. Regarding Mexico, the 035-STPS-2018 Norm [64] came into force in 2019; its objective is to establish the necessary elements to identify, analyze, and prevent psychosocial risk factors, as well as to promote a favorable organizational environment in workplaces, an aspect which was not previously considered a priority as shown by the lack of government regulations on the matter.

The BS was evaluated through a reliable instrument previously validated among the Mexican population in the industrial sector [42]. In the proposed model, the BS was represented by a three-dimensional construct conceptualized in different dimensions, albeit correlated with each other. The results place 59.6% of this population of workers at medium-to-extreme levels, this meaning they should receive attention due to the negative effects on companies such as associated costs due to absenteeism and turnover, reduction in performance and productivity, and accident rates [23], to mention a few and which this population may already be showing.

For Maslach [65], age is a future factor to study; especially, people between the ages of 30 and 40 and older feature high levels of burnout. One of the main causes for the development of the syndrome in this sector is the presence of relationships that do not meet expectations. On the one hand, middle managers must deliver results to their superiors, outcomes which can in turn be evaluated as insufficient contributions or as unachieved goals. On the other hand, senior managers may face situations of rejection from external customers, improved offers by competitors, or decreased productivity in the industry.

Additionally, among the studied population, MSD occurs mainly in the LowB, UpperB, neck, and eyes in a percentage greater than 50%. Professions with work routines similar to those of middle and senior managers, for example, analysts, assistants, customer service roles, engineers, researchers, sales staff, and office workers, coincide in the frequency of MSD with eyestrain and neck, low back [14], [30] and upper back [21]. The similarity lies in the sedentary posture for long periods of time and a sustained forward position, such as the one adopted when using a computer [66], conditions which have been reported to increase the risk of MSD [35] in office workers [29] [12], [19]. Although MSD takes a considerable amount of time to develop as a result of sedentary routines in office, even minimal discomfort anywhere in the body is an early sign of danger [67].

It has been found that in office work positions, poor job satisfaction [68] as well as the lack of implementation of ergonomic practices [14] in the work environment may be associated with discomfort in neck, low back, upper back and shoulders.

Consequently, the effects of physical training, ergonomic modifications and the combination of both in reducing shoulder, neck, and lower back discomfort among office workers have been examined, with encouraging results. The study suggests that managers should consider implementing at least one type of intervention in their offices, and the type of intervention should be based on the organization's work environment and the convenience of office workers [69].

Regarding the relationships found, the Exha dimension was the most representative, coinciding with studies in different professions [70], [71] because, out of the three dimensions, it is considered the most receptive to several stressors in the work environment such as work load and the time pressure to complete a specific job [65]. In addition to being affected by the duration of working hours, this dimension significantly and directly impacted the four type of MSD considered. The results are accordance with Valadez *et al.* [19], Honkonen *et al.* [22] and Langballe *et al.* [35], who hypothesized that the prevalence of physical diseases and MSD increase particularly with the severity of the Exha dimension.

Regarding the dimensions of Proef and Cyn that constitute BS, no effects were found with MSD, as suggested by hypotheses H2a, H2b, H2c, H2d, H3a, H3b, and H3c, except for the Cyn dimension, whose relationship with eye discomfort was statistically significant, with a confidence level of 90%, but in the opposite direction to the one originally posed. This result suggests that a worker's feeling of cynicism may present a decrease in eye discomfort. Although this shows a minimum level of acceptance, for practical purposes in the studied sector, this relationship was dismissed since its interpretation is not consistent with the panorama of the studied sector, it is not supported by a theoretical framework, and was rejected as hypotheses in a similar population of middle and upper management [19].

Of the three causal relationships between the dimensions of the proposed BS, two were significant as they accepted H5a, which mentions that Exha has a direct and positive impact on the Cyn, indicating that if workers experience emotional exhaustion, they will also show attitudes of detachment and indifference towards, their work. This relationship is consistent with the results obtained by Valadez [19] in a similar population of middle and upper management. Other studies have represented BS through these two dimensions only [72]. Even the single-element measures of Exha and Cyn feature strong and consistent associations without including

Proef [36], whose relationship was not significant for this population of workers.

The effect of Cyn on Proef was significant, supporting H5c, considering that if the worker has high levels of Cyn, they will show feelings of incompetence and a lack of productivity at work. Some models have proposed that these two dimensions occur in sequence: first, Cyn feelings are experienced, which in turn leads to Proef [65]. Similar effects between these two dimensions were found in the research of Valadez *et al.* [19].

It was found that the Exha dimension mediates the relationship between the duration of working hours and MSD, as it lacks any direct effects. Ardahan and Simsek [32] found that individuals who did not have breaks while working at a computer experience more pains in their backs, necks, and shoulders, while their total weight score is significantly statistically lower compared to those who have breaks; thus, as the static time increases, so does the discomfort.

In terms of MSD, it is observed that there are relationships between the different types, and thus, they do not occur in isolation from each other. This is important, because it points to the need to contribute to prevention with, a focus on reducing working hours, considering the positive effects it can have on people not only in the work context, but in all areas of their lives [73].

Regarding the presence of BS, studies have found that the higher the level of schooling, the lower the Exha levels in employees. In this sense, it is important to consider that education can be confused with other variables such as the profession or the position held in the organization. It is possible that people with higher education have jobs with greater responsibilities and greater stress. Or it may be that the most educated people hold higher expectations for their jobs and are, therefore, more distressed if these expectations are not met [65], as sometimes happens among the population of middle and senior managers.

The extensive working hours and various responsibilities experienced by middle and senior managers may affect the quality of their nighttime rest. This research work did not study this variable; however, evidence has been found in a group of high-level executives, white-collar workers with high levels of burnout and poor sleep quality. Lack of sleep has been associated with the three dimensions of burnout, but there is an especially significant association between exhaustion and insomnia, sleep initiation and maintenance disorders or non-restorative sleep [74].

The strong relationship between insomnia and burnout could be explained by a chronic hyperarousal that might be related to the accumulation of stress at work responsible for the disturbing emotion [75]. The findings suggest that (1) insomnia should be considered for the prevention of mental illnesses in the workplace; (2) it would be interesting to include monitoring of sleep parameters in the detection of burnout, particularly in workers with high job strain; and (3) participants with high scores of burnout and insomnia can be define as a subgroup at high risk of mental disorder [75].

VI. CONCLUSION

Mental health problems may become debilitating and may restrict the ability to do a job within a normal range of productivity. In turn, organizations also tend to be less productive. In terms of benefits, high levels of psychological well-being and job satisfaction predict good job performance even within a few years [62].

In the middle and upper management, the working day had an indirect impact on the MSD. Although their activities are predominantly sedentary and entailing moderate physical effort, musculoskeletal symptoms were still present. A previous analysis shows that employees who work more than 40 hours per week are more likely to report that their safety and health is at risk [10]. This points to the need to pay more attention to the development of specific measures to reduce or prevent the symptoms of musculoskeletal discomfort among employees in this type of environment since they can impact on both the physical functions and the quality of life of individuals [76]. On the other hand, it was not possible to confirm a direct relationship of the effect of BS (represented by its three dimensions) on MSD; however, it was possible to detect that the emotional exhaustion dimension is the most representative when impacting the MSD in a direct way.

Participants' interest in the results of this research was notorious but also encouraging as such population represents a valuable source of information for the IMMEX of Baja California. Specifically, company directors, project participants and even government agencies such as the manufacture and export industry association and the secretary of labor and social security are important stake holders in the evaluation of results in order to propose and implement strategies aimed at reducing psychosocial risks to which middle and upper managers are exposed and which can trigger long-term physical discomfort. With current results on the meaning and the relationships between the working hours, the BS and the MSD in the group studied, the importance of reinforcing workers' integral health care has been highlighted, as proposed by global organizations such as NIOSH, AIS, WHO, ILO among others. Work organization measures can also be used to help workers develop individual and collective strategies to deal with the emotionally difficult aspects of their jobs [10]. It will be important to include stress management components in the working population in order to visualize improvements in the treatment of BS, fatigue and discomfort in extremities such as the upper ones. This will in turn increase productivity.

VII. LIMITATIONS

The limitation was the difficult access to the IMMEX affiliated companies. Although our University granted us permission to reach them, the research process was long and challenging due to their internal policies. Additionally, many employees did not participate mainly due to tight work schedules, work meetings, or lack of time to answer the survey.

DISCLOSURE STATEMENT

The authors declare no potential conflicts of interest with respect to the publication of this paper.

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