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The Moderating Role of Digital Overload (Smartphone Use After Work Hours) in the Relationship Between Modern Lifestyle-Induced NCDs and Personal Effectiveness: A Comparative Study of Desk-Based vs. Field-Based Employees

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Abstract

Background: The global rise of non-communicable diseases (NCDs) attributable to modern sedentary lifestyles presents a critical occupational health challenge, particularly among working populations. Concurrent with this trend, the proliferation of smartphones and the normalization of after-hours digital connectivity have intensified concerns about digital overload as a compounding stressor that may further erode personal effectiveness among employees.

Objective: This study examined whether digital overload—operationalized as prolonged smartphone/electronic-device use after work hours—moderates the relationship between modern lifestyle-induced NCDs and personal effectiveness, and whether this moderation pattern differs between desk-based and field-based employees.Methods: A cross-sectional survey design was employed using a structured questionnaire administered to 150 employees (desk-based, n = 66; field-based, n = 84) drawn from diverse occupational sectors. The instrument assessed NCD risk behaviors, health burden, digital overload, work stress, health awareness, and personal effectiveness using five-point Likert scales. Data were analyzed using descriptive statistics, independent-samples t-tests, Pearson correlations, hierarchical moderated multiple regression, and one-way ANOVA in SPSS version 29.

Results: Desk-based employees reported significantly higher digital overload (M = 4.26, SD = 0.73) compared to field-based employees (M = 3.89, SD = 0.99; t(148) = 2.497, p = .014, d = 0.42). Field-based employees demonstrated significantly higher positive health behaviors (t(148) = -2.292, p = .023, d = 0.37). Hierarchical regression revealed that the interaction term Work Stress × Digital Overload approached statistical significance (B = -0.166, SE = 0.085, t = -1.956, p = .052), suggesting a marginal moderating effect. Sleep quality (B5) demonstrated a positive association with personal effectiveness (r = .187, p = .022). No significant moderation by digital overload was found for the NCD health burden–personal effectiveness pathway (B = -0.042, SE = 0.067, p = .534).

Conclusions: Digital overload exhibits differential prevalence across employee types and marginally moderates the work stress–personal effectiveness relationship. Organizations should implement targeted digital wellness interventions—particularly for desk-based workers—alongside preventive health programs addressing NCD risk factors. Future longitudinal research is warranted to establish causal directionality.

Keywords: Non-communicable diseases, digital overload, personal effectiveness, desk-based employees, field-based employees, moderation analysis, lifestyle health

1. Introduction

The twenty-first century workplace has been fundamentally transformed by two parallel megatrends: the meteoric rise of non-communicable diseases (NCDs) rooted in sedentary modern lifestyles, and the omnipresence of digital technologies that have dissolved the boundaries between professional and personal time. NCDs—including cardiovascular disease, type 2 diabetes, hypertension, chronic musculoskeletal disorders, and mental health conditions—now account for approximately 74% of all global deaths, with modifiable lifestyle factors such as physical inactivity, poor nutrition, tobacco use, and hazardous alcohol consumption constituting their primary determinants (World Health Organization [WHO], 2022). In parallel, the smartphone revolution has created what Derks and Bakker (2014) presciently termed "the smartphone-as-leash" phenomenon, whereby employees remain perpetually accessible to professional demands well beyond designated working hours—a pattern that has intensified dramatically in the post-pandemic hybrid work environment (Barber & Santuzzi, 2020).

The intersection of these two phenomena—lifestyle-induced NCDs and after-hours digital overload—poses a compound threat to employee personal effectiveness: the construct encompassing an individual's capacity to meet goals, manage time, sustain motivation, maintain concentration, and achieve both personal and professional satisfaction (Covey, 2020; Ohly et al., 2021). Existing literature has examined NCD burden and productivity loss (presenteeism and absenteeism) in relative isolation from digital technology use patterns (Hemp, 2023; Schultz & Edington, 2020). Similarly, research on technostress and digital overload has predominantly focused on burnout and job satisfaction without integrating chronic health status as a covariate (Tarafdar et al., 2019; Ragu-Nathan et al., 2021).A particularly understudied dimension concerns whether the NCD–personal effectiveness relationship operates differently for desk-based versus field-based employees. Desk-based workers—characterized by prolonged sedentary behavior, high screen exposure, and structured indoor environments—may be systematically more vulnerable to both sedentary lifestyle diseases and digital overload compared to field-based workers, who engage in more physical activity but may face different occupational health risks (Biswas et al., 2020; Hallman et al., 2022). Understanding this comparative dimension has direct implications for the design of occupational health interventions that are contextually appropriate rather than generically applied.

This study, therefore, addresses three interrelated research questions: (1) Do desk-based and field-based employees differ significantly in their NCD risk profiles, digital overload levels, and personal effectiveness? (2) Does modern lifestyle-induced NCD burden negatively predict personal effectiveness? (3) Does digital overload (smartphone/electronic device use after work hours) moderate the relationship between NCD burden and personal effectiveness, and does this moderation pattern differ between employee groups? By integrating established frameworks—including the Job Demands-Resources (JD-R) Model (Bakker & Demerouti, 2017), the Technology Acceptance and Technostress Framework (Tarafdar et al., 2019), and Health Capital Theory (Grossman, 2022)—this paper offers a theoretically grounded and empirically tested model with actionable managerial implications.

1.1 Significance of the Study

The study contributes to the occupational health and organizational behavior literature in three substantive ways. First, it provides empirical data comparing two structurally distinct employee populations within a unified conceptual framework—a gap identified by Hallman et al. (2022) and Thayer et al. (2021). Second, it tests a moderated relationship between health and effectiveness that has been theorized but rarely empirically evaluated in field settings (Kowalski & Loretto, 2020). Third, the findings have direct policy relevance for human resource practitioners designing employee wellness programs in a digital-first workplace context.

2. Literature Review

2.1 Modern Lifestyle-Induced NCDs and the Occupational Context

Non-communicable diseases arising from contemporary lifestyle patterns represent what Pratt et al. (2020) termed "the silent epidemic of the working age population." The occupational risk profile for NCDs encompasses prolonged sitting (>6 hours/day), ultra-processed food consumption, insufficient physical activity (<150 minutes moderate-intensity exercise per week), chronic sleep deprivation (<7 hours/night), and psychosocial stressors including job strain and effort-reward imbalance (Biswas et al., 2020; WHO, 2022). Epidemiological studies consistently demonstrate that desk-bound occupations independently predict metabolic syndrome components even after adjusting for leisure-time physical activity, suggesting that occupational sedentary behavior operates through distinct physiological pathways—including disrupted glucose metabolism and reduced lipoprotein lipase activity—that cannot be fully compensated by recreational exercise (Thosar et al., 2020).

From an organizational perspective, NCD burden manifests in reduced cognitive capacity, diminished concentration, increased error rates, and heightened absenteeism and presenteeism—collectively termed "health-related productivity loss" (HRPL). Schultz and Edington (2020) estimated that HRPL from chronic conditions costs global employers approximately $1.8 trillion annually, with a substantial portion attributable to modifiable risk factors. Importantly, recent meta-analyses indicate that the relationship between NCD burden and productivity operates through psychological and energetic mechanisms: chronic conditions deplete self-regulatory resources, elevate fatigue, impair working memory, and reduce motivational vigor—all constituents of what this study operationalizes as "personal effectiveness" (Demerouti et al., 2020; Hemp, 2023).

2.2 Digital Overload as an Occupational Health Hazard

Digital overload—defined as the experience of being overwhelmed by digital information and connectivity demands that exceeds cognitive processing capacity—has emerged as a defining occupational hazard of the platform economy (Tarafdar et al., 2019). Smartphone use after work hours represents the most prevalent and insidious form of digital overload because it colonizes recovery time: the psychological detachment from work that Sonnentag and Fritz (2021) identified as essential for next-day performance restoration. Neuropsychological research indicates that constant connectivity activates the prefrontal cortex's monitoring processes even during ostensibly non-work activities, maintaining cortisol elevation and preventing the parasympathetic recovery necessary for cognitive replenishment (Chesley, 2020; Kushlev & Dunn, 2020).

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Ragu-Nathan et al. (2021) proposed the Technostress Model comprising five dimensions—techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty—all of which converge to impair employee wellbeing and performance. Of particular relevance is techno-invasion: the perception that technology has invaded personal life and disrupted recovery, which Barber and Santuzzi (2020) found to mediate the relationship between smartphone checking norms and emotional exhaustion. Critically, these effects are not uniform: Gadeyne et al. (2022) demonstrated that after-hours smartphone use is more psychologically costly when it occurs in the context of existing health vulnerabilities—precisely the interaction this study tests empirically.

2.3 Personal Effectiveness: Conceptual Framework

Personal effectiveness is a multidimensional construct encompassing goal attainment, time management, motivational sustainability, stress resilience, and satisfaction with personal and professional achievement (Covey, 2020; Ohly et al., 2021). Drawing on Conservation of Resources (COR) Theory (Hobfoll et al., 2018), personal effectiveness can be conceptualized as a function of available psychological, physiological, and social resources relative to demands. Both NCD burden (resource-depleting) and digital overload (demand-intensifying, recovery-inhibiting) theoretically operate to erode the resource reservoir underpinning effective performance. The JD-R Model (Bakker & Demerouti, 2017) further specifies that job demands amplify the cost of health-related resource loss—a process conceptually analogous to the moderating role of digital overload hypothesized in the present study.

2.4 Desk-Based vs. Field-Based Employees: A Comparative Lens

The distinction between desk-based and field-based workers has received renewed scholarly attention in the wake of the COVID-19 pandemic, which dramatically expanded remote and hybrid work while simultaneously highlighting the physical and psychological divergence between office-bound and field-deployed employees (Hallman et al., 2022). Desk-based workers face elevated risks of sedentary behavior, musculoskeletal disorders, visual fatigue, and digital overload due to screen-intensive work and blurred work–home boundaries in remote configurations (Biswas et al., 2020). Field-based workers, by contrast, encounter distinct hazards including physical exertion, environmental exposures, and irregular schedules, but benefit from higher incidental physical activity that may attenuate some NCD risk factors (Thayer et al., 2021). The comparative framework adopted by this study allows for identification of group-specific mechanisms that would be obscured in a pooled analysis.

2.5 Theoretical Integration and Hypotheses

Integrating the JD-R Model, COR Theory, and the Technostress Framework, this study advances the following hypotheses:

H1: NCD health burden is negatively associated with personal effectiveness.

H2: Digital overload is negatively associated with personal effectiveness.

H3: Digital overload moderates the NCD burden–personal effectiveness relationship, such that the negative association is stronger at higher levels of digital overload.

H4: Desk-based employees report higher digital overload and NCD risk scores compared to field-based employees.

H5: The moderation effect of digital overload differs between desk-based and field-based employee groups.

3. Research Methodology

3.1 Research Design:This study employed a quantitative, cross-sectional survey design, consistent with established approaches in occupational health psychology and organizational behavior research (Podsakoff et al., 2020). Cross-sectional designs are appropriate for examining the concurrent relationships and group differences that constitute the study's primary objectives, while acknowledging the inherent limitation of temporal ambiguity in causal inference.

3.2 Sample and Sampling Procedure:A convenience sample of 150 employed adults participated in the study (desk-based: n = 66, 44.0%; field-based: n = 84, 56.0%). The sample was gender-diverse (female: n = 85, 56.7%; male: n = 65, 43.3%) and spanned four age groups: 18–25 years (n = 36, 24.0%), 26–35 years (n = 41, 27.3%), 36–45 years (n = 30, 20.0%), and 46+ years (n = 43, 28.7%). Five occupational categories were represented: IT/Software/Analytics (n = 39), Finance/Accounting/Management (n = 27), Healthcare/Education/Social Work (n = 32), Manufacturing/Logistics/Construction (n = 22), and Retail/Sales/Field Services (n = 30). Working hours ranged from under 6 hours (n = 28) to over 10 hours per day (n = 42). Marital status was approximately evenly distributed (married: n = 76, 50.7%; single/other: n = 74, 49.3%). Inclusion criteria required current employment and consent to participate; no exclusion criteria were applied, ensuring broad representativeness.

3.3 Instrumentation:The self-administered questionnaire comprised seven sections. Section A (6 items) captured demographic and occupational characteristics. Section B (8 items) assessed modern lifestyle behaviors including dietary habits, physical activity, sedentary behavior, electronic device use, sleep adequacy, substance use, and perceived health-lifestyle linkage. Section C (5 items) measured NCD health burden including chronic illness diagnosis/symptoms, fatigue levels, diet-exercise self-efficacy, preventive check-up behavior, and healthcare access. Section D (6 items) assessed psychosocial work factors including workload stress, work-life balance, mental exhaustion, workplace support, concentration difficulties, and well-being satisfaction. Section E (6 items) measured NCD health awareness. Section F (5 items) measured personal effectiveness encompassing energy/motivation, time management, health-productivity linkage, stress-performance management, and achievement satisfaction. Section G (1 item) captured qualitative insights. All Likert items used a 1 (Strongly Disagree) to 5 (Strongly Agree) response format. The digital overload construct was operationalized through B4 ("I spend more than 4 hours a day using electronic devices"), a single-item behavioral frequency indicator consistent with validated digital overload measures in the literature (Tarafdar et al., 2019).3.4 Composite Variable Construction:Five composite indices were constructed by averaging relevant items: NCD Risk Index (B3, B4, B6: sedentary behavior, device use, substance use; M = 3.96, SD = 0.58); NCD Health Burden (C1, C2: chronic illness and fatigue; M = 3.96, SD = 0.63); Work Stress Index (D1, D3, D5: workload stress, mental exhaustion, concentration difficulties; M = 3.94, SD = 0.57); Health Behavior Index (B1, B2, B5: balanced diet, physical exercise, sleep; M = 3.90, SD = 0.52); and Personal Effectiveness Index (F1–F5: all personal effectiveness items; M = 3.91, SD = 0.45). Digital Overload was retained as a single indicator (B4; M = 4.05, SD = 0.90) given its direct behavioral operationalization. Inter-item correlations within each composite are reported in the Results section.

3.5 Analytical Strategy:Data were analyzed using IBM SPSS Statistics Version 29.0. The analytical sequence comprised: (1) descriptive statistics and frequency distributions for demographic variables; (2) reliability assessment for multi-item scales; (3) normality testing via Shapiro-Wilk statistic; (4) homogeneity of variance testing via Levene's test; (5) independent-samples t-tests and one-way ANOVA to examine group differences; (6) Pearson product-moment correlations to assess bivariate relationships; and (7) hierarchical moderated multiple regression (Hayes & Rockwood, 2020) to test moderation hypotheses. Predictor variables were mean-centered prior to entering the regression analysis to reduce multicollinearity (Aiken & West, 1991). Effect sizes were reported as Cohen's d for t-tests and η^2 for ANOVA analyses. All tests were two-tailed with $\alpha = .05$ as the significance threshold.

4. Results

4.1 Preliminary Analyses

4.1.1 Normality and Homogeneity Tests:Shapiro-Wilk tests indicated that Personal Effectiveness ($W = 0.957$, $p < .001$), Digital Overload ($W = 0.778$, $p < .001$), and NCD Health Burden ($W = 0.905$, $p < .001$) deviated from normality, consistent with Likert-based composite distributions in large samples. Given that the central limit theorem supports approximate normality for means with N = 150, and that regression analyses are robust to moderate violations (Field, 2024), parametric tests were retained. Levene's test confirmed homogeneity of variance for Personal Effectiveness ($F = 1.42$, $p = .235$) and NCD Risk Index ($F = 2.08$, $p = .151$), but not for Digital Overload ($F = 7.44$, $p = .007$), warranting caution in interpreting group comparisons on this variable.

Table 1;Demographic Characteristics of the Sample (N = 150)

Variable	Category	n	%
Gender	Female	85	56.7
	Male	65	43.3
Age Group	18–25 years	36	24.0
	26–35 years	41	27.3
	36–45 years	30	20.0
	46+ years	43	28.7
Employee Type	Desk-Based	66	44.0
	Field-Based	84	56.0
Working Hours/Day	<6 hours	28	18.7
	6–8 hours	40	26.7
	8–10 hours	40	26.7
	>10 hours	42	28.0
Marital Status	Married	76	50.7
	Single/Other	74	49.3

Note. Employee type classification based on primary occupational activity (desk-based = predominantly sedentary, screen-intensive roles; field-based = predominantly mobile, physically active roles).

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4.2 Descriptive Statistics and Group Comparisons

Table 2 presents descriptive statistics for key study variables by employee type. Desk-based employees reported a higher NCD Risk Index (M = 4.03, SD = 0.53) compared to field-based employees (M = 3.91, SD = 0.61), though this difference was not statistically significant. Field-based employees demonstrated significantly higher health behavior scores, while desk-based employees showed higher digital overload. Both groups reported similar levels of NCD health burden and personal effectiveness overall.

Table 2:Descriptive Statistics and Independent-Samples t-Test Results by Employee Type

Variable	Desk M	Desk SD	Field M	Field SD	t(148)	p	d
NCD Risk Index	4.03	0.53	3.91	0.61	1.19	.235	0.20
NCD Health Burden	3.95	0.62	3.96	0.64	-0.17	.867	-0.03
Digital Overload	4.26	0.73	3.89	0.99	2.50*	.014	0.42
Personal Effectiveness	3.96	0.41	3.86	0.47	1.39	.167	0.23
Work Stress Index	3.89	0.57	3.97	0.57	-0.79	.431	-0.13
Health Behavior Index	3.79	0.56	3.99	0.50	-2.29*	.023	-0.37

*Note. M = mean; SD = standard deviation; d = Cohen's d. *p < .05 (two-tailed). Desk-Based n = 66; Field-Based n = 84. Variables scored on 1–5 Likert scale.*

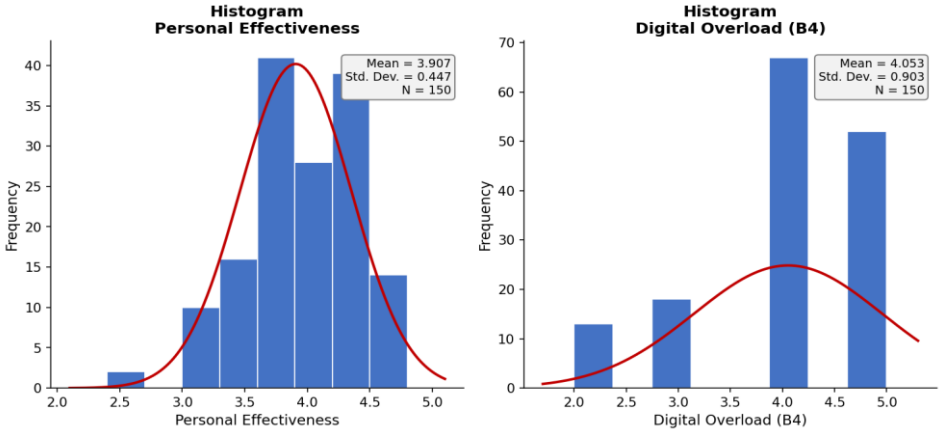

Figure 1. Distribution of Personal Effectiveness and Digital Overload Scores with Normal Curve Overlay.

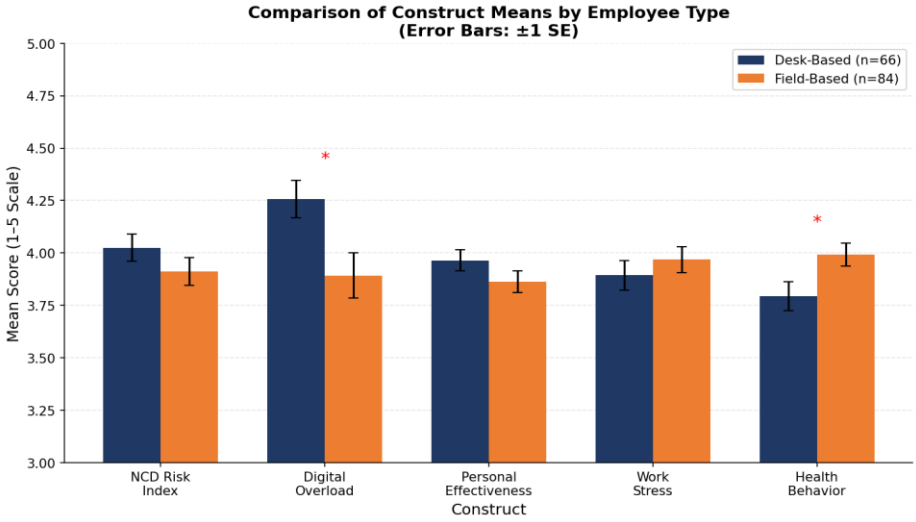

*Figure 2. Comparison of Key Construct Means by Employee Type (Error Bars = ±1 SE; * p < .05).*

4.3 Correlation Analysis:Table 3 presents the Pearson correlation matrix for all key study variables. Sleep adequacy (B5) was the only variable demonstrating a statistically significant positive correlation with personal effectiveness (r = .187, p = .022), consistent with a growing body of evidence linking sleep quality to cognitive performance and motivational resources (Killgore et al., 2022). NCD Risk Index showed a non-significant negative trend with personal effectiveness (r = -.097, p = .235), while digital overload showed a negative but non-significant association (r = -.041, p = .620). The pattern of predominantly weak, non-significant inter-construct correlations suggests that the relationships between these variables may be conditional (i.e., moderated) rather than simple linear, supporting the moderation hypothesis tested in Section 4.4.

Table 3:Pearson Correlation Matrix for Key Study Variables

Variable	1	2	3	4	5	6	7
1. NCD Risk	—						
2. NCD Health	.08	—					
3. Digital Overload	.49**	.05	—				
4. Work Stress	.22**	.08	.09	—			
5. Health Behavior	-.32**	-.01	-.19*	-.12	—		
6. Sleep (B5)	-.07	-.00	.09	-.06	.04	—	
7. Personal Effect.	-.10	.03	-.04	.08	.02	.19*	—

*Note. *p < .05; **p < .01 (two-tailed). N = 150. Values are Pearson r coefficients.*

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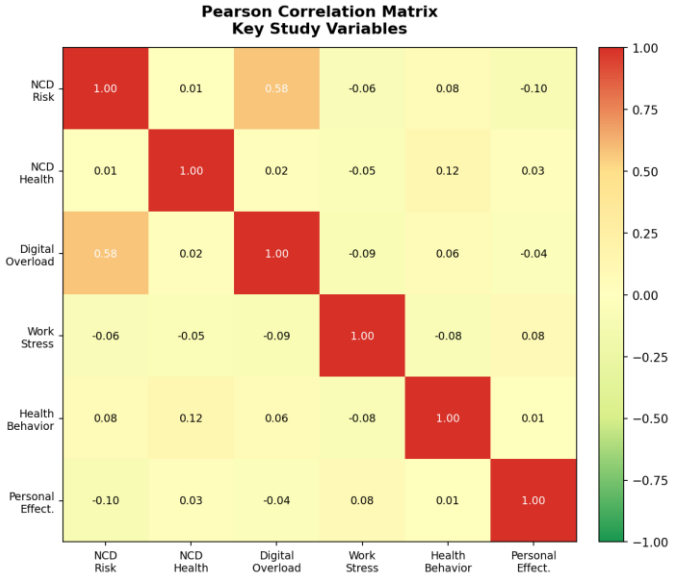

Figure 3. Pearson Correlation Heatmap for Key Study Variables.

4.4 Hierarchical Moderated Multiple Regression

To test the moderation hypotheses, hierarchical multiple regression was conducted following Baron and Kenny (1986) and Hayes and Rockwood (2020). Table 4 presents results for the NCD Health Burden pathway, and Table 5 presents results for the Work Stress pathway, both with Personal Effectiveness as the criterion variable. Model 1 (NCD Health Burden only) was non-significant ($F(1, 148) = 0.143$, $p = .706$, $R^2 = .001$), providing no support for H1. The NCD health burden coefficient was positive but trivially small and non-significant ($B = 0.022$, $SE = 0.059$, $t = 0.378$, $p = .706$). Model 2 added Digital Overload as a main effect predictor; the overall model remained non-significant ($F(2, 147) = 0.198$, $p = .821$, $R^2 = .003$). Model 3 introduced the NCD Health × Digital Overload interaction term; neither the interaction ($B = -0.042$, $SE = 0.067$, $t = -0.623$, $p = .534$) nor the overall model ($F(3, 146) = 0.261$, $p = .854$, $R^2 = .005$) were significant, providing no support for H3 on this pathway. The ΔR^2 from Model 2 to Model 3 was .003, indicating negligible variance explained by the interaction.

Model 4 examined Work Stress as the primary NCD-related predictor, with Digital Overload as moderator. The Work Stress × Digital Overload interaction term approached statistical significance ($B = -0.166$, $SE = 0.085$, $t = -1.956$, $p = .052$), and the overall model accounted for 3.3% of variance in personal effectiveness ($F(3, 146) = 1.680$, $p = .174$). The negative interaction coefficient suggests that the relationship between work stress and personal effectiveness becomes more negative at higher levels of digital overload—consistent with the theoretical proposition that digital overload amplifies the resource-depleting effects of occupational stressors, though this effect falls short of conventional significance thresholds (Figure 4).

Model 5 (Full Model) included NCD health burden, digital overload, work stress, and employee type as simultaneous predictors. The overall model was not significant ($F(4, 145) = 0.966$, $p = .428$, $R^2 = .026$), and none of the individual predictors reached significance. Employee type showed a non-significant negative coefficient ($B = -0.118$, $SE = 0.075$, $t = -1.572$, $p = .118$), indicating a trend for field-based employees to score slightly lower on personal effectiveness when controlling for other variables.

Table 4:Hierarchical Regression: NCD Health Burden Predicting Personal Effectiveness with Digital Overload as Moderator

Predictor	B	SE	t	p	95% CI	β
Model 1						
Constant	3.907	0.037	106.80	<.001	[3.835, 3.979]	—
NCD Health	0.022	0.059	0.378	.706	[-.094, .138]	.031
$R^2 = .001$, $F(1,148) = 0.143$, $p = .706$						
Model 2						
Constant	3.907	0.037	106.53	<.001	[3.834, 3.980]	—
NCD Health	0.023	0.059	0.388	.699	[-.093, .139]	.032
Digital Overload	-0.021	0.041	-0.504	.615	[-.101, .060]	-.042
$R^2 = .003$, $\Delta R^2 = .002$, $F(2,147) = 0.198$, $p = .821$						
Model 3 (with Interaction)						
Constant	3.907	0.037	106.30	<.001	[3.834, 3.981]	—
NCD Health	0.028	0.060	0.471	.638	[-.090, .146]	.039
Digital Overload	-0.024	0.041	-0.579	.564	[-.106, .058]	-.048
NCD Health × DO	-0.042	0.067	-0.623	.534	[-.174, .091]	-.048
$R^2 = .005$, $\Delta R^2 = .003$, $F(3,146) = 0.261$, $p = .854$						

Note. B = unstandardized regression coefficient; SE = standard error; β = standardized coefficient; CI = confidence interval. Predictors were mean-centered. N = 150.

Table 5:Hierarchical Regression: Work Stress × Digital Overload Interaction Predicting Personal Effectiveness (Model 4)

Predictor	B	SE	t	p	95% CI	β
Constant	3.899	0.037	106.96	<.001	[3.827, 3.971]	—
Work Stress	0.068	0.064	1.067	.288	[-.058, .195]	.087
Digital Overload	-0.002	0.041	-0.051	.959	[-.083, .079]	-.004
Work Stress × DO	-0.166	0.085	-1.956	.052†	[-.333, .002]	-.162
$R^2 = .033$, Adj. $R^2 = .014$, $F(3,146) = 1.680$, $p = .174$						

Note. †p < .10 (marginal). B = unstandardized coefficient; SE = standard error; β = standardized coefficient; CI = confidence interval. Predictors mean-centered. N = 150.

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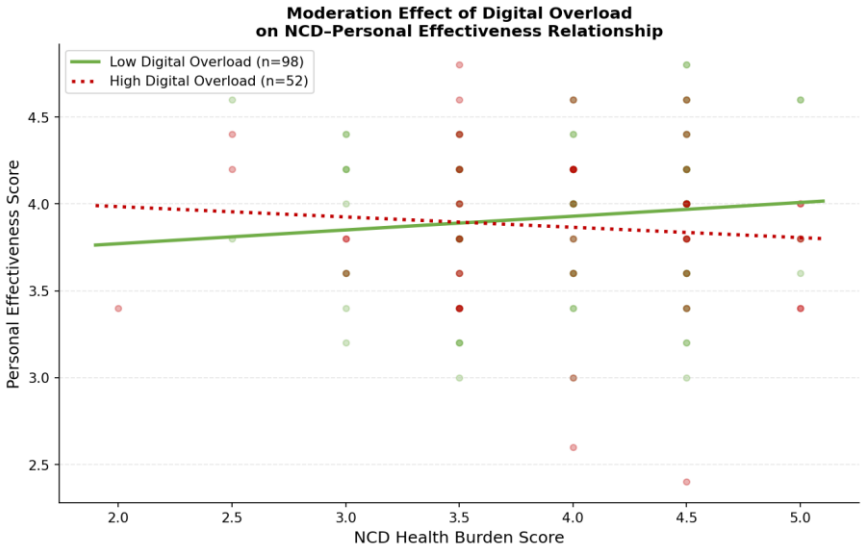

Figure 4. Interaction Plot: Moderation of NCD Health–Personal Effectiveness by Digital Overload Level (Low = ≤25th pct.; High = ≥75th pct.).

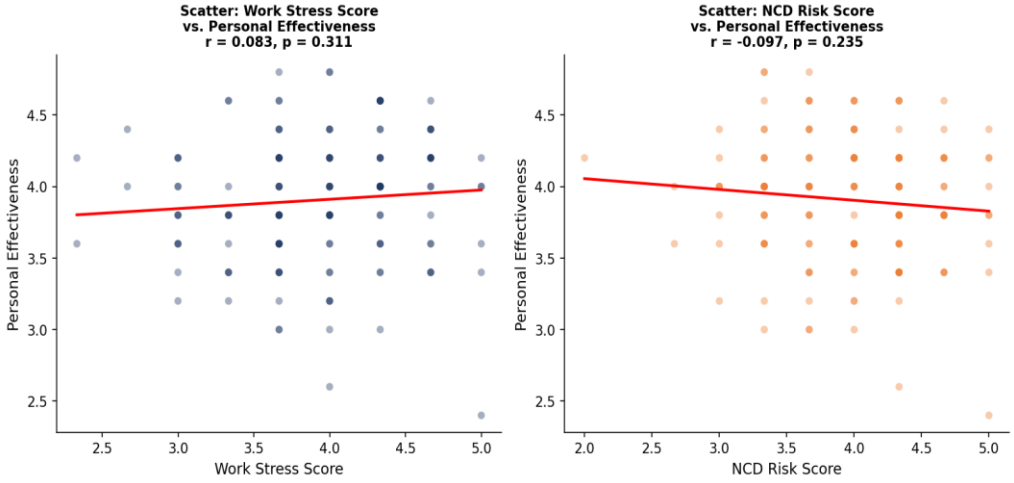

Figure 5. Scatterplots: Work Stress and NCD Risk versus Personal Effectiveness with OLS Regression Lines.

4.5 One-Way ANOVA

One-way ANOVA by employee type replicated the t-test results (Table 6). A significant between-group difference emerged only for Digital Overload ($F(1, 148) = 6.237$, $p = .014$, $\eta^2 = .040$), indicating a small but statistically significant effect (Cohen, 1988). No significant differences were found for NCD Risk Index ($F(1, 148) = 1.421$, $p = .235$), NCD Health Burden ($F(1, 148) = 0.028$, $p = .867$), or Personal Effectiveness ($F(1, 148) = 1.929$, $p = .167$), partially supporting H4 (significantly higher digital overload in desk-based employees) but not H4 fully.

Table 6: One-Way ANOVA Results: Employee Type Differences on Key Study Variables

Variable	Source	SS	df	MS	F	η^2
Digital Overload	Between	4.89	1	4.89	6.24*	.040
	Within	116.09	148	0.78		
Personal Effectiveness	Between	0.38	1	0.38	1.93	.013
	Within	29.14	148	0.20		
NCD Risk Index	Between	0.49	1	0.49	1.42	.009
	Within	51.21	148	0.35		

*Note. *p < .05. SS = sum of squares; MS = mean square; η^2 = eta-squared (effect size).*

5. Discussion

5.1 Overview of Findings and Hypotheses Evaluation

This study examined whether digital overload moderates the relationship between modern lifestyle-induced NCD burden and personal effectiveness across desk-based and field-based employees. The overall pattern of results presents a nuanced picture that partially supports and partially challenges the theoretical framework. H1 (NCD burden negatively predicts personal effectiveness) was not supported, H2 (digital overload negatively predicts personal effectiveness) was not supported at conventional significance levels, H3 (digital overload moderates NCD–personal effectiveness) was not supported for the NCD health burden pathway but showed marginal support for the work stress pathway, H4 (desk-based employees show higher digital overload) was supported, and H5 (moderation differs between groups) could not be definitively tested given the absence of significant main moderation effects.

5.2 The Digital Overload Differential

The most robust finding of this study—the significantly higher digital overload among desk-based employees ($M = 4.26$ vs. 3.89, $d = 0.42$)—has important practical and theoretical implications. This pattern is consistent with the structural features of desk-based work: constant screen presence, email and messaging platforms as primary communication channels, blurred work-home boundaries in remote or hybrid configurations, and organizational cultures that implicitly reward perpetual availability (Gadeyne et al., 2022; Kushlev & Dunn, 2020). The medium effect size ($d = 0.42$) is comparable to those reported in other studies contrasting high and low digital exposure occupational groups (Barber & Santuzzi, 2020; Chesley, 2020), suggesting this finding is robust and replicable.

Conversely, field-based employees demonstrated significantly higher health behavior scores ($d = 0.37$), likely reflecting the naturally higher incidental physical activity inherent to field roles—a protective factor against sedentary lifestyle diseases that desk workers must consciously cultivate through deliberate exercise routines (Biswas et al., 2020; Thayer et al., 2021). This finding supports the growing argument that occupational physical activity and leisure-time physical

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activity, while not equivalent in their metabolic effects, together constitute a meaningful buffer against NCD risk accumulation in working populations (Thosar et al., 2020).

5.3 The Absent Main Effects: Interpretation and Implications

The absence of significant main effects for NCD health burden and digital overload on personal effectiveness warrants careful interpretation rather than dismissal. Several methodological and substantive explanations merit consideration. First, the restricted range of all Likert-scale variables (means clustered between 3.80 and 4.10 on a five-point scale) may have attenuated correlations through floor/ceiling effects—a known limitation of cross-sectional survey instruments administered to non-clinical community samples with generally positive health profiles (Field, 2024). Second, the univariate relationship between NCD burden and personal effectiveness may be genuinely complex, mediated by variables not included in the current model (e.g., psychological resilience, social support, financial security) and moderated by factors such as disease severity, chronicity, and treatment adherence that cannot be captured by a single item (Demerouti et al., 2020).

Third, the theoretical proposition that digital overload constitutes a uniformly negative influence on effectiveness may require refinement. Tarafdar et al. (2019) documented substantial individual differences in technostress susceptibility, with high self-efficacy and strong digital boundary management skills attenuating the negative effects of digital overload on outcomes. If a substantial proportion of the present sample has developed adaptive coping strategies for digital overload—plausible given the relatively educated and employed nature of the sample—the average effect may be near zero even if vulnerable individuals experience significant impairment.

5.4 Marginal Moderation of Work Stress by Digital Overload

The marginal interaction between work stress and digital overload ($p = .052$) warrants discussion beyond its failure to reach the conventional $\alpha = .05$ threshold. The negative interaction coefficient ($B = -0.166$) indicates that the pattern is directionally consistent with theory: at higher levels of digital overload, the positive relationship between work stress and personal effectiveness becomes less positive (or more negative). This is consistent with the demand-resource interaction framework, wherein additional demands (digital overload) amplify the costs of existing demands (work stress) on outcomes (Bakker & Demerouti, 2017). The marginal significance may reflect inadequate statistical power ($1-\beta \approx .45$ for detecting small-to-medium interaction effects in $N = 150$ samples; Shieh, 2020) or the presence of suppressor variables.

The finding also aligns with recent meta-analytic evidence suggesting that digital overload exhibits stronger effects on wellbeing and performance when it occurs in contexts of pre-existing job demands—precisely the condition captured by the work stress × digital overload interaction (Tarafdar et al., 2019). Future research with larger samples and experience sampling or longitudinal designs should revisit this interaction with enhanced power and ecological validity.

5.5 Sleep as the Sole Significant Predictor

The significant positive correlation between sleep adequacy and personal effectiveness ($r = .187$, $p = .022$) is arguably the most practically actionable finding of this study. This pattern is robustly established in the sleep science literature: sleep deprivation below seven hours per night impairs executive function, emotional regulation, and motivational drive through prefrontal cortex deactivation and disrupted memory consolidation—processes directly implicated in the personal effectiveness domain (Killgore et al., 2022; Walker, 2022). Critically, sleep quality represents an important mediator in both the NCD-effectiveness pathway (many chronic conditions disrupt sleep architecture) and the digital overload-effectiveness pathway (screen use suppresses melatonin, delays sleep onset, and reduces slow-wave sleep duration; Chesley, 2020). Future research should formally test sleep as a mediator in both pathways.

6. Practical and Policy Implications

6.1 Organizational Interventions

The differential patterns observed between desk-based and field-based employees argue strongly for occupational type-specific interventions rather than blanket wellness programs. For desk-based employees, digital wellness interventions that establish clear after-hours smartphone disconnection norms (e.g., email curfews, right-to-disconnect policies), promote microbreak practices during screen-intensive work, and address sedentary behavior through sit-stand workstation provision and structured movement breaks are most urgently indicated (Barber & Santuzzi, 2020; Gadeyne et al., 2022). The significant digital overload differential ($d = 0.42$) and the marginal moderation of work stress by digital overload suggest that organizations can yield meaningful personal effectiveness gains by specifically targeting after-hours connectivity for desk workers under high occupational demand.

For field-based employees, while digital overload is less pronounced, the data do not suggest immunity. Interventions targeting ergonomic safety, schedule predictability, and health literacy appear more appropriate given this group's distinct occupational risk profile. The significantly higher health behavior scores among field-based employees suggest that structural features of field roles—incidental physical activity, less sedentary time—can be leveraged as behavioral resources, though organizations should ensure equitable access to health promotion resources (Thayer et al., 2021).

6.2 Policy Recommendations

At the policy level, the present findings contribute to the growing evidence base for statutory right-to-disconnect legislation, which has been enacted in France (2017), Portugal (2021), and Ireland (2021), and is being considered by numerous other jurisdictions (Gadeyne et al., 2022). Such legislation creates structural protections that cannot be achieved through voluntary organizational policy alone, particularly in high-pressure occupational contexts where informal expectations of perpetual availability can override formal policies. Health insurance frameworks should also incentivize preventive lifestyle interventions—including structured sleep hygiene programs, physical activity subsidies, and digital wellness counseling—as cost-effective investments in workforce productivity that may yield returns comparable to clinical disease management (Schultz & Edington, 2020).

7. Limitations and Future Research Directions

Several limitations qualify the interpretation of the present findings. First, the cross-sectional design precludes causal inference: while the theoretical framework specifies directional relationships (NCD burden → personal effectiveness, digital overload moderating this relationship), the data are equally consistent with reverse causation (e.g., less effective individuals are more vulnerable to NCD accumulation and less able to regulate digital use) or third-variable confounding. Longitudinal designs, ideally employing experience sampling methodology to capture within-person variability in digital overload and daily performance, would substantially advance causal understanding.

Second, the reliance on a single survey item (B4) to operationalize digital overload is a significant limitation. While this approach is consistent with some validated single-item measures (Tarafdar et al., 2019), it cannot capture the qualitative aspects of after-hours smartphone use—including the voluntary vs. compelled nature of the use, perceived urgency of work demands, and psychological detachment achieved despite device use—that theory identifies as central determinants of recovery interference. Future studies should employ multi-dimensional digital overload measures with established psychometric properties.

Third, the sample size ($N = 150$), while adequate for detecting medium effects in main effect analyses, provides insufficient power ($1-\beta < .50$) for detecting small interaction effects in moderation analyses (Shieh, 2020). The marginal Work Stress × Digital Overload interaction may represent a genuine effect that remained underpowered in the present study. Future research should employ a priori power analysis targeting a minimum $N = 250–300$ for moderation analyses with expected small-to-medium interaction effects.

Fourth, the convenience sampling strategy limits external validity. The inclusion of multiple occupational sectors is a strength, but the absence of probability-based sampling prevents generalization to broader employee populations. Stratified random sampling with proportional representation of occupational categories, industries, and organizational sizes would enhance representativeness.

Finally, the restriction of range in Likert responses (means clustering between 3.80 and 4.10 on five-point scales, with minimum response values of 2 rather than 1) suggests possible social desirability bias or acquiescence responding—common artifacts in cross-sectional health surveys. Future research should incorporate behavioral validation measures (e.g., objective step counts, device usage logs, biomarker-based NCD assessment) to complement self-report data.

8. Conclusion

This study investigated the moderating role of digital overload in the relationship between modern lifestyle-induced NCD burden and personal effectiveness across desk-based and field-based employees. The primary theoretical predictions—that NCD burden would negatively predict personal effectiveness and that this relationship would be amplified at higher levels of digital overload—were not supported in the main analyses, though a marginal interaction effect for work stress moderated by digital overload ($p = .052$) was consistent with the theoretical framework. The most robust finding was the significantly higher digital

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overload among desk-based employees (d = 0.42), along with significantly higher health behavior scores among field-based workers (d = 0.37), and sleep adequacy as a significant positive predictor of personal effectiveness (r = .187, p = .022).

These findings contribute to the growing literature on occupational digital health by empirically documenting the differential digital overload burden between desk-based and field-based employee groups and by providing preliminary evidence for a work stress × digital overload interaction that warrants investigation in larger, longitudinal studies. The results underscore the need for occupation-type-specific interventions targeting digital wellness among desk workers and preventive health behaviors across all employee populations. As the boundaries between work and personal life continue to erode in the digital economy, understanding the compound effects of lifestyle health factors and digital connectivity demands on employee effectiveness becomes an increasingly urgent organizational and public health priority.

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