

CORRELATION BETWEEN SCREEN BRIGHTNESS AND NECK PAIN AMONG DESKTOP COMPUTER USERS IN BANKING SECTOR

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Abstract :

This study has been undertaken to investigate the correlation between screen brightness and neck pain among desktop computer users in the banking sector. Computer based work is an important part of banking activities and may involve prolonged screen use, sitting and sustained head and neck postures. Screen brightness and surrounding illumination are part of visual work environment.

A cross-sectional observational study was conducted among 130 eligible banking-sector desktop users. Screen-related illumination and ambient illumination were measured in lux under usual workplace conditions. Neck pain intensity was recorded using the Numerical Pain Rating Scale (NPRS), and working posture was assessed using the Rapid Upper Limb Assessment (RULA).

Data were analysed using Spearman's rank-order correlation after Shapiro-Wilk testing showed non-normal distributions. The mean NPRS score was 4.25 ± 2.07 and the mean RULA score was 2.60 ± 1.06 . Mean screen illumination was 546.84 ± 64.22 lux. A strong positive correlation was found between screen brightness and NPRS score ($\rho = 0.777$, $p < 0.001$). Ambient illumination also showed a strong positive correlation with NPRS ($\rho = 0.701$, $p < 0.001$). In this sample, higher measured screen brightness was associated with higher reported neck-pain intensity. The finding supports considering visual and postural factors together during workplace ergonomic assessment, while the cross-sectional design does not establish causation.

Index Terms - Screen brightness, Neck pain, Desktop computer users, Banking sector, NPRS, RULA, Illumination.

I. INTRODUCTION

Computer use is now a routine part of occupational work. In computer users, visual complaints and neck pain are common, and prolonged screen work has been associated with neck and upper-extremity symptoms.^[2,8] Banking employees are a relevant group for this type of study because desktop computers are used for transaction processing, documentation, communication, data entry and other routine activities. Many employees therefore spend a large part of the working day looking at a visual display.

Screen brightness is often considered less important than posture or workstation arrangement. Research on desktop lighting has shown that the relationship between screen brightness and surrounding illumination can affect visual comfort and viewing behaviour.^[4,5] When a screen is difficult to view because of glare, reflection or an unsuitable brightness level, a worker may change head or neck position to see the display more comfortably. Experimental work has shown changes in face-to-screen distance and higher-risk postures under unfavourable combinations of illumination and screen brightness.^[6,7]

Visual discomfort and neck symptoms may also occur together during prolonged computer work. Studies have reported associations between visual symptoms, trapezius activity and neck pain, while reviews of digital eye strain have identified lighting, glare, viewing distance and workstation arrangement as relevant factors.^[7,8,9,10,11] Neck pain during computer work is multifactorial. Screen height and working posture can influence neck and shoulder muscle activity, so the present study included RULA as an additional ergonomic measure.^[13,14]

In this study, screen-related illumination was measured in lux because a lux meter was used under the approved study protocol. Lux represents illuminance and is different from display luminance, which is expressed in cd/m^2 . Both screen-related and ambient illumination were recorded so that the visual environment

could be considered together. The study was undertaken because the specific relationship between measured screen brightness and neck-pain intensity among banking-sector desktop users has received limited attention in the available literature^[2,4,5,6]

II. NEED FOR THE STUDY

Neck pain can affect work productivity, quality of life and general well-being in desktop users. Prolonged screen work has been linked with neck and upper-extremity symptoms, and visual symptoms may occur along with neck pain.^[2,9,10,11] Environmental illumination and display brightness may influence how a person positions the head and upper body while viewing the screen.^[4,5,6] Therefore, the present study was planned to examine whether measured screen brightness is associated with neck-pain intensity among desktop computer users in the banking sector. This study will address this gap by evaluating whether screen brightness is associated with pain severity. The findings may also be useful for physiotherapists when providing ergonomic education related to screen settings, glare, workstation arrangement, posture and movement breaks.

III. AIM AND OBJECTIVES

Aim

To determine the correlation between screen brightness and neck pain among desktop computer users in the banking sector.

Objectives

1. To assess the screen brightness of desktop computers used by banking-sector employees, measured in lux using a lux meter.
2. To assess the intensity of neck pain using the Numerical Pain Rating Scale (NPRS).
3. To assess working posture during desktop use using the Rapid Upper Limb Assessment (RULA) scale.
4. To record ambient illumination at each workstation in lux under usual working conditions.
5. To determine the correlation between screen brightness and neck-pain intensity among desktop computer users in the banking sector.
6. To explore relationships of screen brightness and ambient illumination with RULA score and NPRS as additional ergonomic variables.

IV. REVIEW OF LITERATURE

Coenen et al. (2019) — A systematic review and meta-analysis examined associations between screen work and neck and upper-extremity symptoms and highlighted the relevance of screen-based occupational exposure to musculoskeletal health.²

Meng et al. (2025) — A systematic review and meta-analysis reported an association between sedentary behaviour and neck pain, supporting the relevance of prolonged sedentary occupational work to neck symptoms.³

Han et al. (2021) — The study examined desktop lighting and comfortable computer-screen use and showed that lighting conditions can influence visual and overall comfort during prolonged computer tasks.⁴

Zhou et al. (2021) — The study found that optimum display luminance changed with ambient illuminance, showing that display settings and surrounding lighting should be considered together.⁵

Merbah, Gorce and Jacquier-Bret (2020) — Experimental work on illumination and screen-brightness settings found changes in face-to-screen distance and RULA-rated posture under different lighting conditions. Although the task involved smartphone use, the study provides a possible mechanism linking visual conditions with posture.⁶

Mork et al. (2016, 2018) — Studies of glare during computer work reported visual discomfort and changes related to trapezius activity and forward-bent posture, providing physiological support for an interaction between visual conditions and neck loading.^{7,8}

Teo et al. (2019) — Computer users with persistent neck pain reported higher computer-vision symptom scores than controls, showing that visual and cervical symptoms can coexist.⁹

Sheppard and Wolffsohn (2018); Pucker et al. (2024) — Reviews of digital eye strain identified lighting, glare, viewing distance and workstation arrangement as relevant contributors to visual discomfort.^{10,11}

Sahu et al. (2020) — The study of Indian IT professionals examined ergonomic risk factors associated with upper-body pain and supports the importance of ergonomic awareness in computer-based work.¹²

Villanueva et al. (1997) — The study showed that screen height can influence sitting posture and neck and shoulder muscle activity during visual display terminal work.¹⁴

Namwongsa et al. (2018) — RULA was applied to screen-device users, supporting its use as an observational measure of postural risk.¹⁷

V. METHODOLOGY

Study type	Survey-based study
Study design	Cross-sectional, questionnaire-based observational study
Study population	Desktop-using employees in the banking sector
Study setting	Banking-sector workplaces (branch and administrative offices), Pune
Sample size	130 participants
Sampling method	Non-probability purposive sampling
Age	25–38 years in the completed dataset
Daily desktop exposure	8–12 hours/day
Work experience	2–17 years in the completed dataset
Primary outcome	Neck-pain intensity measured using NPRS
Primary exposure	Screen brightness / illumination measured in lux
Additional measure	RULA score
Environmental measure	Ambient illumination in lux
Statistical analysis	Descriptive statistics, Shapiro–Wilk normality testing and Spearman rank-order correlation

Study design and setting

A cross-sectional, questionnaire-based observational design was used. Data were collected from desktop computer users working in banking-sector workplaces in Pune under their usual working conditions. The design allowed the variables to be assessed at one point in time and was suitable for examining associations, but it did not allow causal conclusions.

Participants and eligibility

The completed dataset included 130 eligible participants aged 25–38 years. All participants reported 8–12 hours of daily desktop work and had more than one year of banking experience. Employees with a history of cervical trauma or cervical surgery, neurological or musculoskeletal conditions affecting the neck, severe postural abnormalities interfering with RULA assessment, or current physiotherapy treatment for neck pain were excluded.

Materials and outcome measures

A self-structured banking-sector questionnaire, NPRS, RULA worksheet, lux meter, data-collection sheet and informed consent form were used. NPRS is an 11-point scale from 0 to 10 for recording pain intensity. RULA is an observational assessment of posture and loading involving the upper limb, neck and trunk and produces a score from 1 to 7. Screen-related illumination was measured in lux at approximately 50–70 cm from the display at eye level, and ambient illumination was recorded separately. The usual workplace lighting was not altered during measurement.

PROCEDURE

- Permission was obtained from the concerned banking workplace authority before data collection.
- The purpose and procedure were explained and written informed consent was obtained.
- Participants were screened according to the eligibility criteria and demographic and occupational information was recorded.
- Screen-use pattern, brightness setting, ambient lighting, glare and workstation practices were documented.
- Neck pain was recorded using NPRS and working posture was assessed using RULA in the participant's usual desktop position.

- Screen-related and ambient illumination were measured with a lux meter and entered into the data-collection sheet.
- After data collection, the information was organised in Microsoft Excel and analysed statistically.

Statistical analysis

Descriptive statistics were used to summarise the study variables. The Shapiro–Wilk test was used to assess normality. Since the principal numeric variables showed non-normal distributions ($p < 0.05$), Spearman's rank-order correlation was selected. Statistical significance was set at $p < 0.05$. Correlation coefficients were interpreted as associations and not as proof of causation. The masterchart was checked for missing values and data-entry errors before analysis.

VI. RESULTS AND DATA ANALYSIS

A total of 130 participants were included in the final analysis. The mean age was 30.63 ± 3.52 years and the mean work experience was 5.55 ± 2.41 years. There were 68 male (52.3%) and 62 female (47.7%) participants. All participants reported 8–12 hours of daily desktop work.

The mean NPRS score was 4.25 ± 2.07 . Mean screen illumination was 546.84 ± 64.22 lux and ranged from 243 to 663 lux. Mean ambient illumination was 1238.60 ± 44.22 lux. The mean RULA score was 2.60 ± 1.06 .

The primary analysis showed a strong positive correlation between screen brightness and NPRS score (Spearman's $\rho = 0.777$, $p < 0.001$). This means that higher measured screen-brightness values tended to occur with higher reported neck-pain scores in this sample.

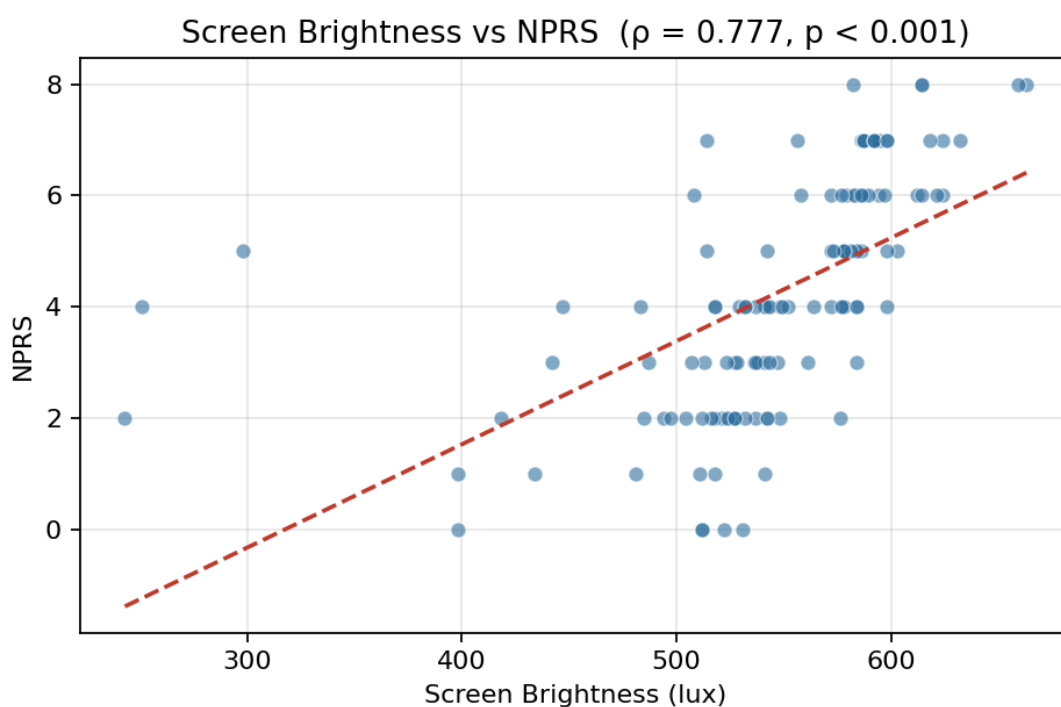


Figure 1. Screen brightness versus NPRS (Spearman's $\rho = 0.777$, $p < 0.001$).

Among the exploratory correlations, ambient illumination also showed a strong positive correlation with NPRS (Spearman's $\rho = 0.701$, $p < 0.001$). As requested, only the strong positive associations are presented here; moderate and weak associations were not included in the main results section.

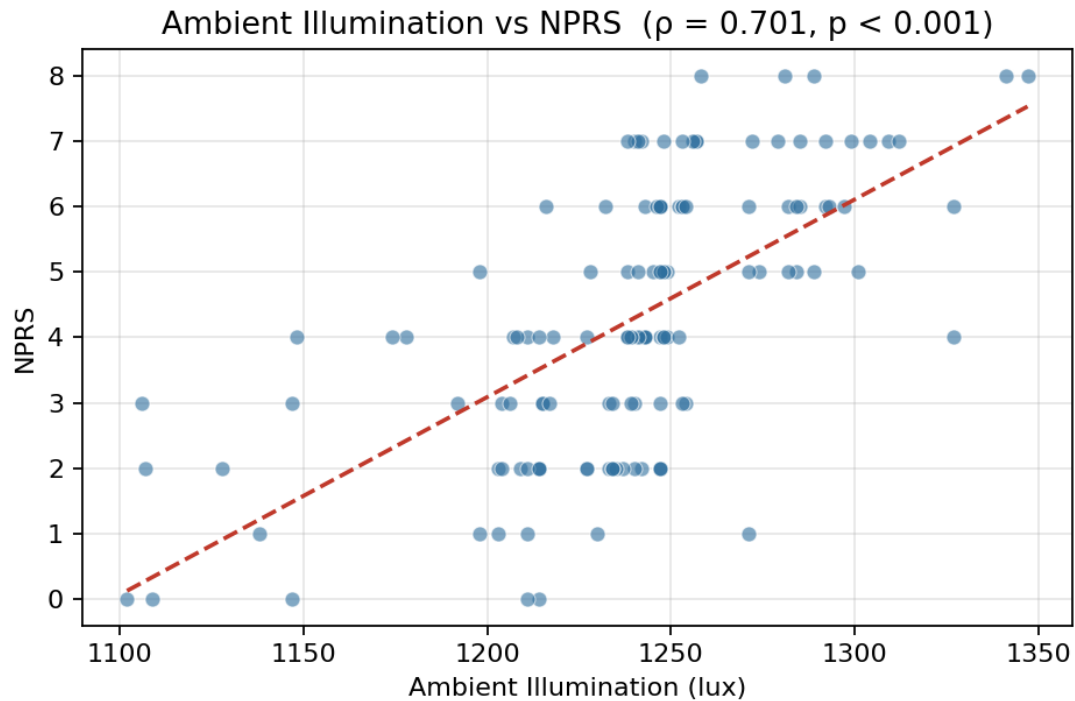


Figure 2. Ambient illumination versus NPRS (Spearman's $\rho = 0.701, p < 0.001$).

The null hypothesis stating that there was no significant correlation between screen brightness and NPRS was rejected at the 5% level. The alternative hypothesis was supported.

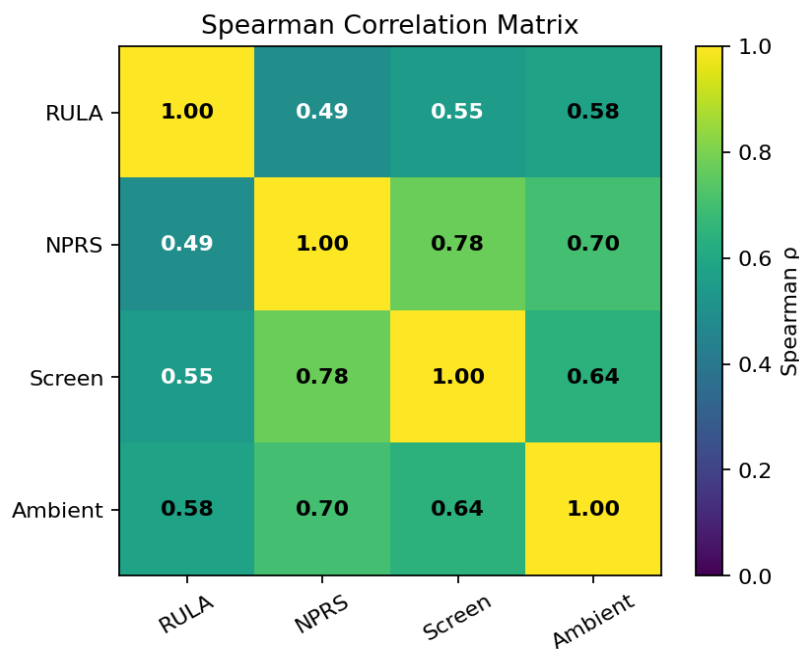


Table 1. Key study findings

Variable / relationship	Result	Interpretation
Sample	N = 130	Banking-sector desktop users
NPRS	4.25 ± 2.07	Mean neck-pain score
Screen illumination	546.84 ± 64.22 lux	Measured under usual work conditions
Screen brightness ↔ NPRS	$\rho = 0.777; p < 0.001$	Strong positive correlation
Ambient illumination ↔ NPRS	$\rho = 0.701; p < 0.001$	Strong positive correlation

VII. DISCUSSION

The main finding of the present study was a strong positive correlation between measured screen brightness and neck-pain intensity. The Spearman correlation was 0.777 with $p < 0.001$. Participants with higher screen-

brightness measurements generally reported higher NPRS scores. This was the strongest association observed in the study.

This finding can be understood in relation to earlier work on the visual environment during computer use. Research has shown that glare and visually stressful conditions can increase visual discomfort and may be associated with changes in trapezius activity and forward head posture.^[7,8] Other studies have also shown that display luminance and surrounding illumination influence visual comfort and that changes in lighting can affect the distance and posture adopted while viewing a screen.^[4,5,6]

One possible explanation is that an uncomfortable visual condition may lead the user to change head or neck position in an attempt to see the screen more clearly. If this position is maintained during long periods of computer work, the cervical and shoulder muscles may be exposed to additional loading.^[6,7,14] However, the present study was cross-sectional and correlational. Therefore, the observed association does not show that screen brightness alone caused neck pain.

Ambient illumination also showed a strong positive correlation with NPRS ($\rho = 0.701$, $p < 0.001$). This finding is consistent with the view that screen conditions cannot be considered separately from the surrounding visual environment. Previous research has shown that optimum display luminance changes with ambient illumination and that lighting conditions influence visual comfort.^[4,5,10]

The present findings also fit with literature showing that visual and cervical symptoms may coexist in computer users. Teo et al. reported higher computer-vision symptom scores in participants with persistent neck pain, while reviews of digital eye strain have identified lighting, glare and workstation arrangement as relevant factors.^[9,10,11]

From a physiotherapy point of view, the results support looking beyond posture alone during workplace assessment. Screen settings, glare, ambient illumination, monitor position, viewing distance and opportunities for movement can be considered together with the usual ergonomic assessment.^[4,6,12] The use of measured illumination rather than only subjective brightness ratings was a specific feature of this study. At the same time, the sample was limited to banking-sector desktop users and all participants had 8–12 hours of daily desktop exposure, so the findings should be interpreted within this occupational group.

VIII. CONCLUSION

The present study found a significant strong positive correlation between screen brightness and neck pain among desktop computer users in the banking sector. Higher screen-brightness measurements were associated with higher NPRS scores ($\rho = 0.777$, $p < 0.001$). Ambient illumination also showed a strong positive association with NPRS. These findings suggest that visual and workplace lighting conditions may be relevant when assessing neck discomfort in prolonged desktop users. Since the study was cross-sectional, the results show association and not causation.

IX. CLINICAL IMPLICATIONS

- Screen brightness and workplace lighting can be included in physiotherapy ergonomic assessment.
- Workstation assessment can consider monitor position, viewing distance, glare and reflections, seating and opportunities for postural variation.
- Employees can be educated to maintain visually comfortable screen and surrounding lighting conditions.
- Regular short movement and postural-change breaks can be encouraged during prolonged desktop work.
- Workers with recurrent neck pain or visual discomfort can be advised to seek early assessment and workstation modification.

X. LIMITATIONS

- The cross-sectional design does not establish a causal relationship between screen brightness and neck pain.
- Screen brightness and ambient illumination were moderately correlated, so their independent contributions cannot be separated in this dataset.
- Lux measures illuminance and is not equivalent to display luminance in cd/m^2 ; the screen measurement should therefore be interpreted according to the study conditions.
- All participants reported 8–12 hours of daily desktop work, so different exposure-duration categories could not be compared.

- The study was limited to banking-sector desktop users, which limits direct generalisation to other occupational groups.

XI. FUTURE SCOPE

- Use a larger sample and include participants from different banking workplaces.
- Conduct longitudinal or interventional studies to examine whether modifying visual and ergonomic conditions changes neck-pain outcomes.
- Include additional workstation factors such as monitor height, viewing distance, screen size and seating arrangement.
- Consider physical activity, psychosocial workload, sleep, previous neck disorders and other possible confounders.
- Compare banking roles with different levels of desktop exposure and compare banking employees with other computer-intensive occupations.

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