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BURNOUT AND AUTOMATION IN HEALTHCARE: THE PSYCHOSOCIAL CONSEQUENCES OF ARTIFICIAL INTELLIGENCE IN RADIOLOGY

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ABSTRACT

Background: Diagnostic imaging is characterized by increasing workloads, workforce shortages, and chronic time pressure, contributing to high occupational burnout among radiologists. Concurrently, artificial intelligence (AI) is rapidly entering clinical workflows, yet its psychosocial impact on clinician well-being remains insufficiently understood.
Aim: To critically analyze occupational burnout among radiologists during digital healthcare transformation, emphasizing how AI may shape psychosocial working conditions, cognitive demands, and professional autonomy.
Methods: A narrative review was conducted using PubMed, Scopus, and Google Scholar (2020 - May 2026). Peer-reviewed studies addressing organizational, behavioral, and psychological aspects of AI and digital transformation in radiology were included. Studies focusing solely on technical performance without human-factor relevance were excluded.
Results: Occupational burnout in radiology is described as a chronic, systemic phenomenon associated with workload pressure, workforce shortages, and organizational strain. AI applications may support workflow efficiency; however, they also alter cognitive demands, including increased system supervision and decision integration tasks. The long-term impact of AI on burnout remains uncertain.
Conclusions: AI should be considered a sociotechnical factor with both potential benefits and risks for clinician well-being. Burnout mitigation requires integrated, system-level interventions and Human-Centered AI approaches, though empirical validation of their impact on burnout outcomes remains limited.

KEYWORDS

Artificial Intelligence; Radiology; Burnout Syndrome; Occupational Stress; Technostress; Cognitive Load

CITATION

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1. Introduction

Modern diagnostic imaging is among the most digitized fields of medicine. While this transformation has significantly improved diagnostic capabilities, it has also contributed to information overload and increasing workflow pressure. The growing disparity between the continuous increase in the number of requested imaging examinations and the shortage of medical staff has become a major organizational challenge. The COVID-19 pandemic and an aging population have further exacerbated this problem, increasing workload intensity and time pressure in radiology practice and contributing to cognitive fatigue and burnout among radiologists [1, 2, 3, 4].

Chronic work overload may contribute to reduced professional autonomy and increasing task routinization. Combined with mounting time pressure, these factors have been linked to workforce shortages and retention challenges in many healthcare systems [5]. This phenomenon has been associated with high levels of occupational burnout, manifested by emotional exhaustion and depersonalization [6]. To ensure conceptual clarity, it is crucial to delineate individual 'radiologist burnout' (psychological and physiological exhaustion of the physician) from 'radiology system burnout' (structural inefficiencies, staff turnover, and operational overload at the departmental level).

Importantly, as healthcare systems navigate the transitional phase of artificial intelligence (AI) adoption, the introduction of AI-based tools in diagnostic imaging is increasingly shaping radiological workflows. Recent literature also highlights that artificial intelligence is increasingly being integrated into healthcare not only as a diagnostic support tool, but also as a mechanism for administrative automation and workflow optimization, further reinforcing its role as a key driver of digital transformation in medicine [7]. However, the latest evidence suggests that its impact on healthcare professionals' well-being is complex and context-dependent. These technologies may offer potential support in terms of workflow optimization and task assistance. However, their implementation may also introduce new forms of psychosocial strain, including increased cognitive demands and technostress. Therefore, the effective integration of digital tools requires careful consideration to ensure that technological progress does not inadvertently exacerbate existing stressors within clinical practice [8, 9].

Although AI systems are being rapidly adopted in radiology departments, there remains a limited body of literature examining human-technology interaction in the context of healthcare work. Many existing studies focus primarily on optimizing technical metrics of algorithms, such as sensitivity or specificity, while comparatively fewer studies examine the multidimensional impact of these implementations on clinicians and healthcare professionals, including cognitive workload, stress, usability, and professional well-being. In the field of medical systems, it is essential to transition toward a Human-Centered AI (HCAI) framework, which prioritizes the radiologist's well-being and cognitive ergonomics on par with the effectiveness of the tools [10].

Despite the growing number of studies on digital technologies in radiology, there is still a lack of comprehensive research examining how automated work environments affect radiologists' stress levels and job satisfaction. This gap remains particularly relevant within healthcare management research, where integrative models linking AI integration, cognitive workload, and burnout outcomes are still limited.

The main aim of this study is to examine and critically analyze occupational burnout among radiologists in the context of ongoing digital transformation in healthcare. By utilizing diagnostic imaging as a critical case study, this review explores the broader implications of human-computer interaction (HCI) and workplace automation, with particular emphasis on the role of AI as one of the key factors shaping psychosocial working conditions. Our study focuses on the balance between potential protective effects of technological support systems, such as improved workflow organization and reduced routine workload, and emerging psychosocial risks, including technostress, cognitive burden, changes in professional autonomy, and job satisfaction.

This review proposes an integrative sociotechnical perspective that conceptualizes AI not merely as a productivity-support tool, but as a factor reshaping cognitive ergonomics, professional autonomy, psychosocial workload, and organizational dynamics in radiology practice.

2. Methodology

This study was conducted as a narrative literature review aimed at synthesizing existing evidence on the psychosocial consequences of digital transformation in radiology, with particular emphasis on occupational burnout and the role of artificial intelligence in shaping working conditions.

A structured literature search was performed in PubMed, Scopus, and Google Scholar. The search was limited to peer-reviewed publications published between 2020 and 2026 (search completed in May 2026), written in English. The review focused on studies addressing the psychosocial, organizational, behavioral, and psychological effects of digital automation on radiologists. The primary search strategy employed a combination of English keywords connected by Boolean operators (AND, OR). The search terms included: "radiology burnout", "radiologist burnout", "artificial intelligence radiology", "AI automation radiology", "workload reduction", "workflow optimization", "radiologist well-being", "occupational health". To ensure a comprehensive synthesis, the initial database search was supplemented by manual reference tracking (snowballing) of the retrieved articles to identify additional relevant literature. Furthermore, a purposive search strategy was employed to integrate seminal theoretical papers and interdisciplinary frameworks essential for thematic synthesis.

The initial search identified a broad body of potentially relevant literature. After screening titles, abstracts, and full texts for thematic relevance to psychosocial and organizational outcomes, studies focusing exclusively on technical algorithmic performance without human-factor implications were excluded from the final synthesis.

Eligible publications included systematic reviews, international guidelines, original research articles, and clinical reports, as well as conceptual frameworks and peer-reviewed perspectives relevant to the study's scope. Studies were included if they examined psychosocial, organizational, behavioral, or psychological outcomes related to digital transformation and AI in radiology practice, or if they provided theoretical foundations for human-computer interaction in healthcare. An exclusion criteria framework was applied. Articles of a purely technical or physical nature were excluded if they evaluated only diagnostic accuracy, computational performance, or software efficiency without addressing human factors, workflow implications, or psychological outcomes. Additionally, non-peer-reviewed opinion pieces, conference abstracts, and publications lacking scientific peer review were excluded. While narrative reviews inherently lack the strict quantitative quality appraisal of systematic meta-analyses, a critical evaluation approach was maintained to identify publication bias and assess the heterogeneity of AI applications across different radiological subfields. Ultimately, a total of 21 articles were included in the final review.

3. Results

3.1. Workforce pressure, organizational strain and system-level overload

The included studies consistently indicate that radiology is characterized by increasing systemic pressure driven by growing imaging demand, workforce shortages, and persistent post-pandemic service pressures. Evidence from workforce analyses suggests that radiology departments are experiencing a sustained imbalance between imaging volume and available specialist capacity, contributing to structural strain within healthcare systems [11]. The psychological toll of the COVID-19 pandemic further exacerbated these systemic pressures, intensifying organizational stress and increasing the risk of post-traumatic stress disorder (PTSD) symptoms and burnout among healthcare professionals, including radiologists [12]. Literature reviewing the impact of the COVID-19 era on the profession indicates that the pandemic exacerbated pre-existing workload-related stressors, confirming that occupational pressure in radiology is a chronic, prolonged issue rather than an episodic phenomenon [4]. These system-level challenges are compounded by broader healthcare workforce shortages, which exacerbate inefficiencies in task distribution and increase individual workload burden [11]. Such structural imbalances represent the primary system-level drivers of distress, initiating the cascade from systemic strain to individual radiologist burnout.

3.2. Occupational stress, burnout prevalence and psychosocial burden

A substantial body of evidence demonstrates persistently high levels of occupational burnout among radiologists and trainees. A recent meta-analysis reported that approximately 82.9% of radiology trainees and practicing radiologists demonstrated positivity in at least one Maslach Burnout Inventory (MBI) subscale [13]. A recent national survey from Germany demonstrated a high prevalence of burnout among radiologists, with burnout strongly associated with workload, time pressure, work-life imbalance, and reduced job satisfaction [14]. Furthermore, research emphasizes that manifestations of emotional exhaustion and depersonalization are

strongly associated with structural workplace stressors and organizational burdens [15]. The literature consistently highlights that burnout has significant implications for professional well-being, job satisfaction, and patient safety, as chronic occupational stress has been associated with increased risk of diagnostic errors and reduced professional performance [13]. Taken together, these findings indicate that burnout in radiology must be conceptualized as a systemic occupational outcome.

3.3. Psychosocial mechanisms: occupational stress and job satisfaction dynamics

Beyond prevalence estimates, recent studies emphasize the importance of understanding the underlying psychosocial mechanisms linking occupational stress and job satisfaction. Network analyses of radiologists demonstrate that occupational stress and job satisfaction form complex relational structures rather than linear cause-effect relationships. Within these networks, organizational management and occupational interests emerge as highly interconnected domains, suggesting that perceived organizational support plays a central role in shaping stress responses. Intrinsic job satisfaction was identified as a central node with high network connectivity, suggesting its important role in maintaining psychological balance and professional engagement [16]. These findings support theoretical models suggesting bidirectional relationships between stress and satisfaction, highlighting the importance of systemic relational factors in shaping the clinician's psychosocial experience.

The key system-level and psychological mechanisms discussed in Sections 3.1-3.3 are summarized in Table 1.

Table 1. Summary of system-level and psychosocial mechanisms contributing to occupational burnout in radiology.

Domain / Factor	Observed Impact on the Work Environment	Potential Burnout Mechanism	Citations
Systemic and Workforce Pressure	Sustained imbalance between increasing imaging demand and available specialist capacity is associated with chronic occupational strain and perceived workload escalation.	Chronic overload, time pressure, reduced recovery opportunities.	[3], [11], [14]
COVID-19 Pandemic Impact	Pandemic-related service disruption is associated with increased organizational strain and higher reported rates of PTSD symptoms and burnout indicators among healthcare professionals.	Acute and chronic psychological stress amplification.	[1, 4]
Burnout Prevalence and Manifestations	High prevalence of burnout-related symptoms, including emotional exhaustion and depersonalization, reported among radiologists and trainees using MBI-based assessments.	Emotional exhaustion, depersonalization, reduced professional efficacy.	[13], [15]
Psychosocial Buffering Mechanisms	Intrinsic job satisfaction and perceived organizational support are associated with reduced burnout risk and improved occupational well-being within network-based models.	Enhanced resilience and improved occupational engagement.	[16]
Organizational and Clinical Outcomes	Occupational stress is associated with reduced professional engagement, increased turnover intention, and higher self-reported risk of diagnostic errors.	Increased turnover intention, reduced patient safety, and professional disengagement.	[13], [17]

3.4. Artificial intelligence, automation and the sociotechnical transformation of radiology work

The reviewed literature indicates that AI is increasingly integrated into radiology workflows, primarily as a tool for diagnostic support, workload redistribution, and administrative automation. Empirical evidence suggests that AI applications, such as triage systems and image prioritization for chest radiographs, can identify low-risk or likely normal scans for workflow prioritization and triage support [18, 19]. Similar productivity enhancements have been reported in magnetic resonance imaging (MRI) interpretation and broader diagnostic workflows, and targeted AI integration has been proposed to mitigate burnout in high-stress subfields like interventional radiology [20, 21, 22].

However, recent prominent analyses highlight that the relationship between AI implementation and radiologist well-being is highly complex [23]. While automation may offer productivity gains, the long-term impact of AI on radiologist burnout remains a 'black box', meaning its true effect on clinician well-being is yet to be fully determined [24]. Human-AI interaction studies emphasize that the introduction of AI reshapes rather than eliminates clinical workload, shifting cognitive demands toward system supervision, decision integration, and error monitoring [25]. To mitigate the emerging risk of technostress, the field must transition toward a Human-Centered AI (HCAI) framework [10]. This paradigm aims to ensure that AI systems are designed to amplify human capabilities while preserving human oversight, trust, and cognitive ergonomics. Within this framework, effectiveness should be evaluated not only by diagnostic accuracy, but also by its impact on clinician well-being [10, 25].

The major sociotechnical implications of AI integration discussed in Section 3.4 are summarized in Table 2.

Table 2. Summary of sociotechnical implications of artificial intelligence (AI) integration in radiology workflows.

Dimension of AI Integration	Implications for Cognitive Workload and Radiologist Well-being	Potential Psychosocial Consequence	Citations
Diagnostic Support and Workload Optimization	AI systems have been associated with improved workflow efficiency, triage support (e.g., chest radiographs), and potential redistribution of repetitive tasks in selected clinical contexts.	Reduced repetitive workload, potential efficiency gains.	[18], [19], [20], [21], [22]
Cognitive Workload Redistribution	AI adoption may be associated with a shift in cognitive demands from primary image interpretation toward system monitoring, algorithmic supervision, and decision integration tasks.	Increased cognitive vigilance and technostress.	[25]
Long-Term Impact Uncertainty	The long-term relationship between AI implementation and clinician burnout remains insufficiently characterized, with current evidence being heterogeneous and context-dependent.	Uncertain long-term occupational adaptation.	[8], [24]
Human-Centered AI (HCAI) Framework	HCAI frameworks have been proposed to optimize alignment between AI systems and clinician cognitive ergonomics, professional autonomy, and trust; empirical validation in burnout outcomes remains limited.	Potential mitigation of technology-related stressors.	[10], [25]

3.5. Organizational outcomes and intervention strategies

Evidence synthesis suggests that occupational stress and burnout in radiology have significant implications for workforce stability, patient safety, and retention. Chronic stress is associated with reduced professional engagement, increased risk of errors, and higher turnover intentions [17]. Systematic evidence highlights that effective mitigation strategies must operate simultaneously at multiple levels. While individual-level approaches such as resilience training and mindfulness are beneficial, they appear insufficient on their own. Multimodal interventions combining personal psychological support with structural workflow redesigns, systemic organizational improvements, and careful ergonomic integration of digital tools may be more effective than isolated individual-level approaches [26]. Addressing burnout in radiology requires an integrated approach that targets both psychosocial resilience and the sociotechnical factors shaping the modern work environment.

4. Discussion

4.1. Principal findings

This literature review highlights that the integration of artificial intelligence into diagnostic imaging is occurring against a backdrop of chronic organizational strain, workforce shortages, and escalating imaging demands [11]. The prevalence of occupational burnout among radiologists remains high [13], suggesting that burnout should be understood primarily as a systemic occupational phenomenon rather than solely an individual psychological issue. Crucially, our synthesis reveals that while AI tools offer significant potential for workflow optimization and diagnostic support [18, 19], their impact on clinician well-being is not uniformly positive. Instead, the implementation of AI acts as a complex sociotechnical modifier, capable of reducing specific repetitive tasks, but simultaneously introducing new cognitive burdens and structural challenges [24, 25]. However, it must be emphasized that direct empirical evidence linking AI adoption to changes in radiologist burnout levels remains limited; therefore, the relationship should be interpreted as associative and hypothesis-generating rather than causal.

4.2. Burnout as a systemic occupational outcome

The findings of this review are consistent with the World Health Organization's (WHO) classification of burnout as an occupational phenomenon resulting from chronic workplace stress that has not been successfully managed [27]. The exceptionally high positivity rate in burnout subscales among radiologists (up to 82.9%) [13] underscores the substantial occupational burden present within radiology. As evidenced by comparative data, these stressors are resilient and chronic, having persisted and evolved beyond the acute phases of the COVID-19 pandemic [1, 3, 4]. The literature consistently demonstrates that emotional exhaustion and depersonalization in radiology are strongly associated with unmanageable workloads, time pressure, and workforce imbalances [11, 14, 15]. Consequently, the literature suggests that approaches focused solely on individual resilience training, without addressing underlying structural demands, may have limited effectiveness [26]. It should be noted that burnout is a multifactorial construct within a biopsychosocial framework, and attributing it primarily to systemic factors may oversimplify individual variability in vulnerability and coping mechanisms.

4.3. Interpretation of psychosocial mechanisms

Network analyses emphasize that occupational stress does not operate in a vacuum. The relational dynamics of job satisfaction and workplace stress indicate that perceived organizational support may function as an important protective factor against burnout. When radiologists feel supported by institutional management, intrinsic job satisfaction emerges as a central interconnected factor within occupational stress and job satisfaction networks, suggesting a potentially important role in shaping responses to occupational stress [16]. This bidirectional relationship suggests that interventions should target the psychosocial climate of the department, fostering autonomy, professional engagement, and a supportive culture, rather than merely focusing on throughput efficiency.

4.4. Artificial intelligence as a sociotechnical factor

A central theme of this review is the conceptualization of AI as a transformative, yet unpredictable, sociotechnical factor. While empirical evidence supports the efficacy of AI in specific use cases, such as the triage of normal chest radiographs [19] or optimizing workflows in high-stress subfields like interventional radiology [22], the broader psychosocial impact remains insufficiently understood [8, 24]. The automation of

routine tasks does not necessarily translate into a reduced overall workload. Instead, it may result in a cognitive shift, from primary perceptual interpretation to the continuous supervision of algorithms, integration of complex automated decisions, and hyper-vigilance against systems errors [25].

AI implementation may additionally introduce medico-legal uncertainty, concerns regarding professional accountability, trust calibration, and dependency on partially opaque algorithmic systems. These factors may contribute to cognitive vigilance and technology-related stress, particularly in high-pressure diagnostic environments [8, 10, 25].

Figure 1 illustrates the conceptual relationship between system-level pressures, AI integration, psychosocial mechanisms, and burnout outcomes in radiology.

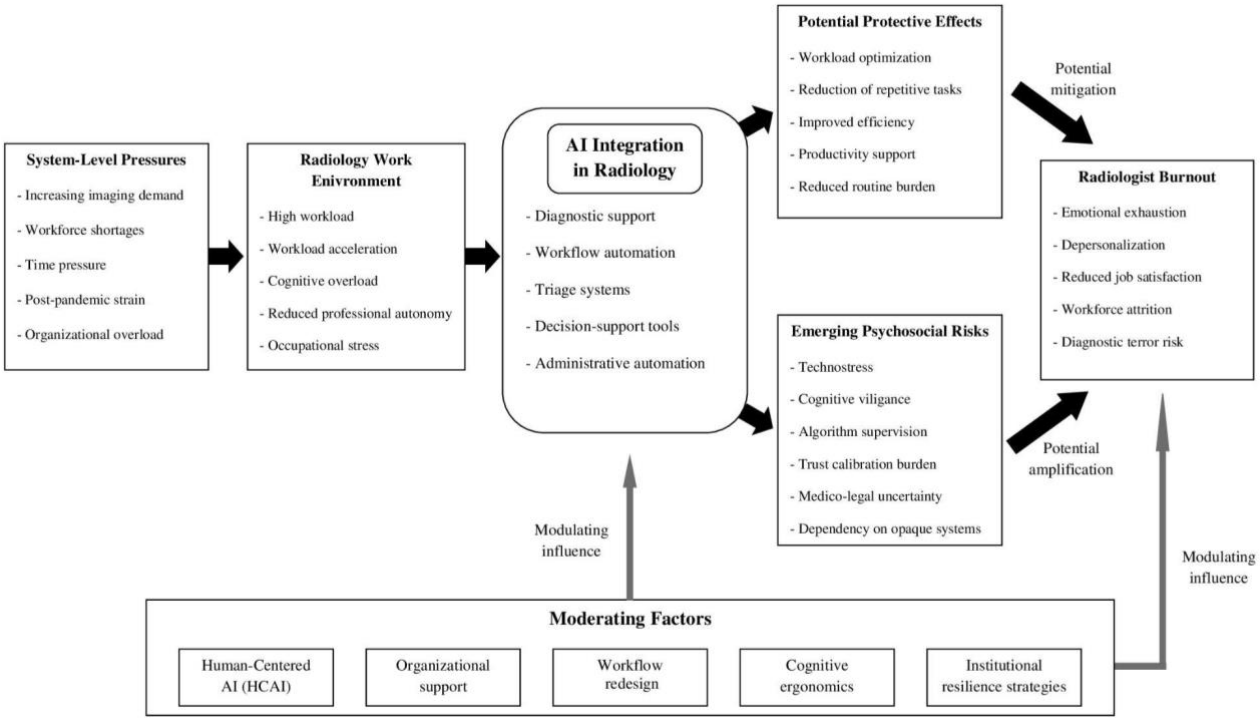

Fig. 1. *Conceptual overview of the relationships between system-level pressures, AI integration, psychosocial working conditions, and occupational burnout in radiology.*
Source: authors' conceptual synthesis based on the reviewed literature.

4.5. Implications for human-centered AI and healthcare management

To prevent AI from exacerbating existing occupational burnout, healthcare management should consider adopting a Human-Centered AI (HCAI) framework [10]. Although empirical validation remains limited, HCAI provides a useful framework for aligning AI systems with clinician cognitive ergonomics and professional autonomy. This paradigm shifts the focus from purely technical performance metrics (e.g., algorithmic sensitivity and specificity) to the holistic evaluation of how these tools affect the end-user's cognitive ergonomics and professional trust [10, 25]. Healthcare leaders and developers must collaboratively design systems that amplify human capabilities and respect professional autonomy, with the goal of ensuring that the integration of digital tools serves as a resource rather than an additional demand. Multimodal intervention strategies that combine structural workflow redesign with careful ergonomic integration appear particularly important [26].

4.6. Strengths and limitations

A key strength of this review is its interdisciplinary approach, bridging clinical radiology, occupational health, and human-computer interaction theories. Furthermore, by rigorously filtering out purely technical algorithmic studies, this paper successfully isolates the psychosocial and organizational implications of digital transformation. However, certain limitations must be acknowledged. As a narrative review, it is inherently susceptible to selection bias compared to a formal systematic review or meta-analysis. Additionally, the rapid

pace of AI development means that the technological landscape is highly fluid; tools evaluated in the early 2020s may differ significantly in usability from those entering the market today. Additionally, the present review does not quantify effect sizes or establish causal relationships between AI adoption and burnout outcomes due to the narrative nature of the synthesis. Furthermore, the absence of a formal study quality appraisal limits the ability to differentiate between high- and low-quality evidence, which may introduce interpretive bias in the synthesis. Additionally, AI systems evaluated across studies varied substantially in functionality, implementation maturity, and degree of clinical integration, limiting direct comparability between findings. Finally, the heterogeneity of included studies precluded meta-analytic integration.

5. Conclusions

Digital transformation in radiology serves as a compelling case study for the broader challenges of workplace automation, fundamentally altering the psychosocial landscape of the profession. Artificial intelligence represents a complex sociotechnical intervention that transcends mere technical implementation, deeply impacting human-computer interaction and occupational psychology. It holds the potential to alleviate some of the workload pressures currently driving radiologist burnout, but it simultaneously risks introducing novel cognitive burdens and technostress. The findings of this review suggest that AI is not a standalone cure for systemic organizational strain. To harness the benefits of automation without compromising clinician well-being, the medical community should transition from technology-centric implementation toward a Human-Centered AI approach. Future research should prioritize longitudinal and prospective studies evaluating how AI-assisted workflows influence burnout trajectories, cognitive workload, and professional autonomy in real-world radiology settings. Future strategies addressing radiologist burnout should integrate psychosocial interventions with human-centered sociotechnical redesign of digital workflows. Ultimately, the lessons learned from AI integration in radiology provide essential insights for managing cognitive load and preserving professional autonomy across other highly automated, high-stakes environments.

Author Contribution Statement:

Conceptualization: A.T. and A.Ko.; Methodology, A.T. and A.Ko.; Formal analysis, M.T.; Investigation, A.T. and M.T.; Data curation, M.T. and A.Kw.; Writing - original draft preparation, A.T.; Writing - review and editing, A.Ko., M.T. and A.Kw.; Visualization, M.T.; Project administration, A.Kw.; Supervision, A.Ko.

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