Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 22 July 2026
Revised 28 Aug 2026
Accepted 10 Sep 2026

Natural Resources for Human Health 2026, Vol. 6 (22s): 1608–1623

KEYWORDS:
workload; patient safety culture; primary healthcare; multidisciplinary teams; burnout; Job Demands–Resources; Saudi Arabia; Vision 2030

The Association Between Workload and Patient Safety Culture Among Multidisciplinary Healthcare Professionals in Primary Healthcare Centers in Saudi Arabia

Muhannad Safar Siraj Alharthi[1], Tawfeg Abddulkarim Ageel[2], Saud Jaber Mohammed Alahmari[3], Sqar Saeed Alghamdi[4], Abdullh Ghrsan Alzhrani[5], Ali Ahmed Ali Khubrani[6], Yaser Abdullah Ali Alasiri[7], Mushabbab Misfer Hamed Alqahtani[8], Musa Alsomali[9], Hanadi Mohammed Altheyab[10]

[1] Specialist-Nursing, Ministry of Interior
[2] Helth Information Technican, National Guard Health Affairs
[3] Senior pharmacist, Makkah Al-Mukarramah Health Cluster
[4] Helth Information Technican, National guard health affairs
[5] Helth Information Technican, National guard health affairs
[6] Radiology Technologist, Ministry of interior
[7] Radiology Technologist, Ministry of interior
[8] Medical Imaging Technologist, King Abdullah bin Abdulaziz University Hospital
[9] Anesthesia Technologist, King Abduaziz Medical City
[10] CSSD TECHNICIAN, Prince Sultan Military Medical City

ABSTRACT:

Background: Primary healthcare (PHC) centers are the first point of contact in the Saudi health system and are being repositioned as the foundation of the Vision 2030 Model of Care. Expanding services, chronic disease burden, and the transition to health clusters have intensified PHC workload. Patient safety culture, the shared values, beliefs, and behaviors that determine an organization's commitment to safety, is sensitive to such pressures, yet the workload–safety culture relationship has been studied mainly in hospitals and among nurses.

Objective: To synthesize the evidence on the association between workload and patient safety culture among multidisciplinary PHC professionals, to propose an original explanatory model (the BALANCE Framework), and to outline a rigorous multilevel cross-sectional design for testing it in Saudi Arabia.

Methods: An integrative review of international, regional (Gulf Cooperation Council), and Saudi literature was conducted, anchored in the Job Demands–Resources (JD-R) model, the Systems Engineering Initiative for Patient Safety (SEIPS 2.0), Reason's Swiss cheese model, and Donabedian's structure–process–outcome triad.

Results: The evidence consistently indicates that high quantitative and cognitive workload is associated with weaker perceptions of staffing adequacy, teamwork, communication openness, and overall safety, partly through burnout, fatigue, and reduced time for safety-related behaviors. Primary-care-specific evidence is thinner but directionally consistent, and profession-level differences are rarely examined.

Natural Resources for Human Health
eISSN: 2583-1194

Conclusion: Workload is a modifiable, system-level determinant of patient safety culture in PHC. The BALANCE Framework identifies demand, allocation, perceived load, buffering resources, strain pathways, culture dimensions, and evaluation as targets for intervention. Multilevel testing would inform health clusters, the Saudi Patient Safety Center, and CBAHI.

1. INTRODUCTION

1.1 Background

Patient safety is a defining dimension of healthcare quality and a global public health priority. The World Health Organization's Global Patient Safety Action Plan 2021–2030 calls on health systems to build a culture of safety, to strengthen the health workforce, and to design care processes that make error less likely and harm less frequent (World Health Organization [WHO], 2021). Although much of the patient safety movement grew out of hospital settings, the majority of patient–health system encounters occur in primary care, and a systematic review estimated that patient safety incidents occur in roughly 2 to 3 of every 100 primary care consultations, with a meaningful proportion of these causing avoidable harm (Panesar et al., 2016). The WHO's technical series on safer primary care identifies diagnostic error, medication error, transitions of care, administrative errors, and human factors, including workload, as priority risk areas (WHO, 2016).

In the Kingdom of Saudi Arabia, primary healthcare (PHC) centers operated by the Ministry of Health (MOH) form the gateway to the public health system. The system has historically been hospital-centric, but successive reforms have sought to strengthen primary care as the first and continuous point of contact (Almalki et al., 2011; Al Asmri et al., 2020). Under Vision 2030 and its Health Sector Transformation Program, care is being reorganized into regional health clusters, a new Model of Care emphasizes prevention, chronic disease management, and population health, and service delivery is progressively being transferred to the Health Holding Company (Ministry of Health, 2017; Health Sector Transformation Program, 2021). These reforms place PHC centers at the center of national health strategy and simultaneously expand the volume and complexity of work expected of PHC teams.

PHC centers in Saudi Arabia are staffed by multidisciplinary teams that typically include family and general physicians, nurses, pharmacists, medical laboratory specialists and technicians, radiographers, dentists and dental assistants, health educators, health information and medical records staff, and administrators. Each profession contributes to safety in a distinct way: physicians to diagnostic accuracy, pharmacists to dispensing and medication reconciliation, nurses to triage, immunization, and chronic disease follow-up, laboratory staff to specimen integrity and result communication, and health information staff to record accuracy and continuity. Because safety in primary care is distributed across these hand-offs, it depends heavily on the shared norms and behaviors that make up an organization's **patient safety culture**.

1.2 Problem Statement

Workload is among the most frequently cited threats to patient safety. When demand exceeds the time, staffing, and cognitive capacity available, professionals compress consultations, skip verification steps, defer documentation, and have less opportunity to speak up or report incidents (Carayon & Gurses, 2008). Over time, chronic overload contributes to burnout, which has been associated with lower safety climate ratings and higher rates of reported errors (Hall et al., 2016; Panagioti et al., 2018). Yet three gaps limit the usefulness of the existing literature for Saudi PHC. First, most studies were conducted in hospitals, particularly intensive care and inpatient wards, where workload has a different structure from the high-throughput, appointment-and-walk-in pattern of primary care. Second, the evidence is dominated by nursing samples, leaving the experiences of pharmacists, laboratory, radiology, dental, and administrative staff largely unexamined. Third, Saudi patient safety culture studies have mostly described culture dimension scores without modeling workload as an explanatory variable, and few have considered the clustered nature of staff within centers.

1.3 Aim and Research Questions

This paper aims to examine the association between workload and patient safety culture among multidisciplinary professionals in Saudi PHC centers by integrating the available evidence, proposing an original conceptual model, and specifying a research design capable of testing it. Four questions guide the work:

- **RQ1.** How is workload conceptualized and measured in healthcare, and which forms are most relevant to primary care?
- **RQ2.** What does the international, regional, and Saudi evidence show about the association between workload and patient safety culture?
- **RQ3.** Through which mechanisms, and under which buffering conditions, does workload influence safety culture in multidisciplinary PHC teams?
- **RQ4.** How can this association be tested rigorously in the Saudi PHC context to inform policy and practice?

1.4 Significance

The paper contributes in three ways. Theoretically, it integrates the Job Demands–Resources model with systems-based patient safety models to explain how individual workload experience translates into collective safety culture. Practically, it offers health cluster leaders and PHC directors a structured set of levers, organized in the BALANCE Framework, for protecting safety under rising demand. Methodologically, it proposes a multilevel, multi-professional design that addresses the shortcomings of earlier single-profession, single-level studies and aligns with national priorities set by the MOH, the Saudi Patient Safety Center (SPSC), the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI), and the Saudi Commission for Health Specialties (SCFHS).

2. CONCEPTUAL FOUNDATIONS

2.1 Patient Safety Culture

Safety culture has been defined as the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine an organization's commitment to, and proficiency in, health and safety management. In healthcare, it is commonly distinguished from safety climate, which refers to the measurable, surface-level perceptions of staff at a given point in time (Halligan & Zecevic, 2011). Most empirical work in fact measures climate as a proxy for culture using validated surveys. A review of the concept identified leadership commitment, open communication founded on trust, organizational learning, a non-punitive approach to error, teamwork, and a shared belief in the importance of safety as its most consistent dimensions (Halligan & Zecevic, 2011).

The instruments most widely used are the Agency for Healthcare Research and Quality (AHRQ) Surveys on Patient Safety Culture (SOPS) and the Safety Attitudes Questionnaire (SAQ). The Hospital Survey on Patient Safety Culture (Sorra & Nieva, 2004) has been the most common tool in the Gulf region, but for ambulatory settings AHRQ developed the **SOPS Medical Office Survey** (MOSOPS), which captures dimensions particularly relevant to primary care, such as patient care tracking and follow-up, information exchange with other settings, office processes and standardization, and work pressure and pace (Agency for Healthcare Research and Quality [AHRQ], 2022). The SAQ measures teamwork climate, safety climate, job satisfaction, stress recognition, perceptions of management, and working conditions, and has shown sound psychometric properties across settings (Sexton et al., 2006). Importantly, both families of instruments already embed workload-related content, such as staffing and work pressure and pace, which has implications for measurement overlap discussed later in this paper.

Safety culture matters because it shapes behavior. Hospitals with stronger safety climate have been shown to perform better on safety outcome indicators (Singer et al., 2009), and team-level psychological safety, the shared belief that it is safe to take interpersonal risks such as admitting a mistake or questioning a senior colleague, is a precondition for learning from errors (Edmondson, 1999). In primary care, where professionals frequently work in parallel rather than side by side, a culture that encourages information exchange and follow-up is especially important for catching delayed diagnoses, abnormal results, and medication problems.

2.2 Workload: A Multidimensional Construct

Workload is not a single quantity. It can be understood at several levels and in several forms, each with different implications for safety. Table 1 summarizes the forms most relevant to primary care.

Table 1. Dimensions of workload relevant to primary healthcare

Dimension	Definition	Typical PHC indicators	Example measures
Unit-level (quantitative)	Volume of demand relative to staffing at the center level	Visits per clinician per day; patient-to-nurse ratio; waiting list length; catchment population per physician	Administrative data; staffing ratios
Job-level	Overall demands of the role, including breadth of responsibilities	Number of clinics covered; administrative duties; on-call or extended-hours work	Job demands scales; JD-R measures
Task-level / cognitive	Mental effort, time pressure, and frustration attached to specific tasks	Consultation length; simultaneous tasks; interruptions; EHR documentation burden	NASA Task Load Index (NASA-TLX)
Emotional	Demands arising from emotionally charged interactions	Patient complaints, aggression, communication across languages and cultures	Emotional demands subscales
Perceived work pressure	Subjective sense of hurry and insufficient time to do the job safely	Feeling rushed; inability to take breaks	SOPS 'Work Pressure and Pace'; SAQ 'Working Conditions'

Sources: synthesized from Carayon and Gurses (2008), Hart and Staveland (1988), and Bakker and Demerouti (2007).

At the task level, the NASA Task Load Index assesses six subscales: mental demand, physical demand, temporal demand, performance, effort, and frustration (Hart & Staveland, 1988). It has been used among intensive care nurses as a measure of overall workload, with evidence supporting its construct validity in clinical settings (Tubbs-Cooley et al., 2018). Interruptions deserve particular attention: an observational study of hospital doctors found that workflow interruptions were associated with higher perceived workload, illustrating how the fragmentation of work, rather than its volume alone, can drive strain (Weigl et al., 2012). Primary care is especially exposed to fragmentation because clinicians frequently manage walk-in patients, telephone queries, electronic prescriptions, referrals, and results in parallel with scheduled consultations.

2.3 The Primary Care Context in Saudi Arabia

Saudi PHC centers operate under conditions that shape workload in distinctive ways. Demand is driven by a young but growing population, a high and rising prevalence of non-communicable diseases such as diabetes, obesity, and hypertension, and the expansion of screening, vaccination, maternal and child health, and wellness programs under the Model of Care (Ministry of Health, 2017). Seasonal surges, such as respiratory infection seasons and the Hajj and Umrah periods in some regions, add predictable peaks. On the supply side, the workforce is highly multinational, with a significant proportion of expatriate professionals working alongside Saudi nationals, which brings diversity of training but also linguistic and cultural communication demands. Digital transformation, including unified electronic health records, e-prescribing, appointment platforms, and virtual care, promises efficiency but introduces documentation and system-learning demands during transition (Al Asmri et al., 2020).

In primary care, safety is rarely lost in a single dramatic event; it erodes quietly in the shortened consultation, the unchecked result, and the incident that no one had time to report.

3. THEORETICAL FRAMEWORK

Four complementary theories explain how workload might shape patient safety culture. Each addresses a different level of analysis, and together they provide the foundation for the BALANCE Framework presented in Section 5.

3.1 Job Demands–Resources (JD-R) Model

The JD-R model proposes that every job has demands, the physical, psychological, social, or organizational aspects that require sustained effort, and resources, the aspects that help achieve goals, reduce demands, or stimulate growth (Demerouti et al., 2001; Bakker & Demerouti, 2007). Two processes follow. In the health impairment process, chronic high demands deplete energy and lead to exhaustion and burnout. In the motivational process, resources foster engagement and commitment. Resources also buffer the impact of demands on strain. The earlier demand–control model similarly predicted that high demands combined with low decision latitude produce the greatest strain (Karasek, 1979). Applied to patient safety, workload is a core job demand; teamwork, supportive leadership, autonomy, and adequate equipment are resources; and burnout is the strain mechanism that may weaken the attitudes and behaviors that constitute safety culture.

3.2 Systems Engineering Initiative for Patient Safety (SEIPS 2.0)

The SEIPS model places the person at the center of a work system composed of tasks, tools and technologies, the physical environment, and organizational conditions, all embedded in a wider external environment (Carayon et al., 2006). SEIPS 2.0 extends this by describing work processes as professional, patient, and collaborative, and by distinguishing proximal and distal outcomes for patients, professionals, and organizations, with feedback loops by which outcomes reshape the work system over time (Holden et al., 2013). From this perspective, workload is not a personal trait but an emergent property of the work system: the mismatch between the tasks assigned and the people, tools, and organizational arrangements available to carry them out. Safety culture is both an organizational element of the work system and an outcome shaped by repeated experience of work.

3.3 Reason's Swiss Cheese Model

Reason's model distinguishes active failures, the unsafe acts of people in direct contact with patients, from latent conditions, the system-level weaknesses created by decisions on staffing, scheduling, design, and resource allocation (Reason, 1990, 2000). Latent conditions create error-provoking circumstances such as time pressure, fatigue, and understaffing, and they open holes in successive defensive layers. Chronic excess workload is a classic latent condition: it does not cause harm directly, but it increases the probability that slips, lapses, and violations will align across defenses. A safety culture that recognizes this distinction focuses on fixing systems rather than blaming individuals, which is itself one of the culture's defining dimensions.

3.4 Donabedian's Structure–Process–Outcome Model

Donabedian's classic model holds that good structure increases the likelihood of good process, which in turn increases the likelihood of good outcomes (Donabedian, 1988). Staffing levels, skill mix, facilities, and information systems are structural attributes that determine workload; safety behaviors such as double-checking, incident reporting, and follow-up of results are processes; and safety culture scores, incidents, and patient experience are outcomes. The model is useful for translating the BALANCE Framework into indicators that PHC centers and health clusters already collect for accreditation and performance management.

3.5 Integrated Hypotheses

Drawing on these theories, the following hypotheses are proposed for empirical testing in Saudi PHC centers.

Table 2. Proposed hypotheses

Code	Hypothesis	Theoretical basis
H1	Higher perceived workload is associated with lower overall patient safety culture scores among PHC professionals.	JD-R (health impairment); Reason
H2	The association between workload and safety culture is partially mediated by burnout.	JD-R (strain pathway)
H3	Teamwork quality and supportive supervision moderate (buffer) the negative association between workload and safety culture.	JD-R (buffering); SEIPS 2.0

Code	Hypothesis	Theoretical basis
H4	The strength of the workload–safety culture association differs across professional groups.	SEIPS 2.0 (person–task fit)
H5	Center-level workload (patient visits per clinical full-time equivalent) explains variance in safety culture beyond individual-level perceived workload.	Donabedian; multilevel systems view

4. INTEGRATIVE REVIEW OF THE EVIDENCE

4.1 Review Approach

An integrative review approach was adopted because the relevant evidence is methodologically heterogeneous, encompassing cross-sectional surveys, observational studies, systematic reviews, and conceptual papers. The literature was organized around four questions: the international evidence on workload and safety outcomes, the role of burnout as a mechanism, the primary care evidence, and the evidence from Saudi Arabia and the Gulf region. Priority was given to systematic reviews, studies using validated instruments, and studies conducted in primary or ambulatory care.

4.2 International Evidence: Workload, Staffing, and Safety

The most robust evidence linking workload to safety comes from nurse staffing research. In a landmark study of surgical patients in Pennsylvania hospitals, each additional patient per nurse was associated with a higher likelihood of patient death within 30 days of admission and of failure to rescue, as well as with nurse burnout and job dissatisfaction (Aiken et al., 2002). A subsequent study across nine European countries found that higher nurse workloads were associated with higher post-surgical mortality, whereas a more educated nursing workforce was associated with lower mortality (Aiken et al., 2014). These findings established the principle that quantitative workload is not merely a staff-welfare issue but a patient-outcome issue.

Workload also shapes the perceptions that make up safety culture. In a study of hospital nurses in the United States, workplace demands, including workload and role conflict, were associated with less favorable perceptions of patient safety (Ramanujam et al., 2008). Among critical care nurses in Oman, fatigue, burnout, poorer work environment, and higher workload were all associated with less favorable perceived patient safety culture (Al Ma'mari et al., 2020). Human factors research has explained these associations by showing that high workload reduces the time available for safety-critical tasks such as surveillance, double-checking, and communication, increases reliance on workarounds, and degrades attention through interruptions and multitasking (Carayon & Gurses, 2008; Weigl et al., 2012).

4.3 Burnout as a Mechanism

Burnout, classically characterized by emotional exhaustion, depersonalization, and reduced sense of personal accomplishment, is the principal strain mechanism through which demands are thought to affect safety (Maslach & Leiter, 2016). A systematic review of 46 studies found that poor wellbeing and moderate-to-high levels of burnout among healthcare staff were associated with poorer patient safety, including medical errors (Hall et al., 2016). A later meta-analysis of physicians reported that burnout was associated with approximately a twofold increase in the odds of involvement in patient safety incidents, as well as with lower professionalism and patient satisfaction (Panagioti et al., 2018). Among American surgeons, burnout and depressive symptoms were independently associated with self-reported major medical errors (Shanafelt et al., 2010).

The relationship appears bidirectional: workload and burnout increase the risk of errors, and involvement in an error can, in turn, increase distress and burnout. For safety culture, the implication is that burnout may undermine willingness to report incidents, the energy needed to participate in improvement work, and the interpersonal openness on which teamwork depends. The Copenhagen Burnout Inventory, which measures personal, work-related, and client-related burnout, offers a non-proprietary and culturally adaptable measure suitable for multidisciplinary samples (Kristensen et al., 2005).

4.4 Evidence From Primary Care

Primary care safety research has developed more slowly than hospital research, but the available evidence highlights work pressure as a recurrent weakness. In a systematic review of patient safety in primary care, the most common sources of harm were diagnostic and prescribing errors, and contributory factors frequently included communication failures and organizational pressures (Panesar et al., 2016). Studies using the MOSOPS in Middle Eastern primary care have repeatedly found work pressure and pace among the lowest-scoring dimensions. In primary care centers in Kuwait, staff reported generally positive safety culture, but work pressure and pace was identified as an area requiring improvement (Ghobashi et al., 2014). In Al-Mukalla, Yemen, primary care staff reported weak scores on several dimensions, including work pressure and pace and patient care tracking and follow-up (Webair et al., 2015). Similar patterns have been reported among community pharmacists in Kuwait, where heavy workload and staffing shortfalls coexisted with weaker safety culture dimensions (Alsaleh et al., 2018).

These findings suggest that, in primary care, workload is experienced not only as fatigue but as a direct threat to the processes that guard against delayed diagnosis and lost follow-up: tracking abnormal results, completing referrals, and reconciling medications. The high-volume, short-consultation model of primary care may also make it harder to hold team huddles, debrief after incidents, or complete incident reports, which are behaviors that both express and sustain safety culture.

4.5 Evidence From Saudi Arabia

Saudi patient safety culture research has grown substantially since the first multi-hospital assessment, which found that teamwork within units scored relatively well, whereas non-punitive response to error, staffing, and frequency of event reporting were areas of weakness (Alahmadi, 2010). A large longitudinal study across MOH hospitals between 2012 and 2015 found improvements in several dimensions associated with national improvement initiatives, but staffing and non-punitive response to error remained persistently low (Alswat et al., 2017). A study of nurses in three Saudi hospitals similarly reported that staffing and non-punitive response to error were among the lowest-rated dimensions (Alquwez et al., 2018). The consistent weakness of the staffing dimension across Saudi studies is notable because staffing adequacy is closely linked to workload, suggesting that workload may be a structural constraint on improvement in other dimensions.

Evidence from Saudi PHC centers specifically remains limited and is often published in regional journals with small, single-region samples. These studies tend to report descriptive dimension scores and rarely model workload, burnout, and team resources simultaneously. They also seldom analyze differences by profession or account for the nesting of staff within centers. These limitations motivate the framework and design proposed in this paper.

Table 3. Selected evidence on workload, burnout, and patient safety culture

Study	Setting / sample	Key finding relevant to this paper
Aiken et al. (2002)	Hospitals, USA; nurses and surgical patients	Higher patient-to-nurse ratios associated with higher mortality, failure to rescue, and nurse burnout
Aiken et al. (2014)	Hospitals in nine European countries	Higher nurse workload associated with higher post-surgical mortality
Ramanujam et al. (2008)	Hospital nurses, USA	Workplace demands associated with less favorable patient safety perceptions
Hall et al. (2016)	Systematic review, 46 studies	Poor wellbeing and burnout associated with poorer patient safety
Panagioti et al. (2018)	Meta-analysis, physicians	Burnout associated with increased odds of patient safety incidents

Study	Setting / sample	Key finding relevant to this paper
Al Ma'mari et al. (2020)	Critical care nurses, Oman	Fatigue, burnout, and workload associated with weaker safety culture
Ghobashi et al. (2014)	PHC centers, Kuwait	Work pressure and pace identified as an improvement area
Webair et al. (2015)	PHC centers, Yemen	Weak scores on work pressure and patient follow-up dimensions
Alahmadi (2010)	Hospitals, Saudi Arabia	Staffing and non-punitive response among weakest dimensions
Alswat et al. (2017)	MOH hospitals, Saudi Arabia, 2012–2015	Improvement over time, but staffing remained persistently low

Note. Findings are summarized at the level of direction of association; readers should consult the original studies for effect sizes and methodological details.

4.6 Multidisciplinary Differences

Professional groups experience workload differently because their tasks, autonomy, and positions in the care pathway differ. Physicians in PHC face high cognitive load from diagnostic uncertainty and short consultations. Nurses experience high task density from triage, vital signs, immunization, chronic disease clinics, and patient education. Pharmacists' workload is driven by prescription volume, counseling, and the verification of electronic orders, with dispensing error risk rising under time pressure. Laboratory and radiology staff face throughput pressures and the risk of specimen or patient identification errors, and their contribution to safety depends on timely communication of critical results to clinicians. Health information and administrative staff carry the burden of registration, scheduling, and record integrity, which underpins continuity of care. Studies that pool these groups risk masking important differences, while studies of a single group cannot capture the interprofessional nature of safety culture. Safety culture surveys also reveal that frontline staff and managers often perceive safety differently, a gap that may be widened when frontline workload is high and leadership visibility is low.

4.7 Synthesis and Gaps

Taken together, the evidence supports four conclusions. First, quantitative workload and staffing adequacy are associated with patient outcomes and with staff perceptions of safety. Second, burnout is a plausible and empirically supported mechanism linking demands to weaker safety performance. Third, in primary care, work pressure and pace is consistently among the weakest dimensions of safety culture in the Middle East. Fourth, Saudi studies have consistently identified staffing as a weak dimension, but have rarely examined workload explicitly as a predictor. The key gaps are a lack of PHC-specific, multi-professional studies in Saudi Arabia, limited use of validated workload measures separate from the safety culture instrument, little testing of mediating and moderating mechanisms, and almost no multilevel analysis.

5. THE BALANCE FRAMEWORK

To integrate the theory and evidence, this paper proposes the **BALANCE Framework**, an explanatory and practical model of how workload shapes patient safety culture in multidisciplinary primary care teams. Its seven components move from the structural sources of demand, through individual experience and mechanisms, to cultural outcomes and organizational learning. The framework is intended both as a set of testable relationships and as a management tool for PHC directors and health cluster leaders.

Natural Resources for Human Health
eISSN: 2583-1194

Table 4. Components of the BALANCE Framework

Component	Meaning	Theoretical anchor	Example indicators and levers
B – Baseline demand	The volume and complexity of patient need presented to the center	Donabedian (structure); SEIPS external environment	Catchment population; visits per day; chronic disease registry size; seasonal peaks
A – Allocation of capacity	How staff, skills, time, and tasks are distributed to meet demand	SEIPS work system; Donabedian	Visits per clinical FTE; skill mix; task-shifting; appointment templates; scheduling
L – Load as experienced	The quantitative, cognitive, and emotional workload perceived by each professional	JD-R job demands; NASA-TLX	NASA-TLX scores; interruptions; overtime; documentation time
A – Attenuating resources	Resources that buffer the impact of load	JD-R buffering hypothesis; psychological safety	Teamwork; supportive supervision; autonomy; functioning IT; protected breaks
N – Negative strain pathways	Mechanisms through which excessive load damages safety	JD-R health impairment; Reason latent conditions	Burnout; fatigue; workarounds; skipped checks; underreporting
C – Culture of safety	Shared perceptions and behaviors regarding safety	Safety culture theory; SOPS/SAQ dimensions	MOSOPS composites; overall safety rating; incident reporting rate
E – Evaluation and feedback	Learning loop that adjusts demand and allocation based on outcomes	SEIPS 2.0 feedback loops	Workload dashboards; incident trend reviews; staff surveys; CBAHI tracers

5.1 How the Framework Operates

In the BALANCE Framework, **Baseline demand** and the **Allocation of capacity** jointly determine the objective workload of a center. When demand grows faster than capacity, or capacity is allocated without regard to skill mix and task complexity, professionals experience high **Load**. Whether that load damages safety depends on **Attenuating resources**: a team with good communication, a supervisor who supports staff, and information systems that reduce rather than add work can absorb peaks without abandoning safety behaviors. When resources are insufficient, load flows through **Negative strain pathways**, burnout, fatigue, shortcuts, and underreporting, which erode the **Culture of safety**. Finally, the **Evaluation and feedback** loop determines whether the center learns: whether incident trends and staff feedback lead to changes in demand management and allocation, or whether the same pressures recur.

The framework deliberately distinguishes objective workload (B and A) from perceived workload (L). This distinction has practical importance. Two centers with identical visit volumes may differ markedly in perceived load if one has efficient workflows, appropriate skill mix, and functioning digital tools while the other relies on manual processes and frequent interruptions. Conversely, a reduction in visit volume will not improve safety culture if documentation burden, interruptions, or poor teamwork keep perceived load high.

The BALANCE Framework treats workload as a design problem to be solved by the system, not a burden to be absorbed by individual professionals.

5.2 Profession-Specific Application

Because different professions experience load through different tasks, the framework is applied at the level of the professional group as well as the center. Table 5 illustrates how the components translate into profession-specific risks and protective resources.

Table 5. Profession-specific application of the BALANCE Framework in PHC

Profession	Dominant load drivers	Safety risks under high load	Key attenuating resources
Family / general physicians	Short consultations; diagnostic uncertainty; documentation	Diagnostic delay; inappropriate prescribing; missed follow-up	Clinical decision support; scheduled consultation time; nurse-led chronic clinics
Nurses	Triage; immunization; chronic disease clinics; health education	Missed vital signs; vaccine errors; incomplete patient education	Adequate staffing ratios; standardized protocols; team huddles
Pharmacists	Prescription volume; counseling; e-prescription verification	Dispensing errors; inadequate counseling; missed interactions	Automated checks; protected verification time; technician support
Laboratory staff	Specimen volume; turnaround targets	Identification errors; delayed critical results	Barcoding; critical result communication protocols
Radiology staff	Throughput; reporting delays	Wrong-patient imaging; delayed reports	Patient ID verification; teleradiology support
Dental staff	Procedure scheduling; infection control demands	Infection control lapses; procedural errors	Sterilization workflow design; adequate chair time
Health information and administration	Registration; scheduling; records	Duplicate or incorrect records; lost referrals	Unified EHR; clear data-quality roles; adequate staffing

6. PROPOSED RESEARCH DESIGN

To address the gaps identified, this section specifies a design for testing the hypotheses and the BALANCE Framework in Saudi PHC centers. The design is reported in line with the STROBE guidance for observational studies (von Elm et al., 2007).

6.1 Design and Setting

A multicenter, analytical cross-sectional design is proposed, with professionals nested within PHC centers and centers nested within health clusters. To capture regional variation, PHC centers would be sampled from at least three health clusters representing different regions (for example, central, western, and eastern), and stratified by center size and by urban versus rural location. Centers would be included if they have operated for at least one year and employ at least two professional groups beyond physicians and nurses.

6.2 Participants and Sampling

The target population comprises all licensed clinical and allied health professionals and administrative staff with direct involvement in patient care processes, including physicians, nurses, pharmacists, laboratory specialists and technicians,

radiographers, dentists and dental assistants, health educators, and health information staff. Inclusion criteria would be at least six months' employment at the current center and current SCFHS registration where applicable. Within selected centers, all eligible staff would be invited, to support center-level aggregation.

Sample size should be calculated for the most demanding analysis. For a hierarchical multiple regression with approximately 15 predictors (workload, burnout, resources, and demographic and professional covariates), detecting a small-to-medium effect ($f^2 = 0.05$) with 80% power at $\alpha = 0.05$ requires roughly 400 participants under conventional power analysis (Cohen, 1988). To account for clustering (an assumed intraclass correlation of 0.05 and an average of 15 respondents per center, giving a design effect of 1.7) and a 70% response rate, a target of approximately 950 invitations across 60 to 70 centers is recommended, with a minimum of 30 centers to support center-level estimates in multilevel models.

6.3 Instruments

Table 6. Study variables and proposed instruments

Variable	Role	Instrument	Notes
Patient safety culture	Outcome	AHRQ SOPS Medical Office Survey (MOSOPS)	Designed for ambulatory settings; composite and overall ratings
Perceived task workload	Predictor	NASA Task Load Index	Six subscales; raw (unweighted) score
Objective workload	Center-level predictor	Administrative data	Visits per clinical FTE per month; staffing vacancies
Burnout	Mediator	Copenhagen Burnout Inventory	Personal, work-related, and client-related subscales
Teamwork and supervision	Moderators	SAQ teamwork climate; supervisor support items	Assess buffering effects
Covariates	Controls	Questionnaire	Profession, experience, nationality, gender, shift pattern, center size, cluster

Because the MOSOPS contains a work pressure and pace composite, which conceptually overlaps with perceived workload, the primary analysis should exclude this composite from the outcome score and report it separately, avoiding inflation of the association by shared item content. All instruments would be administered in Arabic and English. Arabic versions would be prepared using forward and backward translation, expert panel review, and cognitive interviews with a small sample of PHC staff, followed by pilot testing. Internal consistency (Cronbach's alpha and McDonald's omega) and confirmatory factor analysis would be reported, with fit judged against established criteria (Hu & Bentler, 1999).

6.4 Data Collection

Data would be collected through a secure online survey distributed via the health cluster's official communication channels, supplemented by paper questionnaires in centers with limited access. Participation would be voluntary and anonymous, with center codes used only for aggregation. Administrative workload data would be obtained from cluster performance records for the three months preceding the survey to align with the recall period of the safety culture instrument.

6.5 Data Analysis

Analysis would proceed in five stages. First, descriptive statistics would summarize participant characteristics, workload, burnout, and safety culture composites, with percentage positive scores calculated according to AHRQ conventions. Second, differences across professional groups would be examined using one-way ANOVA or Kruskal–Wallis tests with post-hoc comparisons. Third, bivariate associations would be examined using Pearson or Spearman correlations. Fourth, hierarchical multiple regression would test H1, entering covariates first, then workload, then resources and interaction terms to test H3, with assumptions checked for multicollinearity, normality of residuals, and homoscedasticity (Hair et al., 2019). The mediating role of burnout (H2) would be tested using regression-based mediation with bias-corrected bootstrap confidence intervals based on 5,000 resamples (Hayes, 2022). Fifth, multilevel linear models would estimate the proportion of variance in safety culture attributable to centers and clusters and test H5 by entering center-level workload as a level-2 predictor. Common method variance would be assessed and mitigated through procedural remedies, including anonymity, separation of scales, and varied response formats, and statistical checks (Podsakoff et al., 2003).

6.6 Ethical Considerations

Ethical approval would be sought from the MOH institutional review board or the relevant health cluster research ethics committee, in accordance with national regulations on research involving human participants. Informed consent would be obtained electronically before participation. No identifying information would be collected, center-level results would be reported only in aggregate, and individual responses would never be shared with managers. Because questions about burnout may cause distress, participants would be provided with information about available staff support services.

7. DISCUSSION

7.1 Interpreting the Workload–Safety Culture Association

The evidence reviewed in this paper indicates that workload is more than a background condition of primary care; it is an active determinant of how professionals perceive and enact safety. Through the lens of the JD-R model, high workload consumes the energy and attention that safety behaviors require and, when sustained, produces burnout that erodes openness, teamwork, and willingness to report. Through the lens of SEIPS 2.0 and Reason's model, workload is a latent condition created by system design: decisions about staffing, appointment templates, digital workflows, and task allocation that are made far from the consultation room but shape what happens within it. This dual perspective is important for Saudi PHC leaders because it shifts the response from exhorting staff to be more careful toward redesigning the conditions under which care is delivered.

The persistent weakness of the staffing dimension in Saudi safety culture surveys (Alahmadi, 2010; Alswat et al., 2017; Alquwez et al., 2018) gains new meaning in this light. If staffing adequacy is a structural constraint, then improvements in leadership commitment, training, and reporting systems may plateau unless workload is addressed. Conversely, workload interventions may yield returns across several dimensions at once, including teamwork, communication openness, and follow-up, by freeing time and cognitive capacity for safety work.

7.2 Implications for the Saudi Health Transformation

Vision 2030 reforms create both risks and opportunities for the workload–safety relationship. On the risk side, the expansion of PHC services, performance targets for access and waiting times, and the transition to new governance structures may raise workload faster than capacity, particularly during the transition period. On the opportunity side, the reforms provide new levers. Health clusters can plan workforce allocation across centers using population and demand data. The Model of Care encourages team-based care and task-sharing, for example nurse-led chronic disease clinics and pharmacist-led medication reviews, which can redistribute load according to competence. Digital health platforms, if designed with human factors in mind, can reduce documentation burden and support clinical decision-making. The Saudi Patient Safety Center provides a national platform for safety culture measurement and learning, and CBAHI accreditation standards for primary care offer a mechanism for embedding workload monitoring into routine quality assurance.

The SCFHS also has a role. Continuing professional development programs can include human factors, workload management, and resilience training for all PHC professions, while the Saudi workforce localization agenda can be aligned with workload planning so that new Saudi graduates enter teams with adequate supervision and manageable load rather than into already overstretched centers.

7.3 Avoiding Unintended Consequences

Two cautions apply. First, workload interventions focused solely on volume, such as capping daily visits, may shift demand to emergency departments or lengthen waiting lists, creating safety risks elsewhere in the system. The BALANCE Framework therefore emphasizes allocation and resources as much as demand reduction. Second, individual-level resilience programs, while valuable, should not be used as a substitute for addressing structural overload. Teaching professionals to cope with unsafe workloads without changing those workloads risks normalizing latent conditions, which is precisely what a mature safety culture seeks to avoid.

8. RECOMMENDATIONS

Based on the evidence and the BALANCE Framework, the following recommendations are proposed for stakeholders at different levels of the Saudi health system.

Table 7. Multilevel recommendations

Level	Recommendation	BALANCE component
National (MOH, SPSC, CBAHI, SCFHS)	Include workload indicators (visits per clinical FTE, vacancy rates) alongside safety culture surveys in national PHC performance frameworks; integrate human factors and workload management into CPD requirements	B, A, E
Health cluster	Use demand data to allocate staff across centers; establish surge plans for seasonal peaks; benchmark centers on workload and safety culture together	B, A, E
PHC center leadership	Redesign appointment templates; implement task-sharing models; protect time for team huddles and incident review; conduct regular leadership safety walk-rounds	A, A (resources), C
Team	Hold brief daily huddles to anticipate load; use structured communication tools (e.g., SBAR); agree on escalation when workload becomes unsafe	A (resources), C
Digital health	Apply human factors principles to EHR and e-prescribing design; reduce duplicate documentation; implement closed-loop result notification	A, L
Individual and wellbeing	Provide confidential support services and burnout screening; ensure breaks and fair scheduling; offer resilience training as a complement to, not substitute for, system change	N

In addition, health clusters are encouraged to adopt a **workload–safety dashboard** that links monthly workload indicators with incident reports, complaints, and periodic safety culture scores. Such a dashboard would operationalize the Evaluation and feedback component of the BALANCE Framework and provide early warning when demand begins to outstrip capacity.

9. LIMITATIONS

Several limitations should be acknowledged. As an integrative review, this paper did not apply the exhaustive search and formal quality appraisal of a systematic review, and relevant studies, particularly those published in Arabic or in regional journals, may have been missed. Much of the evidence base derives from hospital and nursing populations, so its transferability to multidisciplinary primary care must be confirmed empirically. The proposed design is cross-sectional and cannot establish causality; the relationship between workload, burnout, and safety culture is likely reciprocal, and longitudinal or intervention studies will be needed to establish direction. Self-reported measures are subject to common method bias and social desirability, although the inclusion of objective center-level workload data partially addresses this concern. Finally, the BALANCE Framework is a proposed model whose components and pathways require empirical validation.

10. CONCLUSION

Primary healthcare centers are being asked to do more than ever before as Saudi Arabia builds a prevention-oriented, population-focused health system under Vision 2030. This paper has argued that workload is a central, modifiable determinant of patient safety culture among the multidisciplinary professionals who staff these centers. International and regional evidence consistently associates high workload with weaker safety perceptions, mediated in part by burnout and buffered by teamwork and supportive leadership. Saudi studies point repeatedly to staffing as a weak dimension of safety culture, but few have examined workload directly, across professions, or at the center level.

The BALANCE Framework offers a structured way to understand and act on this relationship, linking baseline demand and allocation of capacity to experienced load, buffering resources, strain pathways, safety culture, and organizational learning. The proposed multilevel cross-sectional design provides a rigorous path to test the framework in Saudi PHC. Protecting patients in primary care will require not only training and reporting systems, but deliberate attention to the conditions under which professionals work, ensuring that the demand placed on each team remains in balance with its capacity to deliver safe care.

DECLARATIONS

Funding: [To be completed by the author(s).]

Conflicts of interest: [To be completed by the author(s).]

Ethics: Not applicable to this review; ethical requirements for the proposed empirical study are described in Section 6.6.

Use of AI tools: [Authors should disclose any use of AI-assisted writing tools in line with the target journal's policy.]

REFERENCES

[1] Agency for Healthcare Research and Quality. (2022). SOPS Medical Office Survey. AHRQ. https://www.ahrq.gov/sops/surveys/medical-office/index.html

[2] Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J., & Silber, J. H. (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. JAMA, 288(16), 1987–1993. https://doi.org/10.1001/jama.288.16.1987

[3] Aiken, L. H., Sloane, D. M., Bruyneel, L., Van den Heede, K., Griffiths, P., Busse, R., et al. (2014). Nurse staffing and education and hospital mortality in nine European countries: A retrospective observational study. The Lancet, 383(9931), 1824–1830. https://doi.org/10.1016/S0140-6736(13)62631-8

[4] Al Asmri, M., Almalki, M. J., Fitzgerald, G., & Clark, M. (2020). The public health care system and primary care services in Saudi Arabia: A system in transition. Eastern Mediterranean Health Journal, 26(4), 468–476. https://doi.org/10.26719/emhj.19.049

[5] Al Ma'mari, Q., Sharour, L. A., & Al Omari, O. (2020). Fatigue, burnout, work environment, workload and perceived patient safety culture among critical care nurses. British Journal of Nursing, 29(1), 28–34. https://doi.org/10.12968/bjon.2020.29.1.28

[6] Alahmadi, H. A. (2010). Assessment of patient safety culture in Saudi Arabian hospitals. Quality and Safety in Health Care, 19(5), e17. https://doi.org/10.1136/qshc.2009.033258

[7] Almalki, M., FitzGerald, G., & Clark, M. (2011). Health care system in Saudi Arabia: An overview. Eastern Mediterranean Health Journal, 17(10), 784–793.

[8] Alquwez, N., Cruz, J. P., Almoghairi, A. M., Al-otaibi, R. S., Almutairi, K. O., Alicante, J. G., & Colet, P. C. (2018). Nurses' perceptions of patient safety culture in three hospitals in Saudi Arabia. Journal of Nursing Scholarship, 50(4), 422–431. https://doi.org/10.1111/jnu.12394

[9] Alsaleh, F. M., Abahussain, E. A., Altabaa, H. H., Al-Bazzaz, M. F., & Almandil, N. B. (2018). Assessment of patient safety culture: A nationwide survey of community pharmacists in Kuwait. BMC Health Services Research, 18, 884. https://doi.org/10.1186/s12913-018-3662-0

[10] Alswat, K., Abdalla, R. A. M., Titi, M. A., Bakash, M., Mehmood, F., Zubairi, B., Jamal, D., & El-Jardali, F. (2017). Improving patient safety culture in Saudi Arabia (2012–2015): Trending, improvement and benchmarking. BMC Health Services Research, 17, 516. https://doi.org/10.1186/s12913-017-2461-3

[11] Bakker, A. B., & Demerouti, E. (2007). The Job Demands–Resources model: State of the art. Journal of Managerial Psychology, 22(3), 309–328. https://doi.org/10.1108/02683940710733115

[12] Carayon, P., & Gurses, A. P. (2008). Nursing workload and patient safety—A human factors engineering perspective. In R. G. Hughes (Ed.), Patient safety and quality: An evidence-based handbook for nurses (Chapter 30). Agency for Healthcare Research and Quality.

[13] Carayon, P., Schoofs Hundt, A., Karsh, B.-T., Gurses, A. P., Alvarado, C. J., Smith, M., & Flatley Brennan, P. (2006). Work system design for patient safety: The SEIPS model. Quality and Safety in Health Care, 15(Suppl. 1), i50–i58. https://doi.org/10.1136/qshc.2005.015842

[14] Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.

[15] Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands–resources model of burnout. Journal of Applied Psychology, 86(3), 499–512. https://doi.org/10.1037/0021-9010.86.3.499

[16] Donabedian, A. (1988). The quality of care: How can it be assessed? JAMA, 260(12), 1743–1748. https://doi.org/10.1001/jama.1988.03410120089033

[17] Edmondson, A. (1999). Psychological safety and learning behavior in work teams. Administrative Science Quarterly, 44(2), 350–383. https://doi.org/10.2307/2666999

[18] Ghobashi, M. M., El-Ragehy, H. A. G., Mosleh, H., & Al-Doseri, F. A. (2014). Assessment of patient safety culture in primary health care settings in Kuwait. Epidemiology, Biostatistics and Public Health, 11(3), e9101.

[19] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (8th ed.). Cengage Learning.

[20] Hall, L. H., Johnson, J., Watt, I., Tsipa, A., & O'Connor, D. B. (2016). Healthcare staff wellbeing, burnout, and patient safety: A systematic review. PLoS ONE, 11(7), e0159015. https://doi.org/10.1371/journal.pone.0159015

[21] Halligan, M., & Zecevic, A. (2011). Safety culture in healthcare: A review of concepts, dimensions, measures and progress. BMJ Quality & Safety, 20(4), 338–343. https://doi.org/10.1136/bmjqs.2010.040964

[22] Hart, S. G., & Staveland, L. E. (1988). Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. Advances in Psychology, 52, 139–183. https://doi.org/10.1016/S0166-4115(08)62386-9

[23] Hayes, A. F. (2022). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach (3rd ed.). Guilford Press.

[24] Health Sector Transformation Program. (2021). Health Sector Transformation Program delivery plan. Vision 2030, Kingdom of Saudi Arabia.

[25] Holden, R. J., Carayon, P., Gurses, A. P., Hoonakker, P., Hundt, A. S., Ozok, A. A., & Rivera-Rodriguez, A. J. (2013). SEIPS 2.0: A human factors framework for studying and improving the work of healthcare professionals and patients. Ergonomics, 56(11), 1669–1686. https://doi.org/10.1080/00140139.2013.838643

[26] Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling, 6(1), 1–55. https://doi.org/10.1080/10705519909540118

[27] Karasek, R. A. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. Administrative Science Quarterly, 24(2), 285–308. https://doi.org/10.2307/2392498

[28] Kristensen, T. S., Borritz, M., Villadsen, E., & Christensen, K. B. (2005). The Copenhagen Burnout Inventory: A new tool for the assessment of burnout. Work & Stress, 19(3), 192–207. https://doi.org/10.1080/02678370500297720

[29] Maslach, C., & Leiter, M. P. (2016). Understanding the burnout experience: Recent research and its implications for psychiatry. World Psychiatry, 15(2), 103–111. https://doi.org/10.1002/wps.20311

[30] Ministry of Health. (2017). The new Model of Care. Ministry of Health, Kingdom of Saudi Arabia.

[31] Panagioti, M., Geraghty, K., Johnson, J., Zhou, A., Panagopoulou, E., Chew-Graham, C., et al. (2018). Association between physician burnout and patient safety, professionalism, and patient satisfaction: A systematic review and meta-analysis. JAMA Internal Medicine, 178(10), 1317–1331. https://doi.org/10.1001/jamainternmed.2018.3713

[32] Panesar, S. S., deSilva, D., Carson-Stevens, A., Cresswell, K. M., Salvilla, S. A., Slight, S. P., et al. (2016). How safe is primary care? A systematic review. BMJ Quality & Safety, 25(7), 544–553. https://doi.org/10.1136/bmjqs-2015-004178

[33] Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

[34] Ramanujam, R., Abrahamson, K., & Anderson, J. G. (2008). Influence of workplace demands on nurses' perception of patient safety. Nursing & Health Sciences, 10(2), 144–150. https://doi.org/10.1111/j.1442-2018.2008.00382.x

[35] Reason, J. (1990). Human error. Cambridge University Press.

[36] Reason, J. (2000). Human error: Models and management. BMJ, 320(7237), 768–770. https://doi.org/10.1136/bmj.320.7237.768

[37] Sexton, J. B., Helmreich, R. L., Neilands, T. B., Rowan, K., Vella, K., Boyden, J., Roberts, P. R., & Thomas, E. J. (2006). The Safety Attitudes Questionnaire: Psychometric properties, benchmarking data, and emerging research. BMC Health Services Research, 6, 44. https://doi.org/10.1186/1472-6963-6-44

[38] Shanafelt, T. D., Balch, C. M., Bechamps, G., Russell, T., Dyrbye, L., Satele, D., et al. (2010). Burnout and medical errors among American surgeons. Annals of Surgery, 251(6), 995–1000. https://doi.org/10.1097/SLA.0b013e3181bfdab3

[39] Singer, S., Lin, S., Falwell, A., Gaba, D., & Baker, L. (2009). Relationship of safety climate and safety performance in hospitals. Health Services Research, 44(2 Pt 1), 399–421. https://doi.org/10.1111/j.1475-6773.2008.00918.x

[40] Sorra, J. S., & Nieva, V. F. (2004). Hospital Survey on Patient Safety Culture (AHRQ Publication No. 04-0041). Agency for Healthcare Research and Quality.

[41] Tubbs-Cooley, H. L., Mara, C. A., Carle, A. C., & Gurses, A. P. (2018). The NASA Task Load Index as a measure of overall workload among neonatal, paediatric and adult intensive care nurses. Intensive and Critical Care Nursing, 46, 64–69. https://doi.org/10.1016/j.iccn.2018.01.004

[42] von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. The Lancet, 370(9596), 1453–1457. https://doi.org/10.1016/S0140-6736(07)61602-X

[43] Webair, H. H., Al-assani, S. S., Al-haddad, R. H., Al-Shaeeb, W. H., Bin Selm, M. A., & Alyamani, A. S. (2015). Assessment of patient safety culture in primary care setting, Al-Mukala, Yemen. BMC Family Practice, 16, 136. https://doi.org/10.1186/s12875-015-0355-1

[44] Weigl, M., Müller, A., Vincent, C., Angerer, P., & Sevdalis, N. (2012). The association of workflow interruptions and hospital doctors' workload: A prospective observational study. BMJ Quality & Safety, 21(5), 399–407. https://doi.org/10.1136/bmjqs-2011-000188

[45] World Health Organization. (2016). Patient safety: Making health care safer—Technical series on safer primary care. WHO.

[46] World Health Organization. (2021). Global patient safety action plan 2021–2030: Towards eliminating avoidable harm in health care. WHO.