**Table 1.** Study details withinfluencing variables that might influence perceived stress or workload: a. team composition and roles; b. telemedicine; c. prioritization of CPR automation or task-focusing techniques; d. tools, CPR-feedback device; e. cognitive aids; f. family presences as socioemotional stress; g. provider experience and exposure. CPR, cardiopulmonary resuscitation; CPR coaches: designated roles for monitoring and providing feedback on the quality of CPR, including compression rate, depth, and interruptions, CA: Cognitive aids

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Article (Country)** | **Design and setting** | **Intervention / Exposure** | **Control** | **Team Composition** | **Participants(n)** | **Workload/Stress Measure** | **Key Findings** |
| **a. Studies with team composition and roles as factors influencing healthcare provider’s workload or stress** |
| 2020 Tofil (Canada)[23] | Nested Randomized Controlled Trial; Pediatric Simulation | Addition of a CPR coach | No CPR coach | Two CPR providers, a team leader, an airway provider and a CPR coach or bedside provider | Pediatric healthcare providers | NASA- TLX scores | 1. Adding a CPR coach increases physical workload and decreases mental workload of cardiopulmonary resuscitation providers. 2. There was no change in team leader’s workload between the groups. |
| 2020 Badke[16] (US) | Randomized Controlled Trial; Adult Simulation | First assistant assuming the role of CPR Coach | No designation of first assist | Resuscitation team size was not standardized, as it was dependent on the availability of PICU providers at the time of the simulation. | Critical care,pediatric, cardiac, or emergency medicine physicians, nurse practitioners, nurses, pharmacists, respiratorytherapists, and medical students | NASA- TLX scores | There were no significant differences in team leader workload for scenarios that included a CPR Coach versus those without a CPRCoach. |
| 2020 Roitsch (US) [21] | Randomized 2 x 2 factorial design study; Pediatric Simulation | Intervention 1: Team sizeIntervention 2: use of a tablet-based DST(decision support tools) |  | Team of 2 or 3, with one advanced provider per team | Healthcare providers (neonatologist, neonatology fellows, neonatal nurse practitioners, registered nurses, and respiratory therapists) | NASA-TLX scores | 1. The NASA TLX scores were significantly increased within teams of 2 compared with 3 (mean difference = 6.2, 95% CI = 0.4 to 12.0, P = 0.036, effect size = 0.42) |
| 2021 Pallas (Australia)[29] | Randomized Controlled Trial; Adult Simulation, non-trauma | Designation of a nursingteam leader | Usual care | Three doctors, two advanced life support (ALS) trained nurses, one additional non-ALS trained staff member, one investigator and one simulation confederate | Available ward staff (20 simulations, n=120) | NASA-TLX scores | 1. Similar total NASA-TLX in the Intervention and Control groups (p=0.28) 2. Medical team leaders in the Intervention group had a significantly lower NASA-TLX (238.4, 95% CI 192.0 to 284.7) compared to control group (306.3, 95% CI 254.9 to 357.6; p=0.02). 3. No statistically significant difference of NASA-TLX was observed between the nursing team leader of the intervention group (mean 223, 95% CI: 189.3 to 256.7) and the senior control nurse (mean 255.5, 95% CI 195.5 to 315.5; p=0.15) |
| 2023 Roman(USA)[8]  | Prospective cohort study; Pediatric resuscitation | team leaders | team members | actual resuscitation team in pediatric resuscitation | 61 participants at 15 different resuscitation events including team leader data from 8 events | NASA-TLX, the stress numerical rating scale-11 (SNRS-11)  | There was no difference in overall workload between team leaders and other team members (p = 0.601). There was higher mental demand in team leaders compared to other team members (p = 0.025). |
| **b. Studies with telemedicine as factors influencing** **healthcare provider’s workload** |
| 2019 Butler(US) [13] | Randomized Controlled Trial; Pediatric Simulation | Senior doctor act as remote team leaders in a separate control room (telemedicine) | Senior doctor present on site | Two doctors (a senior and a junior resident) and two standardized confederate nurses | Emergency Medicine residents (n=twenty teams, 10, intervention | NASA TLX scores | 1. The telemedicine group had a higher workload compared to the usual care group (56 vs. 48, p = 0.020)2. Across the seven sub-domains of the TLX tool, there was a significantly higher mental demand in the telemedicine group. |
| 2020 Gross (Austria)[27] | Randomized Controlled Trial; Pediatric Simulation, neonate | Proactive leader at a remote site(Teleleader)  | Remote consultant, provide guidance on request(teleconsultant) | Participant and a confederate nurse | Emergency Medicine resident, Physician Assistants | NASA TLX scores | 1. No significant difference between the two groups in the overall workload (p = 0.222). 2. When compared to the teleleader group, the teleconsultant group experienced a higher level of mental demand (mean mental demand: teleleader 14.1 vs. teleconsultant 17.0 out of 21, p < 0.05) and a higher level of frustration (teleleader 7.9 vs. teleconsultant 14.7 out of 21, p < 0.05). |
| **c. Studies with different workflows as factors influencing healthcare provider’s workload or stress** |
| 2018 Asselin(USA) [28] | Randomized Controlled Trial; Adult Simulation | Goal-directed, and automation-assistedapproach resuscitation | Standard state protocols and equipment | Two-provider team (1 EMT-B and 1 EMT-I/C/P).  | Emergency medical technicians (EMTs) with regional and/or national licenses at the Basic (B), Intermediate (I), Cardiac (C), or Paramedic (P) levels | Heart rate, salivary amylase, Borg Rating of Perceived Exertion scale, NASA TLX scores | 1. Reduced physical exertion and lower perceived workloads in automation-assisted teams |
| 2013.Hunziker [17](Switzerland) | Randomized Controlled Trial; Adult Simulation | 10-minute instruction with two task-focusing questions (“what’s the patient’s condition?”; “what immediate action is needed?”) when feeling overwhelmed during simulated resuscitation | Usual care | Participant and confederate nurse | 4th year medical students | perceived levels of stress measured on a Likert scale ranging from 1–20 | 1. Significantly smaller amounts of perceived stress and overload compared to the control group (difference of mean perceived stress: -0.6 (95% CI-1.3, -0.1), p = 0.04) |
| **d. Studies with automation tools or equipment failures as factors influencing healthcare provider’s workload or stress** |
| **Workload** |
| 2022 Wagner(Austria) [9] | Randomized Controlled Trial; Pediatric Simulation | Feedback device for chest compression and ventilation | No feedback device | Each participant did CC twice, and ventilations (V) twice afterward | Medical students, fellows, nurses, and consultants from Neonatal Intensive Care Unit (n=40) | NASA-TLX scores | 1.The average workload for chest compression task was 37% in the feedback group, which was 3.5% higher than no-feedback group (P = 0.02)2.The average workload for ventilation task in the feedback group was 36%, which was 8% higher than no-feedback group (P < 0.001)  |
| 2018 Brown (Canada) [19] | Randomized Controlled Trial; Pediatric Simulation | Real-time visual CPR feedback device | Usual care | 1 leader and 2 CPR providers | residents, fellows, physicians, nurses and nurse practitioner (n=108 teams) | NASA-TLX scores | 1. CPR providers reported comparatively higher physical workload. CPR providers reported significantly higher average workload (control 58.5 vs. feedback 62.3; p=0.035) with real-time feedback provided compared to the group without feedback.2. For teams with real-time feedback, there was a significant difference in average workload between team leader and CPR providers [TL 56.1vs. CPR-P 62.3, MD (95%CI): 6.2 (2.5, 9.8), p = 0.001].3. Team leaders had significantly higher mental demand (p < 0.001), but significantly lower physical demand (p < 0.001) and effort (p = 0.032) workloads compared with CPR providers |
| **Stress** |
| 2020 Ontrup(Germany) [24] | Randomized Controlled Trial; Adult Simulation | Equipmentfailure (defective defibrillator) | No equipment failure | Participant and two confederate nurses | Medical students (human medicine) in their 7th to 9th semester | Salivary cortisol and amylase; Five items questionnaires | 1. Participants of both groups showed increased biological stress-levels, independent of group allocation. 2. Paradoxically, participants who encountered the equipment failure subjectively reported less stress. |
| **e. Studies with cognitive aids and smart apps as factors influencing healthcare provider’s workload or stress** |
| **Workload** |  |  |  |  |  |  |  |
| 2020 Roitsch (US) [21] | Randomized 2 x 2 factorial design study ; Pediatric Simulation | Intervention 1: Team sizeIntervention 2: use of a tablet-based DST(decision support tools)\*Scenario A: hypoxemic, and bradycardicfull-term newborn requiring intubation.\*Scenario B: Similar to A, but requires CPR  |  | Team of 2 or 3, with one advanced provider per team | Healthcare providers (neonatologist, neonatology fellows, neonatal nurse practitioners, registered nurses, and respiratory therapists) | NASA-TLX scores | 1. Teams that used the DST scored workload significantly higher during scenario A (−DST − +DST mean difference = −7.5, 95% CI = −14.2 to −0.9, P = 0.027, effect size = 0.40) but in scenario B workload in teams using the DST was not significantly different (−DST − +DST mean difference = 5.1, 95% CI = −1.6 to 11.9, P = 0.135). 2. Individual averages of NASA TLX scores of scenarios A and B was not significantly associated with a change in NASA TLX scores for teams using the DST compared with memory alone (−DST − +DST mean difference = −1.0, 95% CI = −6.7 to 4.7, P = 0.721) |
| 2020 Corazza(Italy) [26] | Non-randomized controlled study; Pediatric Simulation | PediAppRREST (audiovisual interactive app as cognitvie aid) | Without the app | Three pediatric residents | 48 pediatric residents divided into teams of 3; Five teams managed the case following usual care (control group), whereas 11 teams (intervention group) conducted the scenario using the support of the PediAppRREST app | NASA TLX scores | 1. Using the app is not associated with increased team leaders’ workload; Team leaders’ perceived workload was comparable between the 2 groups; median NASA RTLX score was 67.5 (IQR 65.0-81.7) for the control group and 66.7 (IQR 54.2-76.7) for the intervention group (P=.57). |
| 2021 Grundgeiger (Germany)[10] | Randomized Control Trial; Adult Simulation | Cognitive aid application (CA App) group | No application (No App) group | one qualified emergency physician as team leader and one qualified nurse | Prehospital emergency medicine physicians and acute care nurses (n=67 teams) | NASA-TLX scores | 1. For the physicians, the analysis of the NASA TLX scores indicated signiﬁcantly lower mental demand, physical demand, and effort for the CA App group than the No App group 2. For the nurses, the analysis of the NASA TLX scores indicated signiﬁcantly lower mental demand for the CA App group compared to the No App group.  |
| **Stress** |  |  |  |  |  |  |  |
| 2021 Lacour(Switzerland) [18] | Nested Randomized Controlled Trial; Pediatric Simulation | PedAMINES Smart App for dosing calculation | Usual care | Participant alone | Registered paramedics (n=150) | State-Trait Anxiety Inventory, Self-assessment with 10-point Likert visual analogue scale (VAS), Heart Rate | 1. Higher State-Trait Anxiety Inventory–perceived stress increase was observed during the scenario using the conventional methods (mean 35.4, SD 8.2 to mean 49.8, SD 13.2; a 41.3%, 35.0 increase) than when using the app (mean 36.1, SD 8.1 to mean 39.0, SD 8.4; a 12.3%, 29.0 increase). 2. On the Visual Analog Scale questionnaire, participants in the control group reported a higher increase in stress at the peak of the scenario (mean 7.1, SD 1.8 vs mean 6.4, SD 1.9; difference: −0.8, 95% CI −1.3 to −0.2; P=.005).3. Increase in heart rate during the scenario and over the 4 drugs was not different between the 2 groups. |
| 2022.Sellmann(Germany) [14] | Randomized Controlled Trial; Adult simulation | Medical emergency cognitive aid with text-based algorithm. | Usual care | Three to six physicians | Intensive care physicians (n=520 physicians into 80 teams) | Structured questionnaire with 5-point Likert scales | 1. In a high percentage, stress level of the participants was diminished.2. Stress reduction using CA was more likely in “medical” than in “perioperative” subspecialties (3.7 ± 1.2 vs. 2.9 ± 1.2, p < 0.05) |
| **f. Studies with family presences or emotional stress as factors influencing workload or stress** |
| 2020 Zehnder (Canada) [25] | Observational Study; Real patient, neonatal resusci-tation | parental presence during resuscitation | none | usual care | HCPs participated in neonatal resuscitation in the delivery room | NASA TLX scores | 1. TLX scorewas lower when at least one parent was present (33; 16–47)compared with when no parents were present (46; 29–57) duringthe resuscitation (p=0.0004) |
| 2022 Willmes(Germany) [15] | Randomized Controlled Trial; Adult Simulation | Teams were randomised to a family presence  | No family presence |  | Surgery, internal medicine and anaesthesia residents (n=1085 physicians into 325 teams) | NASA TLX scores | 1. Family presence was associated with significantly higher ratings for the domains frustration (45 (30–70) vs 60 (30–75) difference 10, 95% CI 5 to 15; p<0.001), temporal demand (70 (50–80) vs 75 (55–85) difference 5, 95% CI 5 to 10; p=0.001) and mental demand (70 (55–80) vs 75 (60–85) difference 5, 95% CI 0 to 5; p=0.009), but no significant differences for the domains physical demand (60 (40–80) vs 65 (40–80) difference 0, 95% CI 0 to 5; p=0.20), effort (65 (50–75) vs 70 (45–80) difference 0, 95% CI 0 to 5; p=0.09) and performance (70 (50–80) vs 70 (45–80) difference 0, 95% CI 0 to 5; p=0.55). |
| 2011.Bjørshol(Norway)[22] | Randomized Controlled Trial; Adult Simulation | Exposure to socio-emotional stress (an upset friend being emotional and obstructive) | without stress | Two paramedics | paramedics employed atStavanger University Hospital, Stavanger,Norwa (n=20 teams) | NASA TLX scores | 1. ALS with socioemotional stress resulted in a significantly higher rating for mental demands, temporal demand, effort, and frustration compared with the control condition. 2. There was no difference in physical demands  |
| 2022.Sellmann (Germany)[12] | Randomized Controlled Trial; Adult Simulation | agitated relative with loud crying or mourning as well as walking around the room | withdrawn relative quiet crying, mourning, and quiet observation |  | residents in the 2nd to 3rd year in internal medicine (n=355 teams, 113 control, 117 "agitated") , 105"withdrawn" | NASA TLX scores | 1. The presence of a relative increased frustration, effort, and perceived temporal demands (all <0.05 compared to control); in addition, an “agitated” relative increased mental demands and total task load (both p < 0.05 compared to “withdrawn” and control group). |
| **g. Studies with healthcare providers previous experiences as factors influencing workload or stress** |
| 2018 Fernández-Ayuso[11] | quasi-experimental study; Adult Simulation | previous experience in health contexts | none | second year nursing students |  |  Heart Rate (HR) and Blood Pressure (BP), state-trait anxiety questionnaire and perceived stress using Visual Analogical Scale (VAS) | Both groups demonstrated a decrease in the vital signs and levels of stress/anxiety in subsequent simulation sessions, which suggests a positive adaptive process. |

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