Author(s) /Year /Publication	Topic /Purpose	Framework /Method /Sample	Key findings	Limitations	Implications for practice
Jenkins, B Anaesthesia 2014 Anaesthesia 2014, 69, 655–668	Cognitive aids: time for a change? To give an overview of the topic cognitive aids or emergency manuals. To ask the question: is it time to change our current practice of relying on our memory?	Editorial comments	• Cognitive aids are visual prompts or decision guides and are used when tasks are being performed • Checklists contain actions or tasks that cannot be readily recalled and they are used to improve individual and team performance • All task performed by humans and health care systems are prone to error • Safe surgery checklist from WHO in 2009 significantly reduced morbidity and mortality associated with surgery • In emergencies there is a potential for disaster due to an unwillingness or inability to revert to more systematic thinking: Fixation Error • These aids may be viewed as 'cognitive crutches' to provide visual and textual prompts during lapses of memory • Checklists may reduce dependency on factual recall during stress • Checklists must be properly designed and should be validated and agreed upon before use • These aids may be viewed as 'cognitive crutches' • Evidence for adoption of checklists are currently weak (2014) and based on simulated emergencies • Conclusion: investment in cognitive aids seem an effective measure to reduce morbidity and mortality form anesthetic emergencies	• Most of the evidence for cognitive aids inevitably comes from a small number of studies that use simulated emergencies as a proxy for actual emergencies • To maximize benefit, cognitive aids need to be developed at a national level	• Checklists may reduce morbidity and mortality in the OR • Checklists will reduce the reliance of brute memorization • Use of evidence based checklists can improve patient outcomes • With use of checklists everybody in the room will be aware of what is coming next in the process, since everybody will have access to the checklists • Use of checklists will improve communication in the OR and will allow non-anesthesia staff to speak up, when they notice a deviation from the checklist. This can reduce

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					tunnel-vision among the person/persons in charge of the emergency
Gaba, DM Editorial 2013 Anesthesia & Analgesia Anesth Analg. 2013 Nov;117(5):1033-6.	Perioperative Cognitive Aids in Anesthesia: What, Who, How, and Why Bother? An editorial summarizing two articles in same issue of A&A on the topic of cognitive aids	Editorial comments	• Author is professed very pro cognitive aids: First, I am a strong believer in the use of cognitive aids • Historically, there are many pejorative terms for such aids, such as "cheat sheets," "crib sheets," "crutches," and "cookbooks ○ Definitive taxonomy could be counterproductive • While in the past use of aids have been viewed as weakness or lack of intelligence, author emphasizes that their use is actually sign of strength and wisdom and not using them is sign of weakness and perhaps unwarranted hubris (excessive pride) • Mention already in use cognitive aids: ○ MH poster, pocket card, and hotline ○ ACLS poster, pocket card • Currently used aids are developed through formal consensus processes • Level 1a evidenced based literature to support cognitive aids are weak or non-existing • Even within nuclear power and aviation there is weak or non-existing level 1a evidence for the creation of cognitive aids • Implementation is not simple. Process of adoption, placement, training of personnel, creating and sustaining a culture that believe in the use of cognitive aids	• Poor aids, or poor use of aids, may distract clinicians and lead to worse performance than without them • Authors comment: I think that this probability is likely to be very low. • In use of "reader" (someone who reads the aid to the team and checks on their progress in managing the event), there could be a danger implied by the observed results that "total communication" was reduced with a reader in place • Author comment: ○ Since the effectiveness of the teams with a reader (in simulations) were much greater than without a reader,	• Should make sure the cognitive aids are well designed and user-centered • Implementation should be done carefully and with all stakeholders "on board" • Development of cognitive aids should involve a consensus approach

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			• But absence of evidence is not evidence of absence, and the growing number of groups that have decided to vote with their feet by creating or adopting what they see as the best available set of cognitive aids attest to the desire of clinicians to avoid paralysis by analysis and to do something sensible to close the gap from nothing to something • Author opinion is that what we already know about well-crafted emergency manuals and the use of a reader role (when sufficient number of on-scene personnel allows it) is sufficient justification to warrant widespread adoption • "Whoever saves a life, it is as if he has saved the entire world." Hebrew Talmud (Sanhedrin 4:5) and the Muslim Quran (5:32)	this will probably not be the case • Author is professed very much in favor of the use of cognitive aids. Author has worked extensively with the development of cognitive aids	
Goldhaber-Fiebert, S N Howard, S K Anesthesia & Analgesia 2013 Anesth Analg. 2013 Nov;117(5):1149-61. doi: 10.1213/ANE.0b013e318298867a.	Implementing Emergency Manuals: Can Cognitive Aids Help Translate Best Practices for Patient Care During Acute Events?	Special article for the Anesthesia Patient Safety Foundation	• During the stress of a critical event, the vast majority of clinicians do not implement all known best practices optimally. Sometimes, vital steps are never performed • Implementing and using emergency manuals are 2 different but equally important subjects • Emergency manuals are an extension of Crisis Resource Management (CRM) concept • There is a common misconception that emergency manuals are not relevant in the management of time-sensitive acute events • However, manuals can be a helpful resource for important crisis priorities management • Cognitive aids are already in widespread use within aviation and nuclear power plants. • Growing simulation-based evidence for use	• Author emphasizes the importance for practitioners to be familiar and have trained with emergency manuals • Without training they think the use will be limited • There is a common misconception that emergency manuals are not relevant in the management of time-sensitive acute events • Terminology:	• The implementation and use of emergency manuals could be very valuable both in real crises situations, but also during debriefing after a crisis and during training of staff. Both OR staff and anesthesia staff can greatly

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			• Cognitive aids are tools to help people remember to act on important information that they often already know but may either be inert or nondeployable • Experts rapidly recognize a familiar pattern that matches the current situation "well enough," which is often followed by analyzing the fit using mental simulation, then making adjustments as necessary • Emergency manuals may help avert preventable harm as part of a toolbox • Usually, when teams miss crucial steps in the management of simulated or real critical events, it is not because they have never heard of the appropriate intervention • By providing information that is not easily retrievable from memory, emergency manuals can be helpful in allowing us to focus our limited available attention on higher level cognitive tasks • The common culprits in performance gaps, besides knowledge, are a combination of crisis management team challenges communication, leadership, etc. and a failure to implement knowledge under stress • Stressful situations have been shown to negatively impact multiple aspects of human memory: ○ Inert knowledge ○ Working memory ○ Prospective memory • Providers consulting an emergency manual for simulated critical events perform vital actions	○ Difficulty with terminology. The term "cognitive aids" for some individual practitioners unfamiliar with the term may feel it insults their capabilities, implying that they have a cognitive impairment ○ "Checklist", by its components of word, implies a linear flow to check off items, without subsequent reconsideration that may be needed in some medical situations ○ A checklist also does not automatically include other considerations; such as signs or differential diagnoses that are not explicit actions ○ Asking for the checklist during a crisis may create confusion with other routine checklists used in the OR	benefit from this kind of training • The use of emergency checklists will be a significant asset to any OR, but especially to the anesthesia team

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			more often, more efficiently, and more accurately than those who do not • In the case of emergency manuals, the goal is to provide easily accessible information, combined with training, to help clinicians effectively prevent, diagnose, and treat critical events • Article writes extensively on how to implement emergency manuals. They recommend a 4-Element implementation strategy: ○ Create ○ Familiarize ○ Use ○ Integrate • Conclusion: Emergency manuals address an unmet need and resonate almost universally with practicing clinicians		
Marshall, S 2013 Anesthesia & Analgesia Anesth Analg 2013; 117:1162–71)	The Use of Cognitive Aids During Emergencies in Anesthesia: A Review of the Literature The aim of this literature review was to determine 1. whether cognitive aids improve performance	Literature review searching: • MEDLINE • EMBASE • Cochrane • PhycInfo Search terms: • Anesthesia /anaesthesia • Algorithm • Checklist • Cognitive aid • Standard operating procedure	• Cognitive aids are tools created to guide users while they are performing a task, or group of tasks, with the goal of reducing errors and omissions and increasing the speed and fluidity of performance • Difference from guidelines, protocols or standard operating procedures (all lengthy documents) is that cognitive aids are to be used while the task is being performed • During an emergency, time and cognitive resources are limited • A cognitive aid would theoretically guide stressed clinicians through a sequence of complex steps and prevent them from omitting key actions • The cognitive aid must have the following properties:	• Cognitive aids that are deficient in areas of content, design, training, and team alignment may promote the wrong sequence of actions and potentially cause harmful effects. • There is a need for larger prospective trials of the effect of aids on task completion, practitioners' team behaviors, and overall team functioning	• This study showed in great detail that there is not much evidence for the use of cognitive aids • Some of the existing studies may have shown lack of support for cognitive aids because the aids used were poorly designed. Many studies have

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	of individuals and teams and 2. whether recommendations can be made for future cognitive aid design, testing, and implementation	• Guideline Inclusion criteria: • A cognitive aid was used or tested • The paper was specifically relevant to emergencies encountered in anesthetic practice • The cognitive aid related to anesthetic emergencies • The paper described a cognitive aid that was not only for an educational or assessment purpose • Involved the use of a cognitive aid by a group other than anesthesia • If the aim of the aid was to assist in emergencies that might also	○ Its content must be derived from "best practice" guidelines or protocols; ○ Its design should be appropriate for use in the context of the emergency situation; ○ It should be familiar, in a format that has been used in practice and training; ○ It should also assist other team members to perform their tasks in a coordinated manner • Content: ○ The information should represent best clinical practice • Design: ○ The possibilities of harm from improper or unintended use should also be considered ○ There is no reason to assume that poorly designed cognitive aids in health care would not lead to errors • Training: ○ Training may improve the familiarity with a cognitive aid and enhance the chance of it being used effectively • Individual Versus Team Performance: ○ A cognitive aid must support both the individual and the team in managing the emergency ○ A cognitive aid that distracts and interrupts the team from performing their tasks may increase the risk of errors and have the opposite of the intended effect • There is some evidence that cognitive aids improve technical performance during emergencies, but there is much to be learned about when and why they fail	• The maximum benefit is likely only if practitioners are familiar with the structure of each aid, and how it should be used • The current evidence for the efficacy of cognitive aids in emergencies is inconclusive • The lack of evidence is due to both the limited research that has been performed and the deficiencies in design and evaluation of current cognitive aids	shown that design is very important for the correct utilization of aids • This article gave great input in how to implement cognitive aids and what would be important factors when creating those aids • The article was very positive for the use of cognitive aids, but showed that there is not much evidence behind the mandate for the use of aids • One obstacle to overcome in the implementation of cognitive aids is the perceived lack of knowledge and confidence if a provider "must

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		occur during anesthetic care Based on the inclusion criteria, 23 papers describing 22 cognitive aids were selected Evidence was sought to establish: 1. Whether cognitive aids improve performance of individuals and teams 2. Whether recommendations can be made for future cognitive aid design, testing, and implementation Author compared cognitive aids implementation against medical devices	• The content or knowledge contained in cognitive aids should be developed from national or international guidelines or from broad consensus • Content needs to be reviewed and adapted as knowledge changes • Evidence from the human factors literature suggests that poorly designed cognitive aids may lead to unintended consequences • Despite the perceived benefits to the team, there is minimal evidence to support an improvement in team function with the use of cognitive aids • Data suggest that cognitive aids may change team coordination and improve task completion but their effects on team processes are not clear • One study showed effects of a designated reader demonstrating decreased communication by the team. Conversely, it may be that the remaining communication was more efficient and targeted • It is reasonable to assume that familiarization to a cognitive aid before its use would mean that the participants would be more likely to use it and use it more effectively • Ideally, as with any medical device, for the best results the cognitive aid should be intuitive to use and should also be used only by individuals trained in its use • Part of the problem of the underuse of cognitive aids may be the existence of a professional culture that does not support their use. Some testers stated that using a cognitive aid reflected a lack of confidence or knowledge • Cognitive aids must be positioned where it would be naturally to look for them, e.g. where		use an aid" during an emergency. This obstacle may be easier to overcome among younger generations of providers than older

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		implementation standards	emergency drugs are kept (associating the aid with the task at hand) • Cognitive aids are not commonly used during emergencies in anesthesia and at present appear not to be supported by the culture • The current evidence for the efficacy of cognitive aids in emergencies is inconclusive. Although the evidence to support the use of cognitive aids in emergencies is currently weak, the success in other settings is compelling		
Augoustides, John G T Atkins, Joshua Kofke, W. Andrew 2013 Anesthesia & Analgesia Anesth Analg. 2013 Nov;117(5):1037-8. doi: 10.1213/ANE.0b013e31829e443a.	Much Ado About Checklists: Who Says I Need Them and Who Moved My Cheese? Editorial to prime readers about the main special articles regarding use of cognitive aids	Editorial comments	• 89 years ago Dr. Babcock asked: ○ "Have you a plan of action so developed so that the right thing is always done in the emergency and time is not frittered away with useless or non-essential details?" ○ "Do you ever hold emergency drills in your operating room to see if you are constantly prepared for an instant resuscitation?" • Change happens - they keep moving the cheese: • Anticipate change - get ready for the cheese to move • Monitor change – smell the cheese often so you know when it is getting old • Adapt to change quickly - the quicker you let go of old cheese, the sooner you can enjoy new cheese • Change - move with the cheese; enjoy change - savor the adventure and enjoy the taste of new cheese! • Be ready to change quickly and enjoy it again - they keep moving the cheese		This editorial strongly recommends that the time for implementing cognitive aids in anesthesia is now

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			• The weight of the evidence, as summarized in this important article, suggests, however, that it is time to move the implementation of checklists beyond the simulation laboratory (T1 setting) into anesthetic practice (T2 and T3 settings) both for elective and emergency care • Components author believes are required for successful and pervasive implementation of cognitive aids: 1. Create the cognitive aid with a focus on clear content and effective design 2. Familiarize teams with the cognitive aid in training exercises 3. Use the cognitive aids that should be accessible in every anesthetizing location 4. Integrate the cognitive aids into the perioperative culture of the institution. The checklists can be used in team preparation for emergencies (pre-crisis), for patient management in real emergencies (intra-crisis), and for guiding improvements in delivery of care after resolution of the emergency (post-crisis) • Key questions were raised: ○ When do checklists become standard of care in delivery of emergency care? ○ Is the failure to use a cognitive aid in an emergency clinically negligent? ○ Who is responsible for developing effective cognitive aids to guide management of perioperative emergencies? ○ Should the checklists be adapted to local conditions?		

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			○ Who "runs" the checklist protocol during a crisis? • Further it was asked when the whole checklist concept becomes toxic: ○ If this concept is pushed to the extreme, checklist apathy could develop, with deleterious consequences for patient care		
Shekelle, PG Pronovost, PJ Wachter, RM et al. 2013 Annals of Internal Medicine Ann Intern Med. 2013 Mar 5;158(5 Pt 2):365-8. doi: 10.7326/0003-4819-158-5-201303051-00001.	The Top Patient Safety Strategies That Can Be Encouraged for Adoption Now To identify gaps in evidence on patient safety	Literature review, followed by a review of current patient safety strategies, with a final assessment of evidence strength and quality Project team from: • RAND Corporation • Stanford University • University of California, San Francisco • Johns Hopkins University • ECRI Institute • International panel of 21 stakeholders and	• Concluded that 22 Patient Safety Strategies (PSSs) are ready to be encouraged for adoption by health care providers, of which 10 the expert panel believed should be "strongly encouraged" for adoption • Our expert panel believes that providers should not delay adopting these practices particularly the strongly encouraged ones. Enough is known now to permit health care systems to move ahead • The #1 on the strongly recommended list is ○ Preoperative checklists and anesthesia checklists to prevent operative and postoperative events	Many of the authors have personal potential conflicts of interest listed, although none of the listed conflicts appear to be significant	This extensive study clearly recommends that anesthesia implement an emergency checklist on a global level

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		evaluation methods experts • Evidence-based assessment of patient safety strategies (PSSs) • 41 topics were selected of which 18 topics were chosen for in-depth review			
Arriaga, AF Bader, AM Wong, JM Lipsitz, SR Berry, WR Ziewacz, JE Hepner, DL Boorman, DJ Pozner, CN Smink, DS Gawande, A 2013 New England Journal of Medicine	Simulation-Based Trial of Surgical-Crisis Checklists	• OR teams from 3 institutions • Series of surgical-crisis scenarios • Simulated OR • Total of 106 simulated scenarios using 16 teams	• In a high-fidelity simulation study, checklist use was associated with significant improvement in the management of operating-room crises • Failure to effectively manage life-threatening complications in surgical patients has been recognized as the largest source of variation in surgical mortality among hospitals • A total of 97% of the participants agreed with the statement "If I were having an operation and experienced this intraoperative emergency, I would want the checklist to be used."	• Absence of surgeons as participants in most of the scenarios • Small number of teams	The results of this study suggest that hospitals and ambulatory surgical centers should consider implementation of checklists to in-crease the safety of surgical care
Mulroy, M 2013	Emergency Manuals: The Time Has Come	Editorial in APSF Newsletter Spring-Summer 2013	• The reality is that none of us can any longer function as that "lone expert" recalling every		Significant support for the implementation of

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Journal of the Anesthesia Patient Safety Foundation			procedure and drug dose from memory, especially in crisis situations • We are now adapting to the checklist concept that has been used in aviation for 80 years, and for anesthesia machine checks for 50 • Simulation testing of such cognitive aids in Palo Alto, Boston, and Seattle has shown, not surprisingly, that performance in emergency situations is greatly improved with a checklist		emergency manuals
Marshall, SD Mehra, R 2014 Anaesthesia	The effects of a displayed cognitive aid on non-technical skills in a simulated 'can't intubate, can't oxygenate' crisis	• Prospective randomized controlled trial • One-day course on advanced airway management • Simulated study on a 'can't intubate, can't oxygenate' scenario • 64 participants	• According to established guidelines, when all other measures to provide oxygen fail, the final common step is the insertion of a surgical infraglottic airway • Lack of proficiency has been suggested as the main reason why over 60% of initial attempts at needle cricothyroidotomy failed • This study shows that when a cognitive aid is present for a CICO crisis, critical care specialists perform non- technical skills better, but they do not perform technical skills faster • Repeated attempts at laryngoscopy are a common feature of failed airway incidents leading to hypoxic brain injury or death. The inability to change strategy represents a fixation error and it is not yet clear if or how cognitive aids may prevent this • The ability of team members to challenge other clinicians in airway crises has some promise in preventing them from persisting with ineffective airway management strategies, and to focus on oxygenation rather than device placement	• Simulated study using actors instead of real patients • Not able to blind observers to the interventions • Due to high educational level of participants, results is likely to be better than with a wider population of critical care specialists	This study demonstrates that the use of a cognitive aid is associated with higher scores of the quality of team behavior during an airway emergency

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Morell, RC Cooper, JB 2016 APSF Newsletter	APSF Sponsors Workshop on Implementing Emergency Manuals	APSF Newsletter Workshop for over 100 anesthesia expert stakeholders in September 2015	See also "Audit Trail" entry for this meeting • Following Dr. Gaba's presentation audience response data demonstrated that 82% of participants felt that every site of perioperative care should have one or more emergency manuals (EMs) • Dan Raemer, PhD, from Massachusetts General Hospital (MGH) who spoke about the pitfalls and risks associated with the use of emergency manuals ○ In one case of septic shock, the team perseverated on a diagnosis of malignant hyperthermia (MH) ○ Another case of a mixed diagnosis with possible components of anaphylaxis and/or transfusion reaction, the team went back and forth between pages and to other pages without getting to a correct course of treatment ○ Yet, another case, the correct diagnosis was septic shock, for which there is no page in the manual. This team became distracted and did not provide appropriate treatment • Recommend that a part of the pre-surgical timeout should consist of the verification of the presence of an emergency manual, to remind the team that anyone can suggest its use, and that a reader be designated as appropriate to the situation • A relevant audience response question revealed that 99% of participants believed that the introduction of EMs, like any new technique or		This workshop firmly agreed that the implementation of emergency manuals in some form should be instituted. They felt strongly that it should be done sooner rather than later

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			technology in medicine, presents unanticipated risks and potential complications • The audience response indicated that only 19% of participants believed that limitations of checklists must be overcome before their use should be widely adopted. • Similarly, 92% of respondents disagreed with the position that if teams and individuals practice CRM, checklists are not necessary • Hannenberg advised that if we create a "we use checklists" mentality, the idea being that good clinicians use cognitive aids • Audience response revealed that 79% agreed that anesthesia professionals should lead the development of the content for cognitive aids for OR emergency management; however, 96% disagreed that only anesthesia professionals should call for the use of an EM • A large majority of the audience felt that the APSF should take a leading role in promoting EMs; however, the audience was split on the question of whether EMs should ever become a standard of care with only 67% voicing that opinion		
Borshoff, D 2014 Anesthesia & Analgesia	The Limitations of Crisis Checklists	Letter to the Editor	• An incorrect diagnosis can lead to the wrong checklist being used, and a disproportionate sense of urgency can result in fixation error. • Specific checklists will not be a perfect fit for every clinical context and may actually distract from task prioritizing • Emergency manuals may prove their usefulness in anesthesia over time		Letter casts doubt if the time is right for emergency manuals at this time

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Burden, AR Carr, ZJ Staman, GW Littman, JJ Torjman, MC 2012 Simulation in Healthcare	Does Every Code Need a "Reader?'' Improvement of Rare Event Management with a Cognitive Aid "Reader'' During a Simulated Emergency	• Simulation laboratory • 28 residents in mixed specialties • 31 simulation sessions • 2 different scenarios	• Prompt treatment is necessary to assure patient survival during crisis • Reader introduction resulted in execution of all critical actions. During the debriefing of the simulated scenarios, subjects acknowledged the benefit of the Reader • Even subjects who used the cognitive aids reported that they were reluctant to use them, stating that they thought it was not appropriate to use memory assistance tools • Those who did attempt to use the cognitive aids during the event expressed great difficulty in reading the aid while gathering clinical information and communicating with the team. They reported that it was difficult for them to change from a cognitive process to a dynamic process • The subjects noted that the introduction of a Reader helped them overcome these problems and resulted in the appropriate execution of all critical actions • In another investigation of resident physician cognitive aid use during emergent events, some subjects made the wrong diagnosis, chose the wrong cognitive aid, and failed to resuscitate the patient. Complicated, difficult to navigate cognitive aids may have been a limiting factor for our subjects as well. Subjects may have also found it difficult to know which cognitive aid to choose • All subjects acknowledged the benefit of the Reader	• Small number of subjects • Simulation and lab setting only and not a real OR	

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August, DA 2014 ASA News Letter	Cognitive Aids: Trending, Transformative or Just Too Much?	Article in ASA Newsletter	• Are cognitive aids just the latest trend, or will their widespread integration truly transform the level of safe patient care we deliver? • What is the ideal dose of checklists? • Checklist toxicity? • MHAUS, Stanford Cognitive Aids Group checklist • Confirmation bias may also play a role, as clinicians look to verify that, indeed, the suggested items on the checklist are present, rather than seeking any disconfirming evidence to support an alternate diagnosis • Phenomena such as framing effects, premature closure, and confirmation bias are among a larger group of decision factors that might contribute to error and are reviewed in detail elsewhere		
Pollock, JE Berekynei, S Nandagopal, K Howard, SK Goldhaber-Fiebert, SN 2014 ASA abstract		• Surveys were used to assess clinical adoption of EMs in the OR • Pretest-posttest survey	• Emergency manuals, used in anesthesia simulation training at Stanford for many years, have recently been made clinically accessible in all Stanford Hospital operating rooms, along with increased ongoing trainings • The response amongst residents has been positive overall and many residents have successfully used the EMs in direct patient care • Anesthesia training programs that do not currently have emergency manuals should consider implementation, including not only accessibility but also training in why and how to use them effectively		

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Ranganathan, P Phillips, JH Attaallah, AF Vallejo, MC 2014 Anesthesia & Analgesia	The Use of Cognitive Aid Checklist Leading to Successful Treatment of Malignant Hyperthermia in an Infant Undergoing Cranioplasty	Letter to the Editor of A&A	• Describe a real life example of the benefits resulting from introduction of one such cognitive aid, The Emergency Manual into each anesthesia workstation • This case illustrates the clinical advantage of using cognitive aids in the operating room		
Thomassen, O Brattebø, G Heltne, JK Søfteland, E Espeland, A 2010 BMC Health Services Research	Checklists in the operating room: Help or hurdle? A qualitative study on health workers' experiences	Focus group interviews Nurses and physicians Anesthesia and Intensive care	• A head physician with a positive attitude was considered crucial for successful implementation • The patient must not be forgotten • New tools can interrupt workflow • Critical voices must be identified and addressed • A checklist may be used in situations for which it was not intended • Standardization is important for the usefulness of checklists	Qualitative study	