



CHECK IT TWICE

Areas of opportunity exist for the creation and use of checklists and patient care bundles in the veterinary ICU to improve the quality of care for critical patients.

EMERGENCY MEDICINE/CRITICAL CARE

The Evidence for Checklists and Patient Care Bundles in Veterinary Nursing

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In human medicine, checklists and patient care bundles have been widely researched for their effectiveness at preventing medical errors and ultimately reducing morbidity and mortality in the emergency and critical care setting. In the veterinary intensive care unit (ICU), implementation of checklists and patient care bundles allows the veterinary team to elevate the standard of patient care, create a standardized approach, and improve patient outcomes. This article reviews the evidence for checklists and patient care bundles used in human medicine as well as the measures applicable to veterinary patients.

FACTORS IN MEDICAL ERRORS

The potential for medical errors in the hospital setting is of significant concern. In human health care, patient safety research has found that up to 98 000 patients die annually in the United States as the result of medical errors.¹ The most common contributor to these errors is human error resulting from cognitive limitations, deficiencies in nontechnical skills, or system or environmental limitations that influence decisions.¹ Cognitive limitations include mistakes, lapses, slips, distractions, stress, and bias. Nontechnical deficiencies include ineffective communication skills and leadership. System limitations include management, workflow, organization, and staffing deficiencies.¹

Although veterinary research investigating overall morbidity and mortality statistics is limited,

medical errors also occur in the veterinary profession. A survey published in 2004 found that 78% of recent veterinary graduates admitted to making medical errors.¹ The most common causes of these errors included lack of experience, time management, and communication breakdowns.¹ A survey published in 2015 sought to determine the causes and types of errors in veterinary practice.² **BOX 1** lists the causes of errors it identified and **FIGURE 1** summarizes the incidence area of each error type.² Although more research is needed, the findings from this survey closely correlate to the types and causes of errors in human health care.^{1,2}

PATIENT CARE CHECKLISTS

A checklist can be described as a step-by-step process of evidence-based interventions that help prevent medical oversights during ICU patient



BOX 1

Causes of Errors in Veterinary Practice¹

Active failures

- Cognitive limitations (e.g., mistakes, lapses, slips, distractions, stress, bias)
- Individual factors
- Lack of technical ability
- Inadequate care

System failures

- Communication
- Leadership
- Design of product or equipment
- Productivity
- Organizational failure (e.g., management, workflow, staffing)
- Clients

care.^{3,4} A checklist is typically specific to a given procedure or treatment and does not encompass all aspects of patient care.⁴

Checklists have been implemented as patient safety systems in several other fields, including aviation, engineering, construction, and human health care.^{2,5} In

his book *The Checklist Manifesto*, Atul Gawande says in regard to patient care, “this is the reality of intensive care; at any point, we are as apt to harm as we are to heal.”⁵ Gawande’s book focuses on the use of checklists in relation to several elements of daily and professional life and examines how checklists can be used for greater efficiency, consistency, and safety.⁵

Checklists can be used by the veterinary healthcare team as tools to minimize errors and instill a culture of quality improvement when it comes to patient care.²

BOX 2 lists some identified benefits of using checklists in patient care, many of which address causes of error listed in **BOX 1**. **BOX 3** provides links to specific published protocols.

Human Medical Literature

Checklists have been widely researched in the human emergency and critical care setting.³ The most commonly used checklists include those intended to prevent ventilator-associated pneumonia (VAP), to prevent catheter-related bloodstream infections (CRBSIs), and to ensure surgical safety.

Ventilator-Associated Pneumonia

In the human ICU setting, VAP affects 15% of patients who receive ventilation therapy.⁶ Because infection from any source contributes to higher morbidity and mortality rates, a study was conducted in trauma patients to determine if implementation of a VAP prevention checklist would decrease the incidence of VAP.⁶ The elements of the VAP checklist are (1) elevation of the head to 30° to 45°, (2) twice-daily oral cleansing with dilute chlorhexidine, (3) daily assessment of readiness to wean, (4) nasogastric tube placement for peptic ulcer prophylaxis at the earliest possible time, and (5) deep thrombosis prophylaxis. The study results showed a 45% reduction in the incidence of VAP after implementation of the checklist.

Catheter-Related Bloodstream Infections

Similar to VAP, CRBSIs are associated with high morbidity and mortality in human ICU patients, an estimated 48% of whom have indwelling central venous catheters.⁷ In an effort to eliminate CRBSIs in the ICU setting, a study was conducted to examine if implementation of a checklist based on previously developed clinical guidelines would decrease the incidence of CRBSIs. The elements of the CRBSI

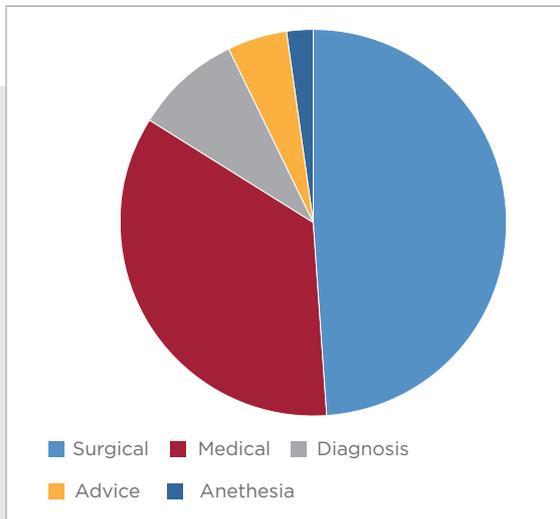


FIGURE 1. Incidence of types of errors in veterinary practice.¹ Surgical=49%, medical=35%, diagnosis=9%, advice=5%, and anesthesia=2%.

BOX 2

Benefits of Checklists and Patient Care Bundles

Checklists^{2,3}

- Create memory recall (e.g., users are less likely to overlook simple steps)
- Create a culture of accountability
- Standardize care
- Reduce patient harm
- Improve consistency of care
- Help avoid medical errors

Patient care bundles⁴

- Maintain consistency in patient care
- Set patient care standards
- Improve overall quality of the nursing care provided
- Establish best clinical practices
- Improve clinical effectiveness
- Reduce morbidity and mortality by promoting a more all-inclusive approach to patient care

checklist were (1) appropriate hand hygiene, (2) skin preparation using dilute chlorhexidine, (3) full barrier precautions during central venous catheter placement (**FIGURE 2**), (4) optimal catheter site selection, (5) sterile field maintenance during central venous catheter placement, and (6) daily assessment of central line necessity.⁸ The study results showed a 66% reduction in the incidence of CRBSIs that was sustained over a



FIGURE 2. Veterinary nurse wearing full barrier precautions.

David Herrera Calzada/shutterstock.com

15-month period after implementation of the checklist.^{7,8}

Surgical Safety

Surgical errors account for 49% of errors in human ICUs.⁹ In 2008, the World Health Organization (WHO) created a surgical safety checklist in an effort to improve patient safety during surgical procedures and reduce adverse events associated with surgical procedures.¹⁰ The WHO looked at the major checkpoints associated with surgical procedures: before anesthesia induction (sign in), before surgical incision (time out), and before recovery (sign out). The authors of a study published in 2009 hypothesized that implementing a surgical safety checklist would improve team communication, reduce surgical complications, and reduce postsurgical infections.⁹ They aimed to evaluate the effect of implementation of the WHO surgical safety checklist. The study results showed that there was a 35% reduction in postoperative morbidity and a 48% reduction in mortality after implementation. As a result of the data, the WHO surgical safety checklist is now routinely used in hospitals around the world.⁹

Veterinary Literature

As veterinary medicine is continuously evolving, so are client expectations for the level of patient care. In the emergency and critical care setting, patient care checklists can be used to optimize patient care quality and standards. The most common checklists used in veterinary medicine include Kirby’s Rule of 20, the RECOVER CPR algorithm, and the surgical safety checklist.

BOX 3

Published Checklists and Patient Care Bundles

- The World Health Organization Surgical Safety Checklist (2009): bit.ly/3Bsn3LI
- RECOVER Initiative CPR algorithm, drugs and dosages chart, and post-cardiac arrest care algorithm (2012): bit.ly/3JBVW36

**BOX 4****Kirby's Rule of 20¹¹**

- Fluid balance, colloidal osmotic pressure
- Oxygenation and ventilation
- Blood pressure
- Heart rate, contractility, rhythm
- Glucose
- Body temperature
- Albumin
- Electrolytes
- Mentation
- Red blood cells and hemoglobin
- Gastrointestinal motility and integrity
- Nutrition
- Renal function
- Coagulation
- Immune status, antibiotics
- Drug dosage and metabolism
- Wound care and bandages
- Pain control
- Nursing care
- Tender loving care

Kirby's Rule of 20

Kirby's Rule of 20 is a checklist created by Rebecca Kirby, DVM, DACVIM, DACVECC. It consists of 20 patient parameters that should be evaluated daily in critically ill patients to ensure quality patient care (**BOX 4**).¹¹ Following the Kirby's Rule of 20 checklist allows veterinary nurses to assess the overall clinical picture of a patient, implement critical thinking skills, elevate the quality of patient care, set standards for patient care, and decrease morbidity and mortality, resulting in improved patient outcomes.

RECOVER CPR Algorithm

The Reassessment Campaign on Veterinary Resuscitation (RECOVER) Initiative was designed to systematically evaluate the scientific literature regarding the clinical practice of cardiopulmonary resuscitation (CPR) in veterinary medicine.¹² The initiative had 2 goals: (1) create clinical consensus guidelines on how best to address cardiopulmonary arrest in dogs and cats

and (2) identify important knowledge gaps within veterinary CPR to improve the consensus recommendations and overall quality of patient care.¹²

The initiative found that cognitive aids used in ICU/CPR settings help with memory recall and rescuer compliance, as well as provide a point of reference for the team about what CPR care is needed.¹³ It therefore created a CPR algorithm as a cognitive aid to summarize the clinical guidelines most relevant for performing CPR.¹³ The algorithm provides step-by-step prompts to the veterinary rescuers involved in CPR efforts.¹³

Surgical Safety Checklist

Since the significant results supporting use of the WHO surgical safety checklist were published in the human medical literature, with subsequent widespread adoption of the checklist across human health care, 2 studies using the WHO checklist have been published in veterinary literature.

In 2014, the University of Georgia Veterinary Teaching Hospital created a study to determine the incidence of specific anesthesia patient safety incidents (closed adjustable pressure limiting valve, esophageal intubation, medication error), develop interventions to address common incidents reported, and evaluate the effectiveness of the developed interventions. In the first period of the study, the rate of anesthesia patient safety incidents was 3.6% (74 incidents in 2028 patients); in the second period, the rate was 1.4% (30 incidents in 2112 patients). Between the study periods, the hospital implemented 2 protocol changes as well as 2 checkboxes in anesthesia records that documented confirmation of intubation both before the operation and in the operating room.¹⁴

In 2016, a veterinary teaching hospital in Sweden adapted the WHO surgical safety checklist to examine its effectiveness in the hospital's patient population. The researchers specifically wanted to evaluate whether the checklist could reduce the incidence of complications after small animal surgery, so they mirrored their study after those published in the human literature. The study results showed a 10% reduction in the frequency of postoperative complications following implementation of the surgical safety checklist (52/300 patients before implementation versus 15/220 patients after).¹⁵

PATIENT CARE BUNDLES

The concept of patient care bundles was first developed at Johns Hopkins University in 2002. Patient care bundles can be described as a grouping of care elements based on evidence-based interventions used in hospital ICUs. The idea is that by combining several practices, healthcare providers will have a greater effect on patient care, leading to more positive patient outcomes.⁴ Similar to checklists, patient care bundles have the overall goal of helping to reduce and/or prevent medical errors and patient care oversights. Unlike checklists, patient care bundles encompass more aspects of patient care and are generally created on a particular clinical sign, treatment, or procedure as part of a general disease process. **BOX 2** lists some identified benefits of using patient care bundles; again, many correlate to active and system failures that can be causes of error.

Human Medical Literature

In the human medical literature, patient care bundles have a longstanding record of success in reducing patient morbidity and mortality. Care bundles came about from an expectation of following evidence-based practice in human health care and an interest in developing tools to improve the quality of patient care.⁴ Although patient care bundles have not been as thoroughly researched or implemented in veterinary medicine, similar concepts can be applied and adapted for use in the veterinary ICU setting.

The most common care bundles used in human medicine that are relevant in the veterinary ICU setting include the patient handoff program, the CRBSI care bundle, and the Surviving Sepsis Campaign (SSC) hour-1 bundle.

Veterinary Nurse/Technician Patient Handoff Form				
Date: _____				
Admit date:	Patient information/ signalment:	Diagnosis:	CPR code:	Nursing notes:
Continued Rounds				
Date: _____ Shift: Day/Swing/Overnight Rounding veterinary nurse/technician initials: _____				
Assigned veterinary nurse/technician: _____ DVM: _____				
Shift highlights (diet, demeanor, diagnostics, procedures, etc.):				

Plan:				

FIGURE 3. Example of a veterinary patient handoff form. CPR=cardiopulmonary resuscitation, DVM=doctor of veterinary medicine.



Patient Handoff Program

A key aspect of patient care is the ability to effectively perform patient rounding. Patient rounds involve the exchange of patient information between care providers. This is most routinely performed at shift changes between off-going and oncoming veterinary nurses but is also indicated during departmental transfers. The patient rounding process should be relatively quick (1 to 3 minutes per patient) and include only the most pertinent patient information (fine details can be found in the medical record). It is also ideal to have any member of the veterinary healthcare team who will be caring for ICU patients participate in patient rounds.

Effective team communication is essential to providing exceptional patient care, and the most effective way to communicate with the entire veterinary team is through a structured, systematic patient handoff program. A 2014 study conducted in 9 human hospitals identified miscommunication as a leading cause of medical errors and aimed to evaluate if implementation of a patient handoff program would reduce medical errors, prevent adverse events, and improve overall workflow.¹⁶ The study found that implementation of a patient handoff form was associated with a 23% reduction in medical errors and a 30% reduction in preventable adverse events. The study results showed that implementation of a patient handoff program was associated with decreases in medical errors and adverse events, development of a standardized rounding routine, and improved communication (e.g., increased rate at which patient information is transferred and retained rather than overlooked or omitted) without negatively affecting workflow.¹⁶ A sample handoff form for use in veterinary hospitals is provided (**FIGURE 3**).

Catheter-Related Bloodstream Infections

In addition to the previously discussed CRBSI checklist, the same study team looked at a patient care improvement bundle to eliminate the incidence of CRBSIs. The elements of the CRBSI bundle were (1) implementing an educational intervention program to increase provider awareness of evidence-based infection control practices, (2) creating a central catheter insertion cart with all the necessary supplies, (3) asking providers daily if central venous catheters could be removed, (4) adhering to the checklist, and (5) empowering nurses to stop the procedure if the bundle guidelines were not followed. The incidence of CRBSIs in the ICU setting was nearly eliminated after implementation of the patient improvement bundle, with the rate decreasing from 11.3 CRBSIs/1000 catheter-days to 0 CRBSIs/1000 catheter-days over a 4-year period.⁷

Surviving Sepsis Campaign

The Surviving Sepsis Campaign (SSC) is a global commitment to reducing morbidity and mortality from sepsis in human and veterinary patients. Consensus guidelines are published every 4 years, with the most recent full guidelines published in 2021.¹⁷ Previous guidelines provided 3-hour and 6-hour care bundles; however, in the 2018 update, these bundles were combined into a single hour-1 bundle.¹⁸ The elements of this revision are summarized in **TABLE 1**. An international multicenter study conducted to evaluate the effect of SSC bundle implementation on morbidity and mortality, conducted before the creation of the hour-1 bundle, showed a 40% reduction in the likelihood of a patient dying in hospital with use of the 3-hour care bundle and a 36% reduction with use of the 6-hour care bundle.¹⁹

TABLE 1 The 5 Key Elements of the Surviving Sepsis Campaign Hour-1 Bundle¹⁸

1	Measure lactate level.
2	Obtain blood culture samples before administering antibiotics.
3	Administer broad-spectrum antibiotics.
4	Begin rapid administration of 30 mL/kg crystalloid for hypotension or lactate \geq 4 mmol/L.
5	Apply vasopressors if patient is hypotensive during or after fluid resuscitation to maintain mean arterial pressure \geq 65 mm Hg.



Nasal Feeding Tube Placement Checklist (Example)

Preplacement (credentialed veterinary nurse/technician and assistant)	Placement (credentialed veterinary nurses/technicians)	Postplacement (credentialed veterinary nurse/technician and DVM)	Documentation (credentialed veterinary nurse/technician)
Feeding tube guidelines have been reviewed? <input type="checkbox"/> Yes Initials _____ Initials _____	<input type="checkbox"/> Instill 2-3 drops of proparacaine into each nostril, then gently tip the patient's nose upward Initials: _____ Initials: _____	<input type="checkbox"/> Aspirate the tube <input type="checkbox"/> Instill sterile saline into the tube <input type="checkbox"/> Rapidly instill air into the tube <input type="checkbox"/> Obtain a right lateral radiograph	<input type="checkbox"/> Date and time <input type="checkbox"/> Size and length of tube (e.g., 8 Fr x 42 cm) <input type="checkbox"/> Nostril tube exits <input type="checkbox"/> Cm or Sharpie mark where tube exits <input type="checkbox"/> Type of suture used
Has the patient had a physical examination prior to placement? <input type="checkbox"/> Yes Initials _____ Initials _____	<input type="checkbox"/> Lubricate the tip of the tube with sterile lubricant Initials _____ Initials _____	<input type="checkbox"/> DACVECC interprets the radiograph to confirm placement <input type="checkbox"/> Secure the tube using 2-0 to 3-0 suture in a fingertrap pattern	<input type="checkbox"/> DVM who confirmed placement
Sedation protocol (provided by DVM)? <input type="checkbox"/> Yes Drug, dose (mg), route: (e.g., butorphanol 2 mg IV) _____ Level of consciousness: _____ Gag reflex: _____	Nasooesophageal: <input type="checkbox"/> Measure from tip of the nose to 7th-8th intercostal space <input type="checkbox"/> Xyphoid process is another landmark <input type="checkbox"/> Mark the tube with a temporary piece of tape		
Location for tube placement <input type="checkbox"/> Radiology <input type="checkbox"/> Treatment room Initials _____ Initials _____	Nasogastric: <input type="checkbox"/> Measure from tip of the nose to the last rib <input type="checkbox"/> Mark the tube with a temporary piece of tape		
Supplies ready: <input type="checkbox"/> Topical anesthetic (e.g., proparacaine) <input type="checkbox"/> Tube <input type="checkbox"/> Sterile lubricant <input type="checkbox"/> 1" nonporous tape <input type="checkbox"/> Sharpie marker <input type="checkbox"/> 2-0 or 3-0 nonabsorbable suture <input type="checkbox"/> Needle holders	Placement: <input type="checkbox"/> Pass the tube while remaining ventral and medial <input type="checkbox"/> Gently lift the nose up, similar to a pig nose, to promote tube passage <input type="checkbox"/> Gently manipulate the head and neck, sometimes upward, to encourage passage into the esophagus <input type="checkbox"/> Patient swallowing is a good sign <input type="checkbox"/> Pass the tube to the predetermined mark		

FIGURE 4. Example of a nasal feeding tube placement checklist. DACVECC=diplomate of the American College of Veterinary Emergency Critical Care, DVM=doctor of veterinary medicine.

**BOX 5****Processes That Might Benefit From Checklists or Care Bundles****Patient checklists**

- Feeding tube placement
- Urinary catheterization
- Central line placement
- Nasal oxygen cannula placement
- Blood transfusion administration
- Anesthetic machine setup
- Operating room setup

Patient care bundles

- Critical assessment plan
- Urinary catheter care
- Recumbent patient care
- Respiratory tube care (e.g., long-term intubation, thoracostomy tubes, tracheostomy tubes)
- Long-term ventilator care

RECOVER Initiative

To supplement its CPR algorithm, the RECOVER initiative created 2 additional cognitive aids: the CPR Emergency Drugs and Doses chart and the Post-Cardiac Arrest Care algorithm. The CPR Emergency Drugs and Doses chart contains only the drugs most commonly used during a cardiopulmonary arrest event and CPR attempt. It provides the volume of each drug based on an estimated patient body weight (in kilograms) to aid in reduction of drug calculation errors. The Post-Cardiac Arrest Care algorithm was designed as a summary of the key interventions the veterinary team should implement for patients that achieve return of spontaneous circulation (**BOX 3**).

The full evidence-based review also provides consensus guidelines over 5 domains: preparedness and prevention, basic life support, advanced life support, monitoring, and post-resuscitative care.¹³

The RECOVER evidence review showed that cognitive aids (e.g., checklists, charts, algorithms) improved compliance with CPR guidelines; therefore, these aids should be readily available and visible in areas where cardiopulmonary arrest may occur (e.g., surgical suite, procedure rooms, treatment area). Using these resources

in addition to the evidence-based clinical guidelines constitutes a patient care bundle for small animal patients.¹³

CHECKLIST AND CARE BUNDLE IMPLEMENTATION

Going through the process of identification, creation, and implementation of checklists and patient care bundles ultimately leads to quality improvement of patient care. Quality improvement is the process of combined, continuous efforts by members of the veterinary healthcare team to make changes that contribute to better patient outcomes and better system performance.²

The human medical literature has identified 7 steps to identifying, creating, and implementing patient checklists and care bundles in practice:⁴

1. Identify a patient, staff, or hospital need. An area in which errors and/or oversights are common is an area to focus on. Some options are suggested in **BOX 5**.
2. Identify interventions/practices that would meet the need.
3. Perform literature research to find published, current, evidence-based practices and recommendations regarding the interventions or practices identified in step 2.
4. Review the evidence-based research to strengthen the integrity of the identified interventions or practices.
5. Establish a clinical protocol (checklist or patient care bundle) based on the literature search and evidence-based review to address the need identified in step 1.
6. Provide team training and education about the protocol (e.g., why it was developed, why certain elements are included based on evidence-based medicine, how the protocol will be used).
7. Audit compliance with the protocol.

In the author's experience, a hospital created and implemented a feeding tube checklist for nasoesophageal and nasogastric feeding tube placement following a medical error that resulted in a patient's death (**FIGURE 4**). The negative patient outcome became a learning opportunity for the veterinary healthcare team, as they were able to identify a critical need, implement an intervention, and establish the checklist as a hospital protocol.

CONCLUSION

As veterinary medicine is continuously evolving, so are

owner expectations for the level of care their pets receive. Research into use of patient checklists and care bundles in veterinary medicine has only just begun; however, the results published so far suggest that checklists and patient care bundles can improve overall patient outcomes and reduce morbidity and mortality. Areas of opportunity exist for creation and use of checklists and patient care bundles in the veterinary ICU to improve the quality of care for critical patients.

TVN

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