Preamble:
Peter Pronovost introduced an intensive care checklist protocol that during an 18-month period saved 1500 lives and $100 million in the State of Michigan. According to Atul Gawande, “Pronovost's work has already saved more lives than that of any laboratory scientist in the past decade”.

That’s pretty impressive but, of course, it is not the checklist / protocol by itself, but the combined effects of the healthcare professionals and better team working.
Having read Dr Iain H Wilson & I.A Walkers Editorial published in Anaesthesia in 2008, prompted me to think about some guidance on checklist construction.
The WHO Safer Surgery Checklist –June 2008 has a caveat:
“This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged”.

This does not appear to have any follow up guidance on how to accomplish this task. The intention is to provide some information for those who will be creating these checklists. The basis of the guidance comes from some 25 years of involvement with aviation checklists, their creation & modification.

What is a checklist?

Checklist Types.

Checklist Issues

Checklist Construction – Do’s & Don’ts

The First Checklist? (Edited from Wikipedia)

In 1934 three manufactures had submitted new bomber aircraft for testing. Martin submitted their Model 146; Douglas submitted the DB-1; and Boeing submitted their Model 299.

Boeing’s entry had swept all the evaluations, figuratively flying circles around the competition. It was a much more sophisticated aircraft with more complex systems than previous types. Many considered these final evaluations mere formalities - talk was of an order for between 185 and 220 aircraft. Boeing executives were excited - a major sale would save the company.

At the controls of the Model 299 this day were two very experienced pilots. Also on board were the Boeing Chief Test Pilot, a Boeing mechanic, and a representative of Pratt and Whitney, the engine manufacturer.

The aircraft made a normal taxi and takeoff. It began a smooth climb, but then suddenly stalled. The aircraft turned on one wing and fell, bursting into flames upon impact.

The investigation found "Pilot Error" as the cause. Hill, the appointed pilot, unfamiliar with the aircraft, had neglected to release the elevator lock (a new concept), prior to take off. Once airborne, the other pilot evidently realized what was happening and tried to reach the lock handle, but it was too late.

It appeared that the Model 299 was dead. Some newspapers had dubbed it as 'too much plane for one man to fly.' Most of the aircraft contracts went to the runner-up, the Douglas DB-1. Only 13 Boeing aircraft were ordered for 'further testing'. Douglas, however, received contracts for 133 aircraft for active squadron service. The DB-1 became the B-18.

Any further accidents or incidents with the Model 299 would end its career. Commanders made this quite clear to all the crews.

What was needed was some way of making sure that everything was done; that nothing was overlooked. What resulted was a pilot's checklist. Actually, four checklists were developed - takeoff, flight, before landing, and after landing. The Model 299 was not 'too much airplane for one man to fly', it was simply too complex for any one man's memory. These checklists for the pilot and co-pilot made sure that nothing was forgotten.

With the checklists, careful planning, and rigorous training, the twelve aircraft allocated for further testing managed to fly 1.8 million miles without a serious accident. The U.S. Army accepted the Model 299, and eventually ordered 12,731 of the aircraft they numbered the B-17 - The Flying Fortress.

Applicability:

A decade ago, Israeli scientists published a study in which engineers observed patient care in I.C.U.s for twenty-four-hour stretches. They found that the average patient required a hundred and seventy-eight individual actions per day, ranging from administering a drug to suctioning the lungs, and every one of them posed risks.

Remarkably, the nurses and doctors were observed to make an error in just one per cent of these actions—but that still amounted to an average of two errors a day with every patient.

Intensive care succeeds only when we hold the odds of doing harm low enough for the odds of doing good to prevail. This is hard. There are dangers simply in lying unconscious in bed for a few days. Muscles atrophy. Bones lose mass. Pressure ulcers form. Veins begin to clot off. You have to stretch and exercise patients' flaccid limbs daily to avoid contractures, give subcutaneous injections of blood thinners at least twice a day, turn patients in bed every few hours, bathe them and change their sheets without knocking out a tube or a line, brush their teeth twice a day to avoid pneumonia from bacterial buildup in their mouths.

Add a ventilator, dialysis, and open wounds to care for, and the difficulties only accumulate.
(Atul Gawande, the New Yorker, 2007)

What is a checklist?

These 5 definitions are straight from Wikipedia, their full selection. The list illustrates some of the uses, but more importantly, some of the drawbacks associated with inappropriate checklists The Comments are in *Italics*.

1. A tool that is used as a human factors aid in aviation safety to ensure that a long list of items are not forgotten. *Reference is made to aviation checklists being a human factors aid. The purpose of a checklist is to aid people in carrying out their task accurately & consistently.*

2. Use in medical practice to ensure that clinical practice guidelines are followed. *In attempting to ensure medical guidelines are followed, it must go hand –in-hand with appropriate training on how to use these checklists, not as an edict from on high.*

3. Used in quality assurance of software engineering, to check process compliance, code standardization and error prevention, and others. *A few years ago, the communications company AT&T had a major "outage" of about half the USA that was traced back to a simple line of code that, exactly following James Reason's error concept had never had cause to run until then.*

4. Often used in industry in operations procedures. *Obvious interaction with complex systems.*

5. Can aid in mitigating claims of negligence in public liability claims by providing evidence of a risk management system being in place. *This is probably the WORST reason to create a checklist. These checklists are not designed to aid the practitioner or the patient. The basic premise will affect the checklist construction. The chances are that it will involve an long tick list. Ticks in boxes for their own sake, do not make a safer environment. Example: Recently the "list" had a patient for a replacement hip wash out. The notes had the Metals box ticked as NO. Probably not a lack of diligence but a poor form (checklist) open to errors.*

6. An ornithological checklist, a list of birds with standardized names that helps ornithologists communicate with the public without the use of scientific names in Latin. *The relevance of including the last item is that it contains a reference to language. Specialists within the team will undoubtedly have their own jargon. It is imperative that the checklist author uses language that is accessible to all participants. This is even more important where those involved do not have English as their mother tongue. Example: A surgical list had a 4-letter acronym (DFSP) and after blank looks the surgeon asked the nurses if they knew what it was – none did but none had asked! Well done to the surgeon for investigating the situation.*

Types of Checklist:
As a generic term, checklists may contain some or ALL of the types of checklist described below. The skill is to use the correct type for its application. Using checklists requires training / practice.

1. **Read & Do**:

This is exactly as its title suggests. It is most suitable for interacting with equipment or machinery that requires a rigid sequence. It is not suitable for confirming information between people. Unless there is a real acceptance that this is the correct method for this application & is conducted correctly, there are opportunities

to generate errors such as the checklist reader talking through the recipient trying to attend to the required action. Early aviation checklists were very focussed on serving the needs of the equipment, completely ignoring the needs of the very people who were trying to use them! It took many years for the people carrying these out to gain the priority they deserved. In the meantime, individuals, defeating the intention of the checklist, created "work-arounds".

Challenge / Response Checklists: The required actions have already been completed. This effectively confirms that all required items have been covered, particularly where the sequence is important. Can be very useful provided that the required response is more than "Yes / No or the worst is "check" – whatever that is supposed to mean! An ideal required response covers a value or a statement that has a plain meaning.
E.g. Challenge: "Sats?" Response: "92% and falling slowly"

2. **Aide –memoire: (Probably the bulk of pre-surgery briefing)** These are typically presented as a series of prompts contained as part of a briefing. These are most useful for exchanging pertinent information and creating the mental model for the whole team. The number of prompts should be as short as practical. The sequence should follow a logical path so that it unfolds like a natural story. The prompts should promote discussion about what is expected and then go on to rehearse strategies that might be used to cover the most likely abnormal event for that particular case. This should not be a monologue! The concept is to exchange pertinent information with the aim of creating a shared mental model for the whole team.

The use of open questions aids the process of creating discussion. Same Questions / Same Answers do not work! *In public transport aviation, during the inter pilot briefing, the engine failure on take–off scenario is always discussed (this discussion mandated in some operations manuals for the first flight of the day), not only because statistically it is the most likely abnormal situation but more importantly because it acts as "tree" on which other abnormal events could be "hung" without too much further discussion. In short, it is preparation for a variety of events.*

e.g. "What unique characteristics does this patient have that might cause us issues today?

Checklist Issues

Positive Side Effects:

If a procedure or process is laid out for everyone, it empowers the more junior staff to require compliance from all.

Monitoring becomes easier within the team as everyone involved should know what the next step should be.

The quality of advocacy & assertion should rise, as there is a defined expectation.

Minor errors are avoided, blocking the path to more major consequences.

Barriers:

Checklist / Protocol "dumped" on to the team without proper introduction.

WIFM (What's in it for Me) not explained.

Not valued by senior staff. (A matter of Education?)

It's a new concept; any change usually meets some resistance.

Perceived time pressure, although a team with a better mental model will be more efficient in the end.

Why bother to state the obvious?

Do's:

1. Do involve those people who will be the users of the checklist.

2. Do pick the correct type of checklist for its application at each stage.

3. Do make the checklist as short as possible. Long tick lists are not that helpful.

4. Do make the checklist easy and attractive to use. It is for the benefit of the patient & the team using it.

5. Do think about the layers of defence that are required at each stage. Using the "Swiss cheese" model (James Reason – Managing the risks of Organisational Accidents) to put in defences against threats, well-constructed checklists have appropriate defences. The most obvious & simplest defence is that items that have the more serious consequences appear more than once in the process at a timely point in the sequence. In this environment, patient, site & required surgical procedure should have several opportunities to trap error.

6. If the same sequence is required at different stages, do ensure that the terminology & presentation is coherent.

7. Do make the checklist flow in a logical path, grouping items appropriately. It can be surprising how powerful the order of items becomes. *Aviation Example: Incidents had occurred when the pilots moved the aircraft before the ground engineer had completed his tasks. This is potentially very dangerous as he would have been near the nose wheel. After much thought, the "trigger" for moving the aircraft was moved to another part of the checklist. This simple change virtually eliminated these incidents.*

8. Do be open to feedback & be prepared to adapt. Work-arounds in checklists defeat the original concept.

9. Do encourage a protocol that would see others in the team take it in turn to run the checklist.

10. Do try to limit the occasions when checklists are changed by storing up minor changes for inclusion. Be wary of the "publish or perish" mentality.

11. Do make sure that the reason for any changes are understood. Explain the intent, and then publish the detail.

Don'ts

1. Don't expect to get it right first time!

2. Don't try to cover every possible situation, rely on the team's ability to adapt to exceptional circumstances.

3. Don't use language or terms that are unfamiliar to any team member.

4. Don't make checklist changes unless there is a real benefit. The process of change has it's own dangers which should not be underestimated. Tinkering to get things slightly better does not work. Too many small changes cause uncertainty & resentment.

Summary:

Checklists are no panacea. They can be very helpful when constructed and used correctly. Research from other high-risk environments indicates that they need proper introduction & training in their use.

Rhyme with origins in the 14th Century:

For Want of a Nail

For want of a nail the shoe was lost. For want of a shoe the horse was lost. For want of a horse the rider was lost. For want of a rider the battle was lost. For want of a battle the kingdom was lost. And all for the want of a horseshoe nail.

The causality is only seen in hindsight! Maybe a checklist in the hands of a well-trained team would have stopped the large consequences from a small detail?

Checklists need to be created for the best motives, rather than as a retrospective Teflon record to avoid corporate blame.