Progress in medical care has brought with it increasing numbers of healthcare-associated infections (HAIs), which contribute significantly to global morbidity and mortality statistics. According to data from the Center for Disease Control and Prevention (CDC) in the United States of America (US), one in 20 people admitted to hospital will contract a HAI. Developing countries typically have HAI rates that are three to five-fold higher than those of US hospitals.

Furthermore there is limited data on HAIs in outpatients, ambulatory care settings and long-term care facilities (LTCF). Estimates from the US indicate that there are between 1.6 to 3.8 million infections in LTCF annually. South African data are scarce and there are no reliable sources of national HAI rates. However, it is largely accepted that it is greater in the public sector than the private sector and is probably somewhere in the region of 10-20%.

Surgical site infection (SSI) accounts for a large proportion of HAIs with approximately 157 500 infections in US hospitals estimated for the year ending 2011. In a prevalence study conducted the same year in England, SSI was the third most common HAI, accounting for 15.7% of all infections.

It is no longer accepted that HAIs are simply the “cost of doing business” and major international and national initiatives have been implemented to reduce the burden of HAIs.
Many of these initiatives have demonstrated remarkable success in reducing HAI rates and it is currently accepted that improvements in patient safety and quality of care are of paramount importance. A so-called “bundle” approach has been the driving force in most interventions to reduce HAIs. The care bundle concept was developed by the Institute for Healthcare Improvement (IHI) and comprises a small group of interventions/practices with proven benefit that are “packaged” together, and administered by the healthcare team to each and every patient who fulfils criteria for that particular bundle.

The purpose is to ensure consistency of delivery with improved quality of care and ultimately a reduction in adverse events, ie. HAIs.

**SSI BUNDLES**

In terms of combatting SSI, the bundle approach typically comprises the following:

1. Appropriate antimicrobial prophylaxis (choice, dose, and timing)
2. Appropriate hair removal (clippers, depilatory creams)
3. Maintenance of homeostasis perioperatively (glucose control, normothermia, oxygen requirements).

There are variations and additions, which may be type of surgery-dependent, centre/unit-specific, and/or resource-dependent. Many countries have developed national priority plans to address SSI. In the US the Surgical Care Improvement Project (SCIP) was introduced more than a decade ago. The aim of SCIP at its inception was to reduce SSI, venous-thromboembolism and cardiac events.

The primary components of the infection prevention bundle included appropriate antimicrobial prophylaxis (correct choice, administered within one hour of incision and discontinuation within 24 hours after surgery), appropriate hair removal, perioperative normothermia, removal of urinary catheters by the second postoperative day and well-controlled blood glucose in cardiac surgery patients. Similarly the United Kingdom introduced a high impact intervention care bundle based on a guideline for prevention of SSI developed by the National Institute for Health and Clinical Excellence (NICE).
A CAUTIONARY TALE OF EVIDENCE FOR REDUCTION IN HAI

Many individual studies have reported on the success of bundles for the prevention of SSI although the overall reduction in SSI rates has been less convincing if compared to rates of reduction for other HAIs. Furthermore there are numerous studies that do not report a benefit of bundles in reducing SSI rates and thus it remains hotly debated. There are multiple potential reasons for this and it is necessary to understand when interpreting data related to reduction in SSI rates. Firstly though, let’s consider the current data for reduction in SSI through use of bundles.

The initial aim of SCIP was to reduce surgical complications by 25% by the year 2010 and despite improvements it has largely fallen significantly short of expected targets. A comprehensive analysis of data from studies reporting on the SCIP demonstrates a cumulative 4% decrease in SSI and an 18% decrease in the odds of developing a SSI. A systematic review of 16 studies assessed the effect of care bundles on SSI among patients undergoing colorectal surgery. Amongst 8,515 patients the authors demonstrated a SSI rate of 7% when following a care bundle, compared to 15.1% in a baseline group.

The CDC reports a 17% reduction in abdominal hysterectomy SSI and a 2% reduction in colon surgery SSI between 2008 and 2014. These two types of surgery make for an interesting comparison as they fall on opposite ends of the spectrum in terms of risk of developing an SSI (colon surgery being high risk and abdominal hysterectomy medium to low risk).

Herein lie some of the confounding factors regarding prevention of SSI and the impact of care bundles – those of the host and the specific type/method of surgery. The former is a recognised contributor to SSI rates in the form of obesity, diabetes, smoking etc. and at present the generic approach of a one-size-fits-all SSI care bundle may not be sufficient for specific patient types. It is quite feasible that certain additional measures (to be added to an existing bundle) may be necessary for selected patients.
The latter factor accounts for the role of the surgical team and the intrinsic risk related to a particular type of surgery. Risk stratification is not routinely accounted for in the literature and thus constitutes a potential confounder.

A second major issue is that of compliance with care bundles. It is recognised that a care bundle is only as good as its implementation and this needs to be an all or nothing approach. Figure 1. illustrates the cumulative benefit from inclusion of all components of a bundle as opposed to one or just a few. The literature is often unable to fully quantify the level of compliance and it is largely accepted that lack of compliance may be a significant contributor towards the low rates of reduction in SSI rates.

**Figure 1. The SSI rate as a function of the number of bundle elements included for patients undergoing colorectal surgery (adapted from Waits et al)**

A third factor that influences the measurement of the impact of SSI bundles is that of surveillance methodology. Comprehensive surveillance of SSI is difficult and there are variations in methodology. These differences may be minor but may have a significant impact on SSI rates. This in turn would influence the measurable impact of care bundles, especially considering that most studies are not randomised controlled trials but cohort studies utilising historical controls.

The quality of surveillance in developed countries has improved with time and it is possible that benefits of care bundles are to some extent being diluted by improved case detection. Locally SSI rates are under-estimated with a reported rate of 3% from a single prevalence survey.
This rate is almost certainly inaccurate considering the reported rates from developed countries and that comprehensive post-discharge surveillance suggests that 10-20% of procedures are complicated by SSI\(^8\). The lack of a national surveillance system in South Africa compounds the problem as we are unaware of the true burden of disease and thus unable to assess the impact of interventions.

Perhaps one of the biggest potential confounders is the quality of the studies reporting on effects of SSI bundles and the ever-changing landscape of surgical medicine.

The meta-analysis by Munday et al on the impact of SCIP states, “how very seldom before and after results are provided for the reader” as their most salient finding\(^7\). It is apparent that the methods by which studies are conducted do not adequately address the complex interplay of various factors that impact on SSI. It would thus seem that the ability to measure the impact of various interventions on reducing SSI rates is fundamentally flawed and may account for much of the varied and inconsistent results.

**CONCLUSION**

The scourge of HAI is not one to be ignored and every effort to reduce rates must be made. Patient safety and quality of care is of paramount importance and it is these objectives that lie at the heart of care bundles. Prevention of SSI has relied heavily on the introduction of care bundles, which to date have shown modest effect in curtailing rates.

However this does not mean care bundles should be abandoned in surgical practice, but rather improved implementation and measures of surgical outcome are desperately needed. There can be little doubt that the introduction of a SSI care bundle contributes to improved quality of care. The challenge lies in demonstrating this in a reliable, reflective and comprehensive manner.
REFERENCES


