Original Article

“Best Case/Worst Case”: Training Surgeons to Use a Novel Communication Tool for High-Risk Acute Surgical Problems

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Abstract

Context. Older adults often have surgery in the months preceding death, which can initiate postoperative treatments inconsistent with end-of-life values. “Best Case/Worst Case” (BC/WC) is a communication tool designed to promote goal-concordant care during discussions about high-risk surgery.

Objective. The objective of this study was to evaluate a structured training program designed to teach surgeons how to use BC/WC.

Methods. Twenty-five surgeons from one tertiary care hospital completed a two-hour training session followed by individual coaching. We audio-recorded surgeons using BC/WC with standardized patients and 20 hospitalized patients. Hospitalized patients and their families participated in an open-ended interview 30 to 120 days after enrollment. We used a checklist of 11 BC/WC elements to measure tool fidelity and surgeons completed the Practitioner Opinion Survey to measure acceptability of the tool. We used qualitative analysis to evaluate variability in tool content and to characterize patient and family perceptions of the tool.

Results. Surgeons completed a median of 10 of 11 BC/WC elements with both standardized and hospitalized patients (range 5–11). We found moderate variability in presentation of treatment options and description of outcomes. Three months after training, 79% of surgeons reported BC/WC is better than their usual approach and 71% endorsed active use of BC/WC in clinical practice. Patients and families found that BC/WC established expectations, provided clarity, and facilitated deliberation.

Conclusions. Surgeons can learn to use BC/WC with older patients considering acute high-risk surgical interventions. Surgeons, patients, and family members endorse BC/WC as a strategy to support complex decision making.

Key Words
Acute care surgery, communication tool, palliative care, shared decision-making

Background

Older adults often undergo surgery in the months preceding death, which can lead to postoperative intensive care unit (ICU) admission and prolonged periods of recovery with progressive decline in functional status.1–6 Yet, most older people prefer care focused on the relief of symptoms rather than aggressive treatments including ICU care and hospitalization...
Despite widespread preference for symptom-focused care, the use of ICU services before death has increased over time. Preoperative communication between surgeons and frail older patients who face a decision about high-risk surgery is a modifiable contributor to the use of treatments that are discordant with patient preferences. Efforts to improve communication during the decision-making process could decrease unwanted burdensome treatments near the end of life.

For patients who develop life-threatening surgical conditions, preoperative decision making is complex. Given the life-altering consequences and substantial prognostic uncertainty, the “right” decision can only be reached by exploring each individual patient’s goals and values. Efforts to improve preference-sensitive medical decisions have focused on the concept of shared decision making and the development of disease-specific decision aids. Although decision aids can improve decision making for many medical choices, they are not applicable or available for in-the-moment treatment decisions for patients who face acute life-threatening illness.

To improve complex surgical decision making for older adults, we developed a novel communication tool called “Best Case/Worst Case” (BC/WC). Building on an established conceptual model of shared decision making and feedback from seniors and surgeons, we designed the BC/WC tool for in-the-moment, acute surgical decisions. Essential tool elements include depiction of two or more treatment choices, creation of a pen-and-paper graphic aid, use of narrative to tell a story about how the patient might experience the outcomes in the best and worst case scenarios, estimation about the most likely outcome, description of how the treatment option affects the larger context of the patient’s overall health, and providing a treatment recommendation at the conclusion of the discussion. During the conversation, the surgeon uses narrative to describe the best and worst possible outcomes of each treatment option and creates a graphic aid to illustrate the range and estimated probability of each outcome to leave with the patient and family for future deliberation (Fig. 1).

![Fig. 1. Example of graphic aid component of BC/WC tool for a patient with a life-threatening surgical condition. The star represents the best-case scenario, the box represents the worst-case scenario, and the oval designates the most likely outcome. The location of the oval indicates whether the most likely scenario is more similar to the best case or the worst case. Adapted with permission from Reference 13.](image-url)
establishing that the patient has a choice between two treatment options. Seniors endorsed BC/WC because it provides an opportunity for patients to consider and incorporate personal values and goals when making a complex medical decision.

Whether surgeons can learn to use this tool for routine clinical practice is unknown. We designed a single-center pilot study to evaluate a two-hour training program designed to teach surgeons to use BC/WC in a clinical setting. The aims of this study were to demonstrate feasibility of surgeon training, evaluate fidelity and variability in the use of BC/WC by surgeons, and assess the acceptability and perceptions of the BC/WC communication tool among surgeons, patients, and families.

Methods
Training Program Design
To accommodate the needs of adult learners, we modeled our training session on Kolb’s cycle of experiential learning, which requires learning new skills through practice. After an educational experience, learners benefit from time for reflection to formulate a conceptual understanding about what occurred. The learner can use this information to plan for the next experience, modifying behavior to move toward a specified goal. We also adapted Ericsson’s work in deliberate practice and individual coaching framework, to provide ongoing challenge through an expert coach to ensure steady progression to expertise. We developed a two-hour training session to provide experience, followed by explicit time for reflection with a coach, and a repeat experience to apply newly learned skills. Our coaches were experts in the fields of palliative care, patient-physician communication, and adult education.

Study Design and Participants
We invited all attending surgeons who practice acute care general, cardiothoracic, or vascular surgery at the University of Wisconsin to participate. Each enrolled surgeon completed a two-hour training session scheduled at his/her convenience. Training included a 15-minute lecture highlighting the essential tool elements followed by demonstration with a standardized patient. After the didactic component, each surgeon practiced using the BC/WC tool with two standardized patients in two different specialty-specific simulated cases (Supplementary Materials 1). A coach observed each case and provided real-time, one-on-one feedback to the surgeon throughout and on completion of the first conversation. The surgeon then used BC/WC in a second case without interruption; we audio-recorded and transcribed verbatim this conversation and collected all graphic aids. Within two months of the training session, coaches met with surgeons individually to address questions and encourage utilization.

To measure surgeon’s ability to use the tool in a clinical setting, we screened hospitalized patients cared for by trained surgeons. We contacted the patient’s surgeon before enrollment to ensure the surgeon was offering a choice between at least two treatment options. We included patients 65 years of age and older facing a decision between an operation and a less invasive alternative (e.g., minor surgery, medical management or supportive/palliative care) who were at high risk for surgical complications. To determine high risk, we screened patients for multimorbidity and confirmed with the treating team that the patient was frail, based on a composite clinical assessment including reduced functional status, recent falls, and weight loss. We included patients without decision-making capacity if a surrogate was present to participate. We excluded patients and surrogates who did not speak English or had severe hearing impairment. We audio-recorded and transcribed verbatim the decision-making conversation between the surgeon and the patient and retained a copy of the graphic aid. The University of Wisconsin Health Sciences Institutional Review Board approved this protocol.

Measurement of BC/WC Fidelity
To evaluate surgeons’ use and fidelity to the BC/WC tool, we scored transcripts of the final standardized patient conversations and each inpatient conversation based on 11 tool elements (Supplementary Materials 2). Two reviewers (J. K., L. T.) used an 11-point checklist to independently score each transcript and the associated graphic aid, assigning one point per element performed by the surgeon. Cohen’s kappa coefficient was 0.74, demonstrating substantial rater agreement. To equally weigh each reviewer’s assessment, we averaged the two total scores and present this as final score for each conversation.

Analysis of Content Variability
BC/WC is a framework that structures the conversation between surgeon and patient and requires the use of narrative to describe outcomes. As such, the content of the decision-making conversation is dependent on the surgeon’s interpretation of the relevant evidence within the context of the patients’ overall health. We sought to measure the variability of clinical information presented to standardized patients when different surgeons were faced with the same hypothetical scenario. To evaluate variability between surgeons, four investigators (J. K., L.T., J.T., M.S.) independently reviewed the transcripts and graphic aids for 13 BC/WC standardized patient conversations (nine general surgeons describing treatment of an anastomotic leak and four vascular surgeons discussing treatment...
of limb ischemia with gangrene). We used inductive qualitative analysis\textsuperscript{22} to identify key domains of variability within the clinical content presented by the surgeons. We then used comparative qualitative analysis\textsuperscript{22} to evaluate and describe variability between surgeons facing identical, simulated clinical scenarios.

**Surgeon Evaluation of BC/WC**

We administered a measure of decision aid acceptability to each surgeon participant at three and six months after the training session. We used a modified version of the Practitioner Opinion Survey\textsuperscript{22} to determine if surgeons were actively using BC/WC in clinical practice and to measure surgeons' perceptions of time required for BC/WC use, ease of use, and benefit of BC/WC compared with usual care. We used descriptive statistics to summarize survey results and the Student t-test to compare responses between three and six months, and we defined a two-tailed \( P \)-value <0.05 as statistically significant.

**Patient and Family Evaluation of BC/WC**

We contacted all enrolled, hospitalized patients or family members between 30 and 120 days after the BC/WC decision-making conversation to participate in an open-ended face-to-face interview. We scheduled interviews at least 30 days after the BC/WC decision-making conversation to account for the prolonged hospitalization and recovery that older, frail patients with serious illness typically face and to respect the families of patients who died. To limit problems with recall, we conducted all interviews no more than 120 days after the BC/WC conversation. The interview guide was developed and iteratively revised by the multidisciplinary team of study investigators. The open-ended questions were designed to elicit patient or surrogate perspectives about the decision-making process, whether the treatment decision was concordant with the patient's values, the impact of best- and worst-case language and the graphic aid, and the acceptability of study participation. We audio-recorded and transcribed these conversations verbatim and used inductive qualitative analysis to characterize patients' and families' perceptions of BC/WC.

**Results**

**Participant Characteristics**

Twenty-five surgeons attended a training session. Twenty-nine of 30 eligible surgeons enrolled in the study, but four (14\%) were unable to attend a training session due to schedule conflicts (Fig. 2). One surgeon left the training session early due to a clinical conflict and did not complete the final evaluation simulated case. Seven surgeons (28\%) rescheduled the training session at least once (one to four rescheduled sessions). Surgeon and patient characteristics are described in Table 1. Surgeons were predominantly men (84\%) and had been in practice for a median of nine years. After completing training, 19 surgeons (76\%) participated in one individualized follow-up meeting with a coach. We were able to enroll at least one patient for 12 of the trained surgeons. The range of hospitalized patients enrolled per trained surgeon was 0–3. Sixty-five percent of patients were women. Patients had a range of acute surgical problems; bowel obstruction was the most common condition (35\%). Follow-up interviews with patients or family members took place a median of 90 days after the BC/WC decision-making conversation.

**BC/WC Tool Fidelity**

During training, surgeons completed a median 10 of 11 tool elements (range 5–11) in the second simulated case. All surgeons presented two distinct treatment options and successfully described the best and worst cases for each treatment. The BC/WC element surgeons most commonly omitted in simulation was “make a recommendation” for a specific treatment option after learning the patient's preferences, which surgeons performed in only 55\% of training conversations. When using BC/WC in clinical practice with hospitalized older adults, trained surgeons continued to achieve a median of 10 of 11 tool elements (range 7–11). Surgeons presented both a best and worst case for two distinct treatment options in 92\% of conversations with hospitalized patients yet failed to make a clear treatment recommendation in 61\% of conversations (Supplementary Table 1).

When presented with the same simulated clinical case, surgeons used similar narratives to describe the best- and worst-case outcomes for each treatment option. For the “worst-case” scenario of operative intervention during simulated cases, almost every surgeon discussed the risk of ICU admission and use of life support preceding death. When explaining the “best case” and “worst case” of nonsurgical supportive care, one surgeon said:

The best case is he would die but he’d live a few weeks at home. We wouldn’t do any of those procedures on him. There would be no risk of that. I think we’d be able to keep him comfortable [...]. And the worst case is that this infection, this, we can’t suppress it, and he dies more quickly. He dies in a matter of days. We certainly can keep him comfortable, but if he never recovers enough to be conscious to speak to, I think that might be the worst case that you would see.

Another surgeon discussing nonsurgical supportive care with the same simulated patient described very similar best and worst cases:

[...] we can make him pain free, and he may come home, and he may at least have, you know a lot
more days where he can spend with his family, and have his good byes [...] the worst case scenario [is] that things may progress quickly, and he may die from this, you know, within a few days.

However, many surgeons struggled to provide an explicit treatment recommendation, an essential element of BC/WC. These surgeons resisted coaching during this component of the simulated cases, stating:

But I usually don’t like to make my recommendation because [...] I think if a physician makes a recommendation [...] I feel it’s kind of manipulating because so I feel my job is to provide all the accurate information, [...] then I think the decision, yes or no, needs to be made by the patient and family.

Another surgeon expressed a similar concern, “I never like to tell anyone what they should do. I can tell them what I can do, and what the outcomes from that can be, but I never want to, I want them to make this, [...] it’s their choice.” This was not a stumbling point for all surgeons. Here a different surgeon spontaneously provided a preference-sensitive recommendation in simulation:

So while I can’t ultimately make the decision for you, I can certainly try to help you through it, and perhaps give you my thoughts on this [...]. I think the problem here, as I see it, is if her ultimate goal would be to live independent, and we really can’t achieve that, then perhaps the kindest thing to do might be just to help her onto the next stage of life comfortably. And just sort of keep her comfortable, and let her die with her dignity.

Content Variability

We identified two major domains of variability between surgeons using BC/WC for the same hypothetical patient: the technical strategy for treatment and the style of narrative detail. Surgeons offered a range of treatment options when faced with an identical, hypothetical case. For the same 75-year-old patient with new-onset limb ischemia and gangrene with a history of stroke who was dependent on his daughter for all activities of daily living, we identified three distinct surgical options and two distinct nonsurgical options offered by four vascular surgeons. Surgeons offered below-knee amputation, above-knee amputation, or vascular bypass with toe amputation. Surgeons offered two different nonsurgical options: either supportive medical care with antibiotics and pain medication or supportive medical care focusing on comfort alone.

We observed more consistency among general surgeons caring for a hypothetical, frail 82-year-old woman with heart failure who developed a small intestinal anastomotic leak. Nine general surgeons offered one of two distinct surgical options offered by four vascular surgeons. Surgeons offered below-knee amputation, above-knee amputation, or vascular bypass with toe amputation. Surgeons offered two different nonsurgical options: either supportive medical care with antibiotics and pain medication or supportive medical care focusing on comfort alone.
Table 1  
Participant Characteristics  
\[ n (\%) \]

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<thead>
<tr>
<th>Surgeon characteristics ((n = 25))</th>
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<td>(12)</td>
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<tr>
<td>Thoracic</td>
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<td>(12)</td>
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<td>(10)</td>
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<td>White</td>
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<td>(95)</td>
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<td>Surgical condition</td>
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<tr>
<td>Bowel obstruction</td>
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<td>(70)</td>
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<tr>
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<td>(15)</td>
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<tr>
<td>Fracture or other trauma</td>
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<td>(10)</td>
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<th>Follow-up interview participant characteristics ((n = 14))</th>
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<td>Interview participant</td>
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<td>Patient and adult child</td>
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<tr>
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<td>(50)</td>
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<tr>
<td>Spouse only</td>
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<td>(7)</td>
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<tr>
<td>Niece only</td>
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<td>(7)</td>
</tr>
<tr>
<td>Time to interview, median (range), days</td>
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<td>(49–119)</td>
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</table>

BC/WC = Best Case/Worst Case.  
*Time from use of BC/WC in hospital to follow-up interview.

Three months after training, 96% of surgeons respondents reported that BC/WC is easy to use, 79% felt that the BC/WC tool is better than their usual approach for helping patients make decisions, and 71% reported actively using BC/WC in clinical practice outside the scope of the research study. However, only 38% of surgeons believed BC/WC saved time (Fig. 3). Surgeon responses were sustained at six months.

**Patient and Family Evaluation of BC/WC**

We identified three important functions of the BC/WC framework during patient and family follow-up interviews (Table 2). First, patients and families reported that surgeons who used BC/WC clearly defined treatment choices and encouraged comparison between the two treatments. Second, by showing the range of possible outcomes, surgeons established expectations and helped patients and families prepare for possible adverse events. Finally, patients and families valued the graphic aid as a tangible reference to facilitate future deliberation and inform family members who were not present for the discussion. Several patients and family members had saved the graphic aid months after hospitalization and reproduced the diagram at the follow-up interview without prompting.

**Discussion**

Surgeons can learn to use BC/WC with high fidelity in clinical practice after completing a two-hour structured training and individualized coaching program. In addition, surgeons found that BC/WC is easy to use and is an improvement on usual care; most trained surgeons reported adopting BC/WC into their clinical practice. After a decision-making conversation with trained surgeons, patients and their family members praised their surgeon for providing clarity about treatment options and establishing expectations. Although surgeons can readily learn and adopt the framework of BC/WC to present similar outcome narratives to patients and families, we identified modest variability in treatment choices and narrative details between individual surgeons. It is notable that surgeons reported discomfort providing a specific treatment recommendation as it conflicted with their understanding about how to support patient autonomy. This was reflected in their clinical use of the tool as less than half provided a treatment recommendation for hospitalized patients.

We have previously shown that seniors and surgeons approve of BC/WC in a hypothetical setting,15 and this study demonstrates the feasibility and acceptability of implementing BC/WC into clinical practice with a structured training program for academic surgeons. Furthermore, BC/WC is valued and embraced by surgeons, a crucial component of sustainable adoption. Because our training program included

wound care, and parenteral nutrition. One outlier offered comfort-focused care without ICU admission.

We also identified variability in the details surgeons chose to describe clinical outcomes. Some surgeons focused on specific medical and technical elements for each possible scenario; they described ICU admission, mechanical ventilation, wound care, nutrition, and antibiotics. For example, one surgeon described a best case scenario with technical details by saying, “we would control the output of her intestines to that fistula with wound care, which would require a plastic bag and pieces, and it would have to be changed.” In contrast, other surgeons emphasized patient-focused outcomes including the ability to eat or drink, return home, interact with family, or control pain. One surgeon described the best case by saying, “she still probably wouldn’t be able to eat or drink. She would still probably be in a long-term care facility [ . . . .] and still, probably because of all of her other medical problems and issues, probably dying from this within a couple of months.”

**Surgeon Evaluation of BC/WC**

Twenty-four (96%) of the trained surgeons completed the Practitioner Opinion Survey at three and six months.
reproducible elements based on seminal theories of adult education,\textsuperscript{19,20} we posit these methods can be applied on a larger scale to facilitate widespread, high-fidelity implementation of BC/WC.

We did observe variability between surgeons in our study as several surgeons offered different treatment options for the same simulated clinical case. Despite the variability in treatment approach, the narratives surgeons used to describe outcomes remained similar, suggesting a general consensus from surgeons about treatment outcomes even with different surgical interventions. This variation is similar to variation currently observed in clinical practice. Surgeons often vary widely in their quantitative risk assessment\textsuperscript{24} or judgment about surgical indications,\textsuperscript{25} yet striving to provide precise, numerical risk estimation may be unnecessary or even misleading to patients.\textsuperscript{26} Furthermore, in high-risk clinical scenarios, precise risk predictions and high-quality evidence are often lacking or difficult to extrapolate.\textsuperscript{26} Instead of reliance on risk prediction, BC/WC uses an alternate strategy, providing a framework for patients and families that describes composite estimates about what is likely to happen and creating boundaries around what is possible. Patients and families in our study used BC/WC to visualize and prepare for treatment outcomes, suggesting their communication needs were met by the BC/WC strategy.

The BC/WC element most frequently omitted by surgeons was “provide a treatment recommendation.” During standardized patient sessions, several surgeons explained their rationale; they believed their recommendation would violate patient autonomy. The misperception that physician recommendations compromise patient autonomy is not novel and is well described.\textsuperscript{27,28} Yet, consistent with the goals of shared decision making, the BC/WC tool includes a physician recommendation that integrates patient preferences with the relevant therapeutic possibilities. This strategy is designed to respect and enhance, not violate, patient autonomy.\textsuperscript{27} Although some surgeons easily incorporated patient preferences into treatment recommendations, our two-hour training session was not able to overcome deep-rooted cultural notions that many attending surgeons have about autonomy and surgical decision making. We have targeted this issue as we make improvements to our training program, but we suspect this will be a difficult challenge to overcome given current practice patterns and widespread physician beliefs.\textsuperscript{29}

Our findings are important for physicians and researchers who aim to improve shared decision making for other high-stakes, complex medical decisions beyond surgery. BC/WC is distinct from typical decision aids that provide standardized content and numeric representation of risks\textsuperscript{30} because it allows physicians to personalize the tool to accommodate the relevant clinical features of each patient’s decision. In addition, BC/WC requires only pen and paper, so it is readily available for acute clinical scenarios and face-to-face conversations between patients, families and physicians. The surgeons in this study found BC/WC easy to use, and the flexibility and accessibility of BC/WC may overcome...

Fig. 3. Practitioner Opinion Survey results at three and six months. “*” Indicates percent of surgeons who agreed or strongly agreed with statement. “Ɨ” Indicates percent of surgeons who responded “yes.” There were no significant differences between surgeon responses at three and six months (P-value > 0.05).
barriers to routine decision aid use for other physicians from different specialties such as critical care, palliative care, and oncology who often treat patients with similar levels of complexity and acuity. This study has several important limitations. We relied on local experts to conduct the didactic sessions and one-on-one coaching, which is resource intensive. In addition, surgeons canceled and rescheduled multiple training and coaching sessions due to patient care and operating room conflicts, highlighting the burdens of a structured training curriculum for busy clinicians. To address these barriers, we have developed an instructional video (https://www.youtube.com/watch?v=FnsS3K44sBu0) linked to a training program to improve the scalability of this intervention. Future evaluation of a revised, lower-resource implementation package is required to determine its effect. Given the challenges of conducting clinical research with frail, hospitalized older patients, we were only able to enroll hospitalized patients for 12 of the 25 trained surgeons, and so our findings may not reflect the range of surgeon practice after BC/WC training. Lastly, patient and family interviews were held between 30 and 120 days after the BC/WC intervention to facilitate collection of perspectives that incorporated longer term patient outcomes and to respect the families of patients who died. However, the delay between the use of the BC/WC tool during a decision-making conversation and the interview may have affected the accuracy or completeness of the patients’ and families’ recall of events.

Conclusions

Academic surgeons can use the BC/WC communication tool in clinical practice with high fidelity after completing a structured training program. Surgeons, patients, and family members endorse the BC/WC tool as a method to support complex decision making, but further investigation is required to determine the effect of BC/WC on clinical outcomes.

Acknowledgments

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References


Supplementary Materials 1

Specialty-Specific Simulated Case Scenarios Used in Training Sessions

**Vascular Case #1: Abdominal Aortic Aneurysm**

Mrs. Rodgers is an 87-year-old woman with chronic kidney disease Stage 3, admitted to the ICU after sudden onset of severe, abdominal pain radiating into her back this morning (about six hours before evaluation). She is independent in her daily activities.

Medical history: Hypertension, chronic kidney disease Stage 3, peptic ulcer disease, abdominal aortic aneurysm, no previous surgeries.

Physical exam: Blood pressure 115/86, pulse 73, respiratory rate: 18.
Alert, awake, conversant.
Abdomen—soft, mildly tender.
CT scan: 7.9 cm abdominal aortic aneurysm with aneurysmal dilatation involving the visceral segment which is dilated to 4 cm confluent through to the infrarenal neck, no evidence for rupture; comparison CT: 18 months before AAA was ~4.8 cm.

Physician instructions: You are about to meet with Mrs. Rodgers to discuss treatment options. You have met her in clinic previously. Your fellow has already given her the news about her CT scan results and the fact that you were going to speak with her regarding treatment options soon. The focus of this conversation should be on discussing treatment options and the decision-making process.

**Vascular Case # 2: Limb Ischemia and Gangrene**

Mr. Starr is a 75-year-old man with critical limb ischemia and wet gangrene on left D1-5. Previous below knee amputation on right leg, left-sided hemiparesis from cerebrovascular accident, current smoker, lives at home with his daughter, but is fully dependent on her for all activities of daily living currently. Developed waxing and waning delirium in hospital.

Physical exam: Elderly man, frail appearing, alert but not oriented.
Large, tender left D1 ulceration with smaller ulcerations between each toe, malodorous, has only palpable femoral pulse.
CT scan: Long-segment occlusion from distal superficial femoral artery to peroneal artery as the only runoff.
Previous hospital course: Revascularization attempted percutaneously, unsuccessful, no other endovascular options, vein mapping shows adequate vein for bypass.

Physician instructions: You are about to meet with Mr. Starr’s daughter to discuss treatment options, given she is his designated health care power of attorney and he has altered mental status. You have met with her daily since her father’s admission. Your team has already given her the news about her father’s CT scan results and told her that you were going to speak with her regarding possible treatments. The focus of this conversation should be on discussing treatment options and the decision-making process.

**General Surgery Case #1: Small Bowel Obstruction**

Mrs. Rodgers is an 83-year-old woman with multiple comorbidities including previous stroke, pulmonary embolism six months ago on warfarin, and S/P coronary artery bypass grafting five years ago. Lives at retirement home and somewhat dependent on family and visiting nurses because of weakness related to stroke.

She underwent left hemicolectomy for ischemic colitis eight years ago and then developed a large midline incisional hernia, which was repaired with mesh two years ago. Two days ago, she presented with nausea and abdominal pain at a recurrent ventral hernia site and was found to have partial small bowel obstruction with a transition point at the hernia on CT scan.

She has had conservative management of small bowel obstruction for three to four days without return of bowel function.

Examination: Distended, hernia larger than usual per patient, not reducible, tender around hernia site. Heart rate: 80, blood pressure: 145/60.
White blood cell count: 11.5.
Physician instructions: You are about to meet with Mrs. Rodgers to discuss treatment options. You have met with her daily since her admission. Your team has already given her the news that her bowel function is not improving and that you were going to speak with her regarding possible treatments. The focus of this conversation should be on the treatment options and the decision-making process.

**General Surgery Case #2: Gastro-ileal Fistula Repair**

Mrs. Starr is an 82-year-old woman who is postoperative Day #3 after ex lap reduction of midgut volvulus and primary repair of gastro-ileal fistula who developed bilious output from her wound early this morning.

MedHx: New York Heart Association Class III heart failure with ejection fraction of 30%, osteoporosis, recently discharged from a skilled nursing facility where she recovered from a recent laparoscopic graham patch, uses a walker, and wheelchair to get around but has lost a lot of her functional ability over the past three months.

PSurgHx: Open right hemicolectomy (eight years before) for cecal volvulus and laparoscopic graham patch for prepyloric peptic ulcer disease (four months before) complicated by wound infection and severe esophagitis/gastrointestinal bleed requiring blood transfusion.

Physical exam: Intubated/sedated, minimal abdominal tenderness, frank bile from wound, normotensive, heart rate 86.

Physician instructions: You are about to meet with Mrs. Starr’s daughter to discuss treatment options, given she is her designated health care power of attorney, and she has altered mental status. You have met with her daily since her mother’s admission. Your team has already given her the news about this complication and told her that you were going to speak with her regarding possible treatments. The focus of this conversation should be on discussing treatment options and the decision-making process.

**Thoracic Case #1: Hiatal Hernia**

Mrs. Starr is an 83-year-old woman with moderate-severe dementia who presented to the hospital today with about one month of intermittent vomiting and now with incomplete food intolerance over the last 24 hours according to her sister. No known medical history aside from moderate-severe dementia, her sister reports that she “does not see doctors.”

Patient is awake and states she has no pain, her abdomen is soft, and nontender.

CT scan shows massive Type IV hiatal hernia with entire stomach and transverse colon hernia into mediastinum and right chest.

An NG tube was placed under fluoroscopy with adequate reduction of stomach, you are consulted for laparoscopic reduction of hernia.

Physician instructions: You are about to meet with Mrs. Starr’s husband, Mr. Starr, to discuss treatment options (he is her designated health care power of attorney and the patient cannot make decisions on her own). You have met with her husband this morning briefly, but he asked to delay the conversation until this afternoon. Your team has already given him the news about this complication and told her that you were going to speak with her regarding possible treatments. The focus of this conversation should be on discussing treatment options and the decision-making process.

**Thoracic Case #2: Esophageal Perforation**

Mrs. White is a 79-year-old woman with severe vomiting and retching and now several hours of severe chest pain. Esophageal perforation seen on esophagram. She lives in a skilled nursing facility, she is cognitively intact, but needs help with nearly all activities of daily living.

PMedHx: HTN, gastroparesis from diabetes mellitus Type II, morbid obesity, previous pulmonary embolism, on warfarin.

Physical exam: Intubated/sedated, blood pressure 82/48 on norepinephrine and vasopressin, pulse 122, SpO₂—92%.

Chest x-ray: Large right hydropneumothorax.

The patient was intubated in the ER for severe sepsis and admitted to the ICU and is currently sedated.

Physician instructions: You are about to meet with Mrs. White’s daughter, Ms. White, to discuss treatment options, she is the designated health care power of attorney. You have met with the daughter briefly when her mother was in the ER. Your team has already given her the news about her mother’s esophageal perforation and current clinical situation. They told her that you were going to speak with her regarding possible treatments for the esophageal perforation. The focus of this conversation should be on discussing treatment options and the decision-making process.
Cardiac Case #1: Severe Aortic Stenosis

Mr. Rodgers is an 83-year-old man with severe aortic stenosis with New York Heart Association Class III heart failure with ejection fraction 35%, moderate COPD (not on home O₂) without previous chest surgery, and recently admitted to the hospital for dyspnea on exertion and presyncopal symptoms. He has undergone full pre-operative evaluation for transcatheter aortic valve replacement and does not have appropriate vascular access for a transfemoral approach, his CT chest shows favorable aortic annulus, and coronary angiography shows mild CAD disease. His calculated Society of Thoracic Surgery mortality score is 5.6%. You are asked by the medical team for consultation about aortic valve replacement.

Physician instructions: You are about to meet with Mr. Rodgers to discuss options for his aortic stenosis. You did meet him briefly this morning, but he asked to delay the conversation until this afternoon. The medical team has already given him the news about his severe aortic stenosis causing his current symptoms. The focus of this conversation should be on discussing treatment options and the decision-making process.

Cardiac Case #2: Native Valve Endocarditis

Mrs. Starr is a 79-year-old woman a history of mitral regurgitation is hospitalized for fevers. She has end-stage renal disease and receives hemodialysis, had a stroke six months before, and is confined to a wheelchair. She underwent dental scaling one month earlier. She notes recent intermittent fevers and weight loss. On cardiac examination, her regurgitation murmur appears to be unchanged. A transthoracic echocardiogram shows a mobile, 10 mm mitral-valve vegetation and severe mitral regurgitation. Transesophageal echocardiogram confirms a paravalvular abscess. Blood cultures revealed *Staphylococcus aureus* and the cardiology team just emergently placed a temporary transvenous pacemaker for new-onset complete heart block. You are consulted for urgent mitral valve replacement.

Physician instructions: You are about to meet with Mrs. Starr’s daughter to discuss treatment options, given she is her designated health care power of attorney and the patient cannot make decisions on her own due to altered mental status. You did meet the patient and her daughter earlier today. The cardiology team has already told the daughter about her endocarditis, abscess, valve dysfunction, and heart block needing the pacemaker. They also told her that you were going to speak with her regarding possible heart valve surgery. The focus of this conversation should be on discussing treatment options and the decision-making process.

Cardiac Case #3: Multivessel Coronary Artery Disease

Mr. Rodgers is an 82-year-old man with poorly controlled diabetes mellitus, 150-pack-year smoking history with moderate COPD who presented to the ED with chest pain, relieved with medication, and no significant electrocardiographic changes. Cardiac catheterization reveals three-vessel disease with good targets. Lives at home but has seemed increasingly frail with weight loss. Had transthoracic echocardiogram, which showed no valve abnormalities, ejection fraction 40%.

Physician instructions: You are about to meet with Mr. Rodgers’ daughter to discuss treatment options, given she is his designated health care power of attorney and the patient cannot make decisions on his own. You met him and his daughter before his transthoracic echocardiogram results. The cardiology team has already given her the news about the catheterization and echocardiogram results. They told her that you were going to speak with her regarding possible treatments for her father. The focus of this conversation should be on discussing treatment options and the decision-making process.
Supplementary Materials 2. Reviewer scoring system for the 11 essential BC/WC tool elements.
## Supplementary Table 1
Percentage of Surgeons Who Performed Each Element of BC/WC

<table>
<thead>
<tr>
<th>BC/WC Element</th>
<th>Simulated Patient Conversations (%)</th>
<th>Hospitalized Patient Conversations (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best case: Treatment Option 1</td>
<td>100</td>
<td>97</td>
</tr>
<tr>
<td>Most likely: Treatment Option 1</td>
<td>89</td>
<td>92</td>
</tr>
<tr>
<td>Worst case: Treatment Option 1</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Best case: Treatment Option 2</td>
<td>100</td>
<td>94</td>
</tr>
<tr>
<td>Most likely: Treatment Option 2</td>
<td>84</td>
<td>89</td>
</tr>
<tr>
<td>Worst case: Treatment Option 2</td>
<td>100</td>
<td>94</td>
</tr>
<tr>
<td>Written diagram complete with patient-friendly terminology</td>
<td>59</td>
<td>83</td>
</tr>
<tr>
<td>Used narrative when describing cases</td>
<td>93</td>
<td>97</td>
</tr>
<tr>
<td>Included patient’s chronic medical conditions in discussion</td>
<td>75</td>
<td>89</td>
</tr>
<tr>
<td>Used questions or phrases to encourage deliberation</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>Made a recommendation</td>
<td>55</td>
<td>39</td>
</tr>
</tbody>
</table>