

Global Scaling of a Surgical Infection Prevention Program to 5 Low-Resource Countries

Writing Group for the Clean Cut Investigators Group

 [Supplemental content](#)

IMPORTANCE Surgical site infections (SSI) are a leading cause of morbidity and mortality from surgery, with higher rates in low- and middle-income countries (LMICs). Clean Cut is a multimodal, adaptive quality improvement program that aims to reduce SSI by improving compliance with perioperative infection prevention standards. The program has been successfully implemented in Ethiopia at 12 hospitals with an associated 35% reduction in SSI.

OBJECTIVE To assess whether this surgical infection prevention program implemented in Ethiopia can be effectively scaled to a variety of geographical and socioeconomic settings.

DESIGN, SETTING, AND PARTICIPANTS This cohort study was a quasi-experimental study of a surgical infection prevention program that was implemented in 1 hospital in each of 5 low-income countries (Liberia, Madagascar, Malawi, India, and Bolivia) from 2021 to 2024. Program introduction and scale-up relied on knowledge transfer from clinicians who had successfully implemented the same program in Ethiopia to build local expertise in each new setting. Participants were patients undergoing surgery who were followed up from their initial operation through discharge and for 30 days postoperatively using follow-up phone calls.

EXPOSURE Implementation of a surgical infection prevention program.

MAIN OUTCOMES AND MEASURES The primary outcome was 30-day SSI rate. Secondary outcomes include compliance with infection prevention standards, death, reoperation, and length of stay.

RESULTS Prospective data were collected for 1865 patients (mean [SD] age, 31.6 [17.5] years; 980 [52.5%] female and 885 [47.5%] male), 478 from the baseline period and 1387 from the intervention period. Thirty-day SSI rates were reduced from 28.4% to 12.1% (difference, 16.3%; 95% CI, 12.0%-20.6%; relative risk, 0.51; 95% CI, 0.38-0.67; $P < .001$). There were also significant improvements in use of the World Health Organization Surgical Safety Checklist, hand and skin antisepsis, antibiotic administration, instrument reprocessing, sterile field maintenance, and gauze counting.

CONCLUSIONS AND RELEVANCE A surgical infection prevention program previously validated in Ethiopia was successful in reducing SSI in 5 LMIC hospitals in 5 other countries. This study demonstrated the scalability and efficacy of this program in preventing SSI across a range of settings. This study also demonstrates a mechanism for scaling the program expertise needed to improve compliance with standards, a step that is crucial to wider implementation.

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Surgical site infections (SSI) are a major cause of morbidity and mortality after surgery, with the highest burden in low- and middle-income countries (LMICs).^{1,2} Patients are more likely to develop SSI after gastrointestinal surgery if they undergo surgery in low and medium Human Development Index settings, with rates of 23% and 14%, respectively, compared with 9% in high-Human Development Index settings.³ Infection prevention and control (IPC) practices have been recommended by the World Health Organization to prevent SSI, but adherence is challenging where resources are limited.³⁻⁶ The Clean Cut program is a quality improvement program developed by the nonprofit organization Lifebox⁷ to reduce SSI by improving compliance with 6 areas of perioperative infection prevention: (1) use of the World Health Organization Surgical Safety Checklist, (2) hand and skin antisepsis, (3) instrument sterility, (4) sterile field maintenance, (5) antibiotic administration, and (6) gauze counting.⁸ In its pilot, Clean Cut improved compliance with infection prevention standards and resulted in a 35% risk reduction in SSI.⁹ Implementation was then streamlined by reducing external support and developing an implementation manual and training materials on the Surgical Safety Checklist,¹⁰ surgical instrument reprocessing, and IPC practices¹¹ but maintained similar SSI reduction.¹² Lasting improvements were noted 6 to 18 months after program completion.¹³

Throughout the program's development and implementation in Ethiopia from 2016 to 2021, Ethiopian clinicians gained familiarity with the program, increasing the capacity to deliver training and provide formal and informal mentorship to clinicians introducing the same surgical infection prevention program to their hospitals, ultimately building an experienced cohort of implementers in Ethiopia. In 2021, the program was scaled outside Ethiopia. This presented challenges: there is resource variability among LMICs,¹⁴ and program expertise was concentrated in Ethiopia. This study evaluates the effectiveness of this surgical infection prevention program in 5 hospitals, 1 each in Liberia, Madagascar, Malawi, India, and Bolivia, to reduce SSI through a peer-to-peer implementation approach using core team members from the Ethiopia "hub."

Methods

Study Design

This study is a prospective quasi-experimental study of a surgical infection prevention program in low-resource settings using a pre-post design. It was reported in accordance with the Standards for Quality Improvement Reporting Excellence (SQUIRE) reporting guideline. As this is a quality improvement intervention in which the standards being implemented are not in question, ethical approval is typically not required.¹⁵ Because this was based in low-income countries where there may be additional ethical concerns, the need for ethical approval from local institutional review boards was deferred to the ethics committee at each individual hospital; in each case, hospital ethics committees waived the need to obtain approval from the institutional review board.

Key Points

Question Can a previously validated quality improvement program shown to be effective in preventing surgical infections in Ethiopia be scaled to other low-income settings through the training of local teams by experienced implementers from Ethiopia?

Findings This cohort study shows that the surgical infection prevention quality improvement program was implemented in 5 countries, including 1865 patients, and demonstrated that it could significantly improve compliance with infection prevention standards with an associated 49% relative risk reduction in surgical site infections.

Meaning The surgical infection prevention program can be effectively scaled to a variety of low-resource settings with similar reduction in surgical infections.

Population

Each hospital designated specific operating rooms for data collection; data were collected for any operation occurring in that operating room regardless of time of day, age, or gender of the patient. Patients undergoing surgery in designated operating rooms were enrolled preoperatively. No patients were excluded.

Data Collection

Data were collected by trained personnel in the operating room, on the ward, and using 30-day follow-up telephone calls.¹⁶ Patients without documented comorbidities were assumed not to have them. Data collectors were not blinded. Operating room data collectors were asked to record intraoperative behaviors associated with compliance with each of the 6 IPC standards; behaviors were intended to be discrete to reduce interpretation and minimize bias (eTable 1 in Supplement 1). Teams were considered compliant only if they demonstrated 100% completion of each aspect of that standard. Data collectors followed clinical outcomes on the ward until discharge through medical record review and wound inspection to identify patients with wound dehiscence, pus draining from their wound, or other documented diagnoses of SSI. Data collectors also documented reoperation, mortality, or other complications. Phone follow-up was conducted at 30 days postoperatively using a tool that focused on easily identifiable signs of wound infection such as wound dehiscence or pus draining.¹⁶

Sample Size and Settings

Power calculations were based on our team's prior experience in Ethiopia. The α was set to .05, and power was set to 80%. We anticipated requiring 1315 patients to detect a 35% risk reduction in SSI assuming a baseline infection rate of 20% and a ratio of 4 patients in the intervention group for every patient in the baseline group.

The surgical infection prevention program was implemented at 1 hospital in Liberia, Madagascar, Malawi, India, and Bolivia from 2021 to 2024. All 5 were referral centers. Site selection was based on a combination of factors, including interest in implementing, partnerships with Lifebox, and the availability of funding.

Intervention

The surgical infection prevention program was designed to be implemented over 6 months in 5 phases: (1) creation of a multidisciplinary team, (2) baseline data collection and process mapping,¹⁵ (3) development of an action plan, followed by targeted training, (4) continuous improvement with monthly action planning as part of plan-do-study-act cycles, and (5) development of a sustainability plan to maintain changes going forward (eTable 2 in Supplement 1).

At each hospital, teams were orientated to the program's implementation manual, a detailed guide on execution, data collection tools, and trainings, which had been developed in advance by Lifebox based on experience in Ethiopia. In Bolivia and Madagascar, the implementation manual was translated into Spanish and French, respectively. Teams at each hospital were tasked with leading implementation, relying on improvement opportunities identified by stakeholders at each hospital. At all sites, Lifebox provided data storage and management, reviewed data for completion and accuracy, and maintained a dashboard of compliance with each IPC standard that hospital teams could use to develop action plans. Program support from the Ethiopia hub to each new site was variable based on the needs and resources in each region. In 4 countries, a clinician based in that country was identified by Lifebox to lead program implementation, data collection, and coordination with the hospital team. They received an introduction and overview of the program from individuals with experience implementing the program in Ethiopia and had access to mentorship virtually as well as programmatic support in organizing the program timeline and activities. In India, a hospital team identified their own lead implementers, relied heavily on the implementation manual, and initiated check-ins with the Lifebox team when needed. Support for new implementing teams was virtual for the most part; however, Ethiopia hub members traveled in person to visit Liberia and Malawi. Otherwise, program expansion relied on a model of remote mentorship and programmatic oversight.

Outcomes

Our primary outcome was 30-day SSI rates as defined by the Centers for Disease Control and Prevention.¹⁷ Secondary outcomes included compliance with IPC standards, death, reoperation, and length of stay. We compared outcomes between the baseline group, defined as all patients whose data were collected before the first action planning meeting, which marked the start of the first plan-do-study-act cycle, and the intervention group, including all patients whose data were collected after the initial action planning meeting.

Data Management and Statistical Analysis

Compliance with IPC standards was compared using χ^2 tests. A compliance score was calculated before and after the intervention, which represented the mean number of standards with which teams were compliant. Compliance scores were compared using 2-sided *t* tests. Our primary outcome was assessed using modified robust Poisson regression¹⁸ adjusting for age, sex, comorbidities, case urgency, wound class, American Society of Anesthesiologists score, hospital, and type of

procedure, an approach consistent with our pilot work.⁹ To account for loss to follow-up, we conducted the same analysis using best- and worst-case scenarios, where patients missing outcomes data were assumed either to not have an SSI or to have an SSI, respectively. We also conducted sensitivity analyses in which hospital was treated as a random effect rather than a fixed effect to account for intrahospital correlation. To understand if 1 specific hospital was driving clinical outcomes, we conducted additional sensitivity analyses by sequentially removing each hospital from our regression. To understand the effects of high compliance on each of our clinical outcomes regardless of intervention status, we performed a preplanned analysis using the same regression model, where high compliance was the exposure of interest rather than intervention status. High compliance was defined as compliance with at least 3 of 6 standards in an effort to be consistent with pilot work.⁹

Results

A total of 1865 patients were enrolled from 2021 to 2024 in Liberia, Madagascar, Malawi, India, and Bolivia (Figure 1). The mean (SD) age was 31.6 (17.5) years; 980 patients (52.5%) were female and 885 (47.5%) male. There were 478 patients in the baseline group and 1387 in the intervention group. The intervention group was younger and included more women, while a higher proportion of patients in the baseline group had dirty wounds¹⁹ and underwent elective surgery (Table 1). This was driven primarily by 1 hospital that disproportionately enrolled more patients in the baseline group and had many orthopedic injuries requiring elective, subspecialty surgery, with fewer women and fewer emergent surgeries (eTable 3 in Supplement 1).

Compliance with infection prevention standards improved significantly, with a mean score of 2.93 of 6 in the baseline period compared with 4.25 in the intervention period (difference, 1.21; 95% CI, 1.10-1.33; *P* < .001); improvements were noted at all hospitals (Figure 2 and eTable 4 in Supplement 1). There were significant improvements in all 6 IPC standards, including hand and skin antisepsis from 61.3% to 92.9% (difference, 31.6%; 95% CI, 35.1-28.1; *P* < .001), preoperative antibiotic administration from 89.5% to 98.3% (difference, 8.9%; 95% CI, 6.8%-10.9%; *P* < .001), instrument sterility from 41.1% to 51.9% (difference, 10.9%; 95% CI, 5.5%-16.2%; *P* < .001), sterile field maintenance from 16.3% to 40.8% (difference, 10.9%; 95% CI, 5.5%-16.2%; *P* < .001), gauze counting from 86.8% to 95.9% (difference, 9.1%; 95% CI, 6.6%-11.7%; *P* < .001), and use of SSC from 11.2% to 60.6% (difference, 49.4%; 95% CI, 44.6%-54.2%; *P* < .001) (Table 2).

A total of 1325 patients (71%) had complete 30-day follow-up of the primary outcome and were included in our analysis. The prevalence of SSI decreased from 28.4% in the baseline group and 12.1% in the intervention group (difference, 16.3%; 95% CI, 12.0% to 20.6%; relative risk [RR], 0.51; 95% CI, 0.38 to 0.67; *P* < .001) (Table 3 and eTable 5 in Supplement 1). The mortality rate was unchanged between the baseline and intervention groups (difference, 0.9%; 95% CI, -0.6%

Figure 1. Framework of Enrollment to Complete Follow-Up

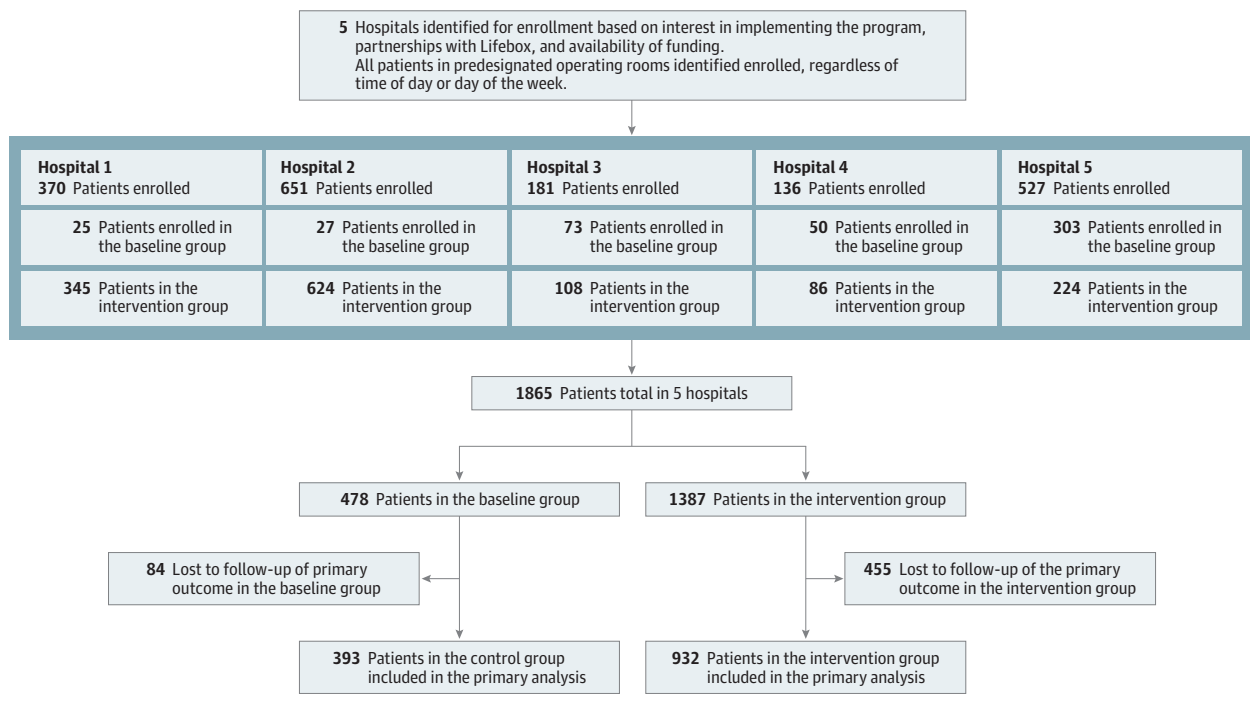


Table 1. Patient and Procedure Characteristics

Characteristic	No. (%)			P value
	Total	Baseline group	Intervention group	
No. of patients	1865	478	1387	
Age, mean (SD), y	31.6 (17.5)	37.2 (18.2)	29.7 (16.8)	<.001
Sex				
Female	980 (52.5)	156 (32.6)	824 (59.4)	<.001
Male	885 (47.5)	322 (67.4)	563 (40.6)	
Diabetes	49 (2.6)	16 (3.3)	33 (2.4)	.25
Hypertension	110 (5.9)	51 (10.7)	59 (4.3)	<.001
Case urgency				
Elective	1004 (53.8)	328 (68.6)	676 (48.7)	<.001
Emergency	838 (44.9)	144 (30.1)	694 (50.0)	
Unknown	23 (1.2)	6 (1.3)	17 (1.2)	
Wound class ^a				
Clean	795 (40.3)	299 (62.6)	496 (35.8)	<.001
Clean-contaminated	787 (39.9)	62 (13.0)	725 (52.3)	
Contaminated	55 (2.8)	9 (1.9)	46 (3.3)	
Dirty	210 (10.7)	105 (22.0)	105 (7.6)	
Unknown	125 (6.3)	3 (0.6)	15 (1.1)	
Procedure type				
GI surgery	400 (21.4)	30 (6.3)	370 (26.7)	<.001
Skin/soft tissue	43 (2.3)	17 (3.6)	26 (1.9)	
OB-GYN	889 (47.7)	125 (26.2)	764 (55.1)	
Subspecialty surgery	533 (28.6)	306 (64.0)	227 (16.4)	

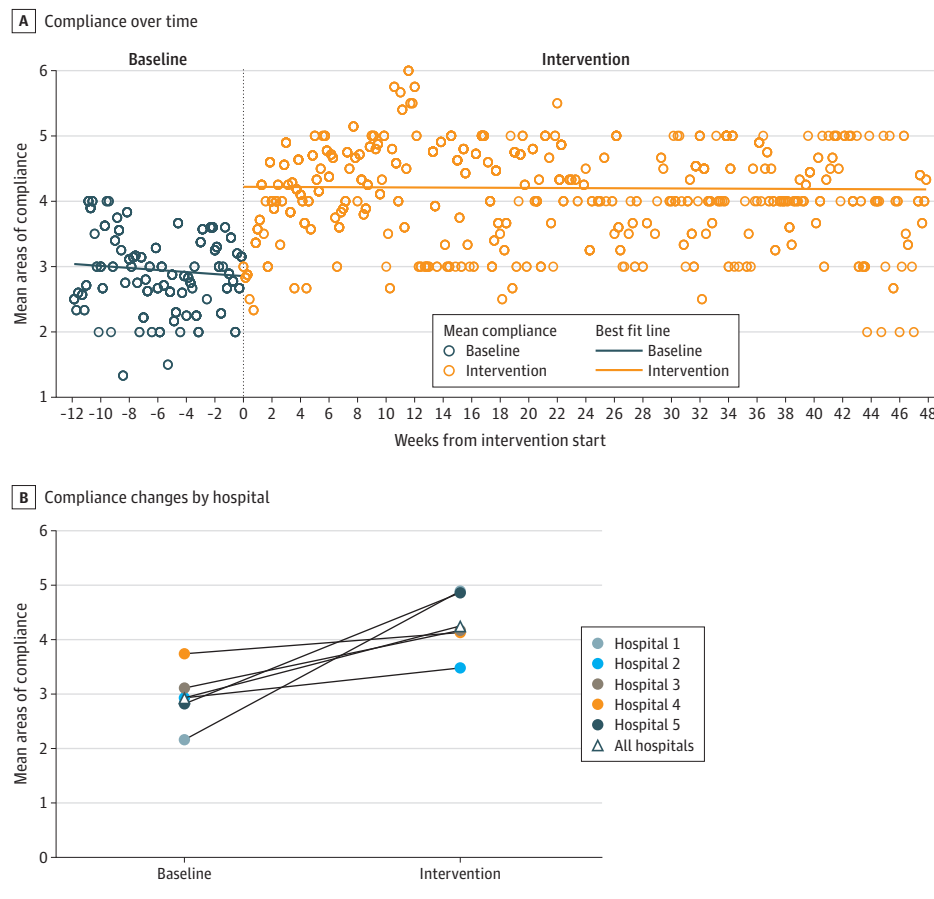
Abbreviations: GI, gastrointestinal; OB-GYN, obstetric-gynecologic.

^a As described in Herman et al.¹⁹

to 2.5%; RR, 1.1; 95% CI, 0.40 to 3.03; $P = .85$); the rate of re-operation decreased nonsignificantly from 10.40% to 3.26% (eTable 5 in Supplement 1). Although there was a significant observed decrease in length of stay from 6.27 to 4.05 days (dif-

ference, 2.2 days; 95% CI, 1.76 to 2.69; $P < .001$), after risk adjustment this was no longer statistically significant (RR, 0.79; 95% CI, 0.60 to 1.03; $P = .08$). Patient demographic details among those with complete follow-up differed from those who

Figure 2. Changes in Mean Compliance Over Time and by Hospital



A, Equations for the best fit lines in the baseline and intervention periods are $-0.001 \text{ days} + 2.90$ and $-0.0002 \text{ days} + 4.22$, respectively, and were noted to be significantly different ($P < .001$).

Table 2. Improvements in Compliance With Infection Prevention Standards

Standard	Compliance ^a		
	Baseline group, No. (%) (n = 478)	Intervention group, No. (%) (n = 1387)	Absolute difference, % (95% CI) ^b
Use of the WHO SSC	51 (11.2)	818 (60.6)	49.4 (44.6 to 54.2)
Sign-in compliance	175 (38.3)	1252 (91.8)	53.5 (49.9 to 57.1)
Time-out compliance	340 (73.4)	931 (68.5)	-5.0 (-0.1 to -9.8)
Sign-out compliance	126 (27.7)	1147 (84.5)	56.8 (52.7 to 60.9)
Hand and skin antisepsis	288 (61.3)	1274 (92.9)	31.6 (28.1 to 35.1)
Antibiotic administration	408 (89.5)	1309 (98.3)	8.9 (6.8 to 10.9)
Instrument reprocessing	184 (41.1)	685 (51.9)	10.9 (5.5 to 16.2)
Sterile field maintenance	63 (16.3)	350 (40.8)	24.6 (19.1 to 30.1)
Gauze counting	407 (86.8)	1316 (95.9)	9.1 (6.6 to 11.7)
Compliance score out of 6, mean (95% CI)	2.93 (2.84 to 3.02)	4.15 (4.09 to 4.21)	1.21 (1.10 to 1.33)

Abbreviations: SSC, Surgical Safety Checklist; WHO, World Health Organization.

^a All compliance rates are reported without risk adjustment as compliance with standards was not dependent on clinical or patient factors.

^b All results had a P value $< .001$.

were lost to follow-up, with a higher proportion of patients lost to follow-up who had obstetric or gynecology operations and a different distribution of wound classes (eTable 6 in Supplement 1). To account for loss to follow-up, we conducted sensitivity analyses, assuming all patients lost to follow-up either did not have an SSI (best-case scenario) or had an SSI (worst-case scenario). Improvements in SSI remained significant in both scenarios (Table 3). When hospital was treated as a random rather than a fixed effect, SSI reductions were similar, though not statistically significant (RR, 0.50; 95% CI, 0.24 to

1.06; $P = .07$). To assess whether any individual hospital was driving overall improvements in SSI, we conducted sensitivity analyses in which we sequentially excluded each hospital from our regression model; statistically significant reductions were maintained when each hospital was excluded (eTable 7 in Supplement 1). In particular, 1 hospital exacerbated differences between the baseline and intervention groups; when this hospital was eliminated, patient and procedure characteristics were more similarly matched, and a significant SSI reduction was maintained (difference, 22.6%;

Table 3. Clinical Outcomes by Program Phase and Compliance Rate

Outcome	Risk-unadjusted outcome, No./total No. (%)		Risk-adjusted outcomes	
	Baseline group	Intervention group	Relative risk (95% CI)	P value
By baseline vs intervention status				
SSI	112/394 (28.43)	113/932 (12.12)	0.51 (0.38-0.67)	<.001
Sensitivity analyses				
SSI (best-case scenario)	112/478 (23.40)	113/1387 (8.15)	0.38 (0.27-0.53)	<.001
SSI (worst-case scenario)	196/478 (41.00)	468/1387 (40.95)	0.87 (0.76-0.99)	.03
Hospital as a random effect	112/394 (28.43)	113/932 (12.12)	0.50 (0.24-1.06)	.07
Mortality	9/376 (1.34)	15/1024 (1.08)	1.10 (0.40-3.03)	.85
Reoperation	44/423 (10.40)	35/1074 (3.26)	0.77 (0.51-1.18)	.23
Length of stay, mean, d ^a	6.27	4.05	0.79 (0.60-1.03)	.08
By compliance rate (<3 vs ≥3)				
	Low compliance	High compliance		
SSI	59/196 (30.10)	217/1181 (18.37)	0.50 (0.38-0.65)	<.001
Death	4/220 (1.36)	20/1180 (1.11)	0.57 (0.18-1.81)	.34
Reoperation	19/228 (8.33)	67/1325 (5.06)	0.80 (0.48-1.33)	.56
Length of stay, mean, d ^a	4.92	4.63	1.04 (0.77-1.42)	.78

Abbreviation:

SSI, surgical site infection.

^a Used an odds ratio and ordinal regression, adjusting for the same factors.

95% CI, 16.1% to 29.1%; RR, 0.56; 95% CI, 0.38 to 0.84; $P = .005$) (eTables 7 and 8 in Supplement 1).

When compliance was high, there was an 11.7% absolute reduction in SSI (95% CI, 5.7% to 17.8%; RR, 0.50; 95% CI, 0.38 to 0.65; $P < .001$) compared with those operations where compliance was low (Table 3). High compliance was also associated with nonsignificant improvements in mortality (difference, 0.1%; 95% CI, -1.7% to 1.9%; RR, 0.57; 95% CI, 0.18 to 1.81; $P = .34$) and reoperation (difference, 3.3%; 95% CI, 0.1% to 6.5%; RR, 0.80; 95% CI, 0.48 to 1.33; $P = .39$).

Discussion

In this cohort study, the Clean Cut surgical infection prevention program reduced the relative risk of SSI by half and improved compliance with IPC standards in 5 hospitals in different countries. Following the prevention program's success in Ethiopia, understanding if the program could be successful in other settings was a priority. This study assessed the program's efficacy outside Ethiopia for the first time and noted that SSI reductions were consistent with our prior experience.^{9,20} This intervention aimed at changing behavior and strengthening processes but did not address financial limitations or supply chains. Although we did not reach 100% compliance with any of the standards, improvements were possible even with resource limitations.

This surgical infection prevention program has been implemented in Ethiopia since 2016; while the program initially was resource intensive, it was subsequently streamlined to a lighter-touch format.^{9,13} However, it relied on local expertise, where a number of Ethiopian clinicians who had participated in program development were available to local hospital staff for technical support, process mapping, leading action planning meetings, and acting as facilitators in training sessions. Implementation outside of Ethiopia presented several challenges. First, resource constraints are variable between geographical

areas, with different limitations on both material and human resources that vary in relation to each country and region's economic and political context. For example, antibiotic administration was challenging in Ethiopia but was easier to achieve in this cohort. In Ethiopia, the Lifebox team and hospital teams often shared common language, culture, and an understanding of hospital processes, characteristics that are often advantageous when navigating organizational challenges such as supply chain management, resource acquisition, and support from hospital administration.²¹ Finally, hospital visits from experienced personnel were limited, restricting direct observation of IPC processes by those who had successfully executed the program in the past.

Despite these challenges, improvements were seen in all hospitals. The program relied on fostering local champions at each implementing hospital who were familiar with each hospital's resource constraints and who worked at the implementing hospital. Local champions helped bridge cultural differences, allowing those most familiar with hospital structure and processes to build cohesive and effective implementing teams. Virtual support was combined with visits from Ethiopian staff when possible. Ultimately 3 hospitals completed the core components of the program with virtual support only, while the remaining 2 received 2 to 3 visits from the Ethiopia-based team. Visits by members of the Ethiopia hub were highly reliant on the availability of funding and were affected by health restrictions during the COVID-19 pandemic. When visits were not possible, local champions received support virtually, through a combination of the implementation manual, virtual program orientation, and direct coaching by hub members.

Limitations

One limitation of this study is the 30% loss to follow-up. We followed up patients via a previously validated phone questionnaire at 30 days because patients often live far from hospitals and do not have cameras or phones with photo capabilities.¹⁶ However, telephone follow-up is time inten-

sive for hospital staff and difficult where phone service is limited. The patients lost to follow-up had different demographic characteristics to those who had complete follow-up. We conducted sensitivity analyses to address this loss to follow-up by assuming that all patients without follow-up either had an SSI or did not have an SSI, a strategy that accounts for differences between the followed-up and not-followed-up groups in identifying the effect of loss to follow-up.²² Significant reductions were found in SSI in both scenarios, supporting the validity of our results. Additionally, the baseline and intervention groups differed, specifically with regards to the high number of patients who had dirty wounds in the baseline group. To address this limitation, we adjusted for wound class, type of surgery, and enrollment site. Intrahospital correlation may also have had an effect. While we used similar methodology to prior studies, we included a sensitivity analysis where hospital was treated as a random effect, which demonstrated a similar SSI reduction, though it was not statistically significant.

Another limitation was the variability in program support. This variability reflects the real-life challenges of program implementation and the need to adapt to each setting. In some cases, external support for the program was entirely virtual when it would otherwise have occurred in person. For further scaling, more investigation is needed to understand in which settings more external support is required and where hospital teams can complete the program more independently. It is unknown if this program would be replicable or sustainable without such support.

Finally, this study included implementing a surveillance system of IPC standards throughout the length of the program. It is possible that surveillance alone may increase compliance with standards as opposed to the interventional components of the program. In this study, there was variability in the timing in each interventional component of the intervention, based on the needs of each hospital. This presented difficulties in adjusting for secular effects. Further research

using a cluster-randomized stepped-wedge approach is ongoing in Ethiopia to address these limitations.²³ This study was unblinded, which may have introduced bias. This was a pragmatic consideration, as blinding can be challenging where staff size is limited, and interventional activities cannot be easily kept secret from data collectors.

Despite well-established best practices for SSI prevention, implementation of those practices is challenging.^{24,25} Interventional studies to reduce SSI are limited in LMICs; of those that exist, many are small in scope.^{24,26} Quality improvement is 1 mechanism of improving surgical safety in LMICs^{26,27} and can improve adherence with evidence-based practices that have been associated with SSI reductions when implemented.^{28,29} This scaling strategy relied on some rigid elements, such as the phased nature of the program, to guide teams through clearly defined steps and checkpoints, while others were adaptable and context dependent.³⁰ Partnerships between teams in the 5 countries and the Ethiopia hub allowed for troubleshooting among a network of clinicians and program implementers to identify local solutions with the support of clinicians who had experienced and overcome similar challenges in their own settings. This program demonstrates an effective model to expand small-scale but high-impact quality improvement initiatives in surgical care, relying on peer-to-peer learning among LMIC-based clinicians.³¹ A scale-up of low-cost, innovative programs to address gaps in surgical quality has the potential to improve access to safe and effective surgery globally.^{32,33}

Conclusions

A surgical infection prevention program successfully improved compliance with IPC standards and reduced SSI in 5 hospitals outside of Ethiopia, where the program was developed and piloted. These results support scaling of the program beyond Ethiopia.

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Other: Mammo.

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Fogarty International Center during the conduct of the study; being a Safe Surgery fellow at Lifebox; and being employed at Boston Medical Center and Stanford University outside the submitted work. Dr Tesfaye reported a grant from NIH Fogarty International Center and working at Lifebox during the conduct of the study. Dr Gebeyehu reported being a Safe Surgery fellow at Lifebox. Dr Starr reported nonfinancial support from Lifebox as senior fellow and as surgical advisor during the conduct of the study. Dr Arimino reported currently working as a clinical lead at Lifebox. Dr Chaula reported being a Safe Surgery fellow. Dr Harrell-Shreckengost reported receiving a Fogarty Global Health Fellowship and being a Safe Surgery fellow at Lifebox during the conduct of the study. Dr Ambulkar reported being a part-time consultant for Lifebox. Dr Rocabado reported personal fees from Instituto Oncologico del Oriente Boliviano outside the submitted work. Dr Taye Haile reported being on staff at Lifebox. Dr Mammo reported being the Clinical Director at Lifebox outside the submitted work and having a patent for Clean Cut issued. Dr Weiser reported serving as consulting medical officer at Lifebox during the initiation of Clean Cut during the conduct of the study. No other disclosures were reported.

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