

# Impact of a Slaughterhouse Hygiene Intervention in Western Kenya

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## Overview

Adherence to strict hygiene standards in slaughterhouses is critical for ensuring food safety and protecting workers from zoonotic disease. The International Livestock Research Institute (ILRI) and International Food Policy Research Institute (IFPRI) conducted a study to evaluate the impact of low-cost interventions on hygiene practices in slaughterhouses in western Kenya.

## Study Design

Initial Key Informant Interviews (KIIs) were conducted to collect the perspectives of meat handlers, slaughterhouse owners, meat inspectors, and Sub-County Veterinary Officers on the main challenges and potential opportunities to improve hygiene in slaughterhouses in the region. Findings from these interviews informed the design of two interventions:

- ▶ **Training & monitoring:** Meat handlers were trained on hygiene practices by Sub-County Veterinary Officers and provided with PPE (gumboots, aprons). Each slaughterhouse/slab owner was provided with a handwashing station and cleaning equipment. Meat inspectors monitored compliance with training recommendations and completed a weekly hygiene checklist for each facility for a period of 12 weeks.
- ▶ **Training, monitoring & incentives:** In addition to the same training, equipment provision, and monitoring as above, workers received mobile money incentives of 50 KSh for each day worked for maintaining hygiene standards.

The intervention phase employed a randomized control trial (RCT) design to evaluate the effectiveness of the interventions among 140 slaughter facilities in six counties. The slaughterhouses were randomly assigned to one of three groups: control, training and monitoring, and training, monitoring and incentives.

## Data Collection Methods

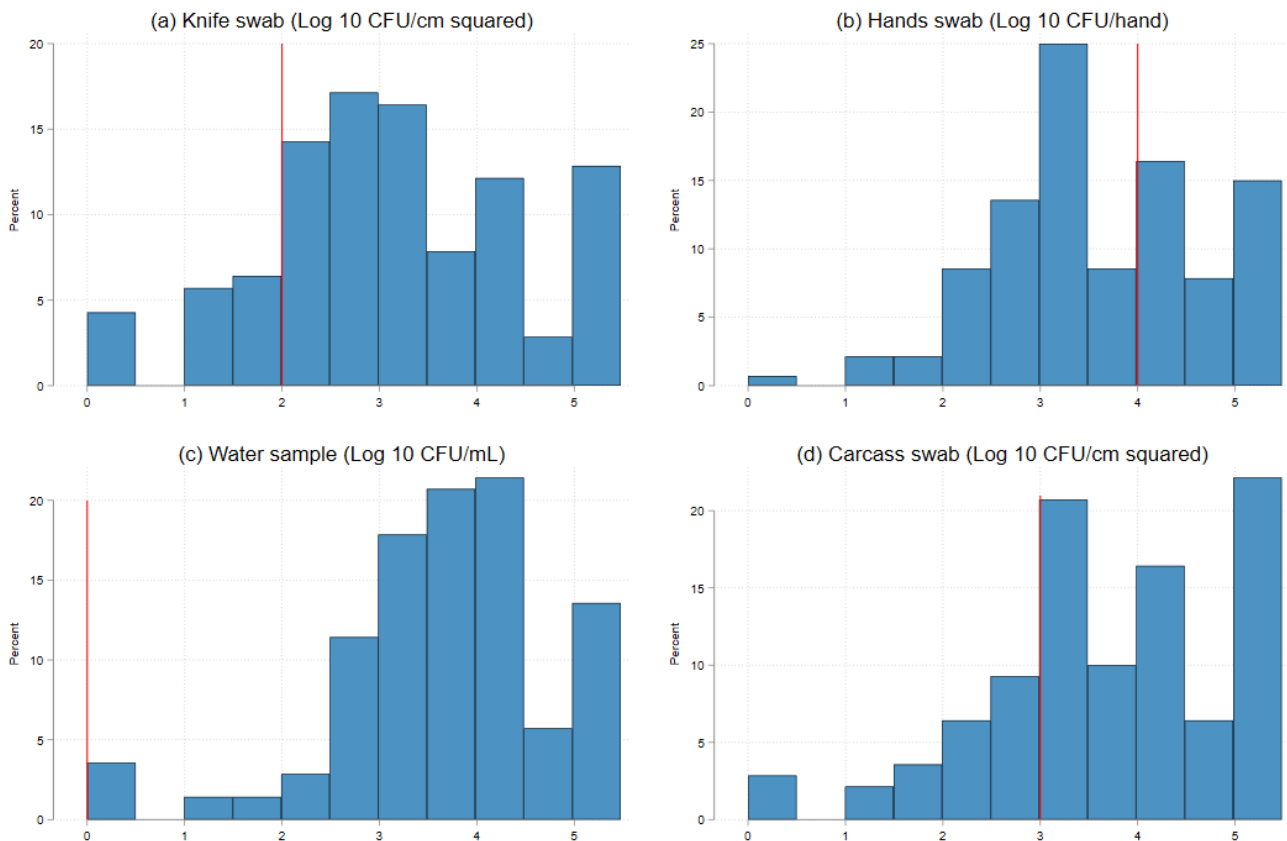
Data were collected through face-to-face surveys of meat handlers, slaughterhouse managers, and customers before, during (4-5 weeks post-training), and four weeks after the intervention ended (16 weeks post-training). In addition, data collectors entered their observations of slaughter practices, following one animal from start to finish, into an electronic data collection form. Swabs from the carcass for which slaughter had been observed, the hands of the worker who had sectioned that animal, the knife used to section the carcass, and a sample of water used to rinse knives were all collected and analyzed in the ILRI laboratory in Busia town for coliforms and *Escherichia coli* (*E. coli*) contamination. The results are presented as log<sub>10</sub> of the colony forming units for hands, per cm squared for knives and carcasses, and per ml for water.

## Results

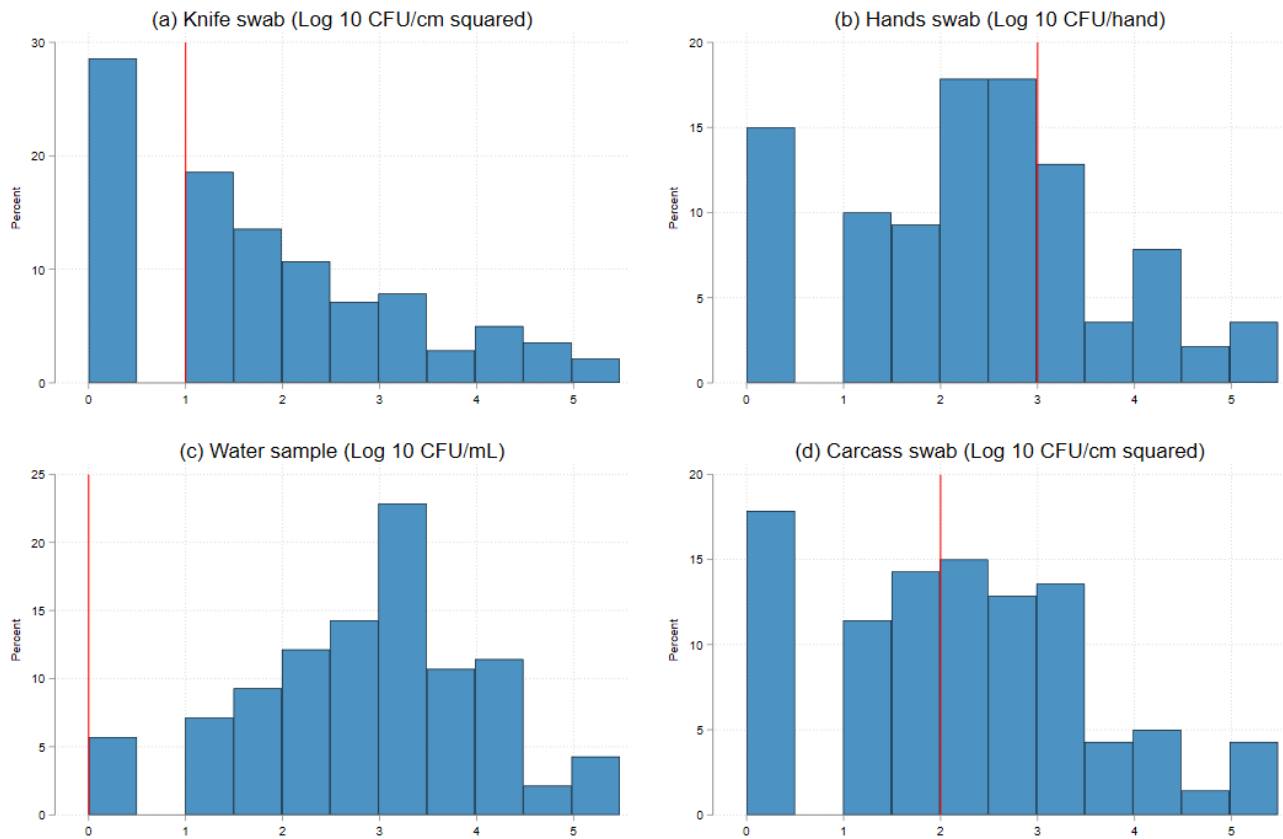
### *Pre-intervention levels of contamination*

Prior to the intervention, most samples collected from knives had unacceptable levels of coliforms (>log<sub>2</sub>CFU) and *E. coli* (>log<sub>1</sub>CFU) (Figures 1&2). Coliforms and *E. coli* were detected in almost all water samples which is above acceptable limits since potable water should have zero coliforms. Carcass contamination was high for most samples. Acceptable limits in raw meat are <log<sub>3</sub>CFU for coliforms and <log<sub>2</sub>CFU for *E. coli*.

**Figure 1:** Coliform concentration (Log<sub>10</sub> CFU) by sample type at baseline



**Figure 2:** E. coli concentration (Log<sub>10</sub> CFU) by sample type at baseline



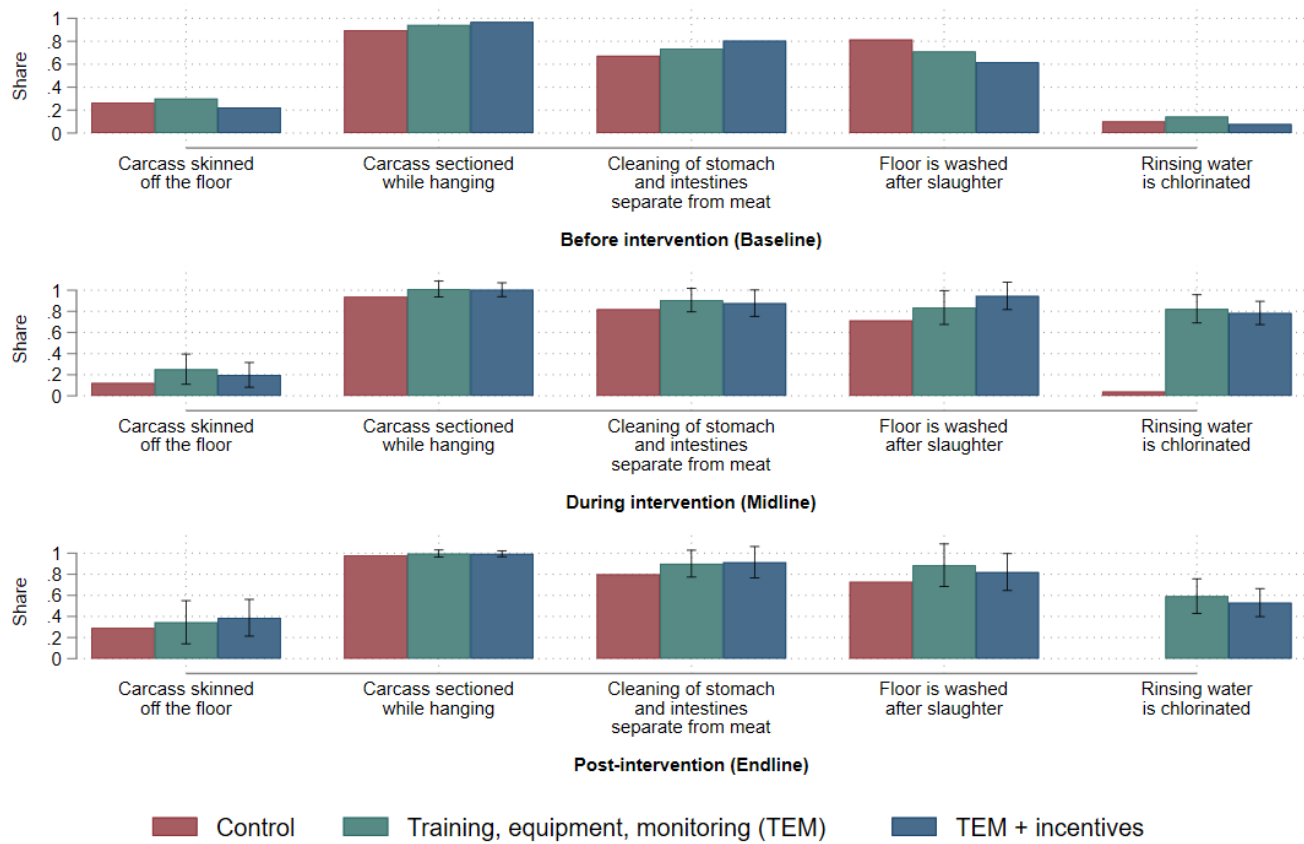
**Note:** Red lines indicate acceptable limits

### *Environmental hygiene*

To prevent contamination from the floor, workers in treatment group facilities were trained to skin and section animals while hanging or on a raised surface. Skinning on the floor was common at baseline. During the intervention, workers at treatment facilities were more likely to skin carcasses raised off the floor. Some improvement among the control group on this practice was also observed post-intervention. In most cases (96%), animals were already hung during sectioning at baseline and this was almost universally observed during the final round of data collection (Figure 3).

To prevent contamination of the carcass from the gastrointestinal tract, workers were trained to clean the stomach and intestines outside the slaughter area and away from where meat was stored. We see modest improvement in this practice during and after the intervention, as well as in the proportion of facilities in which the floor was washed between each animal. Chlorination of rinsing water was dramatically affected, from 11% at baseline to 80% among the treatment groups during the intervention. This practice was maintained at a high level four weeks after the intervention ended (Figure 3).

**Figure 3.** Environmental hygiene practices before, during, and after interventions, by group



### *Hand and knife washing practices*

Meat handlers were trained to wash their hands with soap between each step of the slaughter process. During the intervention, workers in both treatment groups washed their hands more times during the slaughter process. The proportion of times that soap was used was even more strongly affected – likely because soap was provided through the interventions. Both handwashing in general, and handwashing with soap, remained elevated after the end of the intervention, though the use of soap declined markedly after this was no longer provided (Figure 4).

**Figure 4.** Hand and knife washing practices before, during, and after interventions, by group

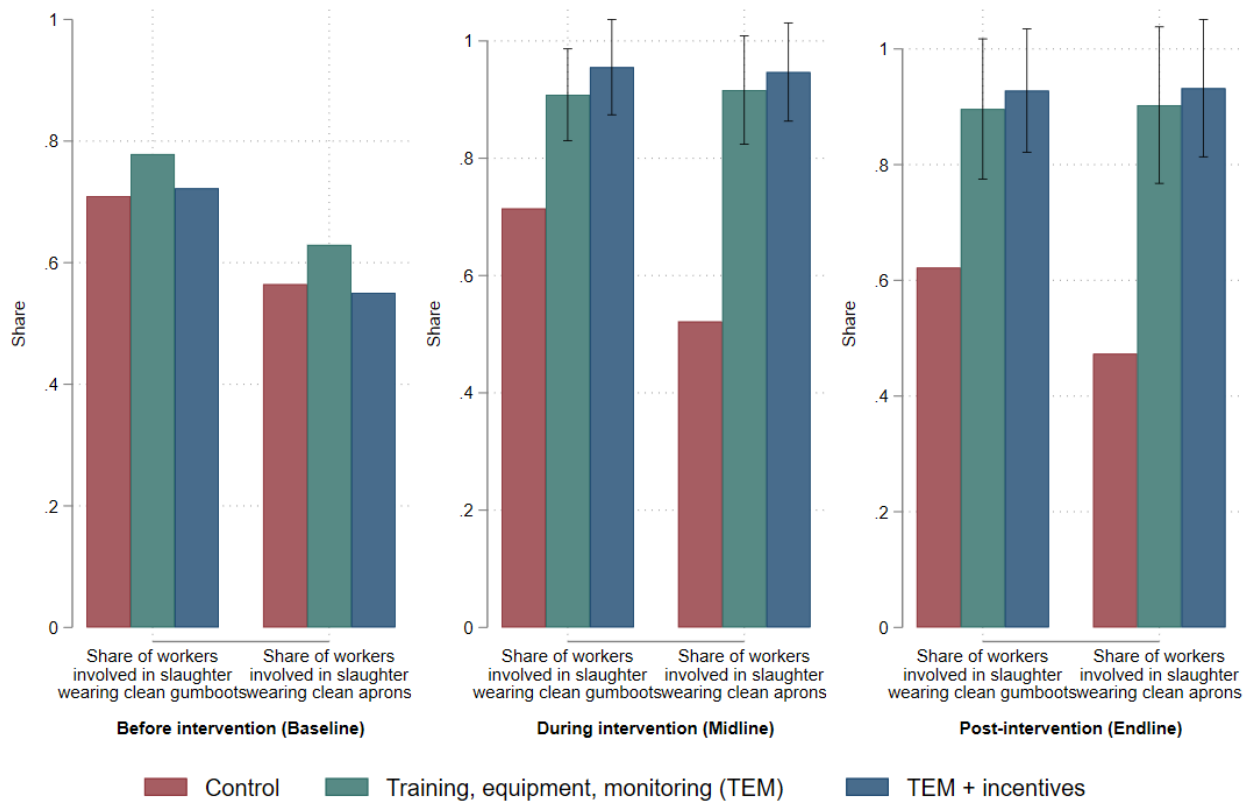


Note: The first two variables, Share of steps at which all workers washed hands and Share of steps at which all workers used soap, indicate the proportion of the following steps at which all workers involved washed their hands or used soap: (i) After skinning/scalding, (ii) before evisceration, (iii) before sectioning, and (iv) after cleaning the stomach and intestines. The last two variables, Share of steps at which knife was washed and Share of steps at which knife was washed using a 3-step system, indicate the proportion of the following steps before the knives were washed: (i) Evisceration, and (ii) sectioning.

### Use of personal protective equipment

Aprons and gumboots were provided to all workers who attended hygiene training sessions. It is therefore unsurprising to see that both interventions increased the use of this equipment to between 90% and 95%, as shown in Figure 5. This effect was maintained four weeks after the use of equipment was no longer monitored through the weekly hygiene checklist conducted by meat inspectors.

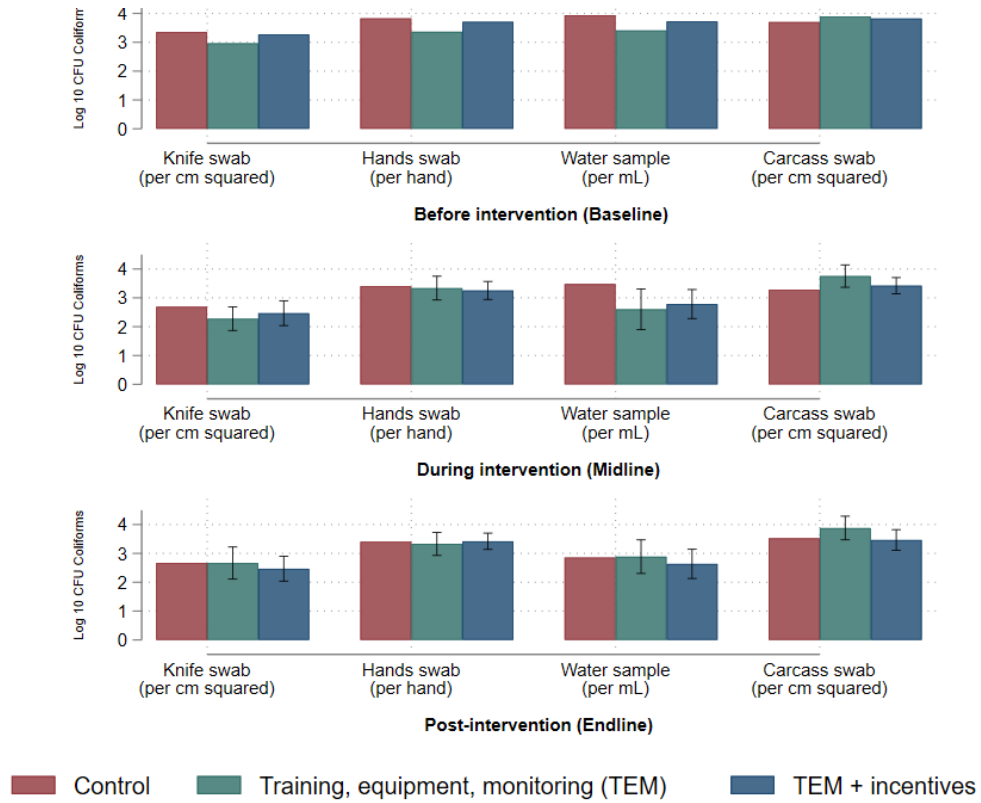
**Figure 5.** Meat handler use of PPE before, during, and after interventions, by group



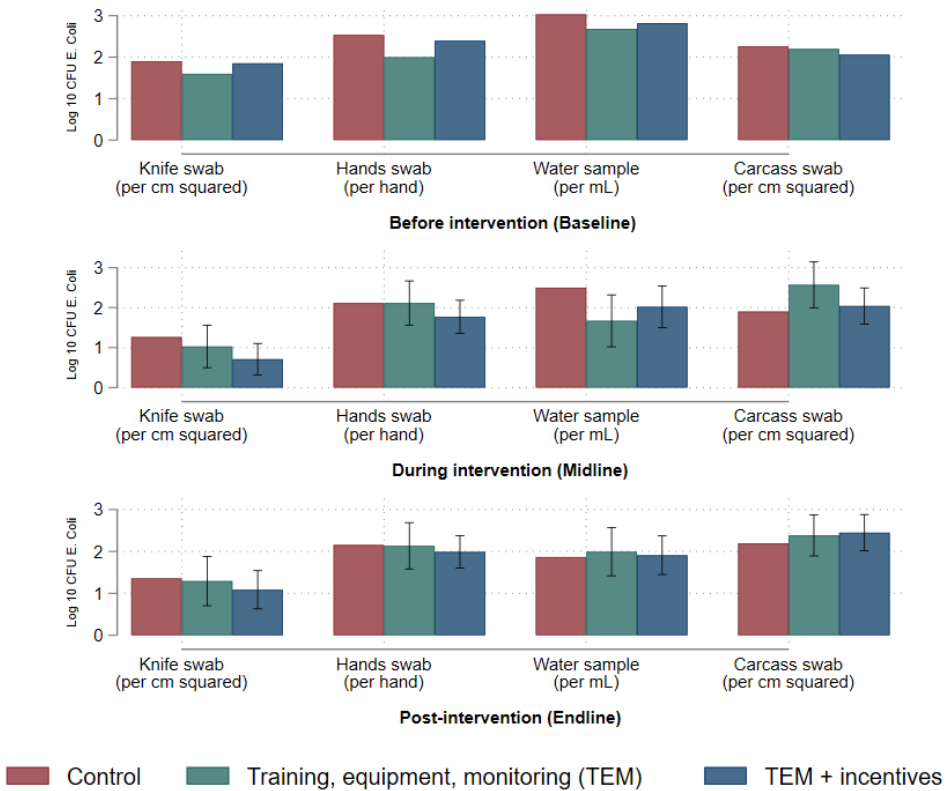
### **Contamination**

Both coliform and E. coli contamination were lower on knives and water samples in treatment group slaughter facilities than control facilities during the intervention (Figure 6 & 7). While these directional differences persisted four weeks after the end of monitoring, the magnitudes of these differences were smaller and no longer statistically significant. However, the intervention did not reduce contamination found on workers' hands or on carcasses.

**Figure 6.** Coliform contamination, before, during and after intervention, by group



**Figure 7.** *E. coli* contamination, before, during and after intervention, by group



Water was typically transported from the source to the slaughter floor manually in jerricans. This practice posed additional challenges, including contamination risks and inefficiency. Workers often rationed or reused water to reduce trips to the source, limiting its availability for cleaning and handwashing and making it difficult to maintain cleanliness during slaughter operations.

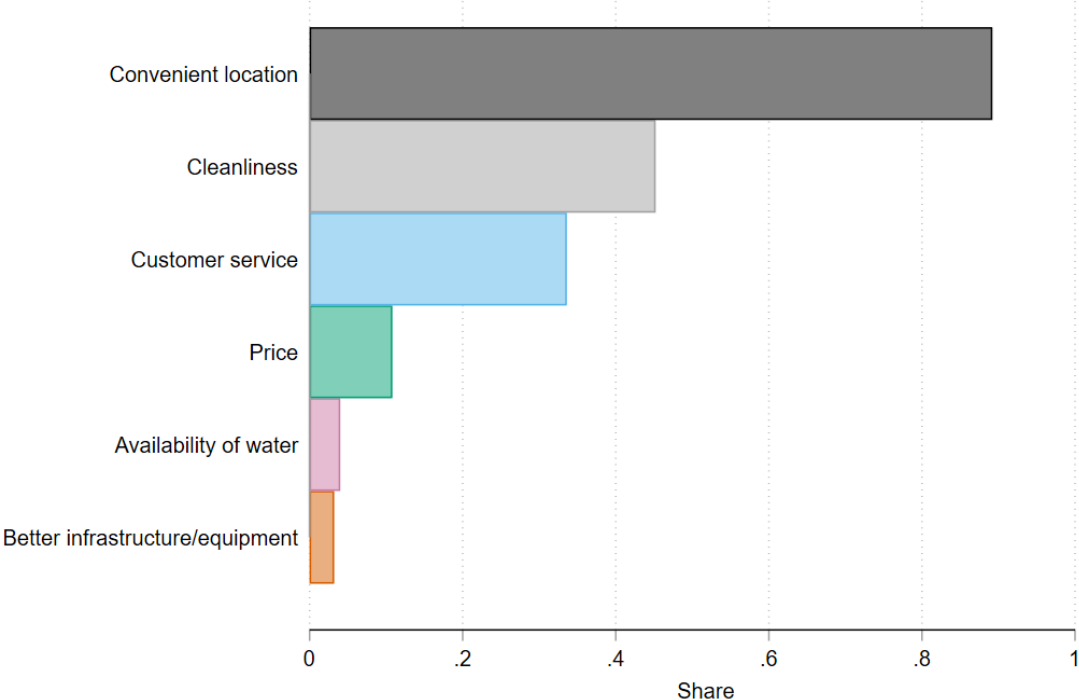
**Business impacts**

At baseline, approximately 90% of livestock owners report that location was a factor in their choice of slaughter facility. Cleanliness was the next most common reason for choosing a facility, cited by just under half of slaughter facility customers (Figure 8).

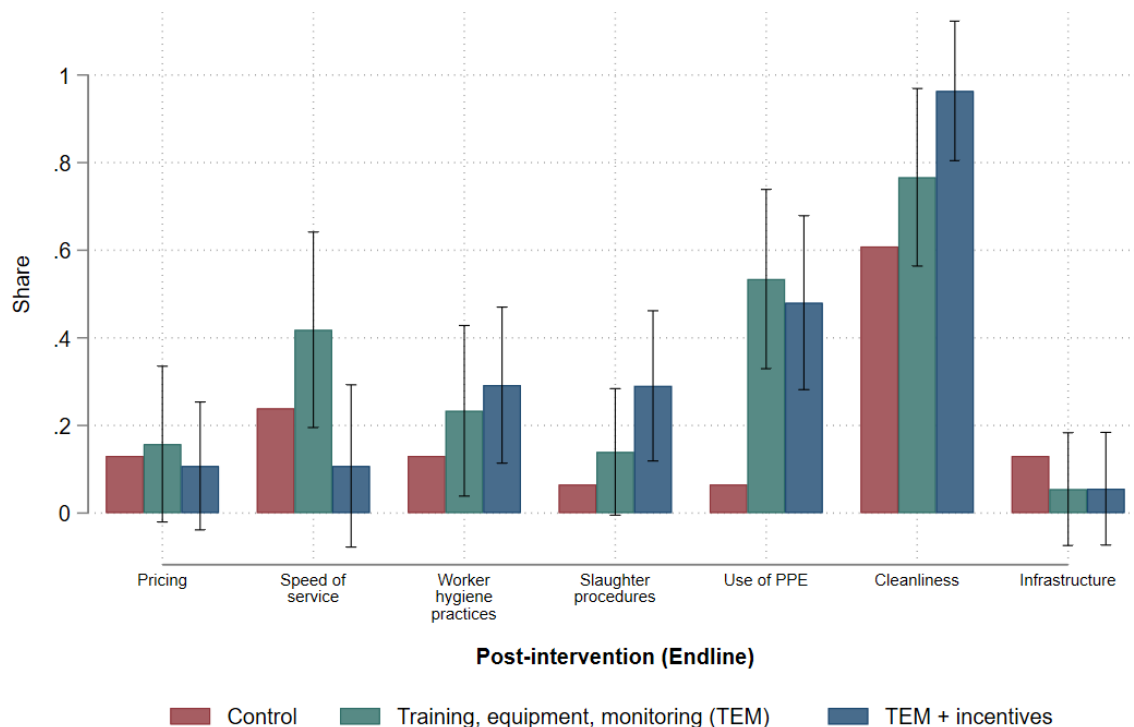
Four weeks after the end of monitoring and 16 weeks after training, customers noted that worker hygiene, slaughter procedures, and cleanliness had improved in recent months (Figure 9). These effects were particularly strong at facilities where workers could earn incentive payments. Improvements in the speed of service, on the other hand, were less commonly perceived at facilities assigned to the incentive payment group.

Possibly linked to the perceived improvements, livestock owners appeared to shift to using treatment group facilities; in both treatment groups, the number of animals processed per day increased during the intervention and remained elevated four weeks later (Figure 10). This effect was particularly strong for the training and monitoring group, where customers noticed that cleanliness and use of PPE had improved, and where perceived speed of service was better than in incentive facilities. The number of workers engaged to slaughter and process animals was also higher in treatment group facilities.

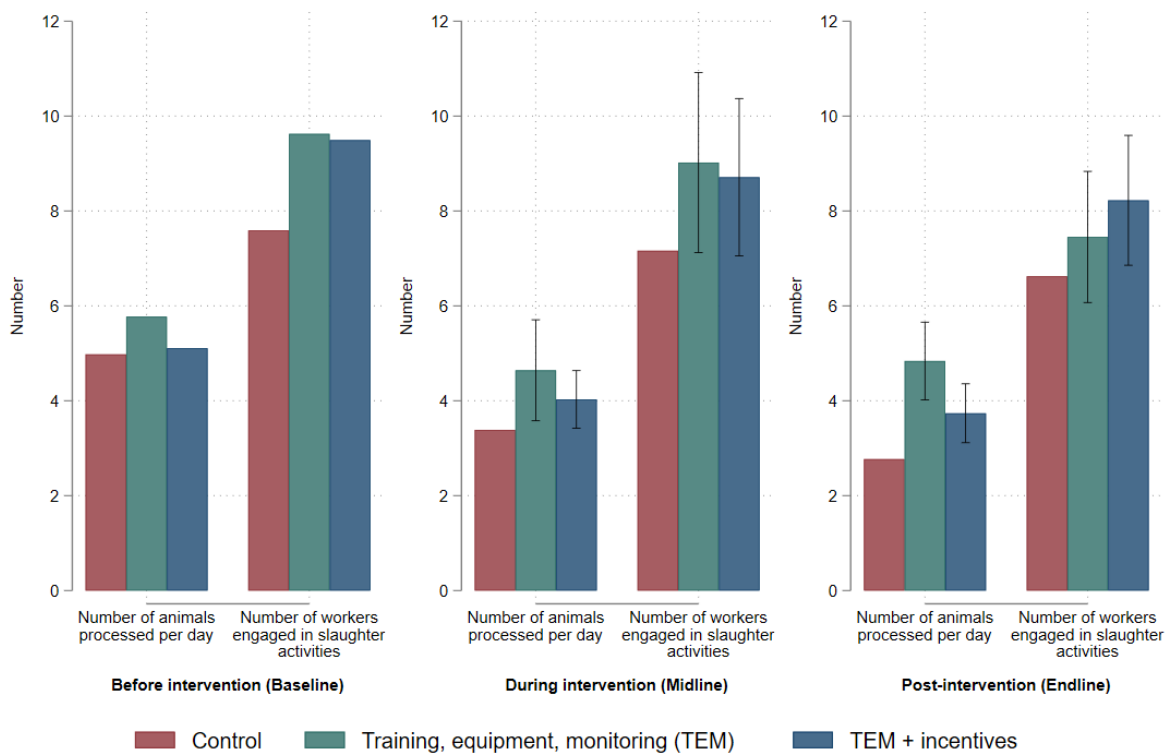
**Figure 8.** Reasons cited by customers for choice of slaughter facility at baseline



**Figure 9.** Share of customers who noticed positive changes to slaughter practices, by group



**Figure 10.** Number of animals processed and workers engaged in slaughter, by group



## Conclusion and Recommendations

The study demonstrated that meat handler training, combined with provision of equipment and monitoring of hygiene by meat inspectors, can significantly improve slaughterhouse practices and reduce contamination in water and tools. While some indicators, including customer perceptions, show that worker incentives have a stronger effect on behaviour than training, equipment and monitoring alone, most outcomes are similar across the two interventions tested.

However, there is a need for interventions that specifically reduce carcass contamination. One option to reduce contamination is to spray meat with a food-safe disinfectant or sanitizing chemical. Spraying carcasses with peracetic acid is done in export facilities in Kenya and hypochlorous acid has been trialled on meat in Ethiopia. Hypochlorous acid kills most microbes on contact and has been shown to be highly acceptable to consumers in other ILRI research. The advantages of hypochlorous acid over other chemicals is that is non-corrosive, non-irritating to workers, and environmentally friendly.

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## ABOUT THE AUTHORS

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