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RESEARCH AND EVALUATION REPORT

Using quality improvement to reduce hospital-acquired infections: Evaluation of the USAID ASSIST Project in the West Bank

JULY 2018

This evaluation report was prepared by University Research Co., LLC (URC) for review by the United States Agency for International Development (USAID) and authored by Ghazaleh Samandari, Maesa Irfaeya, and Lisa Dolan-Branton of URC and Gareth Parry and Jennifer Ross of the Institute for Healthcare Improvement. The hospital-acquired infections improvement collaborative in the West Bank was supported by URC under the USAID Applying Science to Strengthen and Improve Systems (ASSIST) Project, which is made possible by the generous support of the American people through USAID and its Office of Health Systems.

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For more information on the work of the USAID ASSIST Project, please visit www.usaidassist.org or write assist-info@urc-chs.com.

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Acronyms

AMS	Antimicrobial stewardship
ASSIST	USAID Applying Science to Strengthen and Improve Systems Project
ATCC	American Type Culture Collection, a global biological materials resource and standards organization
AVH	Augusta Victoria Hospital
CRE	Carbapenem-resistant enterobacteriaceae
ECHO	Extension for Community Healthcare Outcomes (University of New Mexico)
FGD	Focus groups discussion
HAI	Hospital-acquired infection
HH	Hand hygiene
HHP	Hand hygiene process
IC	Infection control
IPC	Infection prevention and control
ISO	International Organization for Standardization
MDR	Multi-drug resistant
MOH	Ministry of Health
MRSA	Methicillin-resistant staphylococcus aureus
MUSIQ	Model for Understanding Success in Quality
NGO	Nongovernmental organization
OR	Operating room
PA	Palestinian Authority
PDSA	Plan-do-study-act
QC	Quality control
QI	Quality improvement
QPD	Quality Planning Department (PA MOH)
TBP	Transmission-based precautions
UNRWA	United Nations Relief and Works Agency for Palestine Refugees
URC	University Research Co., LLC
USAID	United States Agency for International Development
VISA	Vancomycin-intermediate/resistant staphylococcus aureus
VRE	Vancomycin-resistant enterococcus

EXECUTIVE SUMMARY

Introduction

Despite recent gains in health indicators in the Palestinian Territories, evidence from hospital studies suggests that the country is facing a surge in antibiotic-resistant infections due to a lack of standardized infection prevention and control processes and systems. In 2017, together with Ministry of Health (MOH) officials, infection and prevention control and infectious disease specialists in the West Bank, the USAID Applying Science to Strengthen and Improve Systems (ASSIST) Project launched a national-level quality improvement collaborative to build the foundation for a long-term strategy for reducing HAIs in the Palestinian Territories. The nine-month project, implemented from January-September 2017, created a robust learning network among 22 participating hospitals and experts to apply quality improvement methods and tools to establish reliable processes for infection control and prevention, including transmission-based precautions and sepsis detection and treatment; antimicrobial stewardship; improvement of microbiologic laboratory processes and procedures; and active antibiotic management. The learning network included face-to-face, action-oriented learning sessions with teams, monthly quality improvement coaching visits to support hospitals' processes of change, and technology-driven virtual communities (on video conference and group messaging applications) where collaborative members could share and learn from one another.

This internal evaluation of the HAI collaborative was conducted to understand the progress made in establishing this improvement system over the nine-month collaborative and to provide insights into how and where the initiative was most successful. Specifically, the evaluation sought to determine what effects the intervention had on process and outcome measures, participants' experience with barriers and enables to improved infection prevention and control, and the development of improvement capability in participating hospital teams.

Methods

The evaluation used a prospective, non-experimental design, employing quantitative and qualitative data to understand the process, outcomes, and lessons learned from the improvement collaborative. We tracked HAI process and outcome indicators across hospital facilities, applied improvement capability measurements to hospital teams at two time-points during the intervention, and conducted focus group discussions with intervention participants during the intervention (February to August of 2017).

Given the brevity of the intervention, we focused on process indicators that have an established causal link with reduction in hospital-acquired infections, including measures related to hand hygiene, environmental cleanliness, and transmission-based precautions. We assessed improvement in performance of laboratory testing measures by examining the completion and accuracy of monthly bacterial testing from June to August 2017. We examined specific measures including 1) whether bacterial testing was performed; 2) whether antibiotic susceptibility testing was performed; 3) whether the antibiotic testing performed was in line with standard procedures; and 4) percentage of bacteria correctly identified by the lab testing.

Results

We examined an aggregate measure combining five components of transmission-based precautions. At an aggregate level, use of transmission-based precautions improved from 53% in February to 84% in July. We found a similar but less dramatic upward trend in hand hygiene performance in the same period, with 77% of hospitals performing proper hand hygiene procedures in July, compared to a baseline of 64% in February.

In addition to hospital infection prevention measures, we also examined the performance of hospital laboratories in testing and identifying bacterial samples. In May 2017, 16 hospitals performed bacterial testing, attempted antibiotic sensitivity testing, and performed antibiotic sensitivity testing in line with

manual. Of the 16, no hospital correctly identified all the bacteria samples to allow for antibiotic sensitivity testing. By August 2018, 18 hospitals were performing bacterial tests, and 10 of the 18 (55%) correctly identified all bacteria.

With respect to improvement capacity, we asked hospital teams to self-assess their QI capacity based on questions related to the likelihood of successful completion of an improvement project. Respondents in almost all hospitals are within a feasible range of success, provided that extant contextual barriers be addressed. Furthermore, the direction of aggregate scores across all hospitals was upward, suggesting improvements may continue over time with ongoing support to QI teams.

Analysis of focus group interview transcripts revealed several key findings related to participants' experiences with the learning collaborative methods and activities used in reducing HAIs. The main themes of these discussion were: 1) challenges faced in reducing HAIs; 2) perceptions, views, and experiences in each learning collaborative activity; 3) network creation for change; and 4) the future and sustainability of the learning collaborative.

Discussion

One main strength of the learning collaborative was in its multi-pronged approach of engaging providers, which included a variety of in-person and virtual tools. By supplying providers with a variety of methods for learning, the collaborative was able not only to create an improvement community across a geographically vast network of hospitals, but it also allowed QI teams to focus and iterate learning sessions according to the natural evolution of the group itself.

The HAI collaborative used multiple forms of communication and data to maintain a network of improvement providers across the 22 target hospitals over the duration of the project. Participants regarded tools such as ECHO and WhatsApp as effective and efficient means of maintaining contact within the network and of problem-solving within the context of a larger improvement community. These tools, which are affordable and readily available, can be an essential means of bridging the communication gap in settings like the West Bank where physical travel is greatly hampered. The embedding of data tools at the facility level also encouraged the collection and use of data for local action.

Participants in the improvement collective demonstrated a high degree of engagement and enthusiasm. However, many hospitals reported a general lack of resources and staffing, which limited their capacity to make huge gains in improvement. With additional time and resources, the improvement efforts could make greater changes that could translate into reduced HAIs. Limited resources at the facility level may also have affected participants' long-term engagement with improvement efforts. Lack of basic supplies and space, high workloads and persistent staff shortages all contributed to frustration and fatigue among front-line providers tasked with improving patient care on a daily basis. As a result of these limitations and the short duration of the intervention, the evaluation was not able to track improvements in patient outcomes. However, the upward trends in process indicators suggests improvements in care that could yield patient benefits if sustained.

Conclusions

Despite the contextual and resource constraints in the West Bank, the USAID ASSIST Project created a technology-driven, multifaceted learning collaborative that encouraged networking of providers across physical boundaries to support improvement in care quality. By embedding their work within the existing health care system, the project fostered a sense of ownership and exchange among previously disconnected local entities. This approach enabled sustainability of key improvement practices and led to the undertaking of new initiatives in improved patient safety practices by the MOH. The project is a successful example of how to rapidly stimulate long-term improvement changes in a resource-constrained environment.

I. INTRODUCTION

Health indicators in the Palestinian Territories show recent gains, with an average life expectancy of 73.6 years for females and 70.8 years for males, a decline in infant mortality from 25.5 per 1,000 live births in 2000 to 20.6 per 1,000 live births in 2010, and a decline in under-five mortality rates from 28.7 per 1,000 live births in 2000 to 25.1 per 1,000 live births in 2010 (Palestinian Central Bureau of Statistics 2006; Qlalweh et al. 2012). Despite limited resources in the region, leading causes of death in this population are non-communicable diseases such as cardiovascular disease, cancer, and diabetes (Qlalweh et al. 2012). However, these positive indicators belie a growing surge in antibiotic-resistant infections due to a lack of standardized infection prevention and control processes and systems.

Combined with a lack of uniform microbiology protocols and processes within the Palestinian health system, hospital-acquired infections (HAI) pose a serious public health risk across the territories. In fact, HAI has reached alarming levels across the West Bank and Gaza, with no signs of improvement. Physicians at Augusta Victoria Hospital, part of the East Jerusalem Hospital Network, have noted very high rates of multiple drug-resistant hospital-acquired infections among patients referred from the hospitals across the West Bank. A study conducted on patients referred to Augusta Victoria Hospital from West Bank hospitals showed high levels of methicillin-resistant staphylococcus aureus (MRSA) and vancomycin-resistant enterococcus (VRE), among others. In a series of studies, Dr. Musa Hindiyeh and his team at Caritas Baby Hospital in Bethlehem collected samples in collaboration with several West Bank hospitals. They found multiple antibiotic-resistant bacteria present: MRSA, VRE, vancomycin-intermediate/resistant staphylococcus aureus (VISA), carbapenem-resistant enterobacteriaceae (CRE), and multi-drug-resistant (MDR)-Acinetobacter (Hindiyeh 2017). These infections place a heavy burden on the entire health system.

In 2017, together with Ministry of Health (MOH) officials, infection prevention control (IPC) and infectious disease specialists in the West Bank, the United States Agency for International Development (USAID) Applying Science to Strengthen and Improve Systems (ASSIST) Project launched a national-level collaborative to institutionalize a long-term strategy for reducing HAI in the West Bank. Efforts focused primarily on implementing antimicrobial stewardship (AMS) through a robust, technology-based learning network using quality improvement methods and tools to drive improvement of infection prevention and control systems and processes (**Figure 1**).

A. Intervention

The USAID ASSIST Project in the West Bank first assessed the capacity of the existing health system for infection control and found that several key elements were already in place to facilitate enhancement of HAI control processes. These included a robust MOH policy-making and patient safety program since 2011; a 2017 policy manual to guide infection control (IC) practices across the West Bank; a network of staff certified in IC and quality improvement practitioners at each MOH hospital; national quality standards to drive improvement in several MOH and private hospitals; the presence of certified Patient Safety surveyors who had been working to assess and support sites' progress; and medical laboratories accredited in ISO standards.

Next, ASSIST worked with the MOH to identify areas of IPC and AMS which were absent or weak within the existing system. The design team of national and international experts, led by the USAID-funded project, used an improvement collaborative to jump-start a long-term improvement strategy. The collaborative brought together multiple health care facilities (13 public and 9 private hospitals in the West Bank) through a facilitated shared learning approach that emphasized peer-to-peer learning and supportive coaching by experts. The learning network included face-to-face, action-oriented learning sessions with teams, monthly QI coaching visits to support their processes of change through plan-do-study-act (PDSA) cycles, and technology-driven virtual communities (on video conference and group messaging applications) where collaborative members could share and learn from one another.

Figure 1. Primary drivers of reducing hospital-acquired infections

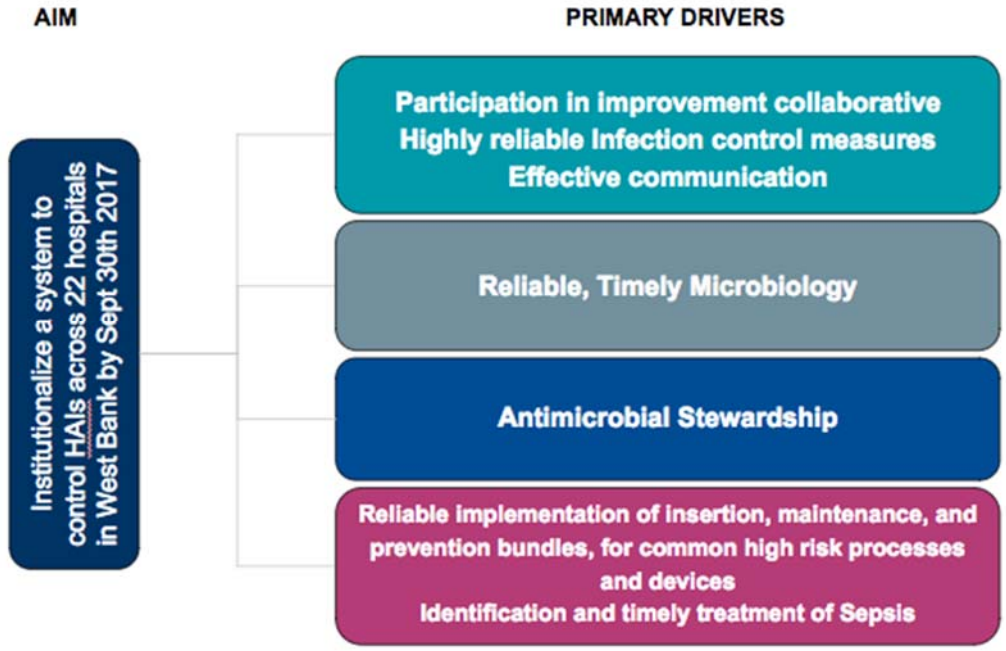
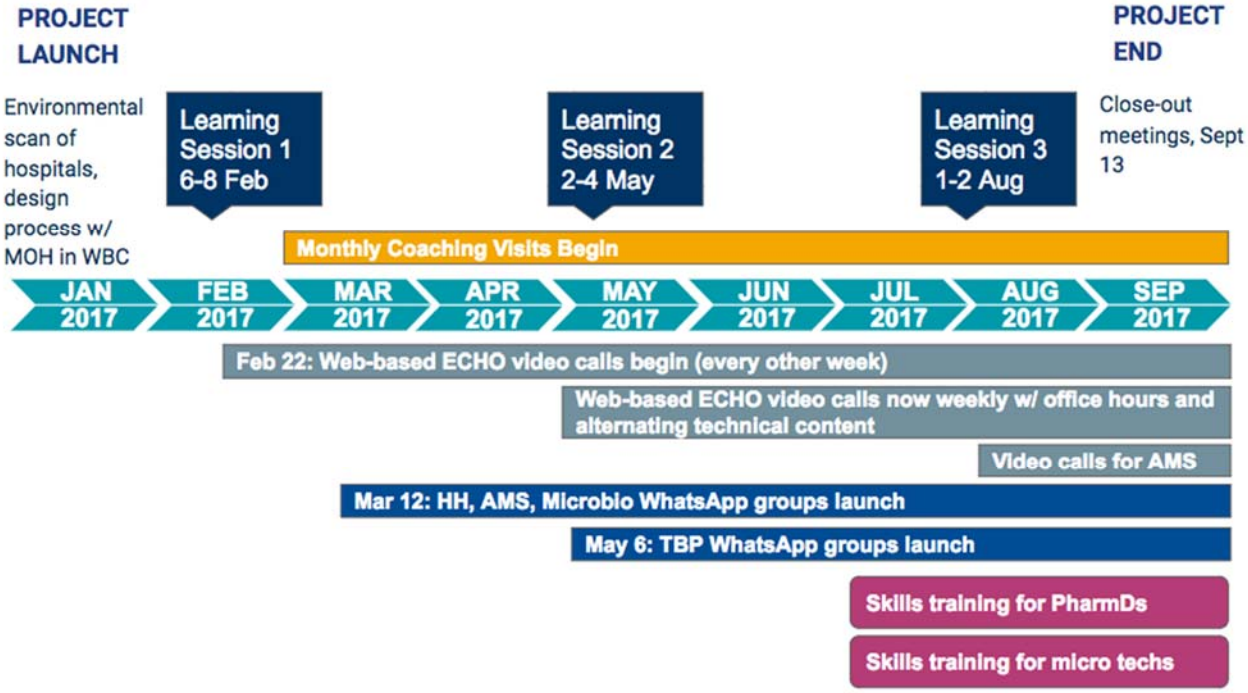


Figure 2 shows the timeline of activities from the first learning session in February 2017, through the end of the project in September 2017.

Figure 2. Timeline of Project Events



B. Evaluation aim

The aim of this evaluation is to understand the progress made in establishing this improvement system over the nine-month implementation and to provide insights into how and where the initiative was most successful. Our evaluation approach was informed by the ideas generated at the Salzburg Global Seminar in July 2016 and used a collaborative evaluation approach led by the USAID ASSIST team (Coly and Parry 2017). This allowed the evaluation team to gain clarity on the theory of the overall improvement initiative, paying particular attention to the goals, processes, measurement system, and context.

The evaluation questions were:

- What impacts on process and outcome measures were achieved during the intervention?
- What did participants experience as barriers and enablers to progress within the collaborative?
- Did improvement capability increase in participating organizations/hospital teams over the course of the improvement collaborative?

II. METHODS

This evaluation used a prospective, non-experimental design, employing quantitative and qualitative data to understand the process, outcomes, and lessons learned from the improvement collaborative. We tracked HAI process and outcome indicators across participating facilities, applied improvement capability measurements to hospital teams at two time-points during the intervention, and conducted focus group discussions with intervention participants during the intervention (February to August of 2017). Methods are further described below, according to each evaluation question.

A. Process and outcome measures

Given the brevity of the intervention, we did not expect systematic, wide-scale improvements in patient outcomes, as measured by infection rates, to be achieved by August 2017. Instead, we chose to focus on process indicators that have causal links to HAI improvement. To understand the extent to which high-level processes associated with infection reduction were improved, we analyzed data collected by facilities during the collaborative for hand hygiene, environmental cleanliness, and use of transmission-based precautions. We also tracked improvements in laboratory testing procedures.

The **hand hygiene** (HH) measure was a composite of four process measures collected from each site by improvement teams examining five random sinks per week and reporting availability of running water (HHP1), liquid soap (HHP2), paper towels (HHP3), and alcohol rub (HHP4). For **environmental cleanliness**, we analyzed data collected by improvement teams, aligning with a measure (CEEO1) inspecting the cleanliness of patient bed spaces and equipment. **Transmission-based precautions** were measured by observing p

Finally, we assessed performance of **laboratory testing** measures by examining the completion and accuracy of monthly bacterial testing from June to August of 2017. We examined specific measures, including: 1) whether bacterial testing was performed; 2) whether antibiotic susceptibility testing was performed; 3) whether the antibiotic testing performed was in line with standard procedures; and 4) percentage of bacteria correctly identified by the lab testing. For all measures described above, we examined improvement within each hospital, applying run chart rules over time.

B. Participants' experience

To understand factors that both enabled participants in the collaborative to make changes to prevent HAI, we conducted several focus groups discussions (FGD) across hospital groups (see **Appendix 1** for a description of the participants in each FGD). Four focus groups were conducted in July 2017 among a

purposive sample of 23 participants (infection prevention and control officers and/or quality coordinators). In addition, we held one open group discussion meeting composed of 31 participants (microbiologists/laboratory technicians) on August 7, 2017. Two moderators used a discussion guide with open-ended questions to learn about participants' experiences with the learning collaborative. All meetings were tape-recorded with the permission of the participants, then transcribed by hand. The open group discussion meeting was only transcribed by hand and not audio-recorded. All meetings were conducted in Arabic language and covered a range of topics including challenges faced in reducing HAI, views of participants on the improvement collaborative methods and activities, network creation, and the future/sustainability of the improvement collaborative in reducing HAI. Findings were analyzed by hand, using the discussion guide as an inductive tool.

C. Improvement capability

We measured improvement capability using the Model for Understanding Success in Quality (MUSIQ) tool. The MUSIQ tool was designed to help organizations assess themselves on a variety of contextual factors that contribute to improvement capability, including dimensions related to quality improvement capacity, organizational factors, infrastructure, and the external environment (Kaplan et al. 2012). The tool was completed by representatives of each hospital (n=22) participating in the collaborative two times: once in May 2017, and again in August 2017. Representatives completed the MUSIQ tool independently at the end of learning sessions at each time point. To explore variation over time across settings, we analyzed the MUSIQ data in the form of small-multiples – i.e., displaying data from each site – and in aggregate form. It is important to note that the same person did not necessarily fill out the MUSIQ form at each time-point.

III. RESULTS

The results are presented in relation to the specific evaluation questions described above. Each section also includes details on limitations of the research and interpretation of findings. **Table 1** describes the specific number of improvement collaborative events and participants therein, over the life of the project.

Table 1. Improvement collaborative activities, by number of events and participants

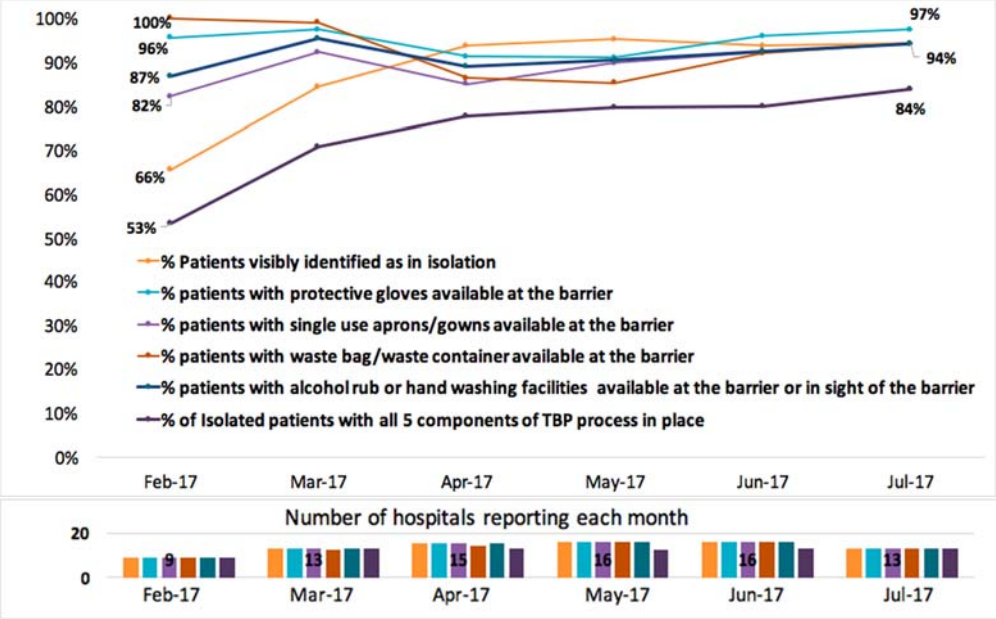
Activity	# Events	# Participants
Learning Sessions (Hospital, Lab, Leadership)	3 sessions/each discipline	Average of 200 participants per event; 600 participants total
WhatsApp Groups-IPC focused	Group shared 2400 messages/ 270 images over 5 mos	50 participants
WhatsApp Groups-Microbiology/Lab focused	Group shared 5800 messages/ 500 Images over 5 mos	70 participants
Coaching Visits--Hospital	70	Average of 5 hospital participants per visit
Coaching Visits--Lab	18	Average of 5 hospital participants per visit
Video Calls--Hospital	14	Average of 15 hospitals/call
Video Calls--Lab	7	Average of 17 hospital labs/call
Skills Training for PharmDs	5-day sessions over 8 weeks	21 PharmDs

Activity	# Events	# Participants
Skills Training for Microbiology Techs	5-day sessions over 8 weeks	20 Microbiology techs

A. What impact on process and outcome measures was achieved during the intervention?

We examined three key process indicators for HAI improvement to understand the impact of the improvement collaborative on service improvements at the facility level. **Figure 3** shows the progress of each indicator used to measure transmission-based precautions, and an aggregate measure combining all five components of transmission-based precautions (TBP). At an aggregate level, use of transmission-based precautions improved from 53% in February to 84% in July.

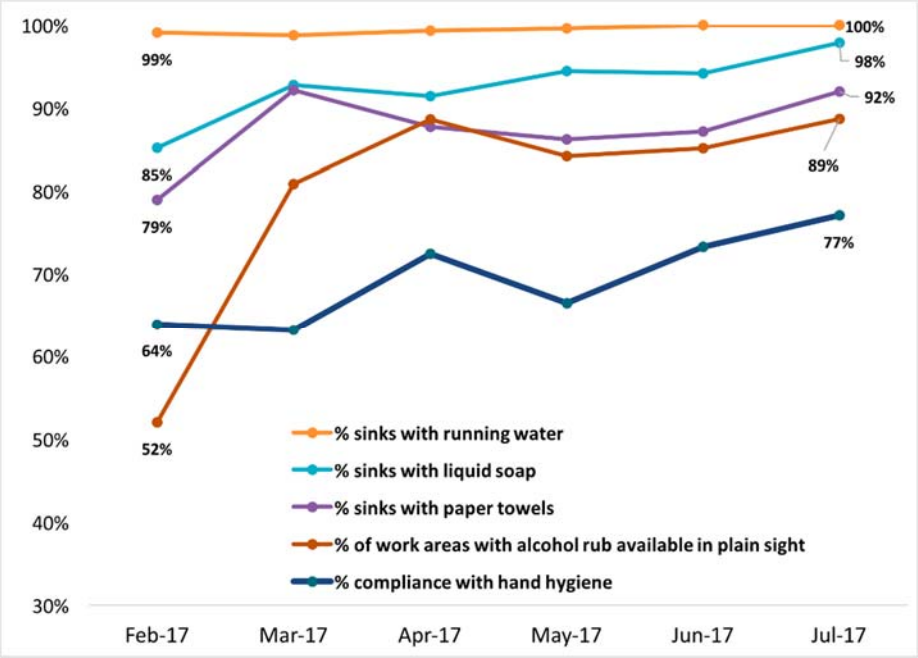
Figure 3. Improvement in transmission-based precautions (Feb-May 2017)



We see a similar but less dramatic upward trend in hand hygiene performance in the same period (**Figure 4**). In the aggregate, hospitals were performing at 77% compliance with proper hand hygiene procedures in July, compared to a baseline of 64% in February. At the facility level, Beit Jala, Al Muhtaseb, Al Ahli, Palestine Red Crescent Society, and An Najah hospitals all show marked improvement in their reported hand hygiene metrics (individual-level data not shown). Five of the 22 hospitals either did not report hand hygiene metrics or reported them inconsistently.

With regards to environmental cleanliness measures, we saw very little change in the aggregate metric from February to July 2017 (**Figure 5**). **Figure 6** shows improvement only in newly admitted patient screening procedures over the project period, from 76% in February to 88% in July. Consistent data on this indicator were available from only seven hospitals, and among these none demonstrated improvement and one trended downwards. When interpreting these data, we should note that an initial decline in scores is expected as organizations become more comfortable and accurate with collecting and sharing data for improvement. Moreover, the drop-off in reporting in July was due to a natural slow-down in reporting at the end of the project.

Figure 4. Percent compliance with hand hygiene indicators over time (Feb-July 2017)



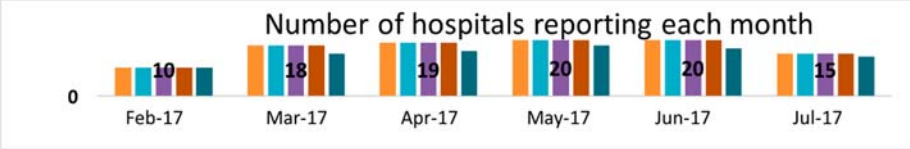


Figure 5. Environmental cleaning Process and Outcome (Feb to July 2017)

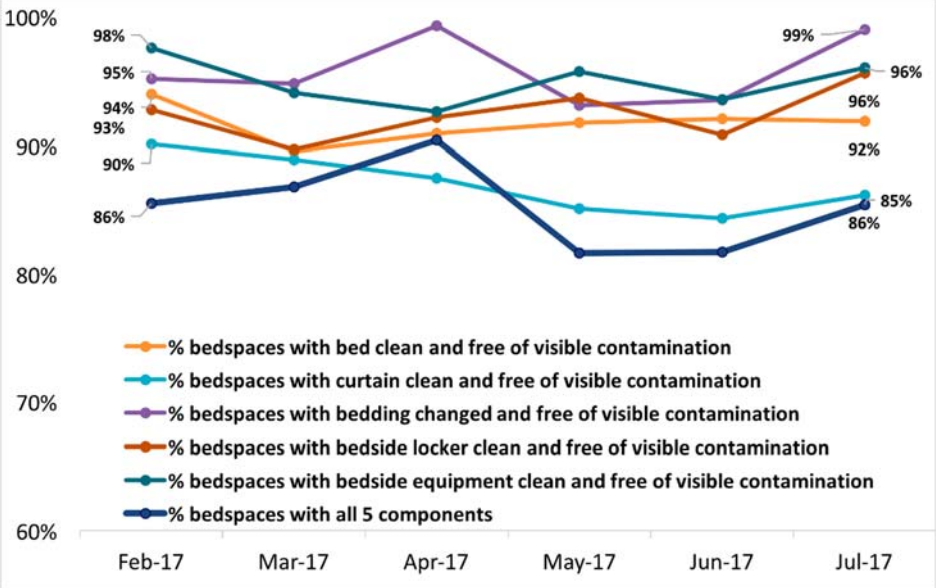
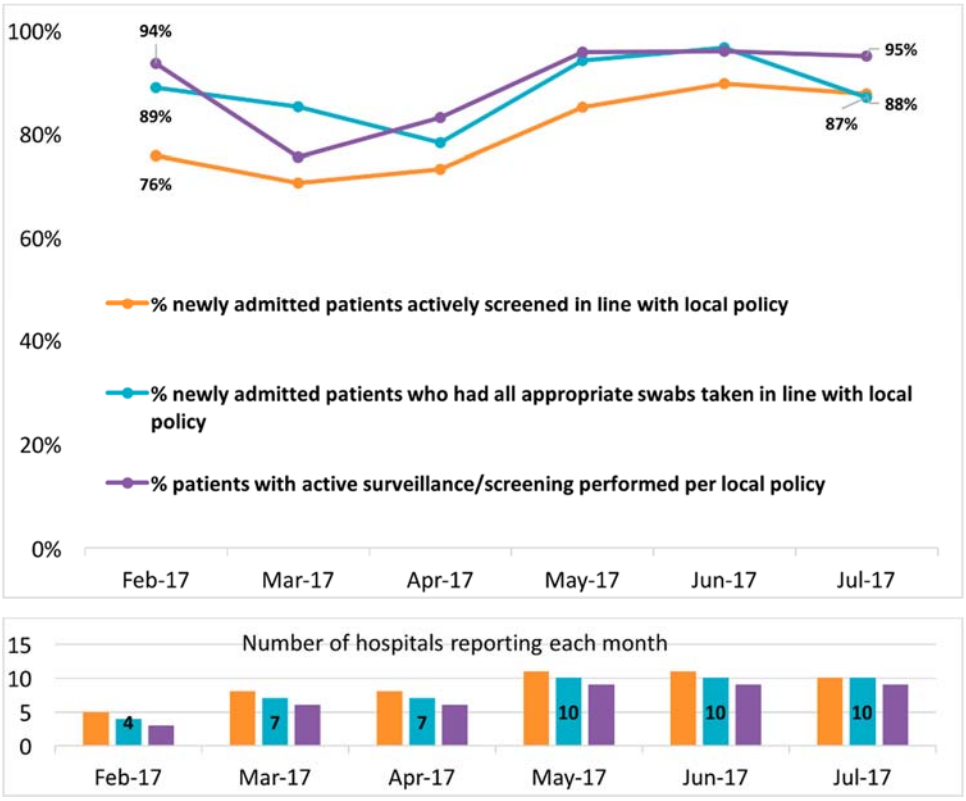


Figure 6. Screening process and outcome measures (Feb – July 2017)

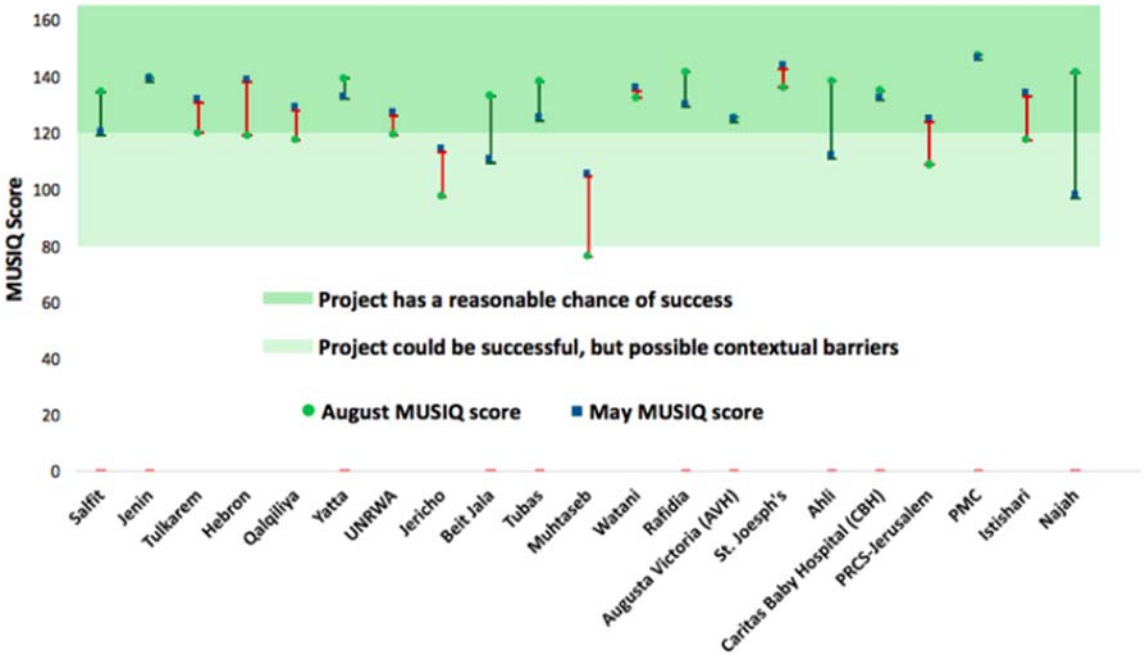


In addition to hospital infection prevention measures, we also examined the performance of hospital laboratories in testing and identifying bacterial samples. In May 2017, 16 hospitals performed bacterial testing, attempted antibiotic sensitivity testing, and performed antibiotic sensitivity testing in line with manual. Of the 16, no hospital correctly identified all the bacteria (data not shown). Of the 18, 10 hospitals correctly identified all bacteria. This constitutes a notable increase in percentage of hospital laboratories' able to appropriately identify bacterial samples and antibiotic sensitivity testing procedures (from 0% in May 2017 to 55% in August 2017).

B. Did improvement capability increase in participating organizations/hospital teams over the 9-month collaborative?

Figure 7 shows the aggregate change in MUSIQ scores for each hospital between May and August of 2017, with red bars indicating a decline. Several hospitals, such as Najah, Beit Jala, and Ahli, showed marked improvements over two months, while others, such as Hebron, Muhtaseb, and Istishari, dropped their score substantially over that same period. Almost all hospitals are within a feasible range of success, provided that extant contextual barriers be addressed. Furthermore, the direction of aggregate MUSIQ scores combined across all hospitals is upward (data not shown), suggesting improvements may continue over time with ongoing support to QI teams.

Figure 7. Hospital-level change in MUSIQ scores, May-Aug 2017



Overall, results from the MUSIQ tool were largely inconclusive, as aggregate scores showed a flat trend and there were no clear patterns or significant differences across MUSIQ score domains by hospital (data not shown). MUSIQ scores are meant to demonstrate self-assessments of QI capacity by training participants, so variation in scores could be attributed to several testing effects. First, the self-assessment was applied twice over a short period (two months), which is insufficient time for substantial changes in QI capacity to take place. Furthermore, the test may have been taken by different individuals from the same hospital at different time points, which could have contributed to variation in results. Finally, it is common to see a fluctuation (particularly downward) in self-assessment scores of this nature. With time and a greater understanding of the QI process, the tester may have been more parsimonious in their scoring during the second round. Of note is that by the second round of testing, 17 hospitals were within a range that suggests they have a reasonable chance of success, while all but one of the remaining hospitals were in a range for success once possible contextual barriers are addressed. Only one hospital was assessed as having serious contextual issues that threatened their capacity for success.

C. What did participants experience as barriers and enablers to progress within the collaborative?

Analysis of focus group interview transcripts revealed several key findings related to participants' experiences with the improvement collaborative methods and activities used in reducing HAIs. These main themes of the discussion were: 1) challenges faced in reducing HAI; 2) perceptions, views, and experiences in each collaborative activity; 3) network creation for change; and 4) the future and sustainability of the improvement collaborative. **Appendix 1** summarizes the number and participants in each focus group discussion. As any identifying information would compromise the anonymity of participants, direct quotes are left anonymous throughout the report.

1. Challenges faced in reducing hospital-acquired infections

Focus groups participants were asked to discuss the major challenges they faced in reducing HAIs at the hospitals they work in**.** According to participants, **poor infrastructure** and **lack of sufficient space** were major barriers to introducing changes for improvement. For example, participants mentioned the difficulty

with installing new sinks for hand hygiene and the lack of isolation rooms/spaces to implement the transmission-based precautions due to current infrastructure and space limitations. Those in the laboratories echoed similar concerns about the poor infrastructure in hospital laboratories.

> *"We raised the issue with the director and medical director, then brought the hospital engineer to assess the situation, and he confirmed that there is no way to have a new sink."*

> *"Our laboratory has very old infrastructure that we cannot perform microbiology cultures. There is no space or possibilities to expand its size."*

Shortage of supplies was another major challenge, with many participants reporting that supplies needed for hand hygiene, TBP, and microbiology were inconsistently available due to gaps in logistics and lack of a dedicated budget for hygiene at the facility level.

> *"[There is a] lack of coordination between the hospital quality coordinators and the MOH central stores, which sometimes creates a gap…[and] makes the staff of the hospital keep thinking that the needed supplies are out of stock."*

> *"There is no allocated budget for infection control and there is shortage in all supplies [such as] liquid soap, paper towels, alcogel, personal protective equipment, and so there is no continuity of the work we have started few months ago, to reduce HAI in our hospital."*

High workload and **staffing shortages/turnover** create further obstacles to HAI improvement. Many hospital departments were not staffed in the required ratios, and participants noted how this affected the implementation of work to reduce HAI and the collection of compliance rates for the various HAI indicators. As one participants stated: *"sometimes the workload does not allow us to have time to do the five moments of HH."* Most participants also stressed an urgent need for a full-time infection control officer at all hospitals. At the time of the study, only one private hospital had a full-time infection control officer. High turnover, especially among cleaners contracted by cleaning companies, created another challenge in work continuity, especially at MOH hospitals. Several participants explained: *"we train the cleaners on HAI and infection control topics and after a week or two, they leave their work, and new cleaners come, and we have to start all from the beginning."*

Consistent with these concerns, the lab track group expressed that a combination of supply shortages, staff shortages, and high workload hindered their ability to improve their work. Some labs are small with limited workspace, and nearly all participants reported that there is no full-time microbiologist at hospitals, which is essential to implementing all policies and indicators.

Another challenge the participants faced was **the lack of/limited knowledge and awareness on HAI** among staff members, including specialists, patients, and the community. All hospital staff, including cleaning and support staff, should be trained in HAI improvement.

> *"Through our work, we see that the awareness on HAI is limited among staff members, especially nurses and then specialists who have a problem in accepting the culture of infection control."*

> *"We believe that there is a need to focus also on cleaners as they have contact with patients and so training them will have much impact on reducing HAI."*

Obstructive cultural beliefs and attitudes were perceived by the participants as a major challenge to HAI improvement as long-standing practices are difficult to change. There was recognition that beliefs and attitudes take time to change, which may be why returns on HAI improvement efforts may have seemed slow at first. Physicians were seen as particularly resistant to change.

> *"We see that our staff members are resistant to change and we need to keep reminding them frequently on certain issues, which makes the work progress to be slow."*

> *"Our hospital does not have a problem with supplies or infrastructure, but it is in the culture of patients, companions, and specialists. The leadership of the hospital managed to work on the non-*

compliance of physicians with hand hygiene and personal protective equipment for the isolated patients."

"Health staff needs time to change and sometimes difficult to deal with, but we see that nurses are more compliant than physicians. We believe that physicians, especially specialists, are the most difficult group to work with."

While all participants recognized the value and necessity of change, every group identified the **rapid pace of change due to the short duration of the project** as a challenge because it did not allow sufficient time for reflection and concrete results. As one participant explained *"we need a long time to implement policies and measure indicators, and the project requests from us many things in a very short time; this does not allow us to track the change we aim to have."*

Participants reported other factors added to the workload, such as the **political situation** in the country. Several participants said: *"The current political situation in the country and having many referred patients from Gaza to the West Bank and to Jerusalem makes it difficult to limit the visiting hours and to limit the number of visitors/companions which in turn highly affects the indicators we work on."*

2. Perceptions, views and experiences in each of the improvement collaborative activities

Participants were asked about successes, challenges, and potential improvements in the learning activities used during this collaborative. Specifically, we asked about their impressions of learning sessions, web-based video calls (following the model of the University of New Mexico ECHO program), data collection sheets, coaching visits, and WhatsApp groups.

Learning sessions

All participants believe that there were concrete **benefits** from the learning sessions such as improved knowledge and information, new tools/methods of measurement, and strategies and timeframes for improvement work. They also believed that learning sessions formed an opportunity to get to know new colleagues and to exchange experiences, which led to improved sharing and communication.

"Currently after attending the learning sessions, we can communicate easier with other hospital teams."

"It is the first time that I work according to a clear methodology and an action plan. This is very important as I currently have the tools to measure, data to refer to which help me track the progress in our work."

"During the sessions, we have the chance to see and hear what other hospitals achieved, and this encouraged us to work more effectively."

The fact that the attendees of the learning sessions were multidisciplinary was considered by participants as a successful strategy in the improvement collaborative, because working on reducing HAIs requires a team of several specialties to have complementary work. The teams who attend the learning sessions had nurses, physicians, laboratory technicians, and pharmacists. One participant said: *"The way we deal with the staff members at our hospital changed to better now, and we wished that the number of staff to attend the sessions could be increased."* Another success observed by all groups was the introduction of antimicrobial stewardship in the learning sessions, which was perceived as being a top priority at all hospitals: *"There is more attention to the AMS topic which will help us reduce antibiotic prescriptions and so resistance, and now the hospitals have a reference in case of consultation from the infectious disease physicians who work in the project."*

Participants from the laboratory track believe that the learning sessions standardized the work throughout hospitals by working on/sharing standardized protocols, internal quality control, ATCC, increased their

knowledge, and increased the communication with other hospitals: *"The learning session empowered the staff members that they can now communicate better with the medical staff 'physicians', discuss types of bacteria, MDROs, and discussions are not based on expectations, rather on facts/evidence as the lab technician is more confident of the results."*

Most participants were satisfied with the methods used during the learning sessions, such as story boards, breakout sessions, knowledge café, and the evaluation of learning sessions. The best activity for the lab track participants was the 'unknown microorganism' exercise. One participant said: *"the exercise is very specific and provides an excellent challenge to correctly identify bacteria."* Another added: *"the unknown microorganism exercise helped us to identify our strengths and weaknesses."*

Challenges reported by the participants during the learning sessions were: a number of lectures were long and the use of English language. Few participants said: *"the language was not clear in some of the 1st and 2nd learning sessions, and we hope to have more sessions in Arabic in the 3rd learning session."*

ECHO Web-based video calls

Web-based video calls were viewed by participants to have a **positive impact** on the methodology of work and communication with other hospitals. Participants viewed calls as a way of standardizing work methodology across hospitals. However, a few participants could not see the value of the calls to adding new knowledge, as they felt some questions raised during calls were left with no resolution.

> *"The calls are a method of continuing education, and they standardized our work methodology and gave us an idea about the achievements of other hospitals."*
>
> *"We raised certain questions during the calls, but sometimes there were no definite answers to the raised questions."*

The main **challenges** that were experienced by participants in the calls were: no or poor internet connection which affected sound and picture quality; much time was spent at the beginning of the calls for signing in; some hospitals did not attend on time; and timing and frequency of the calls were not convenient for some participants.

When **comparing video calls with phone calls**, most participants expressed that video calls were more useful than phone calls as there was a more direct connection between participants who could see one another during conversation. Video calls also enabled the real-time exchange of documents and resources, as needed. One participant expressed: *"The video call is better than the phone call when there is good internet connection and it enables you to share documents and there is more attention and interaction by the participants; we feel that a video call is similar to a small meeting."* Three participants believed that phone calls were more useful than the video call because one can get quicker answers to questions. One said: *"By phone, you quickly describe the problem and get the answer on the spot."* Most participants thought that it was important to keep the video calls in the future as they save money, time, and effort of transportation.

Recommendations from the participants to improve the calls were: better internet connection; less frequent calls, such as once a month; send the schedule of the calls beforehand for time planning; discuss relevant information in the calls; and also have a facilitator to guide the calls in Arabic and have a reference person identified in case there are questions.

Data collection sheets

Participants considered **datasheets as one of the best tools** they used throughout the improvement collaborative. Datasheets provided an opportunity to compare infection rates between months and between departments, perform follow-up on compliance rates of indicators, identify problems, and take action. They enable IPC officers to identify departments with weaknesses. They were perceived as methods of documentation and to standardize work. One participant stressed that datasheets formed a type of evidence when discussing issues with the leaders at hospitals.

"Numbers and percentages are very important to identify where problems/obstacles are, and any change gives us a sign where to work and focus."

"Datasheets give us justification for improvement. Through data, we could identify the groups that are not compliant with performing indicators, and we focused our work with those groups."

"We attach the results of the compliance rates in the reports to our director to show where the problem is, and we feel that this brings the attention of the director to the work that we are doing."

"We feel that the leadership provides more support to our work now as we communicate the data to them, and there is evidence for the performance and they are more oriented to what we are doing."

The collaborative also brought data collection to the forefront of activities, encouraging greater participation from all staff members: *"Before the project, data collection was a difficult task because many staff members considered it as spying on them but after the project the image is different and the team realized that there are several methods for data collection and there is much value of the data."* Participants in the lab group believed that the quality control datasheets helped in tracking the selection of the correct antibiotic and directly impacted HAI reduction: *"When we correctly identify the bacteria causing the infection, we can surely reduce HAI."*

The main **challenges** the participants faced in data collection sheets were: workload and shortage of time to collect data or train staff to collect data. In most cases, it was the QC or IPC officers who collected data. As one participant said: *"We also need to train other team members, mainly heads of departments on data collection. For continuity/sustainability, there is the need to have more than one person to collect the data."* Others considered the poor cooperation between nurses and physicians as an obstacle to having the datasheet completed on time. Similar to IC groups, participants from the lab group considered time shortages as a major challenge for completing the quality control datasheet. One participant said: *"There is much workload on me that I sometimes need to take work home to have it finished on time."*

Some participants reported that they needed **additional support** and training on datasheet use; others considered validity of data to be an issue as the observer is not always the same when observation/data collection is done.

Coaching visits

Benefits of coaching visits included having an opportunity to learn, having feedback, identifying problems, and immediately thinking of solutions. Feedback from coaches was seen as an important way to reinforce the skills learned through the collaborative and to provide essential positive encouragement. They are also an opportunity to draw attention to important work being done by the improvement team within the hospital.

"We felt that the coaching visits give more commitment, attention, and importance to our work."

"When the coach observed improvement and positive change, we as team were praised and encouraged to continue."

Coaching visits were also viewed as an effective means of problem-solving and improving systems for infection prevention. Several participants noted the importance of data use in these visits, which further fueled improvement activities.

"The coaching visit provided us with ideas to implement with the newly contracted cleaning company, such as using forms/checklists, new uniforms, and how to fulfill the five components on the sinks."

"We had ideas on how to present data so that all the team can see the results. We also got ideas on incentives and on creating competition between staff members and between departments."

"After the coaching visit, we started to collect the HH compliance data on weekly basis as the rate was low in some departments and we presented the rates in run charts. After implementing this plan, the HH rate increased to 95% in one department and to 92% in another department."

The **challenges** mentioned around coaching had more to do with systemic infrastructural limitations and the focus on one department of the hospital. Participants' recommendations for improving coaching sessions included creating clear goals for each visit, having standard protocols for the visits, reinforcing coaching sessions with more follow-up visits, and sharing copies of the coaching report for future planning. Participants also called for continued coaching support from the MOH, once project activities have ended.

WhatsApp groups

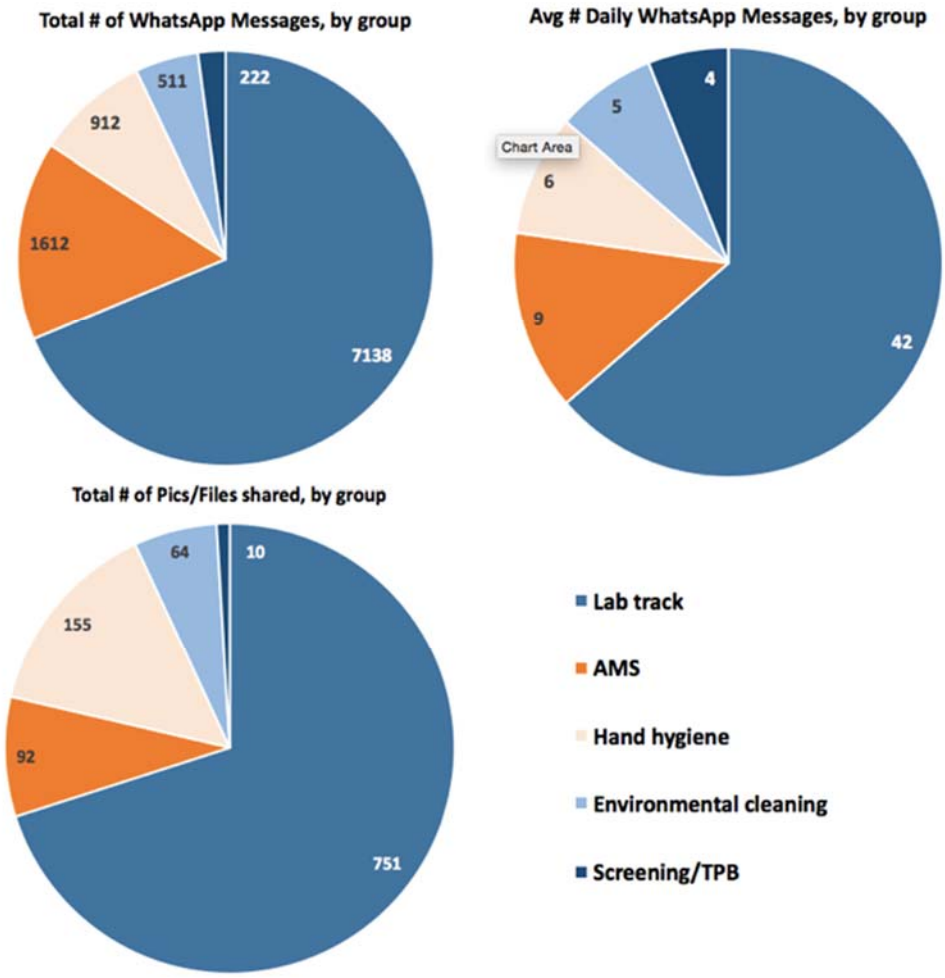
Over the course of the project, five WhatsApp text messaging groups were created, one each for the laboratory track, AMS, hand hygiene, environmental cleaning, and screening TBP. The WhatsApp groups were designed to provide real-time communication and foster collaborative problem-solving. Most participants reported using the WhatsApp chat at least once a day to exchange messages or images. However, the laboratory group was much more active, clocking a daily average of 42 exchanged messages compared to an average of five daily messages among the other groups (**Figure 8**).

Perceived **benefits** of the WhatsApp groups included, having a forum for quick rapid feedback to questions, having a space to share photos and video, and providing the feeling of team work. Documenting conversation helped standardize work and strategies.

Challenges of the WhatsApp groups included, the misuse of the space for discussion of personal/social issues, arguments among participants, photos and videos that consumed an overwhelming amount of space, and the lack of a designated facilitator/referee for each group. Compared to traditional phone calls, participants felt that WhatsApp messages provided a useful, free means of documentation, but that phone calls were more efficient for rapid problem-solving.

Most participants suggested continuing with the WhatsApp groups, particularly for the lab track, but to designate a facilitator for each group to control the topics and responses to questions.

Figure 8. Activity on WhatsApp groups, March-August 2017



3. Network creation

One of the main goals of the multi-faceted improvement collaborative approach was to create a well-connected network of providers across the West Bank that operated in both virtual and real spaces. Participants reported that the improvement collaborative gave them the tools communicate better with their improvement teams as well as the leadership at their hospitals. Respondents felt they were better able to share new knowledge on infection control with their in-house teams and had access to a broad network of care providers to trouble-shoot difficult infection control problems. Additionally, the collaborative was perceived to form the basis of infection control, improving the constitution of the quality team, and supported standardizing methods, protocols, and forms in hospitals. Several participants even reported that their hospital committees related to infection control were re-activated after participating in the HAI improvement collaborative.

Some participants credited the collaborative with creating a stronger network of sharing and cooperation within individual hospitals, whereby participants shared their new knowledge on PDSA cycles, data sheets, and HAI prevention techniques with colleagues. Several participants credited their collaborative networking with increasing interest among other staff members of the facility to learn about and participate in infection prevention and control efforts. Respondents also reported that the improvement collaborative improved communication with colleagues from the same cadre and with other staff members, such as the laboratory staff, physicians, and students who train at their hospitals. Members of

the lab group shared that the network helped create a documented chain of communication for reporting results and providing follow-up, as needed.

> *"We felt that sharing what we learn with the other staff members improved the cooperation and increased interest and knowledge. There are topics that are standardized in all hospitals now. Participation of what has been learnt is done in the monthly meetings we perform as a quality committee."*
>
> *"The staff members know what is being done, what will be needed, and what needs to be followed up and communicated."*
>
> *"There is an increase in the participation in the infection control courses at the electronic library at the hospital, which is considered as a positive change."*
>
> *"The head of the operating theatre and the head of the Neonatal Intensive Care Unit started to prepare PDSAs and heads of units prepare datasheets."*

Collaborative members also reported that the network improved their communication with staff from other hospitals through visits to other hospitals, visits to the Quality Department at the MOH, phone calls, WhatsApp texts/photos, and emails. Participants credit this increased networking with tangible improvements in record-keeping, referrals, and overall patient care.

> *"We believe that due to the discussions among the hospitals, there is more information in the transfer documents of the patients."*
>
> *"For active screening results for referred patients, we communicate with the referring hospitals to make sure about the report of the patient."*

When asked for suggestions to improve the network, many participants stated that the Quality Department at the MOH must take a leading role in providing follow-up support to all hospitals, including those in the private sector: *"We consider that the MOH is the umbrella of all quality work and should be the reference for all hospitals to have the work done in the best quality."* Other suggested methods to improve the network included, establishing a website for the 22 hospitals in the project; holding monthly meetings for the IC committee with recommendations being communicated to responsible health staff, and that each of the QI, AMS, and laboratory groups need a full-time moderator.

4. The future of the improvement collaborative

Participants were asked to share their thoughts on the potential future of the collaborative, after the ASSIST Project support ends. Most respondents described the improvement collaborative as forming the foundation for reducing HAIs and they believe "*it is a must"* to continue with the work that has started through the project. As one participant described: "*we have been looking for the start point and we found it in the Learning Collaborative of the ASSIST project. Many of us have quality certificates, we attended several workshops and had training sessions, but we believe that the Learning Collaborative supported us to implement methodologies, to put plans, to identify goals, and to use tools to reach the goals."*

Challenges to sustainability at the hospital level is the high workload and limited hours the IPC officer works at the hospital (not full-time). Other challenges described by the participants included financial barriers, limited resources, and lack of commitment from part of the staff members. Challenges at national level mentioned by the participants included limited supervision work by the MOH due to limited number of staff at the Quality Department and possible turnover of staff in the MOH departments. Several participants said hospitals should learn to operate independently: "*We should not rely on the [ASSIST] project as it is going end; we have to depend on ourselves with the resources we have.*"

Many participants had the expectation that the collaborative would stop as soon as the project ends and thus there would be no follow-up on what has started/was built and what is being done. Other participants believed the activities would continue but at a slower pace. One participant said: "*The sustainability can*

continue inside each hospital, and there needs to be support from the MOH Quality Department." Another participant said: "*We know that the project ends, but we will keep in touch with each other.*"

IV. DISCUSSION

Though the USAID ASSIST Project in the West Bank lasted only nine months, the experience provided invaluable lessons on how to improve performance to reduce systemic limitations and daily behaviors that contribute to HAIs. One main strength of the improvement collaborative was in its multi-pronged approach of engaging providers, which included a variety of in-person and virtual tools. By supplying providers with a variety of methods for learning, the collaborative was able not only to create an improvement community across a geographically vast network of hospitals, but it also allowed QI teams to focus and iterate learning sessions according to the natural evolution of the group itself.

The ASSIST West Bank project also used multiple forms of communication and data to maintain a network of improvement providers across the 22 target hospitals over the duration of the project. Participants regarded tools such as ECHO and WhatsApp as effective and efficient means of maintaining contact within the network and of problem-solving within the context of a larger improvement community. These tools, which are affordable and readily available, can be an essential means of bridging the communication gap in settings like the West Bank where physical travel is greatly hampered. The embedding of data tools at the facility level also encouraged the collection and use of data both at the facility level, as well as at the MOH, which has since used hospital data trends to determine allocation of improvement resources.

Participants in the improvement collective demonstrated a high degree of engagement and enthusiasm. However, many hospitals reported a general lack of resources and staffing, which limited their capacity to make huge gains in improvement. With additional time and resources, the improvement efforts could make greater changes that could translate into reduced HAIs. Limited resources at the facility level may also have affected participants' long-term engagement with improvement efforts. Lack of basic supplies and space, high workloads and persistent staff shortages all contributed to frustration and fatigue among front-line providers tasked with improving patient care on a daily basis. As a result of these limitations and the short duration of the intervention, the evaluation was not able to track improvements in patient outcomes. However, the upward trends in process indicators suggest improvements in care that could yield patient benefits if sustained.

V. CONCLUSION

Despite the contextual and resource constraints in the West Bank, ASSIST created a technology-driven, multifaceted learning collaborative that encouraged long-term networking of improvement care providers across physical boundaries. By embedding their work within the existing health care system and working hand in hand with the MOH, the project fostered a sense of ownership and exchange among previously disconnected local entities. This approach enabled sustainability of key improvement practices and led to the undertaking of new initiatives in improved patient safety practices by the MOH. The ASSIST West Bank project served as a successful example of how to rapidly stimulate long-term improvement changes in a resource-constrained environment.

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APPENDICES

Appendix I: Characteristics of Focus Group Discussions

Date and location of FGD	Participating hospitals	Description of participants
10.07.2017 Maqassed Hospital, Jerusalem	● 4 East Jerusalem Hospitals: Augusta Victoria Hospital, Maqassed (2 participants), St. Joseph, Palestinian Red Crescent Society hospital	● Gender: 2 females, 3 males ● Qualification: 4 nurses and 1 physician ● Current role: 4 infection control officers and 1 infection control physician ● How long in this role: 2-6 years ● How long at facility: 2-16 years
18.07.2017 Rafidia Hospital, Nablus	● 8 hospitals from North West Bank (6 MOH, 1 private, 1 UNRWA): Rafidia, Watani, Tulkarem, Qalqilia, Tubas, Jenin, Najah National University Hospital and UNRWA hospital	● Gender: 2 females, 6 males ● Qualification: 4 nurses, 1 hospital administrator, 1 medical engineer, and 1 lab technician ● Current role: 6 quality coordinators, 2 infection control officers ● How long in this role: 7 months-4 years ● How long at facility: 4-26 years
20.07.2017 Hebron Hospital, Hebron	● 6 hospitals from South West Bank (4 MOH, 2 NGO): Beit Jala, Hebron, Yatta, Muhtaseb, Caritas Baby Hospital and Ahli)	● Gender: 2 females, 4 males ● Qualification: 4 nurses, 1 biotechnologist, 1 business administrator ● Current role: 4 quality coordinators, 2 with two positions: quality coordinators and infection control officers ● How long in this role: 3 months-7 years ● How long at facility: 1.5-15 years
25.07.2017 MOH, Ramallah	● 4 hospitals from Middle West Bank (3 MOH and 1 private)	● Gender: 1 female, 3 males ● Qualification: 3 nurses, 1 lab technician ● Current role: 3 infection control officers, 1 quality coordinator ● How long in this role: 6 months-3.5 years ● How long at facility: 1-10 years
7.08.2017 Caritas Baby Hospital	Open Group Discussion Meeting composed of 31 participants from 21 hospitals (one hospital was absent)	All participants were microbiologists/ lab technicians

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