KAIZEN Case 3
- Ultrasound machines at a regional workshop -

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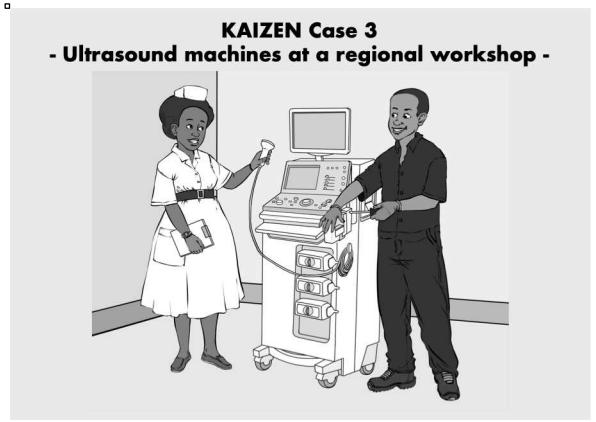


KAIZEN Case 3
Ultrasound machines at a RWS

[Lines]

Hi, I'm Sam! I work for a regional workshop in XYZ region as an assistant engineering officer. Although we don't always have enough resources, I enjoy my work and using my creativity.

In addition to my actual job, I've been doing 5S activities with my colleagues, and the fact that our workplace is well-organized also motivates me. But recently we noticed some problems at the workshop, and decided to do something about them.

KAIZEN Case 3
- Ultrasound machines at a regional workshop -

1

Step 1: Theme selection

Theme selection

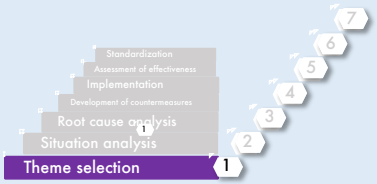
Possible KAIZEN themes	Urgency	Resource availability	Time required	Importance	Overall feasibility
1. The inventory list is updated on a regular basis.	1	3	2	2	**8**
2. Job cards and maintenance requisition forms are always available.	2	2	2	2	**8**
3. Ultrasound machines in XYZ region rarely malfunction.	3	2	2	3	**10**
4. Necessary parts are procured promptly.	3	2	1	3	**9**

1 **3**: High priority/easy to take action, **2**: Moderate, **1**: Low priority/difficult to take action

[Lines]

So we, the workshop members, sat together and had a brainstorming session about the problems we were facing. Finally, four problems were listed: the issue of regular updates on the inventory list, the unavailability of job cards and requisition forms, ultrasound malfunctions, and the procurement of parts. Then we scored each problem, one-by-one, for urgency, resource availability, time required and importance. No. 3, ultrasound malfunctions, got the highest score and was selected as our KAIZEN theme, but we also agreed to tackle No. 2 through small KAIZEN. For No. 4, we decided to propose to the administration that we team up them with and work together, as the issue of procurement can't be solved by the workshop alone.

Theme selection



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1

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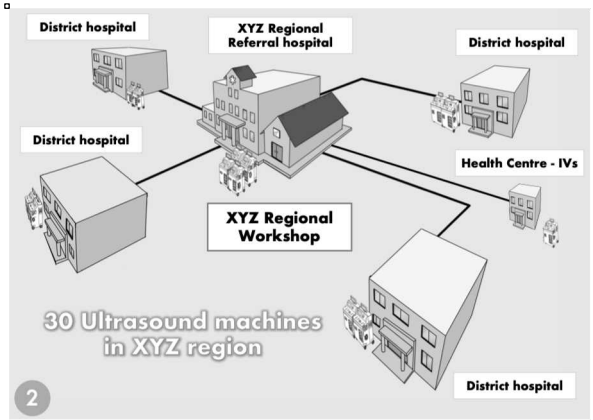
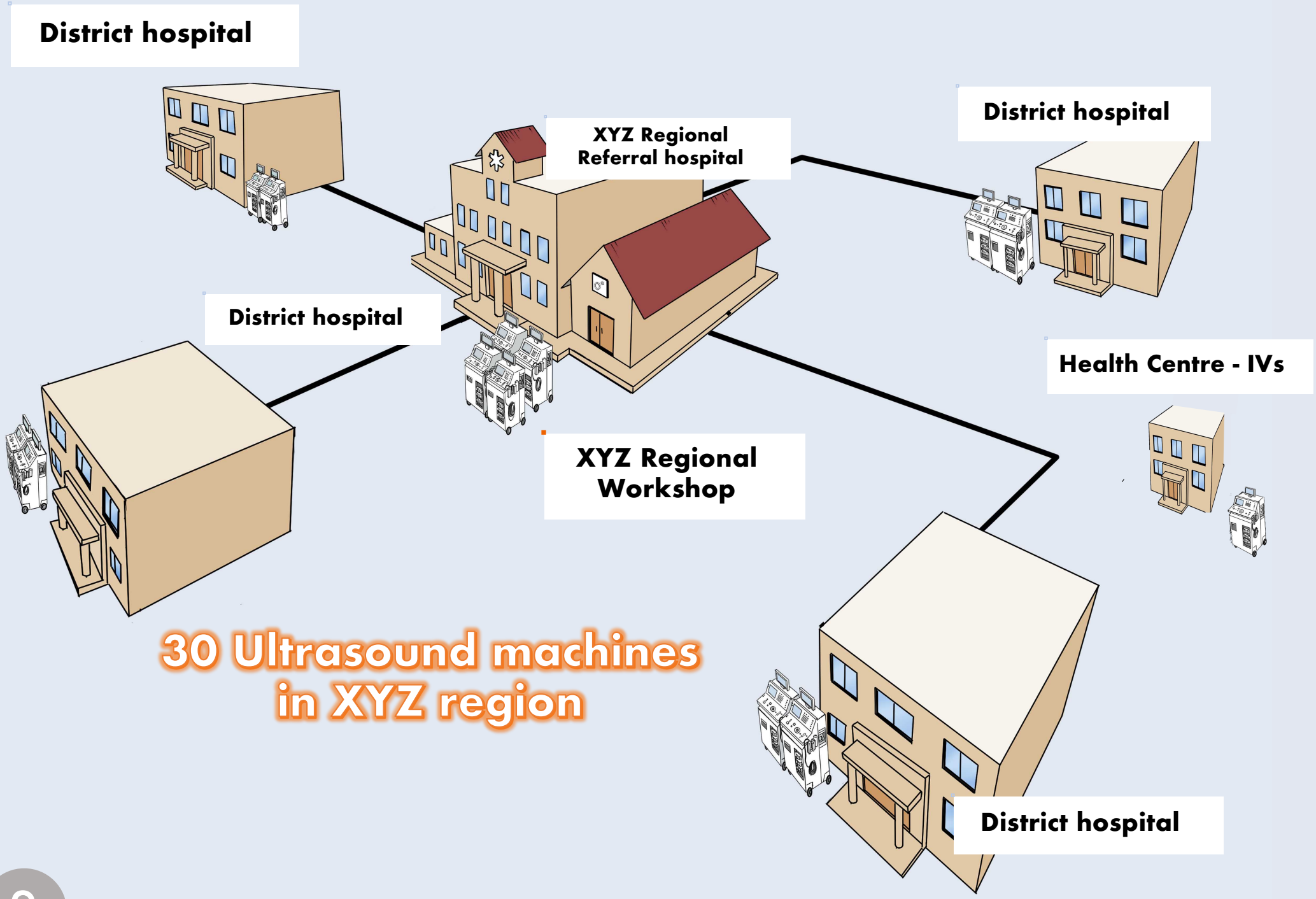
2



Step 2: Situation analysis

[Lines]

In our region, there is 1 regional referral hospital, 4 general hospitals and 12 health centre-IVs. Each health facility has at least one ultrasound machine. In total there are 30 machines in XYZ region.
The regional workshop is responsible for maintaining all of these machines and receives requests for repairs from the health facilities.

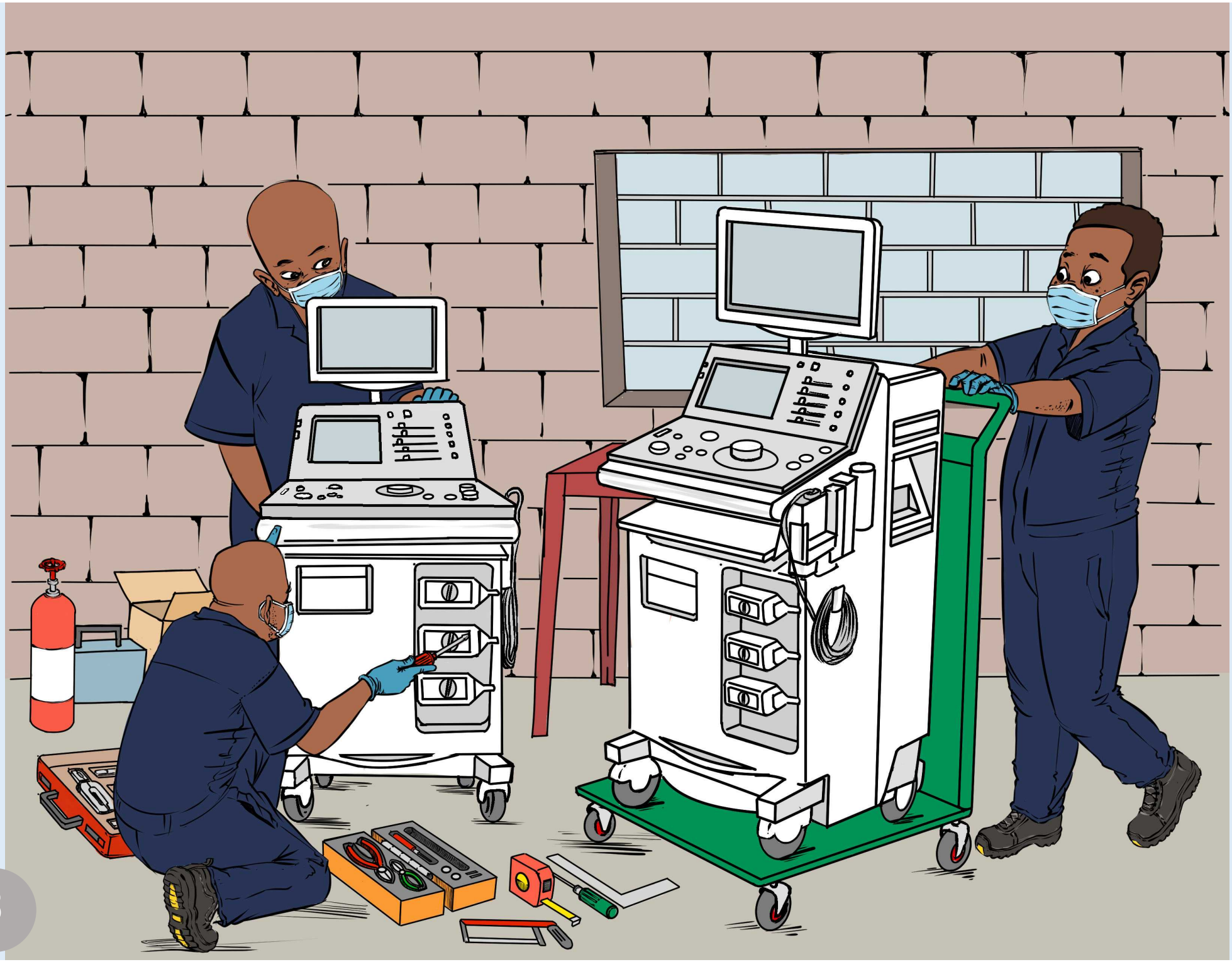

District hospital
XYZ Regional Referral hospital
District hospital
District hospital
Health Centre - IVs
XYZ Regional Workshop
30 Ultrasound machines in XYZ region
District hospital

3

Collecting data (Step 2)

[Lines]

In order to get the details of the malfunctions, we started by ascertaining which parts needed to be repaired. We gathered the information by examining the machines that were malfunctioning, as well as looking through past Job Cards.



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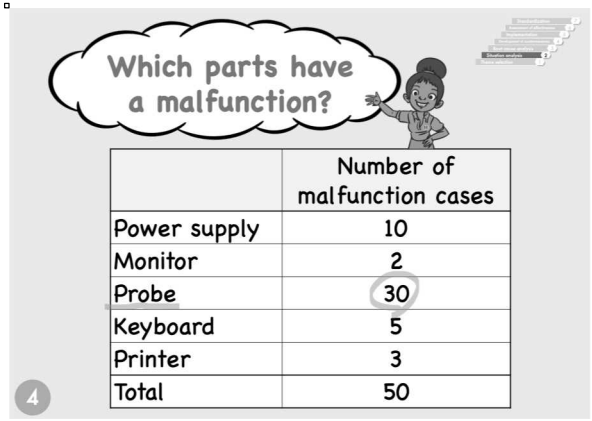
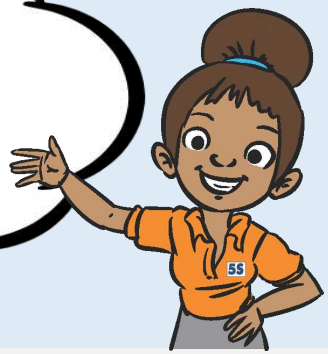


Results of data collection (Step 2)

[Lines]

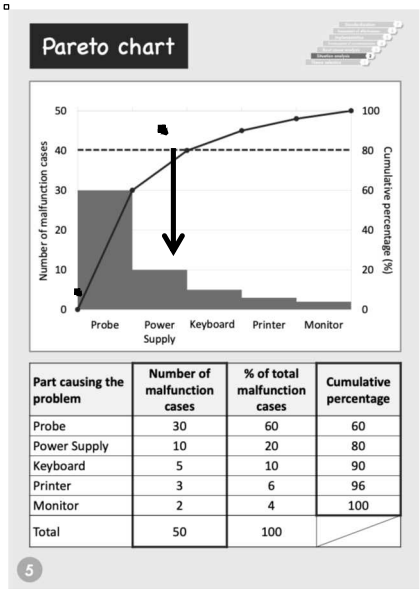
These are the results: There were 50 cases of ultrasound machine malfunction in the last 6 months. The breakdown of malfunctioning parts is shown in the table. Probe failures were the most common type of malfunction, with 30 cases, followed by 10 cases of power supply malfunction and 5 cases of keyboard malfunction.

Which parts have a malfunction?



	Number of malfunction cases
Power supply	10
Monitor	2
Probe	30
Keyboard	5
Printer	3
Total	50

5



Part causing the problem	Number of malfunction cases	% of total malfunction cases	Cumulative percentage
Probe	30	60	60
Power Supply	10	20	80
Keyboard	5	10	90
Printer	3	6	96
Monitor	2	4	100
Total	50	100	

A Pareto chart (Step 2)

[Lines]

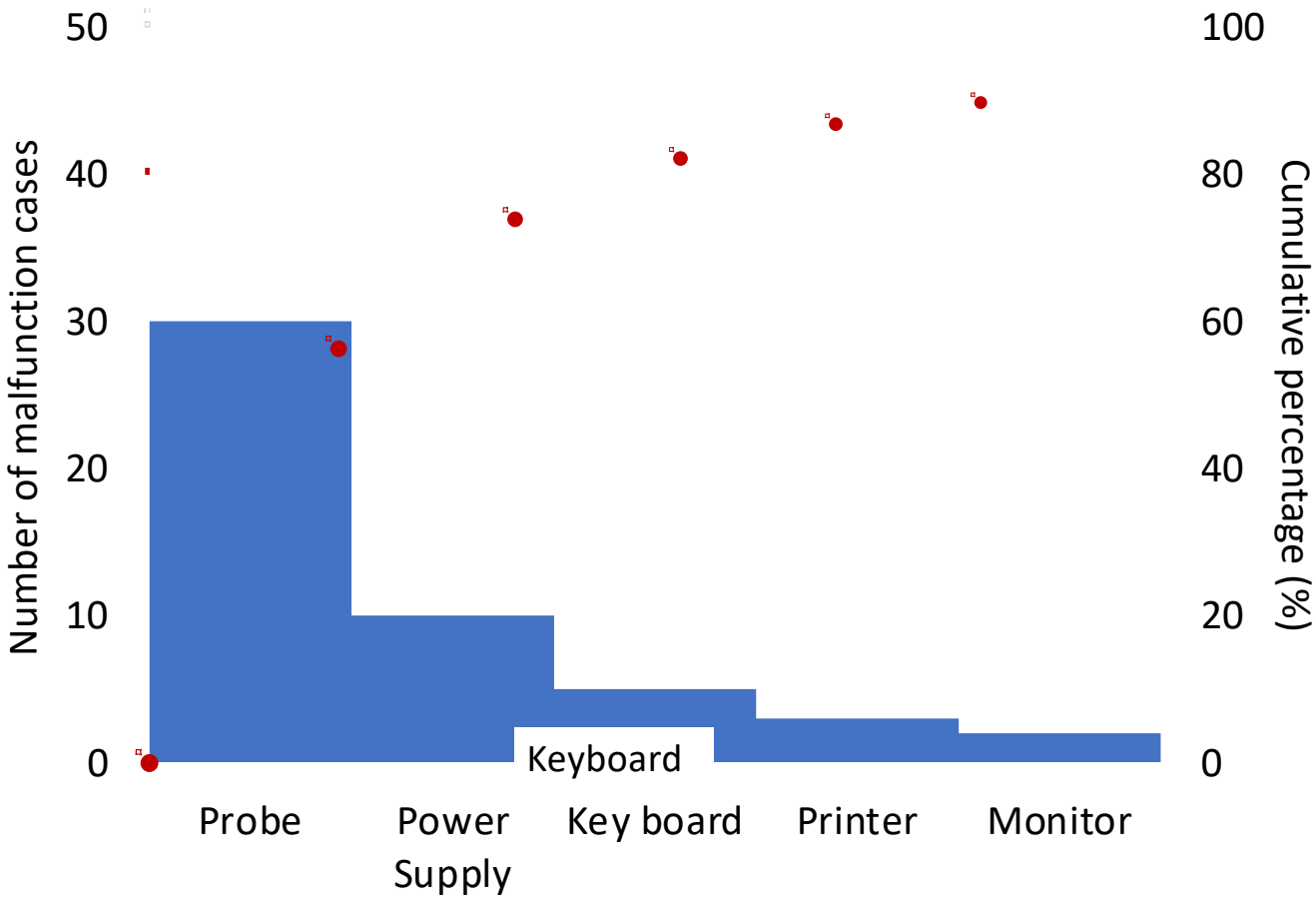
Next, we created a Pareto chart from the data. We agreed to set the cut-off at 80% and found that malfunctions of probe and power supply were the cause of 80% of total ultrasound machine failures.

[Tips]

Pareto charts are used when several contributing factors exist, and you would like to highlight the most important among a set of factors. In this case, they used a Pareto chart as they wanted to see which types of malfunctions were contributing most to the total number of failures.

For more information on Pareto charts, such as how to calculate cumulative percentage, please see 5S-CQI(KAIZEN)-TQM Implementation Guidelines in Uganda (the Guidelines), pages 40-42.

Pareto chart



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Probe	30	60	60
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Printer	3	6	96
Monitor	2	4	100
Total	50	100	

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Step 3: Root-cause analysis

[Lines]

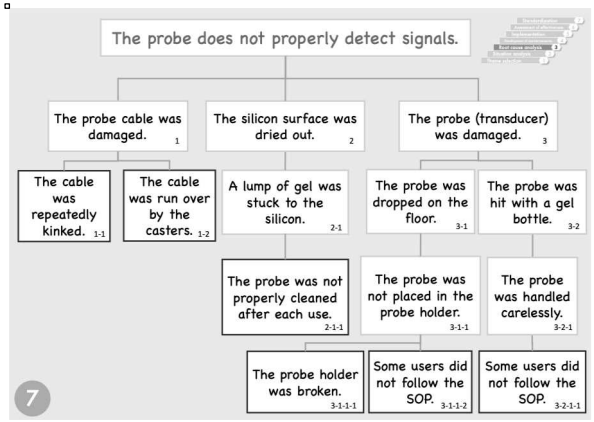
We agreed that the observations and insights of the machine users are also important and decided to have some nurses join the discussion on root-cause analysis. Using sticky notes, we wrote as many causes as we could think of. Then we put the notes in order, keeping in mind the logic of cause and effect.

[Tips]

It is good to involve other stakeholders from outside of your department in your discussion. In this case, they wanted to invite the physicians who are the main users, but the physicians were too busy to attend the discussion. However, some of the nurses who joined the discussion were certified User Trainers and provided useful ideas from the viewpoint of users.

7

Read the cards from top to bottom !



Tree diagram (Step 3)

[Lines]

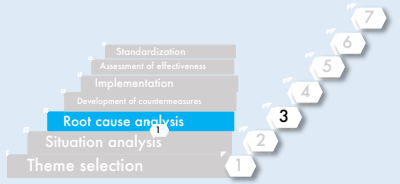
Next, we created a tree diagram for each problem. For probes, we described the problem as "The probe does not properly detect signals". Three direct causes were identified: damaged cables, dried out silicon surfaces and damaged probes or transducers. For example, the probe was damaged (3) because the probe was dropped on the floor (3-1) or because the probe was hit by a gel bottle (3-1). Why was the probe dropped on the floor (3-1)? Because the probe was not placed in the probe holder (3-1-1). Why not? Because the probe holder was broken (3-1-1-1) and because some users did not follow the SOP (3-1-1-2).

Please read the other direct causes (1 and 2) and their contributing factors from top to bottom.

All the factors bordered in red are the identified root causes in our case.

[Tips]

- When reading the cards, please point to each card so that the learners understand the cause-effect relationship/why-because relationship.
- They should repeat the same analysis for power supply if time permits.



The probe does not properly detect signals.

The cable was repeatedly kinked.

The probe cable was damaged.

1-1 was run over by the casters.

The silicon surface was dried out. 1

1-2 stuck to the silicon. 2-1

The probe (transducer) was damaged. 3

3-1 The probe was hit with a gel bottle. 3-2

The probe was dropped on the floor.

2-1-1

3-1-1 The probe was handled carelessly.

7

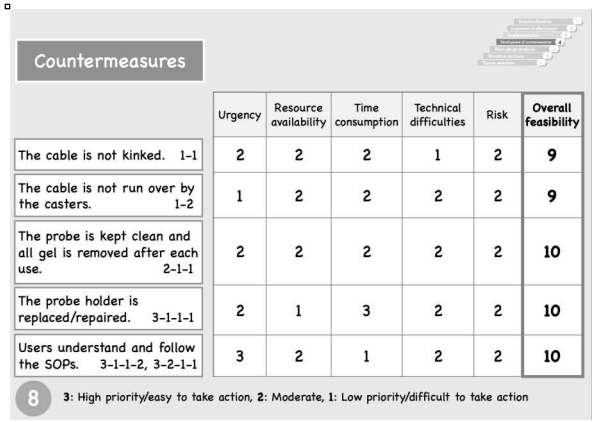
3-1-1-1 The probe was properly cleaned

The probe holder was broken.

Some users did not follow the SOP.

Some users did not follow the SOP.

8



Countermeasures

	Urgency	Resource availability	Time consumption	Technical difficulties	Risk	Overall feasibility
The cable is not kinked. 1-1	2	2	2	1	2	9
The cable is not run over by the casters. 1-2	1	2	2	2	2	9
The probe is kept clean and all gel is removed after each use. 2-1-1	2	2	2	2	2	10
The probe holder is replaced/repaired. 3-1-1-1	2	1	3	2	2	10
Users understand and follow the SOPs. 3-1-1-2, 3-2-1-1	3	2	1	2	2	10

8 3: High priority/easy to take action, 2: Moderate, 1: Low priority/difficult to take action

Step 4: Identification of countermeasures

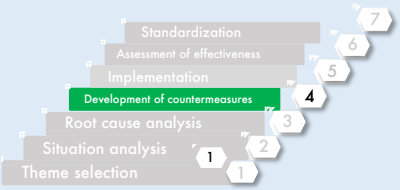
[Lines]

Next, we discussed what countermeasures we should take. We rephrased the root causes to express the state we are aiming for, and scored them according to urgency, resource availability, time consumption, technical difficulties and risk. Since there was no significant difference in the scores, we decided to tackle them all.

[Tips]

Generally a cut-off line is set to pick and choose activities.

Countermeasures



	Urgency	Resource availability	Time consumption	Technical difficulties	Risk	**Overall feasibility**
The cable is not kinked. 1-1	2	2	2	1	2	**9**
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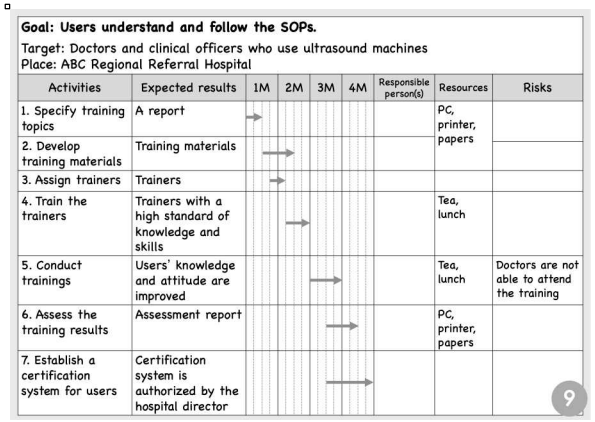
The probe is kept clean and all gel is removed after each use. 2-1-1	2	2	2	2	2	**10**
The probe holder is replaced/repaired. 3-1-1-1	2	1	3	2	2	**10**
Users understand and follow the SOPs. 3-1-1-2, 3-2-1-1	3	2	1	2	2	**10**

3: High priority/easy to take action, **2**: Moderate, **1**: Low priority/difficult to take action

9

Step 5: Implementation (An action plan)



Goal: Users understand and follow the SOPs.
Target: Doctors and clinical officers who use ultrasound machines
Place: ABC Regional Referral Hospital

Activities	Expected results	1M	2M	3M	4M	Responsible person(s)	Resources	Risks
1. Specify training topics	A report	→					PC, printer, papers	
2. Develop training materials	Training materials	→	→					
3. Assign trainers	Trainers	→						
4. Train the trainers	Trainers with a high standard of knowledge and skills		→				Tea, lunch	
5. Conduct trainings	Users' knowledge and attitude are improved			→			Tea, lunch	Doctors are not able to attend the training
6. Assess the training results	Assessment report			→			PC, printer, papers	
7. Establish a certification system for users	Certification system is authorized by the hospital director			→	→			

9

[Lines]

In order to complete the necessary activities successfully and efficiently, we developed an action plan for each countermeasure. This is the action plan for SOPs. Our goal under this countermeasure was for ultrasound machine users to understand and follow the SOPs. The activities required to achieve this were identified and listed in order of earliest to latest start.

Please read the activities and other items accordingly.

[Tips]

Action plans for other countermeasures, such as the issue of cable and probe holders, should also be developed.

Goal: Users understand and follow the SOPs.

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Activities	Expected results	1M	2M	3M	4M	Responsible person(s)	Resources	Risks
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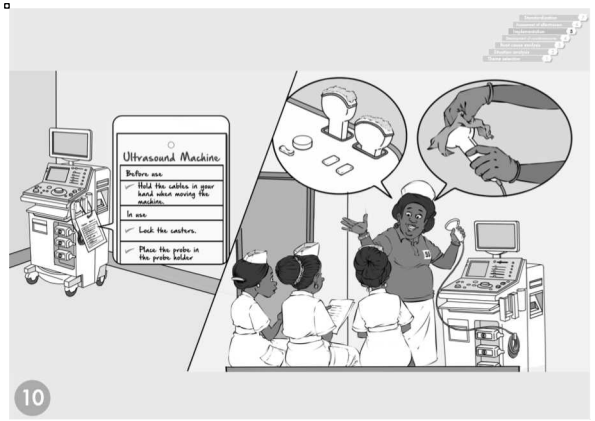
7. Establish a certification system for users	Certification system is authorized by the hospital director				→			

10

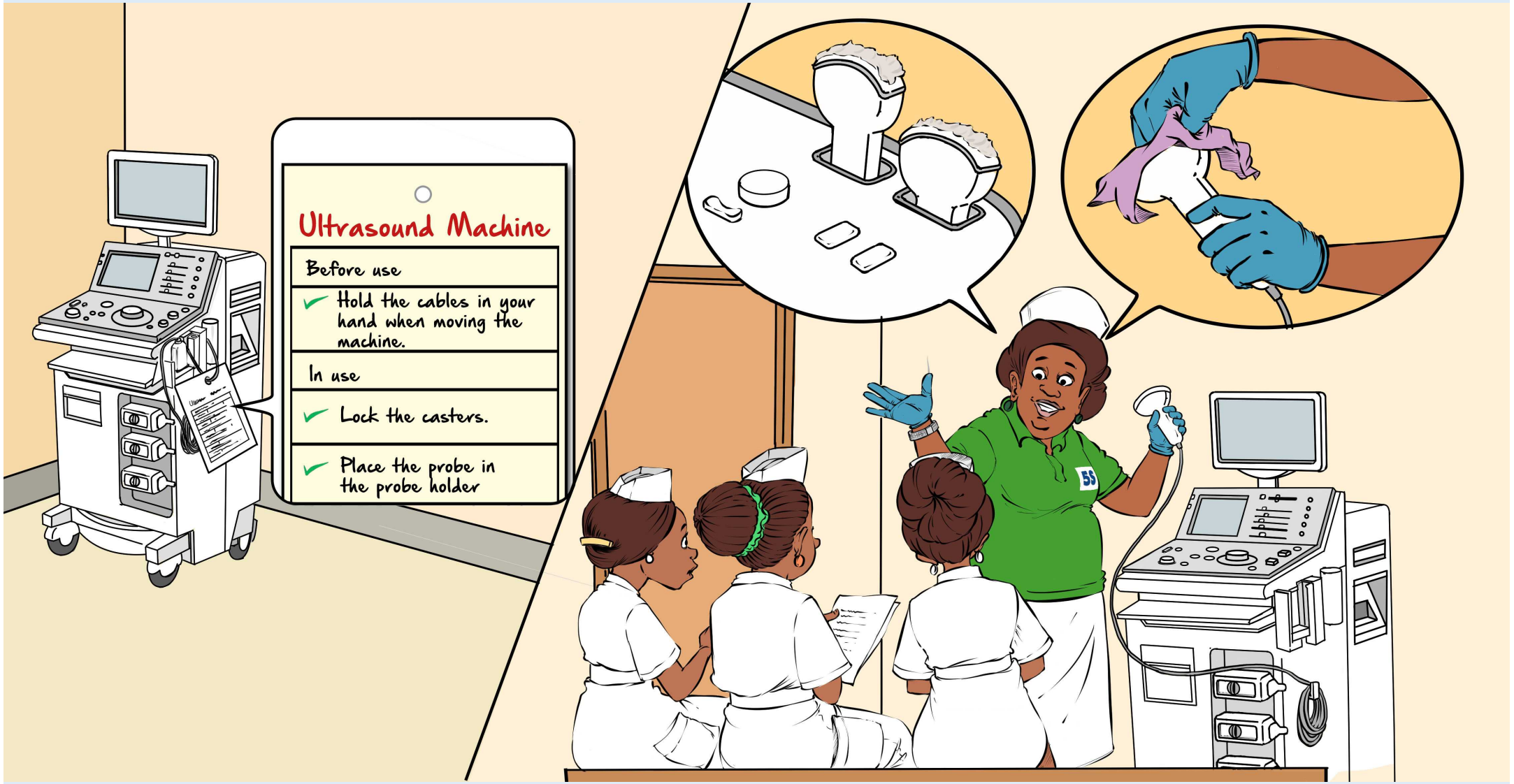


Actual activities (Step 5)

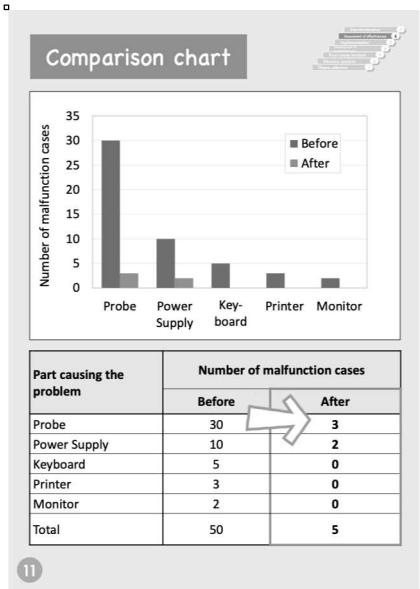
[Lines]

In addition to developing and disseminating SOPs, we also made tags and hung them on the machines. The tags describe the precautions that must be taken when using the machines (see the illustration on the left).

Also, as a part of user training, the certified User Trainers taught nurses how to keep the probes clean after each use (see the illustration on the right).


Ultrasound Machine
Before use
✔ Hold the cables in your hand when moving the machine.
In use
✔ Lock the casters.
✔ Place the probe in the probe holder

11



Part causing the problem	Number of malfunction cases	
	Before	After
Probe	30	**3**
Power Supply	10	**2**
Keyboard	5	**0**
Printer	3	**0**
Monitor	2	**0**
Total	50	**5**

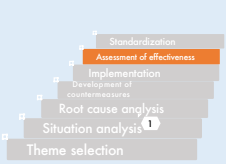
11

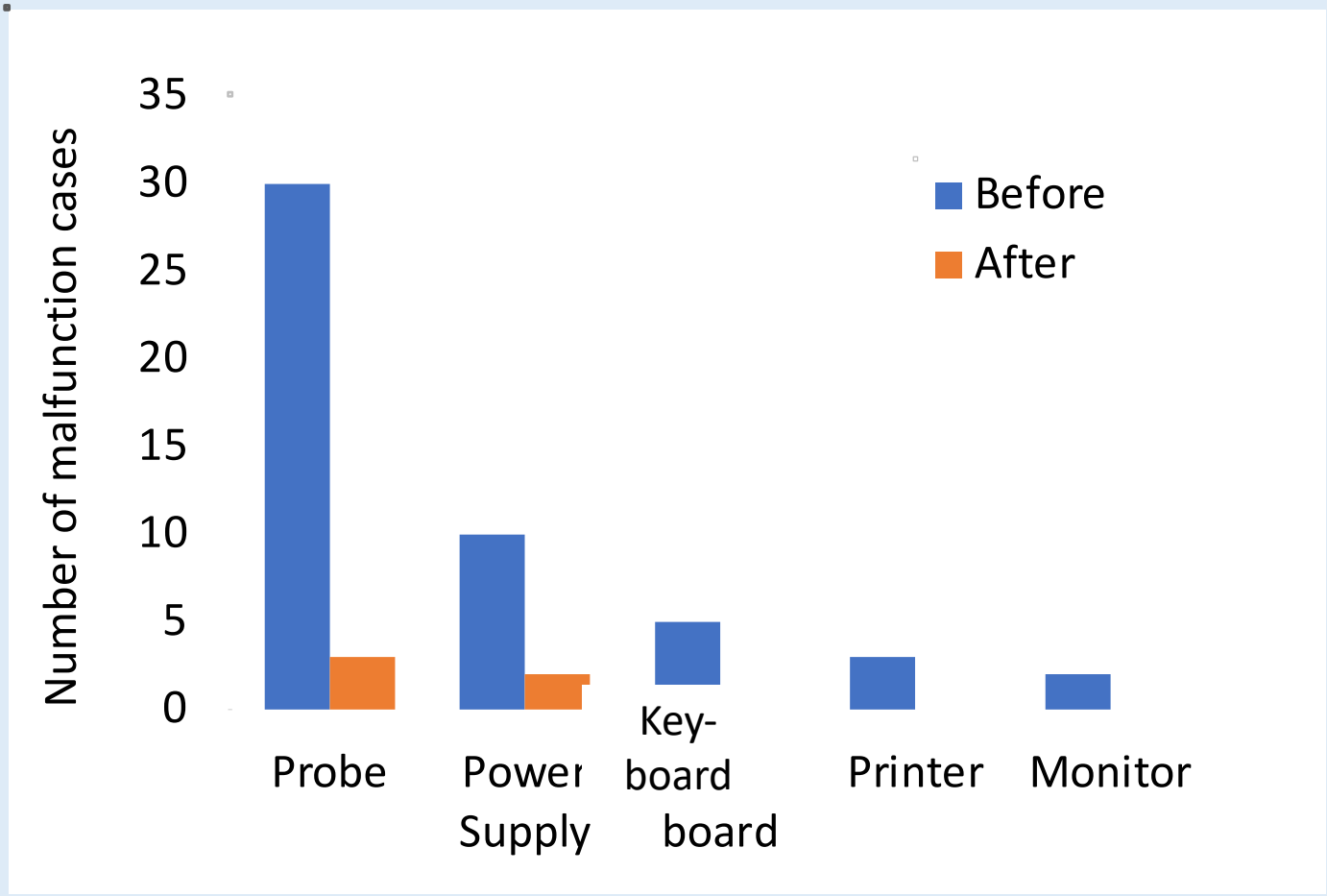
Step 6: Assessment of effectiveness

[Lines]

After 4 months, when all the planned activities were done, we checked the condition of the ultrasound machines in our region and counted the number of machines that had a failure occur in the last 3 months. We spent the next three months tracking the number of failures. This gave us the same six months of data as before we started, and allowed us to make comparisons before and after the intervention. As you can see, there was a significant reduction in probe failures, and the overall number of failures dropped by a factor of ten. So we concluded that our countermeasures were successful.

Comparison chart





Part causing the problem	Number of malfunction cases	
	Before	After
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Power Supply	10	**2**
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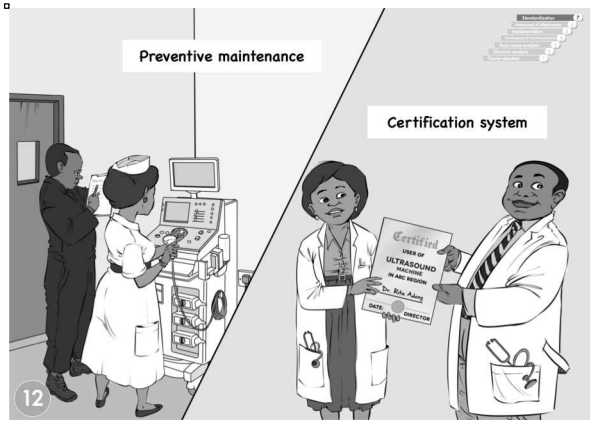
12



Step 7: Standardization

[Lines]

We wanted to keep breakdowns of ultrasound machines to a minimum, so we developed a standardization plan. The plan includes planned preventive maintenance by an engineer and a machine user (see the illustration on the left) and the introduction of a certification system that stipulates that doctors who use ultrasound machines must participate in the required training as users. This is a system within the hospital, but we made it with the help of our director.

We would like to keep all the machines in good condition and move on to solving other problems through KAIZEN as well!

Preventive maintenance

Certification system