OP06: REDUCING LEAKAGE OF SPUTUM FOR MTB CULTURE DURING TRANSPORTATION TO JOHOR BAHRU PUBLIC HEALTH LABORATORY

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#tbmkajbsquad

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INTRODUCTION

All the sputum samples for *Mycobacterium tuberculosis* (MTB) culture from the health clinic in Johor state will be sent to Johor Bahru Public Health Laboratory (JBPHL)

At JBPHL, the samples are analyzed for the acceptance and rejection criteria before processing for culture

Good-quality samples will give fast and accurate results

TERMS AND DEFINITION

Culture: A conventional laboratory test using solid/liquid media in obtaining bacterial growth
Mycobacterium tuberculosis: Bacteria that cause Tuberculosis disease
Rejection criteria: Criteria which the sample does not met the requirement
Leaking : An occurrence in which something (such as a liquid or gas) out through a surface
Sistem Informasi Makmal Kesihatan Awam (SIMKA): Laboratory data system developed by National Public Health Laboratory, Ministry of Health Malaysia

1. SELECTION OF OPPORTUNITIES FOR IMPROVEMENT

PROBLEM IDENTIFICATION AND PRIORTISATION

NO	PROBLEM	S	M	A	R	T	TOTAL
1	**High numbers of leaking sputum samples for MTB culture**	**26**	**27**	**23**	**23**	**26**	**125**
2	High contaminant rate for tuberculosis culture tests	20	18	21	14	18	**91**
3	Expensive price for TB QC slide	14	27	24	20	12	**97**
4	High numbers of low-quality culture samples (saliva) were received	22	27	24	11	21	**103**

Table 1: Problem prioritization with nominal group technique using SMART criteria (Group members:11)

Weightage	1=Low	2=Medium	3=High

REASONS FOR SELECTION

S — **SERIOUSNESS**
Leaking samples will result in misdiagnoses, delays in patient treatment, increased morbidity and mortality due to tuberculosis.

M — **MEASURABLE**
Rejection data was accessible from Sistem Informasi Makmal Kesihatan Awam (SIMKA) and Tibi/Leprosy Laboratory database

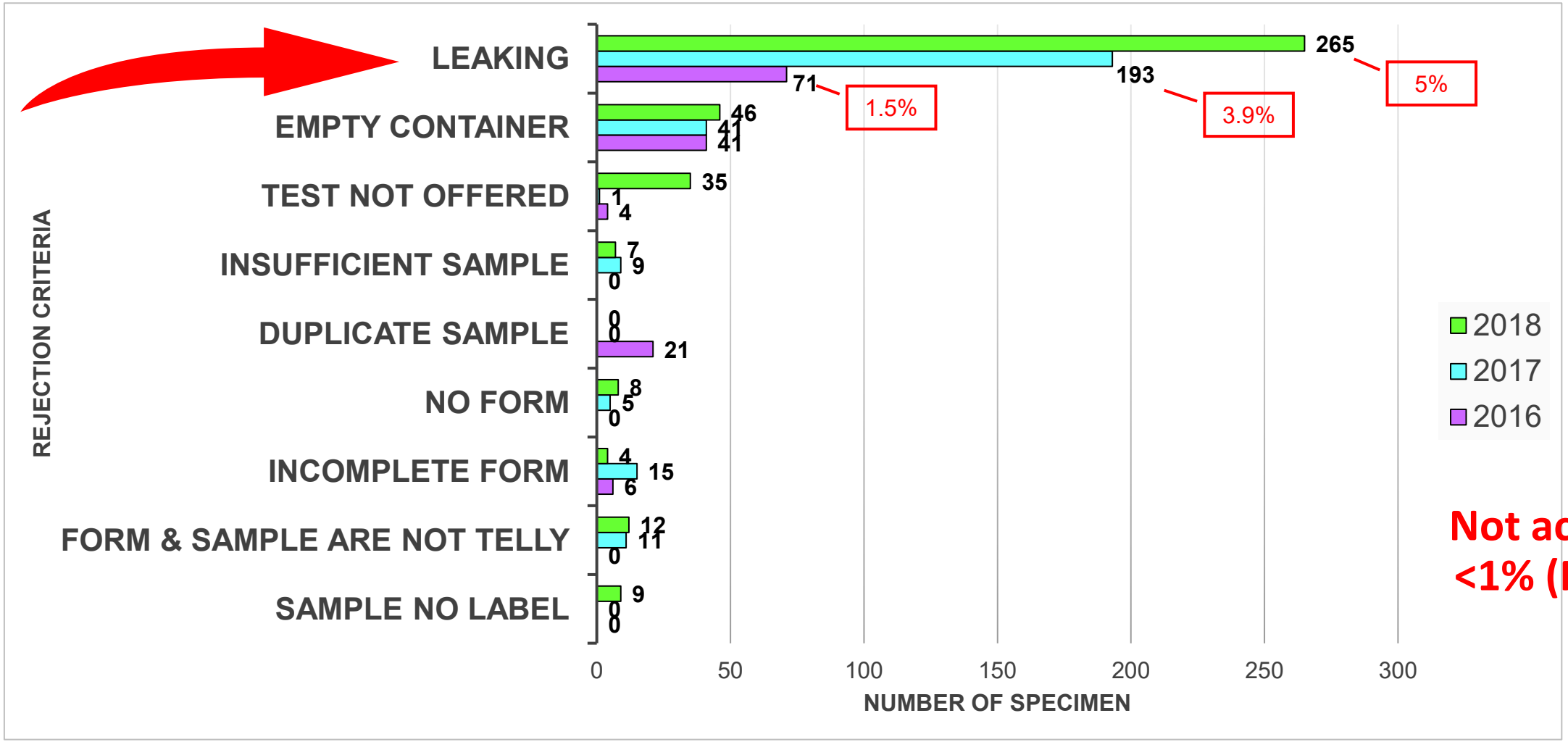
A — **APPROPRIATENESS**
Related to sample processing for MTB culture in diagnosing Tuberculosis infection

R — **REMEDIAL**
Remedial action can be taken against sample delivery policy/sop, inappropriate specimen packaging, and low quality of sample container.

T — **TIMELINESS**
Sample management procedures and the proper use of sputum containers can be frequently assessed for adherence.

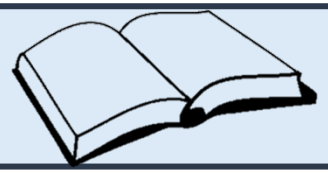
PROBLEM VERIFICATION

TOTAL OF REJECTED SAMPLE BASED ON REJECTION CRITERIA IN 2016-2018



Not achieved <1% (MSQH)

LITERATURE REVIEW



One critical aspect affecting TB diagnosis and management is the rejection of sputum samples, particularly due to leaking specimens. A study by Zerbini et al (2023) shows that leaking specimens are the primary cause of rejection, leading to challenges in obtaining fast diagnostic results and timely treatment initiation.

Zerbini, Maria & Singh, Sarishna & Botha, Magda & Ghebrekristos, Yonas & Opperman, Christoffel Johannes. (2023).

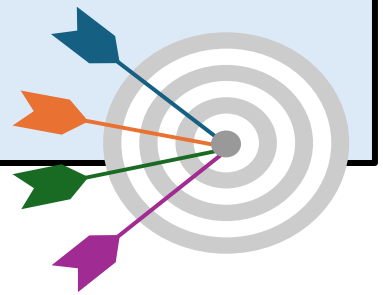
Shiferaw, M. B., Yismaw, G., & Getachew, H. (2018).

Emphasizing the critical nature of maintaining sample quality to avoid rejection, underscores the importance of adhering to proper collection, handling, and transportation procedures to minimize the risk of sample leakage and subsequent rejection

PROBLEM STATEMENT

Problem	The database for MTB culture obtained from Unit Tibi/Kusta JBPHL record showed that the percentage of leaking sputum specimens increased from 1.5% in 2016 to 5% in 2018
Effect	The leaking of the samples will cause inaccurate results, leading to misdiagnosis, inappropriate treatment, and increased morbidity and mortality due to TB.
Possible cause	Multiple factors including improper packaging of specimens, improper sample positioning during transport, low quality of sputum container, no proper carrier for sample delivery, lack of awareness among staff, failure to adhere to the sample delivery policy and ineffective Standard Operating Procedures
Aim of study	This study aims to reduce the number of leaking sputum samples for MTB culture received at JBPHL to < 1%.

OBJECTIVES



General Objective

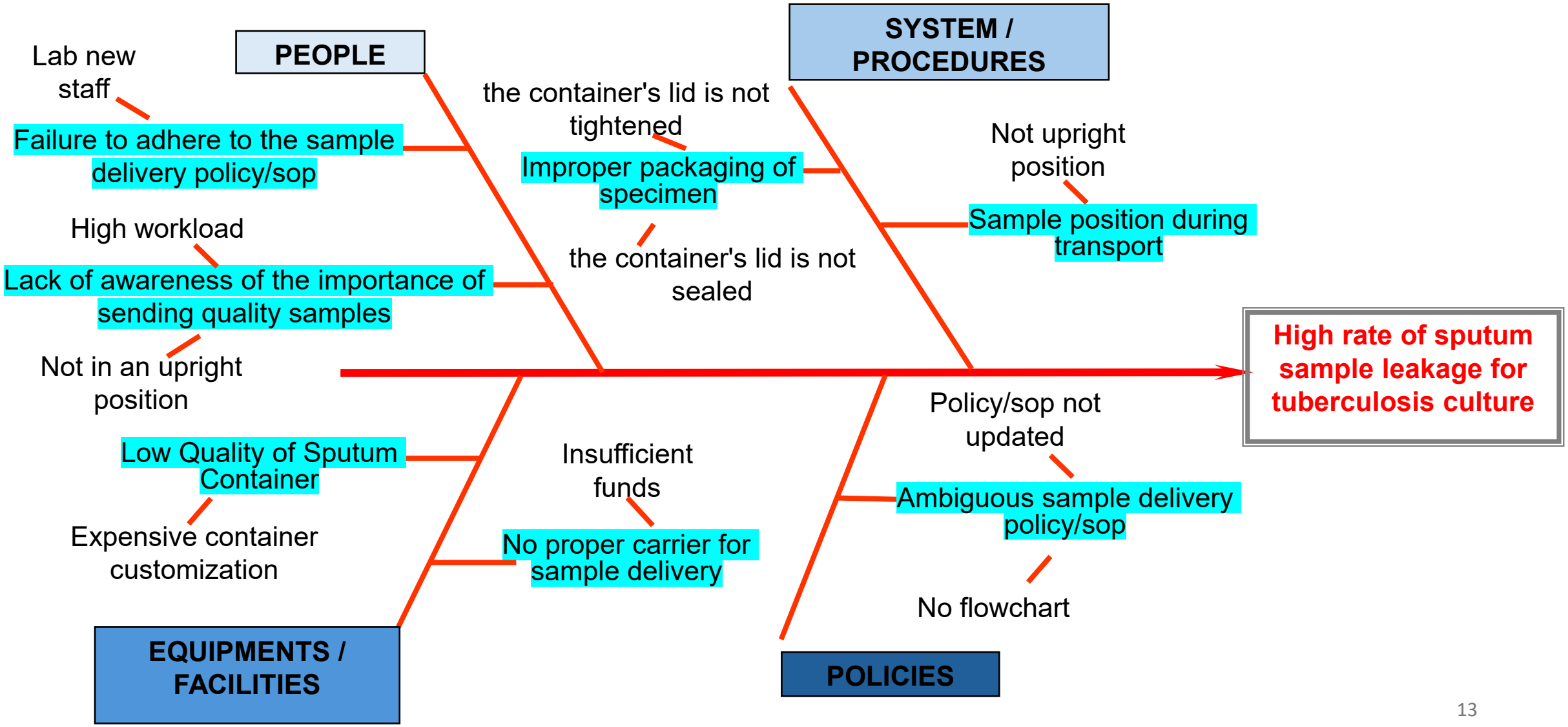
The goal of this study is to reduce the rate of sputum sample leakage for MTB culture to <1% based on the MSQH Performance Indicator standard.

Specific Objectives

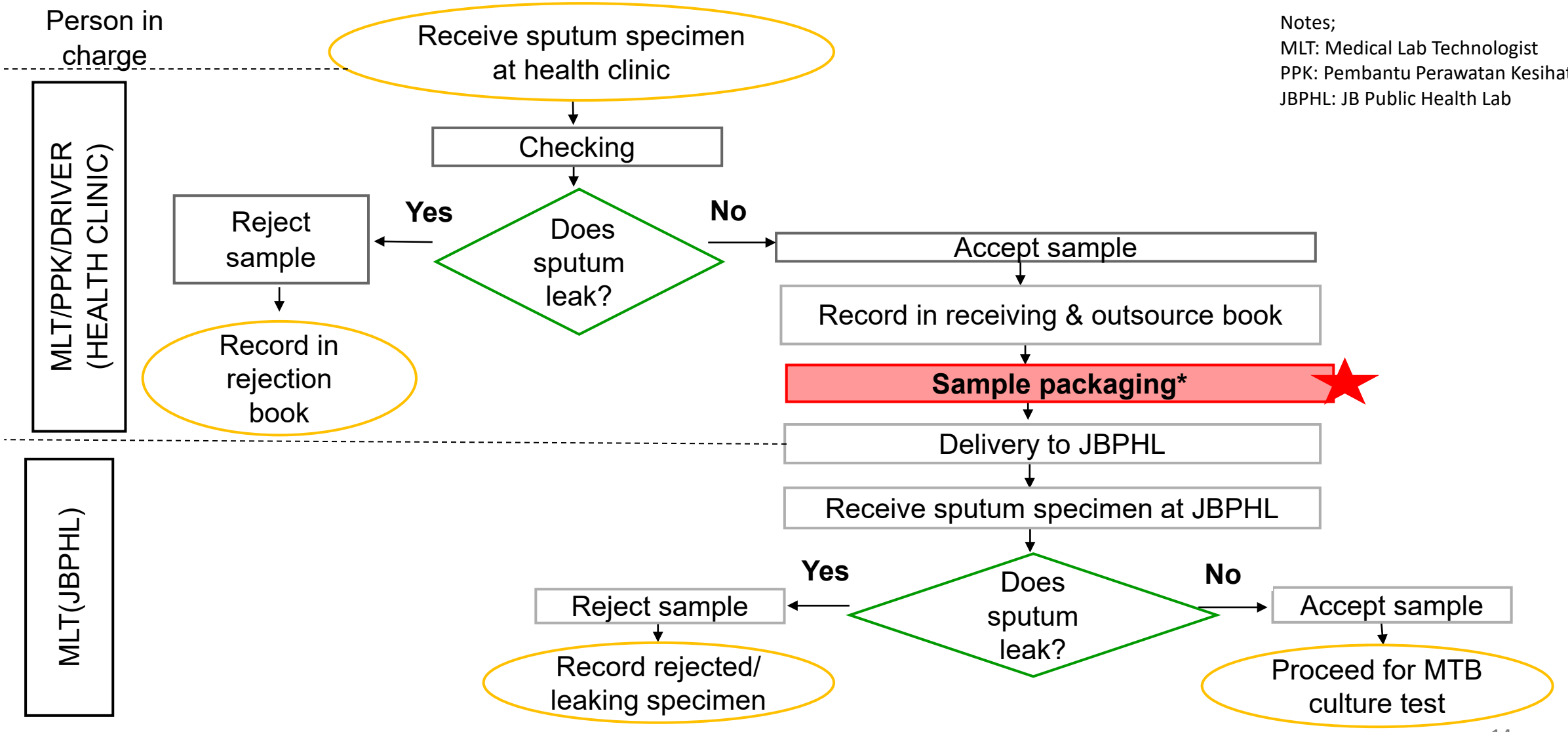
1. To determine the leaking rate of sputum specimen for MTB culture received in JBPHL
2. To identify the possible contributing factors for the incidence of high leaking rate of sputum specimens for MTB culture received in JBPHL
3. To formulate and implement proper remedial measures to decrease the leaking rate
4. To evaluate the effectiveness of remedial actions taken

2. KEY MEASURES FOR IMPROVEMENT

CAUSE-EFFECT ANALYSIS



PROCESS OF CARE



Notes;
MLT: Medical Lab Technologist
PPK: Pembantu Perawatan Kesihatan
JBPHL: JB Public Health Lab

MODEL OF GOOD CARE

No	Process/Steps	Criteria	Standard
1	Received the sputum specimen at health clinic	1.Receive form & sample	100%
2	Checking	1.Completed form 2.Sample leaking/not leaking	100% 100%
3	Rejection/Receiving at health clinic	1.Reject specimen/Record in rejection book 2.Receive specimen/Record in receiving book	100% 100%
4	Record	1.Record the details of the specimen in an outsourced book	100%
5	Sample packaging	1.Tighten the lid of the container 2.Seal it with parafilm 3.Put the sample in the carrier 4.Put the sample into cool box in upright position 5.Triple layer packaging with ice 6.Separate the form- place the form at the outside of cool box	100% 100% 100% 100% 100% 100%
6	Delivery to JBPHL	1. Place cool box in upright position, 2-8 ^{0}C, 24hrs	100%
7	Receive sputum specimen at JBPHL	1.Receive form & sample 2.Completed form 3.Sample leaking/not leaking	100% 100% 100%
8	Rejection/Receiving at JBPHL	1.Reject & record leaking specimen	100%

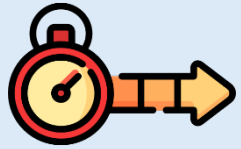
INDICATOR

INDICATOR	FORMULA	STANDARD
Rejection Rate of Specimens	$\frac{\text{Total Number of Specimens Rejected due to LEAKING}}{\text{Total Number of Sputum Specimens Receive for MTB Culture}} \times 100$	<1%

[According To MSQH Performance Indicators Standard]

3. PROCESS OF GATHERING INFORMATION

STUDY TIMELINE



2018

Problem verification.
Factors identification.

PRE-INTERVENTION (VERIFICATION STUDY)

CYCLE 1

Strategy for change: 2019-June 2021

Post-Intervention: July-Dec 2021

CYCLE 2

Strategy for change: Jan-June 2022

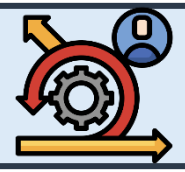
Post-Intervention: July-Dec 2022

CYCLE 3

Strategy for change: Jan-June 2023

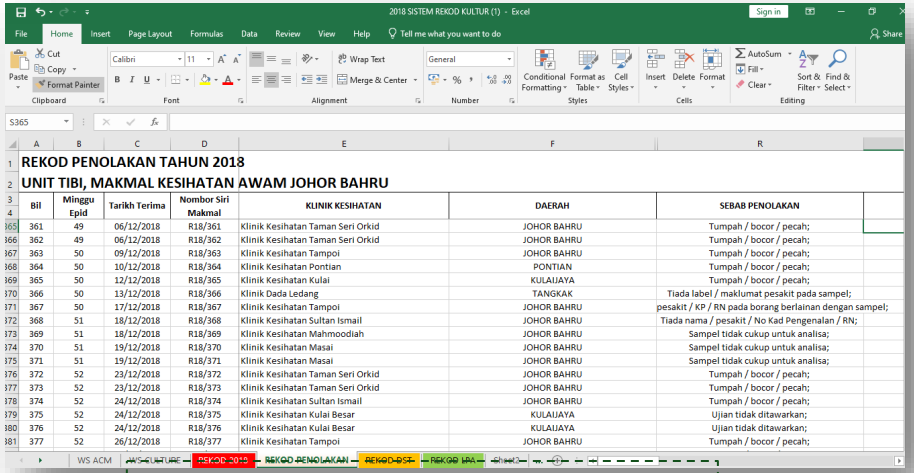
Post-Intervention: July-Dec 2023

METHODOLOGY

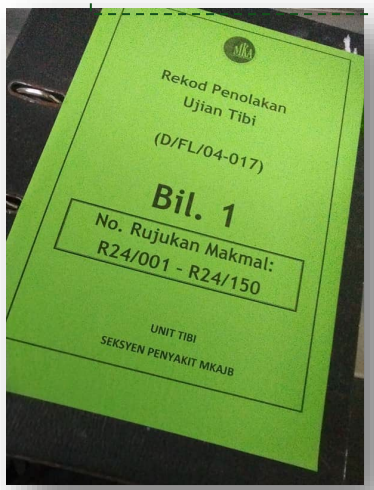


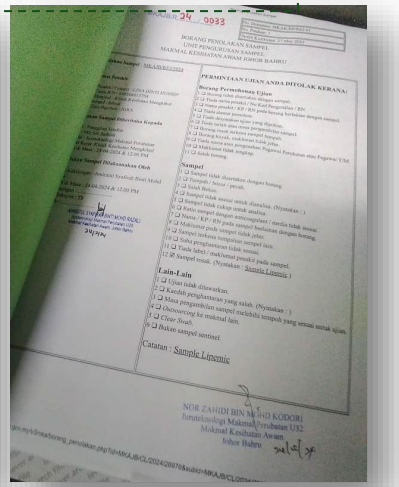
TYPE OF STUDY	SAMPLE POPULATION	TOOLS	INCLUSION CRITERIA	EXCLUSION CRITERIA
Cross Sectional	Sputum specimen for MTB culture	Data Analysis of *Rekod penolakan sampel* & Client Surveys using Excel	MTB Culture Test	Other TB diagnostics test and other rejection criteria

DATA COLLECTION TOOL



Laboratory records

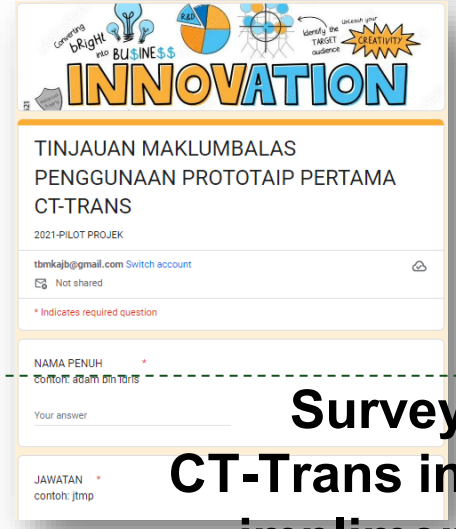




TOOLS

Data Analysis of *Rekod penolakan sampel* & Client Surveys using Excel

Survey on; The factor causing leaking



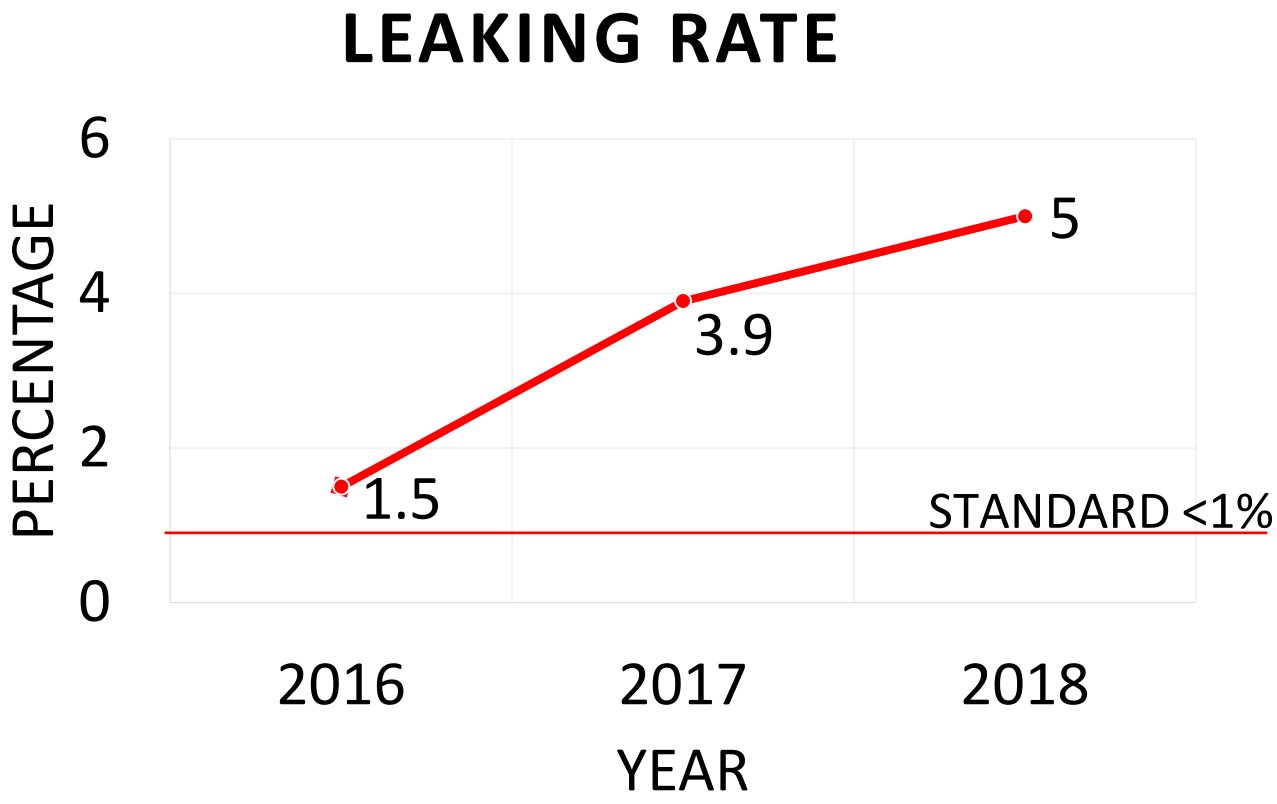
Survey on; CT-Trans innovation implimentation

4. ANALYSIS AND INTERPRETATION

VERIFICATION STUDY

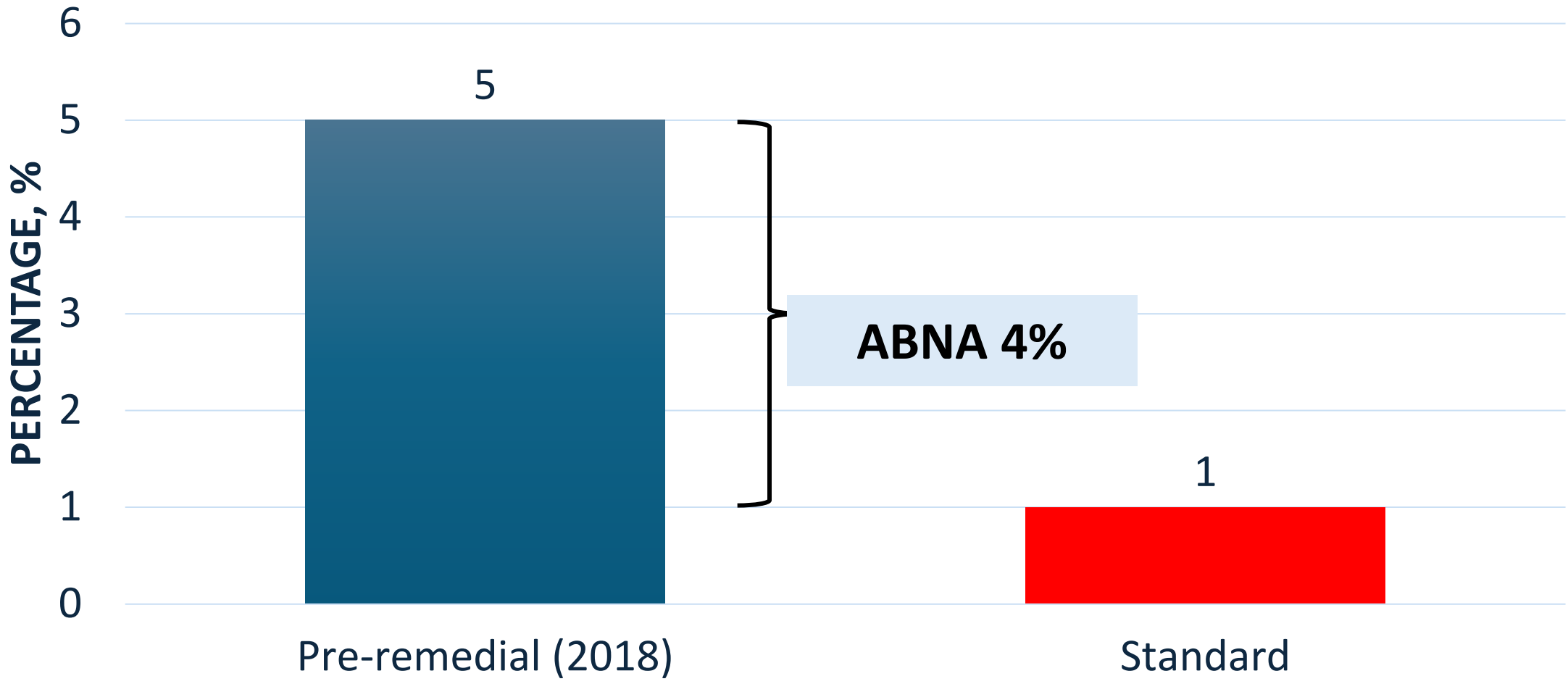
YEAR	Total sputum MTB culture received *	Total LEAKING	% LEAKING
2018	5327	265	5.0
2017	4893	193	3.9
2016	4635	71	1.5

*** Sample received from health clinic in Johor state**

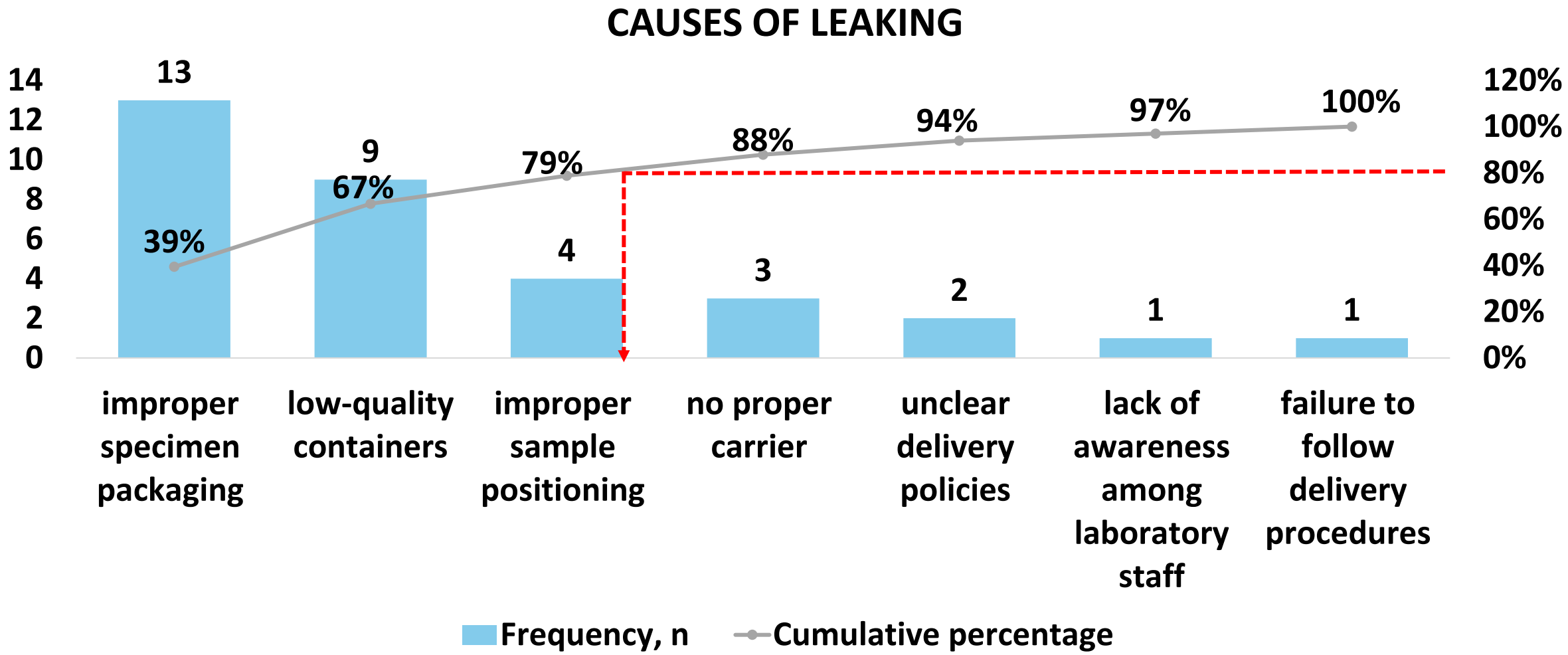


Not achieved <1% (MSQH) FAIL

ACHIEVABLE BENEFITS NOT ACHIEVED (ABNA)



PARETO CHART



MODEL OF GOOD CARE

No	Process/Steps	Criteria	Standard	Pre-intervention
1	Received the sputum specimen at health clinic	1.Receive form & sample	100%	100%
2	Checking	1.Completed form 2.Sample leaking/not leaking	100% 100%	100% 100%
3	Rejection/Receiving at health clinic	1.Reject specimen/Record in rejection book 2.Receive specimen/Record in receiving book	100% 100%	100% 100%
4	Record	1.Record the details of the specimen in an outsourced book	100%	100%
5	Sample packaging	1.Tighten the lid of the container 2.Seal it with parafilm 3.Put the sample in the carrier 4.Put the sample into cool box in upright position 5.Triple layer packaging with ice 6.Separate the form- place the form at the outside of cool box	100% 100% 100% 100% 100% 100%	85% 70% Nil 50% 100% 0%
6	Delivery to JBPHL	1. Place cool box in upright position, 2-8 ^{0}C, 24hrs	100%	100%
7	Receive sputum specimen at JBPHL	1.Receive form & sample 2.Completed form 3.Sample leaking/not leaking	100% 100% 100%	100% 100% 100%
8	Rejection/Receiving at JBPHL	1.Reject & record leaking specimen	100%	100%

5. STRATEGY FOR CHANGE

Cycle 1:2019 to Jan-Jun 2021

FACTOR	STRATEGY	IMPLEMENTATION	STAFF INVOLVED
Failure to adhere to the sample delivery policy/sop	Established SOP for sample handling (*Kriteria Penghantaran Sampel Ujian Kultur TB*) for accomplish adherence to the sample delivery policy/procedure	1. Communication via WhatsApp group 2. CME on Sample Rejection Issues in TB Seminar/ Courses /Meetings	Health Clinic staff and District Health Officer
Ambiguous sample delivery policy/sop and improper sample packaging	Assess the work process at the laboratory	1. On-schedule visit to the health clinic's laboratory 2. Provide simple flowchart	Health Clinic staff (MLT's)

Figure : WhatsApp Group Quality KK Johor

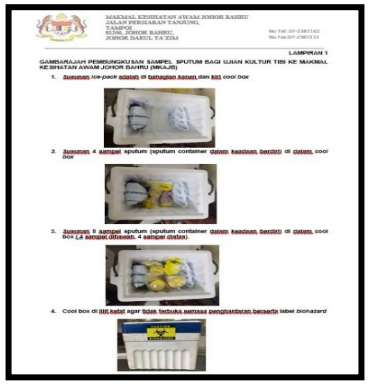


Figure : SOP for sample packing

Figure : On-site visit

Cycle 1:2019 to Jan-Jun 2021

FACTOR	STRATEGY	IMPLEMENTATION	STAFF INVOLVED
Lack of awareness of the importance of sending quality samples	Staff awareness on sample management (packaging & transportation)	1. Organized *Bengkel* Good Sampling Techniques (*Hari Bersama Pelanggan*)	Health Clinic staff (MLT's)
Improper sample position during transportation, low quality of sample container and no proper carrier	Invented a container transportation system known as "CT-Trans"	1. Introducing CT-Trans innovation container sputum to 21 health clinics (pilot project) 2. Organized *Bengkel Inovasi Bekas Sputum*	Health Clinic staff (MLT's)

Figure : *Hari Bersama Pelanggan*

Figure : Innovation project 'CT-Trans'

Figure : *Bengkel Inovasi Bekas Sputum 2021*

Cycle 2: Jan-Jun 2022

FACTOR	STRATEGY	IMPLEMENTATION	STAFF INVOLVED
Sample positioning not upright during transportation	Introducing CT-Trans innovation to all health clinics in the state of Johor (expansion project-79 health clinics)	Organizing *Bengkel Inovasi "CT-Trans" to* the respective health clinic laboratory	Health Clinic staff (MLT's)

Figure : *Bengkel Inovasi CT-Trans 2022*

Cycle 3: Jan-Jun 2023

FACTOR	STRATEGY	IMPLEMENTATION	STAFF INVOLVED
Improper sample arrangements during transportation to the laboratory	Introducing CT-Trans innovation to new lab personnel from the health clinic (sustainability project)	Organizing *Bengkel Replikasi & Pengukuhan "CT-Trans"* (TOT new laboratory staff in "CT-Trans" preparation and replication	Health Clinic staff (New MLT's)

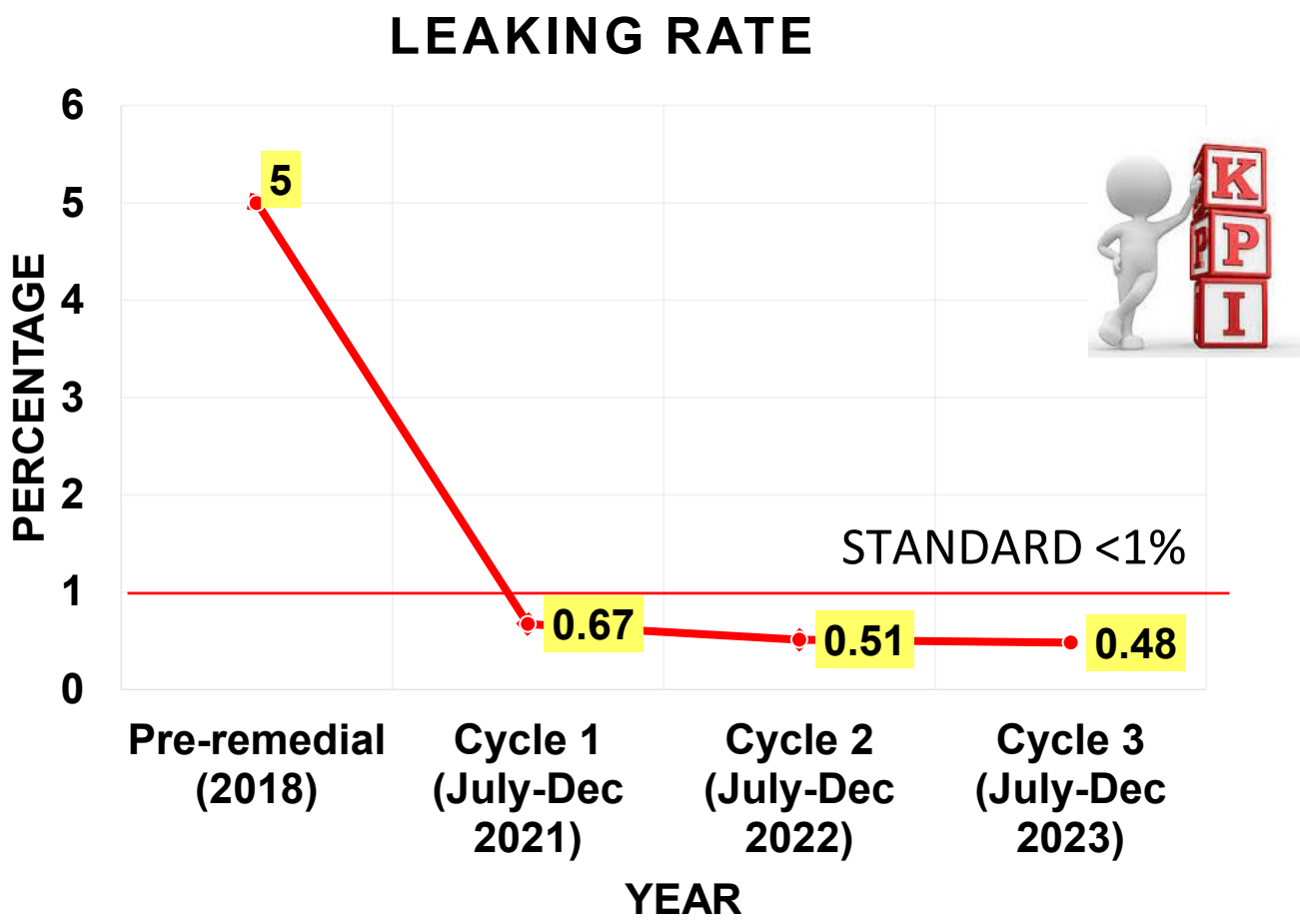
Figure : *Bengkel Replikasi & Pengukuhan CT-Trans 2023*

6. EFFECTS OF CHANGE

POST-INTERVENTION

YEAR	Total sputum MTB culture received	Total LEAKING	% LEAKING
2018	5327	265	5.0
2021 Cy 1	1947	13	0.67
2022 Cy 2	4479	23	0.51
2023 Cy 3	6296	30	0.48

Table : Comparison of leaking rate after remedial measures



ABNA POST-INTERVENTION

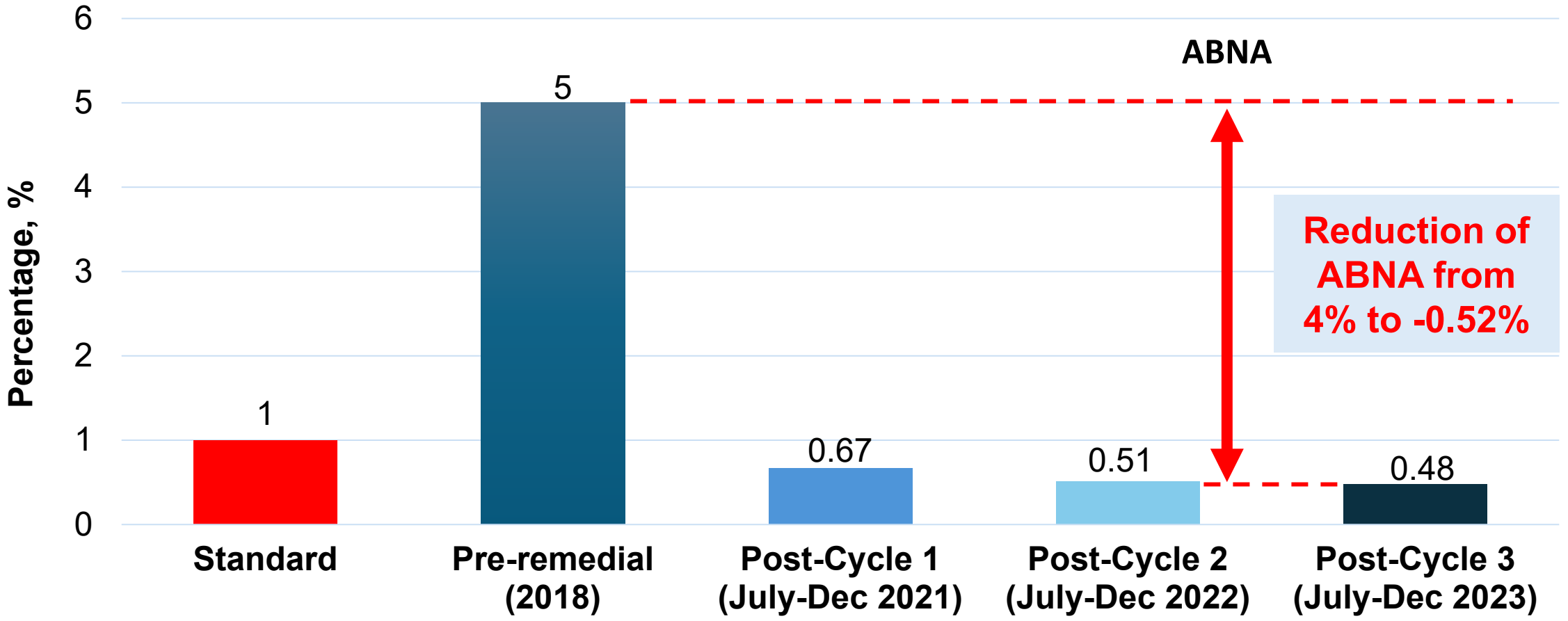


Figure : ABNA Pre VS Post. ABNA was been reduced from 4 % to -0.52%.

MODEL OF GOOD CARE

No	Process/Steps	Criteria	Standard	Pre-intervention	Post-intervention		
					Cycle 1	Cycle 2	Cycle 3
1	Received the sputum specimen at health clinic	1. Receive form & sample	100%	100%	100%	100%	100%
2	Checking	1. Completed form 2. Sample leaking /not leaking	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%
3	Rejection/Receiving at health clinic	1.Reject specimen and record in rejection book 2.Receive specimen and record in receiving book	100% 100%	100% 100%	100% 100%	100% 100%	100% 100%
4	Record	1.Record the details of the specimen in outsource book	100%	100%	100%	100%	100%

MODEL OF GOOD CARE

No	Process/Steps	Criteria	Standard	Pre-intervention	Post-intervention		
					Cycle 1	Cycle 2	Cycle 3
5	Sample packaging	1. Tighten the lid of the container	100%	85%	90%	94%	98%
		2. Seal it with parafilm	100%	70%	90%	94%	98%
		3. Put sample in the carrier	100%	Nil	90%	94%	98%
		4. Put sample into cool box in upright position	100%	50%	90%	94%	98%
		5. Triple layer packaging with ice	100%	100%	100%	100%	100%
		6. Separate the form- place the form at the outside of cool box	100%	0%	90%	95%	100%
6	Delivery to JBPHL	1. Place cool box in upright position	100%	100%	100%	100%	100%
7	Receive sputum specimen at JBPHL	1. Receive form & sample	100%	100%	100%	100%	100%
		2. Completed form	100%	100%	100%	100%	100%
		3. Sample leaking/not leaking	100%	100%	100%	100%	100%
8	Rejection/Receiving at JBPHL	1.Reject & record leaking specimen	100%	100%	100%	100%	100%
		2.Proceed non-leaked specimen for MTB culture test	100%	100%	100%	100%	100%

COST IMPACT

TOTAL COST SAVING: RM13,252.00

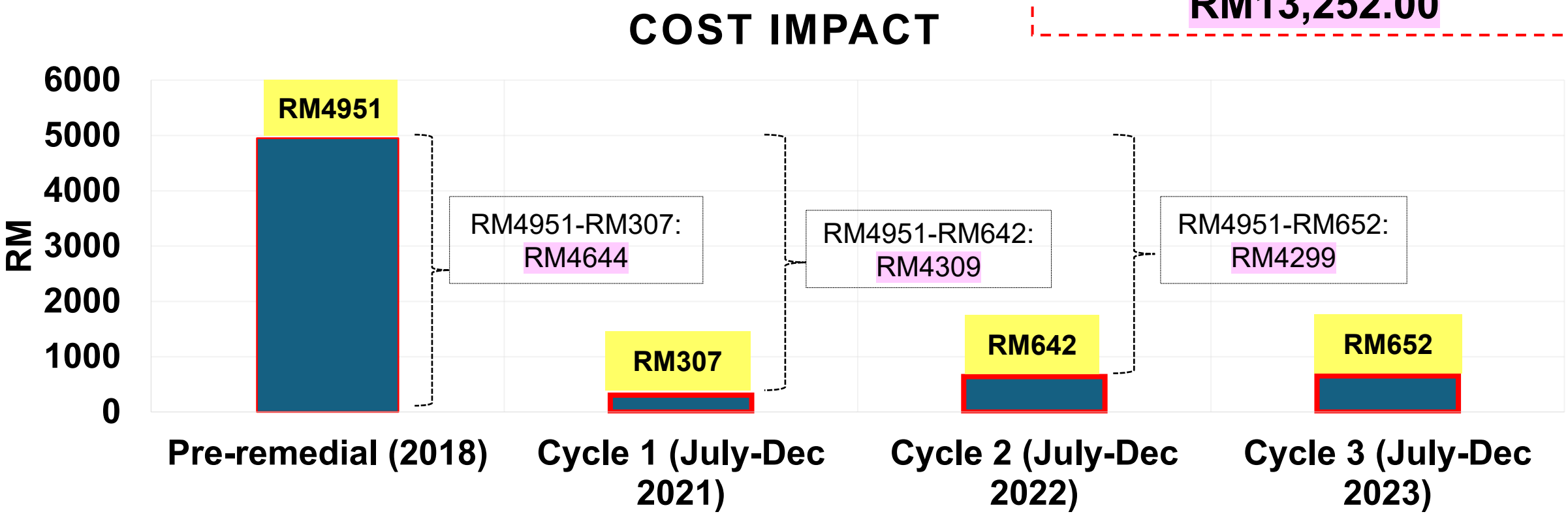
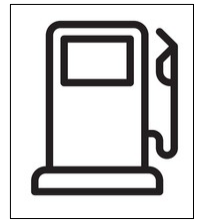


Figure: Cost impact reduction of leaking (fuel and consumable items)



CT-TRANS INNOVATION

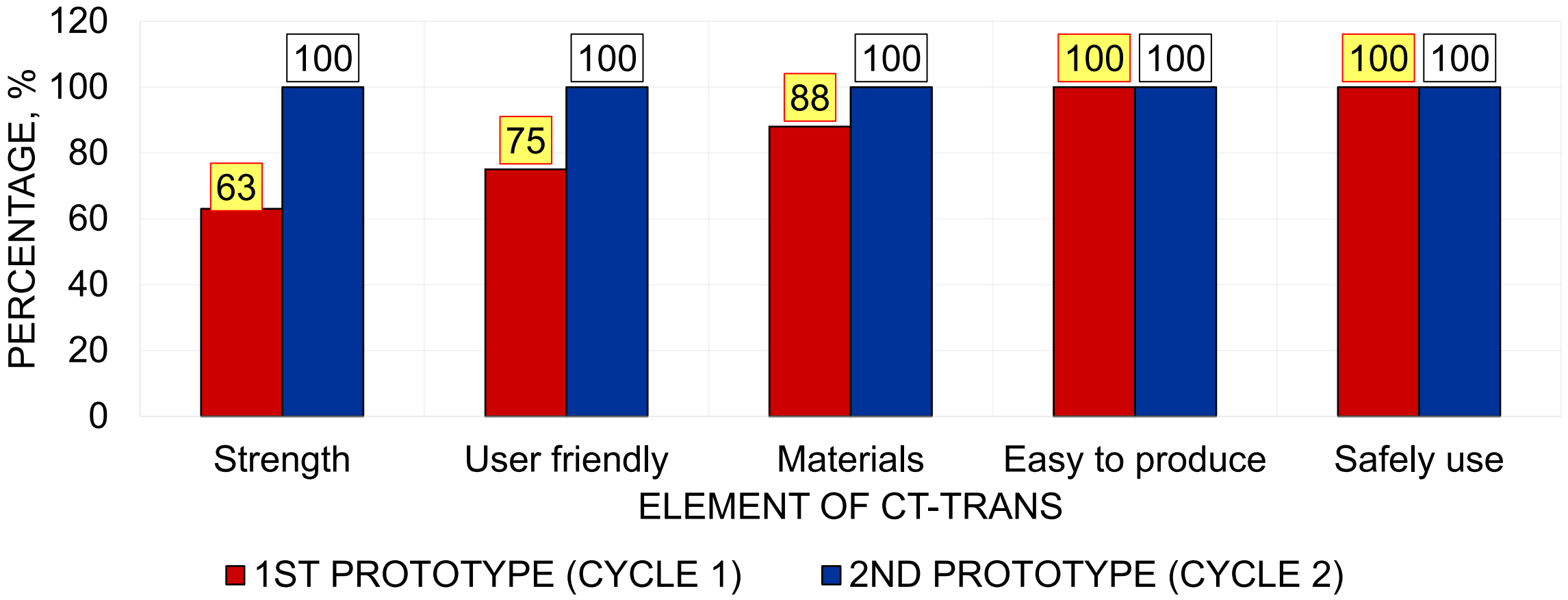


Figure: Customer satisfaction survey- Implementation of CT-Trans Innovation

PROJECT DEVELOPMENT AND REPLICATION

1 ST PROTOTYPE (6 DISTRICTS) CYCLE 1

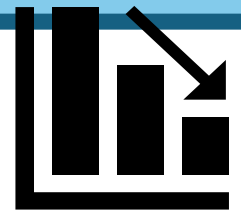
2 ND PROTOTYPE (10 DISTRICTS) CYCLE 2

7. CONCLUSION

CONCLUSION

01

Continuous monitoring of the quality of samples has decreased the rejection rate of leaking sputum samples according to MSQH indicator requirements (<1%)



02

The usage of CT-Trans has facilitated the reduction of the number of leaking sputum samples for MTB culture

8. THE NEXT STEP

THE NEXT STEP

1	• The improvement strategy will be continued and monitored to sustain the rejection rate below 1%, as well as the performance usage of CT-Trans
2	• Expanded the CT-Trans innovation nationally, particularly with other healthcare facilities, universities, and government organizations

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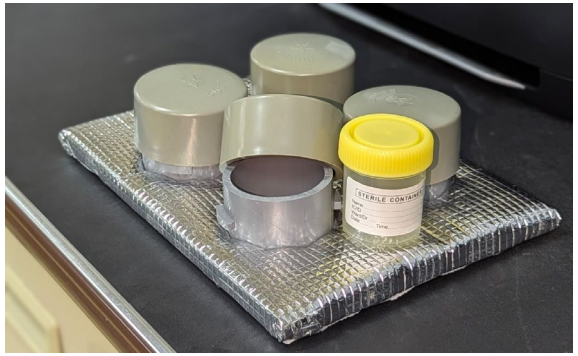
THE NEXT STEP

3

- Designing the third prototype of the "CT-Trans" using more robust and resilient materials.



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CR - 1

Application No:

Applicant :

* **Title of work** *(Original language)* : CT-Trans

Translation *(If the title of work is neither in Bahasa nor English)* : N/A

Transliteration *(If the title of work is neither in Bahasa nor English)* : N/A

Name of the Language *(Language use in the work)* : Bahasa Melayu

* **Section A : Category of Works** (Please tick **ONE** only)

☐ Literary ☐ Musical ☐ Artistic ☐ Film ☐ Sound Recording ☐ Broadcast *('broadcasting service' only)* ■ Derivative

Date of Creation / Fixation : 1 | M | 2021

Section B : Publication

MyIPO
Perbadanan Harta Intelek Malaysia
Intellectual Property Corporation of Malaysia

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5. Shiferaw, M. B., Yismaw, G., & Getachew, H. (2018). Specimen rejections among referred specimens through referral network to the Amhara Public Health Institute for laboratory testing, Bahir Dar, Ethiopia. BMC research notes, 11(1), 781.

ACKNOWLEDGEMENT

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THANK YOU