Healthcare @ Doorstep

RightBiotic: Detection platform for Antibiotic Resistant Bacteria

A radical innovation

Rapid system for detection of bacterial pathogens and their sensitivity to a panel of antibiotics

Save the Environment and Save Lives !!

Outline of the Presentation

1. Gap Identified: Rationale
2. Requirements of a rapid system
3. Solution: RightBiotic-About the Product
4. Results obtained till date
5. Future Prospective
6. Conclusion

The environmental connection

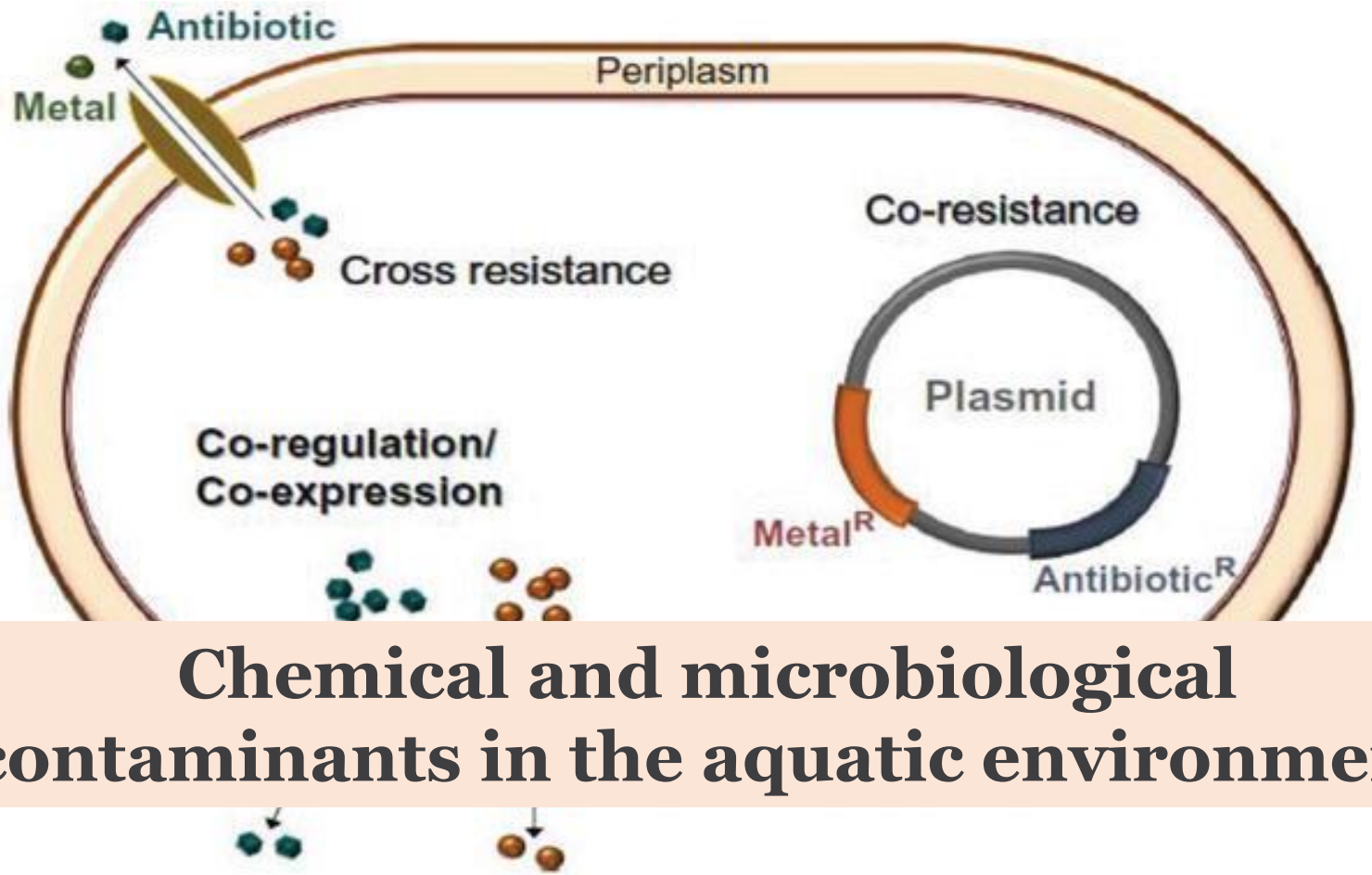
Human Use

ONE HEALTH

Agricultural Use

Veterinary Use

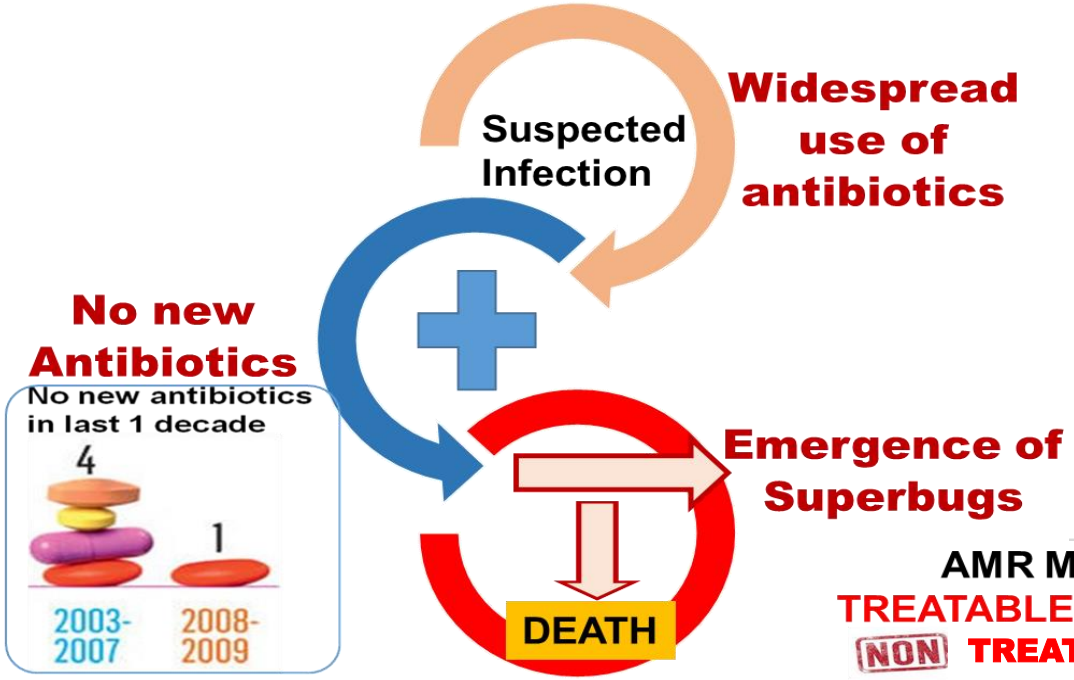
Co-occurrence of metal and antibiotic resistance

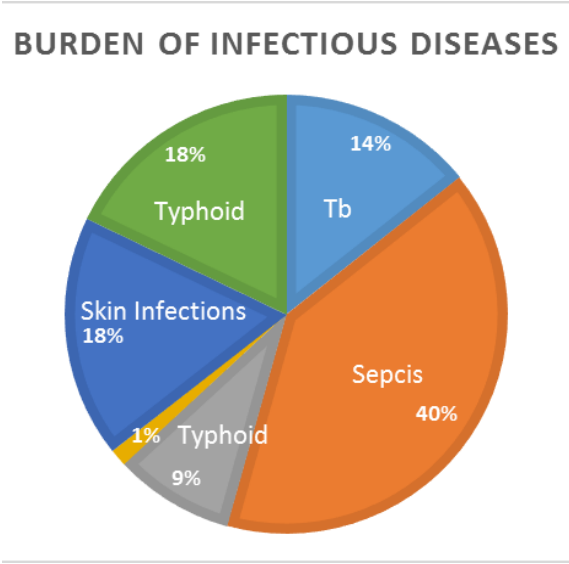


Chemical and microbiological contaminants in the aquatic environment

Rationale

An understanding of the incidence of diseases is a key for decision making in prescribing the right antibiotic in timely manner for clinical care & avoid Anti Microbial Resistance (AMR)





AMR MAKES
TREATABLE INFECTION
NON TREATABLE

Integrated antibiotic resistance surveillance

WHO's global action plan on antimicrobial resistance mandates AR surveillance

European Center for Disease Prevention tracked the prevalence of antibiotic resistant bacteria present in blood and cerebrospinal fluid samples from patients in 30 countries

Amount of ARGs in wastewater from seven European countries matched prevalence of ARBs found in patients in those regions

Message is Loud and Clear

Another study from University of South California concluded that ***Engineered water treatment systems end up being sort of a hot-bed for antibiotic resistance (AR) or Anti Microbial Resistance (AMR)***

These studies suggests that wastewater treatment plants might act as a breeding ground for antibiotic resistance

They also highlight the need to implement regular surveillance and control measures, which may need to be ***tailored for specific geographic regions***

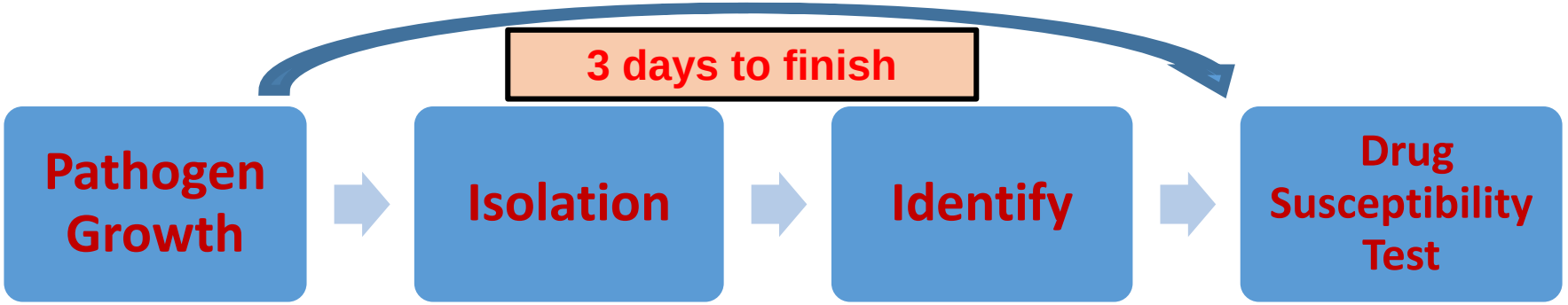
Healthcare @ Doorstep

RightBiotic: Fastest Antibiotic Finder

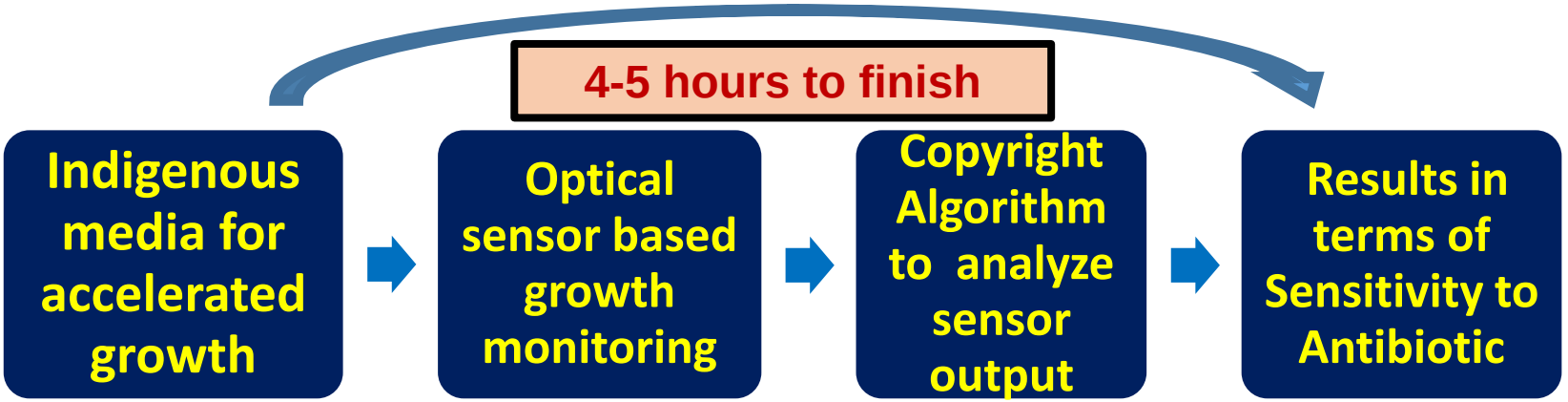
A radical innovation

Rapid Antibiotic Resistance Testing System

Problem with today's technology



RightBiotic: The Solution



Venture IPRs in: Biochemistry (patent filed) Optical sensing device (design registered) Analytical software (copyright)

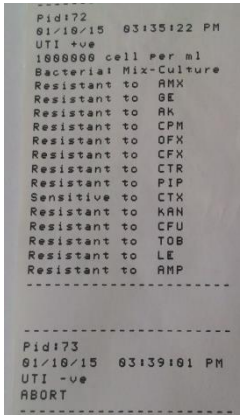
RightBiotic comprises of:

RightBiotic Machine

- Optical Reader

RightBiotic Kit

- Pre loaded antibiotic strips for UTI
- Pi and P1-P6 strips
- Dehydrated BITGEN vial (1Pc)
- Syringe (1Pc)
- Sterile Water ampule (1Pc)
- Filter (1Pc)



Prepackaged kit for testing

Sample prep. time-20'
Incubation time- 2+3hrs
Optical readout- 10'
Analysis of results- 10'

Identification of Right Antibiotic for treatment < 5hrs

Quick Hygienic Survey of Musi River

BITS Pilani
Hyderabad Campus

ABESD International Conference on Advances and Innovations in Biotechnology for Sustainable Development
5-7 April, 2019
AKS University, Satna (M.P.) India

Hyderabad's once mighty Musi has been reduced to a giant sewer

- Once a flourishing river, Musi is now dying a slow death due to excessive encroachment and extreme pollution
- As it flows through Hyderabad, it turns into a giant sewer, filled with garbage, industrial waste, chemicals, pharmacophores, APIs (active pharmaceutical ingredients) like antibiotics as major pollutants
- Concentration of antibiotics in some river waters has been reported to be much higher than what is considered safe
- According to the AMR industry alliance standards, safe levels range from 20ng-32µg/litre, depending on antibiotic

Role of the natural environment in the antimicrobial resistance problem

According to a report 65% of 711 sampled sites tested for presence of antibiotics had unacceptably high levels

Highest concentration of antibiotic Ciprofloxacin (31 mg/L) found in water bodies located in Patancheru area in Hyderabad

Norfloxacin, Cetrizine, Terbinafine, Citalopram & Enoxacin are other antibiotics also found in Musi water [Riebl & Davy 2013]

Antibiotic contamination of rivers could be an important contributor, says Alistair Boxall, of York Environmental Sustainability Institute

A study released in March 2019 showed that a large number of ARBs in River Ganga are resistant to commonly used antibiotics (BHU)

H'ble National Green Tribunal ordered a quick hygienic survey of Musi vide order, OA No.426/2018, dt 5/4/2019 (Conducted in collaboration with CPCB and TSPCB)

This study comes in wake of a commitment taken by member states at the World Health Assembly on May 23, 2019.

This resolution urges member states to strengthen

1. Infection prevention and control measures, including water sanitation and hygiene
2. Participation in global AMR surveillance system
3. Ensure prudent use of quality-assured antimicrobials
4. Support multi-sectoral annual self-assessment survey

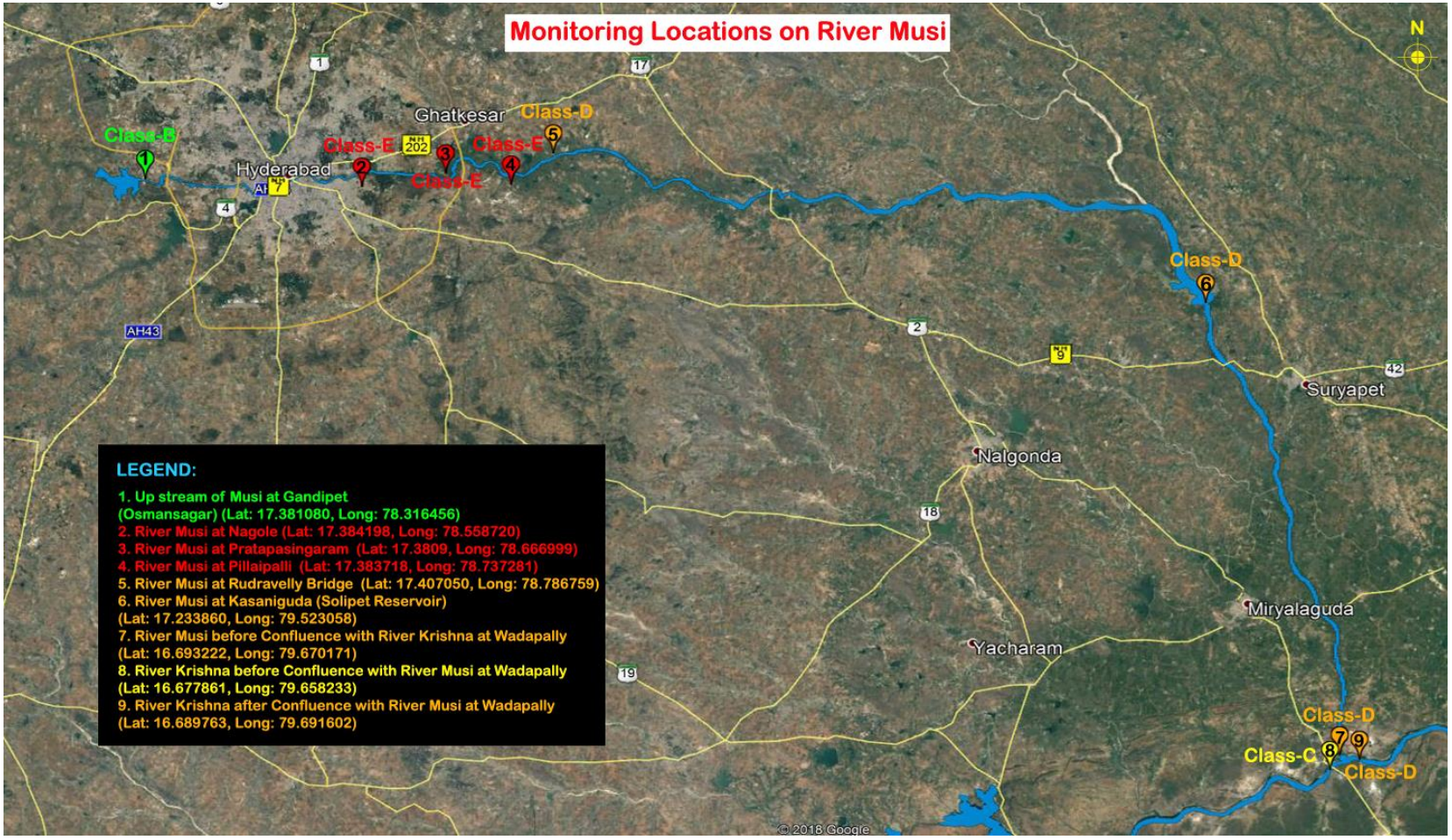
Present study: Objectives

1. Characterize and identify bacteria present in the water samples collected from pre-decided sites (N=9) over a 3 month period
2. Identify AMR pattern of different bacterial strains isolated
3. Sample extraction for subsequent analysis by TSPCB for presence of antibiotics/APIs/ pharmacophores in river water
4. Conduct a one-day training program for officials of CPCB and other state PCBs
5. Develop guidelines for hygienic survey of river waters

Sample collection sites

Sl. No.	Sample collection Site	Coordinates
1	Gandipet (Osman Sagar)	17°23′N 78°18′E
2	Nagole	17°31′N 78°55′E
3	Pratapsingaram	17°38′N 78°66′E
4	Pillaipalli	17°004′N 78°60′E
5	Rudravelly	17°.4109` N, 78.7852` E
6	Kasaniguda	17°.4109`N, 79° 31' E
7	Musi at Wadapally (Before confluence)	16.698°N 79.659°E
8	Krishna at Wadapally (Before confluence)	16.698°N 79.659°E
9	Musi+Krishna at Wadapally (After confluence)	16.698°N 79.659°E

Map of Musi river depicting the monitoring locations



Sample Collection Schedule

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Date	Proposed Activity
9th May 2019	Sampling at all 9 locations
23rd May 2019	Sampling at all 9 locations
13th June 2019	Sampling at all 9 locations
Interim Report Submitted to CPCB on 3rd July 2019	
26th Jun 2019	Sampling at all 9 locations
9th July 2019	Sampling at all 9 locations
23th July 2019	Sampling at all 9 locations

Note : Sampling completed and total of 9x6=54 samples analyzed

Sample processing and further testing

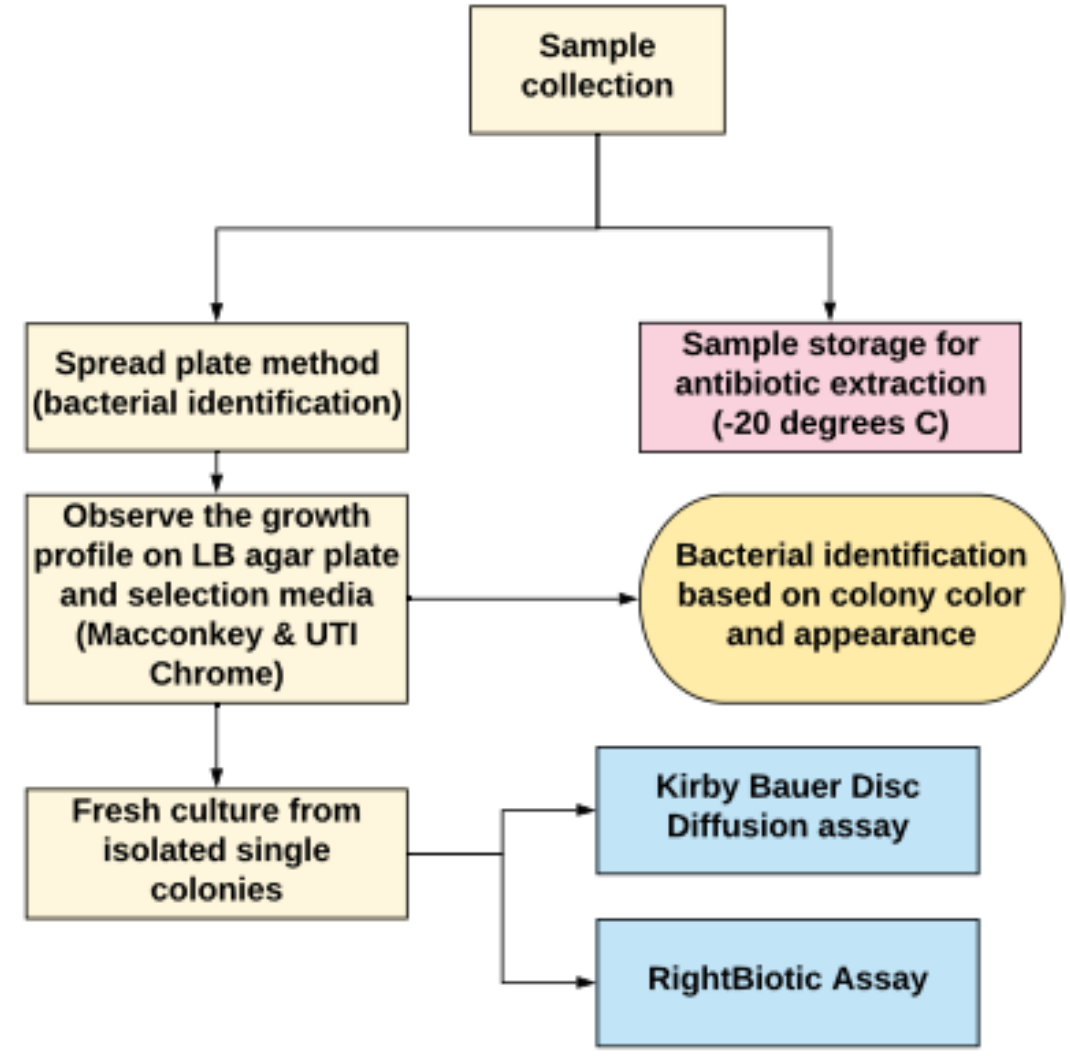
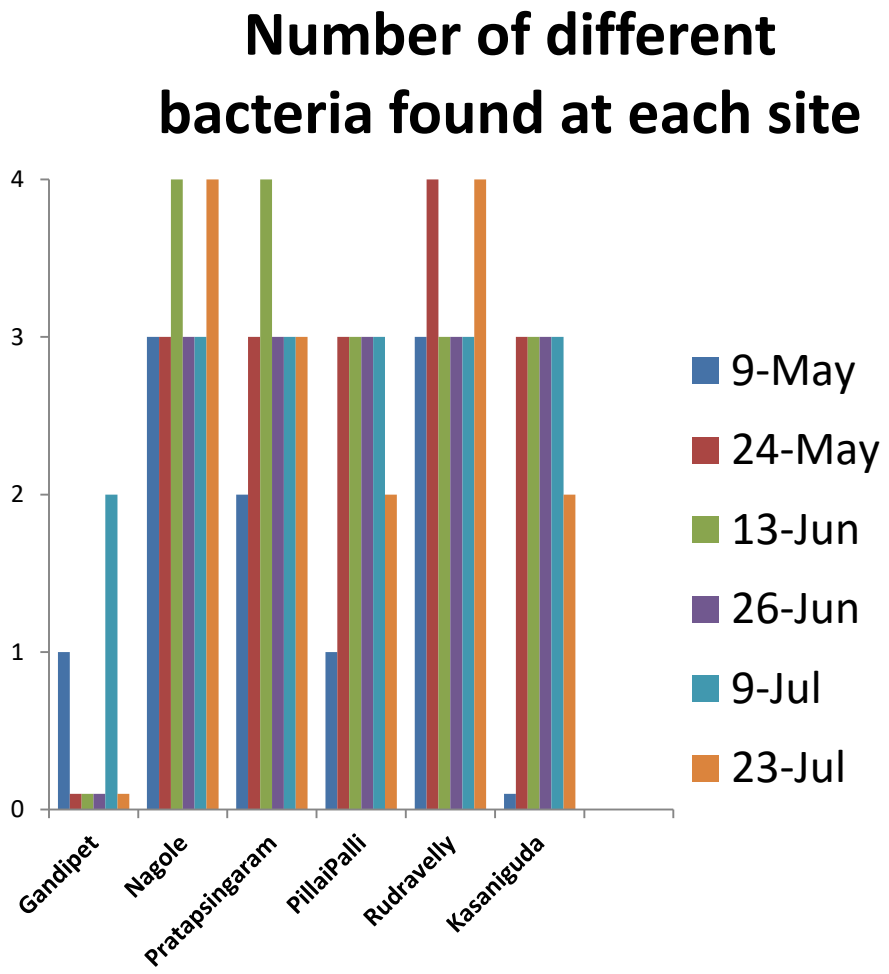


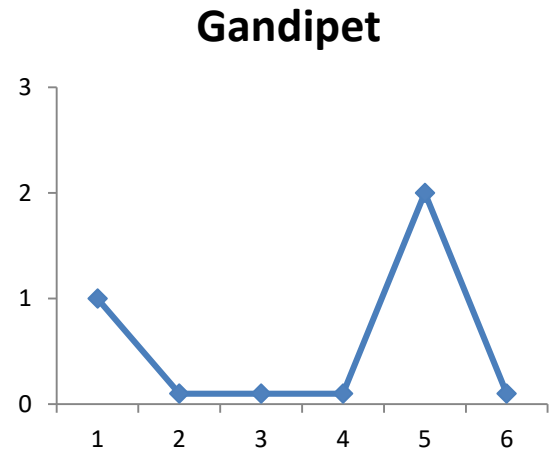
Fig. 1: Illustration of sample processing of water samples obtained from different sites

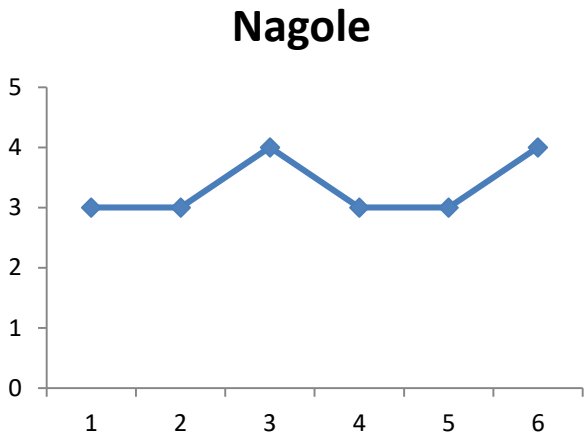
Results: Findings of the study

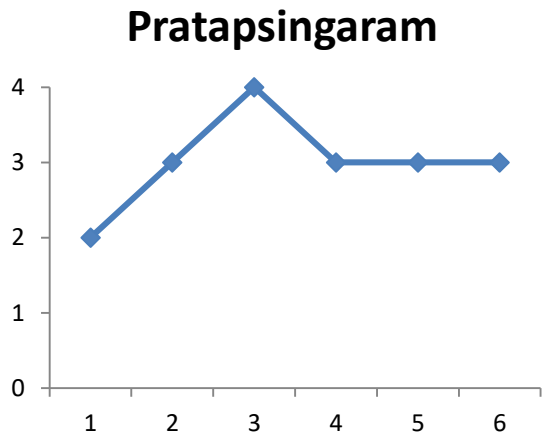
- Types and number of bacteria at each site
- AMR pattern (by two methods)
- Longitudinal changes in number of bacteria in water samples
- Applicability of the rapid test on RightBiotic platform for "Hygiene survey" of river water and other natural water reserves

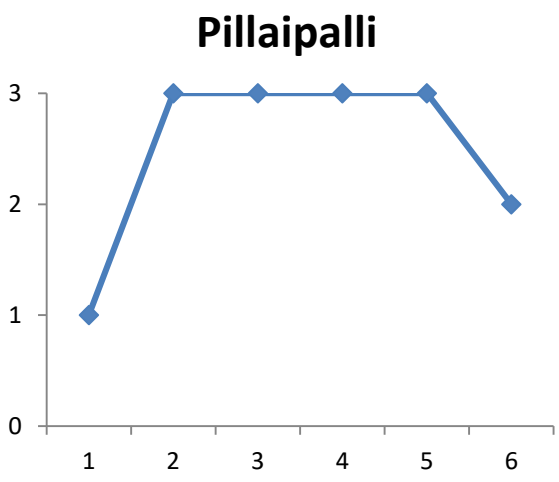


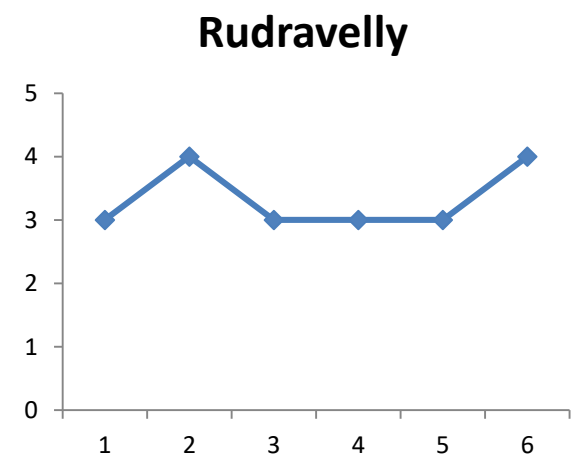
Change in Bacterial Load over 10 week period

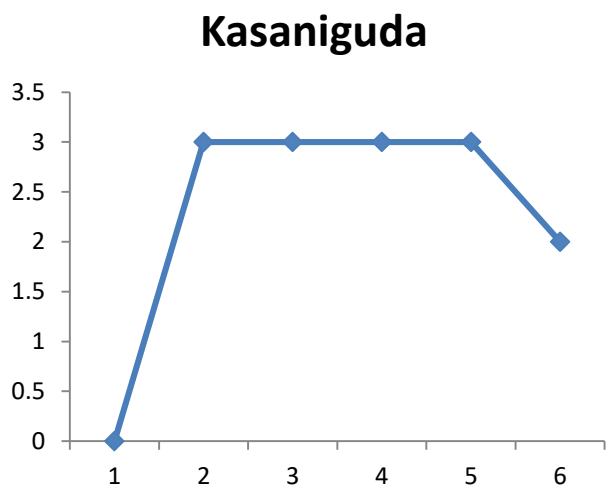






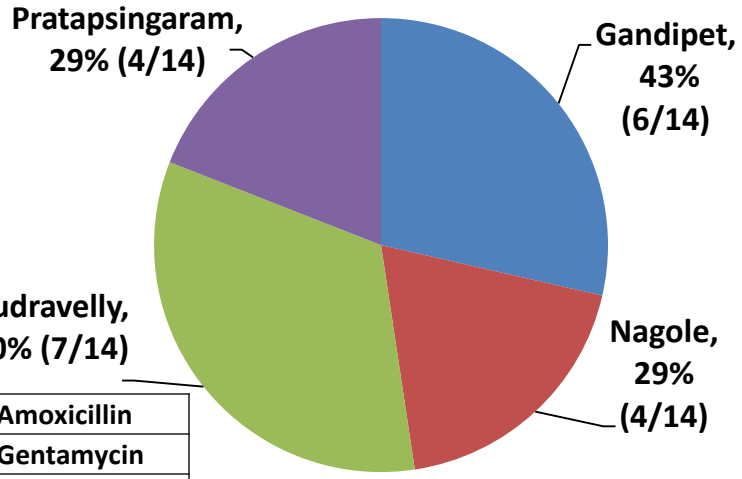






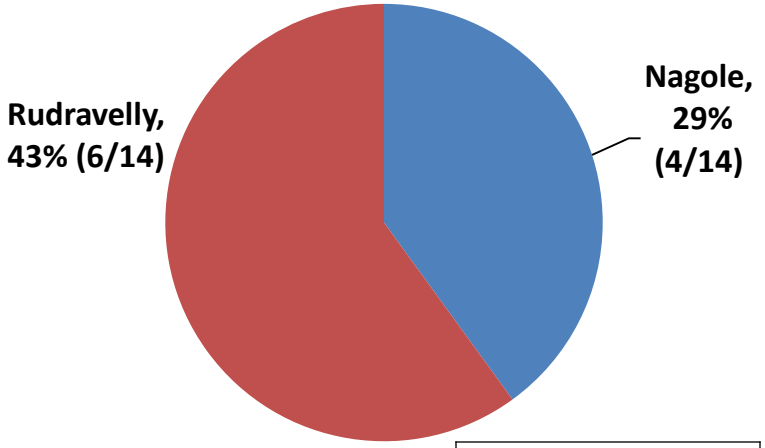
Antibiotic Resistance Pattern (09/05/2019)

E. coli (Gram –ve)



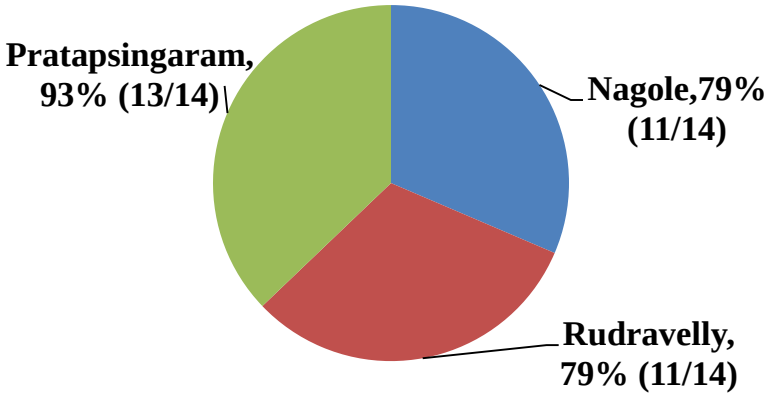
1. Amoxicillin
2. Gentamycin
3. Amikacin
4. Cefepime
5. Ofloxacin
6. Ciprofloxacin
7. Ceftriaxone
8. Piperacillin-tazobactam
9. Cefotaxime
10. Cefuroxime
11. Tobramycin
12. Levofloxacin
13. Cefazolin
14. Imipenem

Klebsiella (Gram –ve)



1. Co-Trimexazole
2. Teicoplanin
3. Meropenem
4. Cloxacillin
5. Ceftazidime
6. Clindamycin
7. Linezolid
8. Moxifloxacin
9. Nitrofurantoin
10. Lincomycin
11. Netilmicin
12. Vancomycin
13. Tigecycline
14. Azithromycin

Staphylococcus (Gram +ve)



Antimicrobial resistance pattern of various bacterial species

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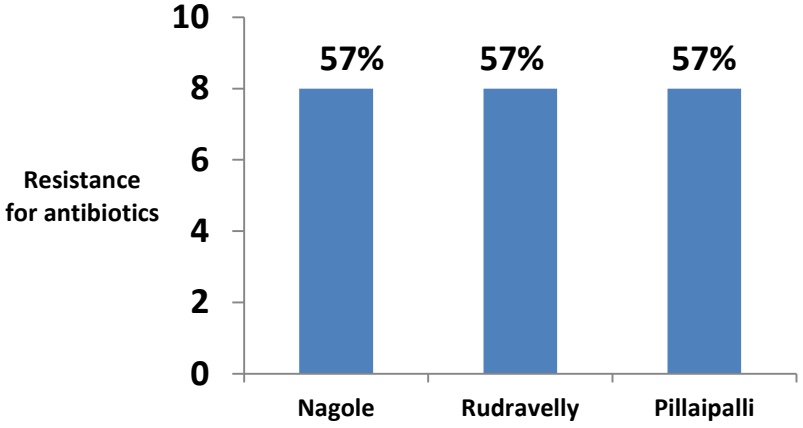
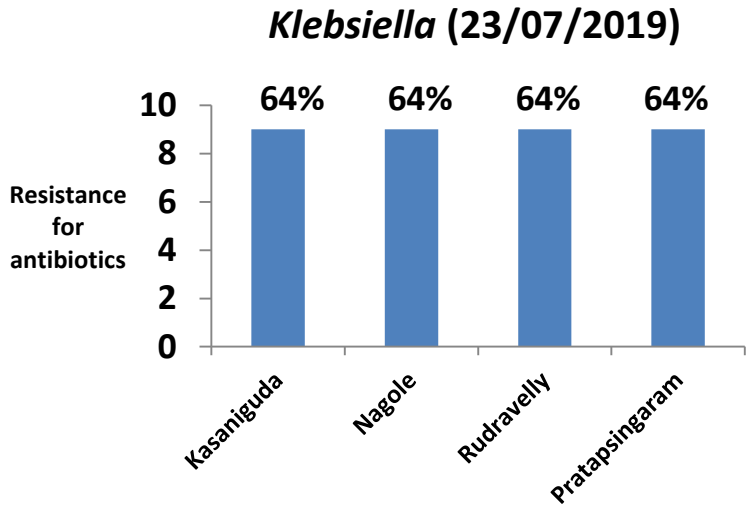
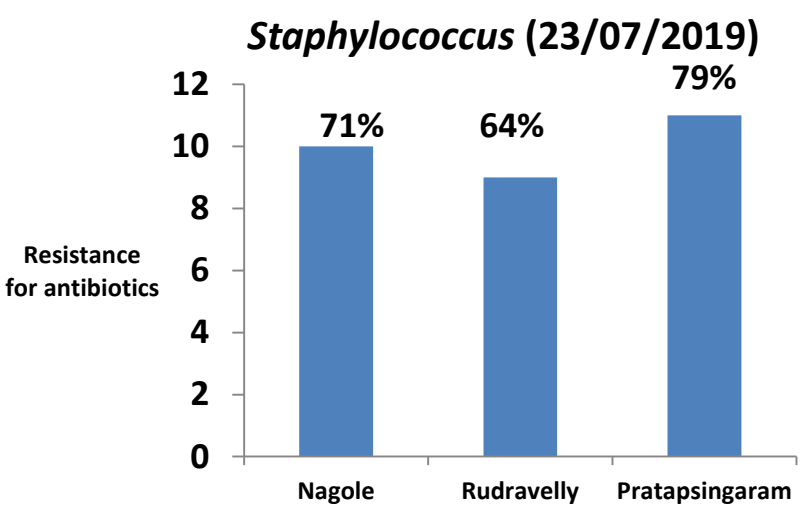
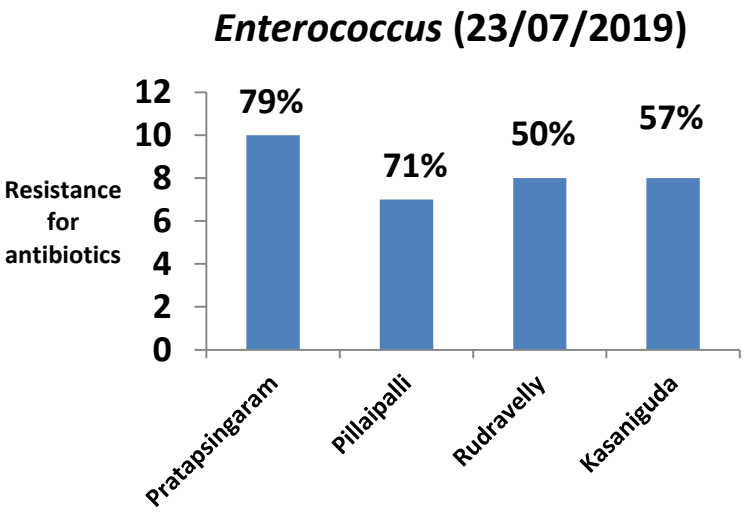


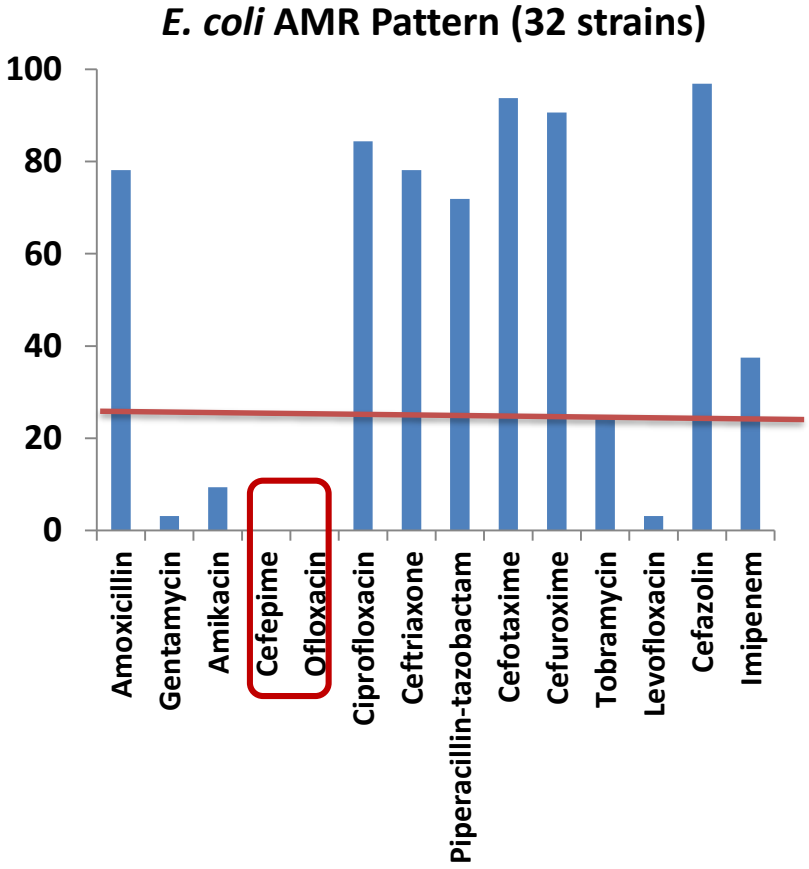


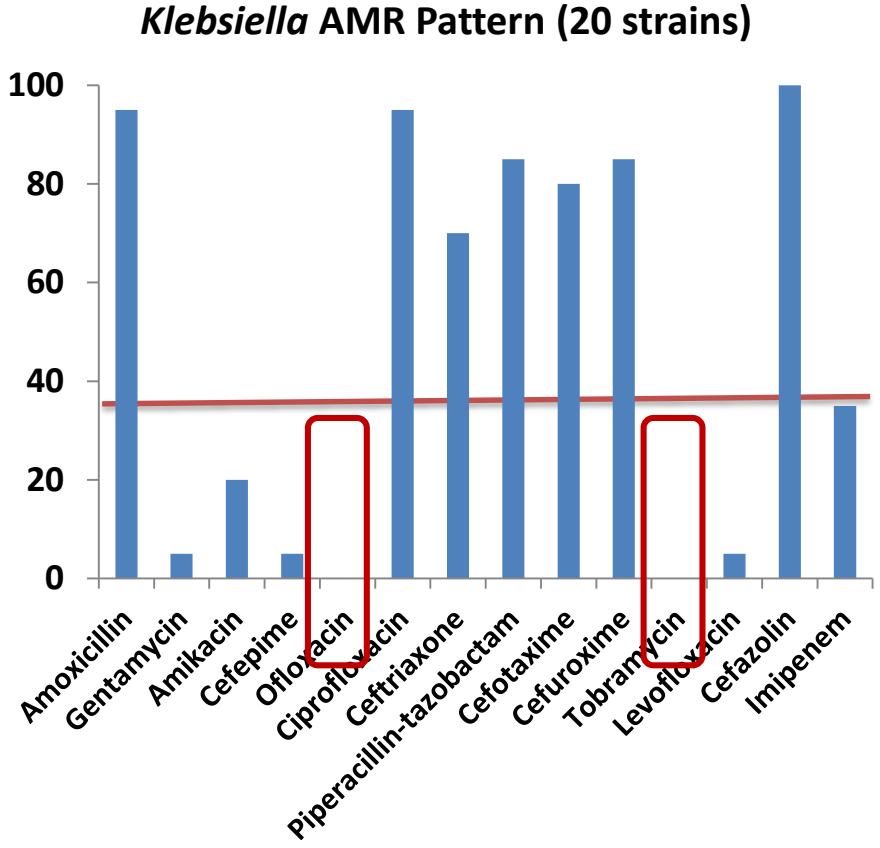




Antimicrobial resistance pattern of various bacterial species isolated from different sampling locations

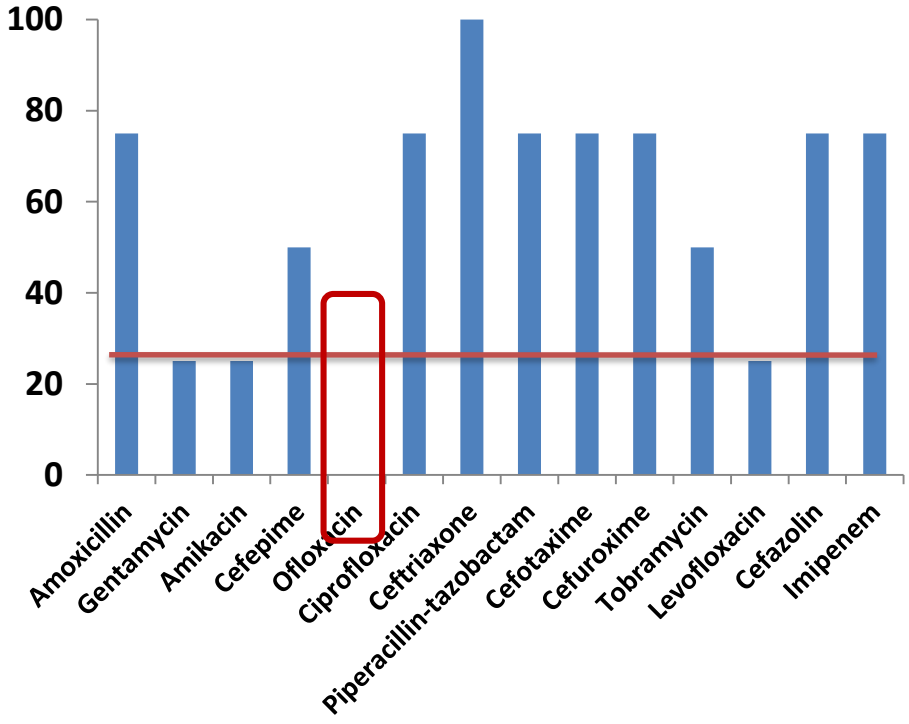
Antimicrobial resistance pattern of various bacterial strains

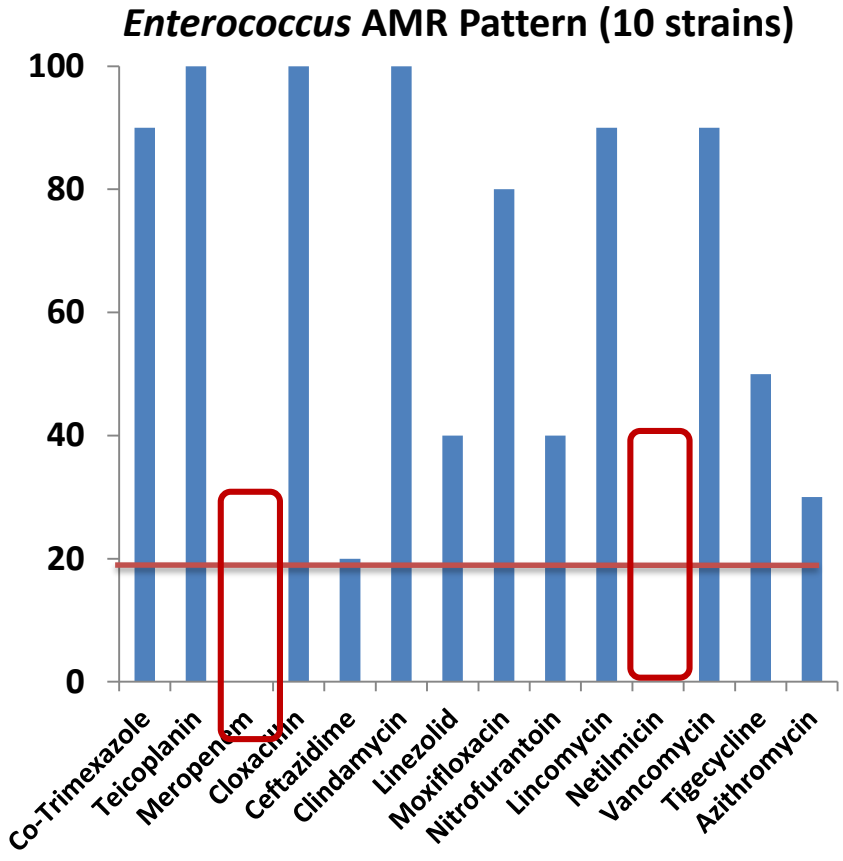




All *E.coli* strains tested were sensitive to Cefepime and Ofloxacin. All *Klebsiella* strains tested were sensitive to Ofloxacin and Tobramycin

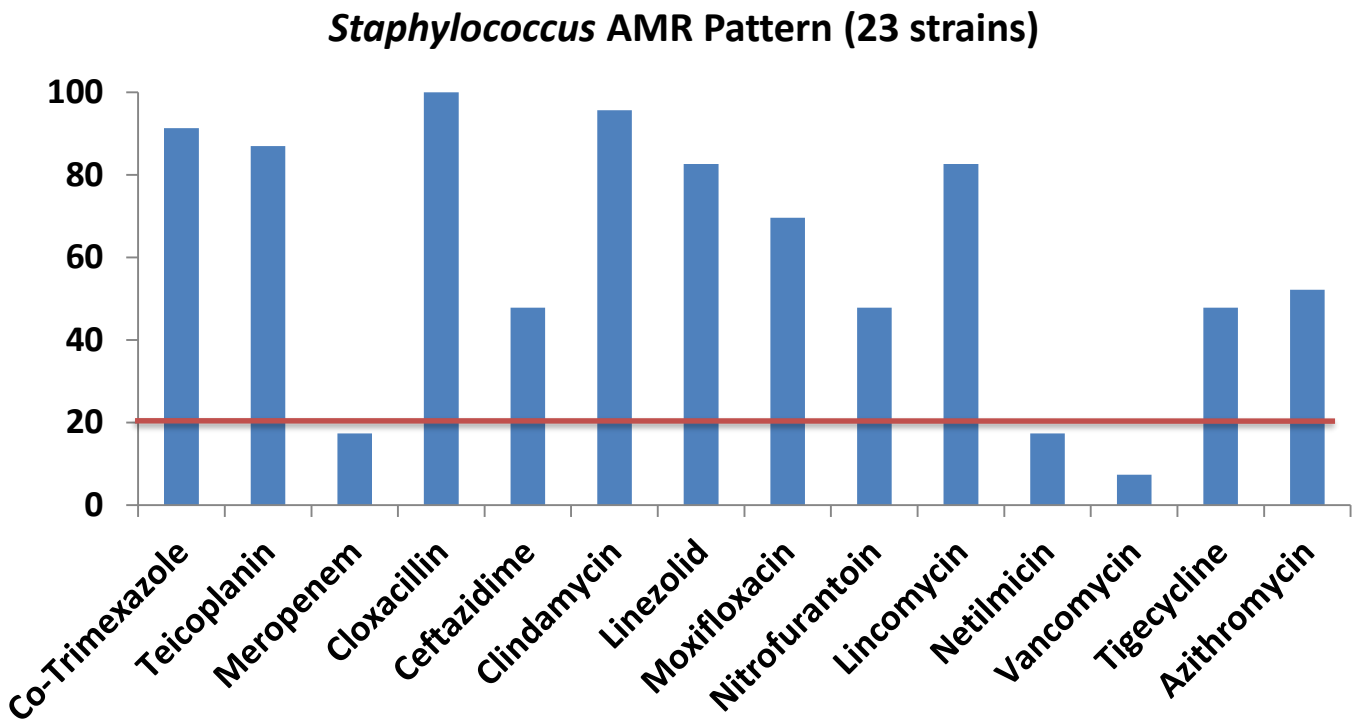
Antimicrobial resistance pattern of various bacterial strains





All the *Pseudomonas* strains tested were sensitive to Ofloxacin. All the *Enterococcus* strains tested were sensitive to Meropenem and Netilmicin

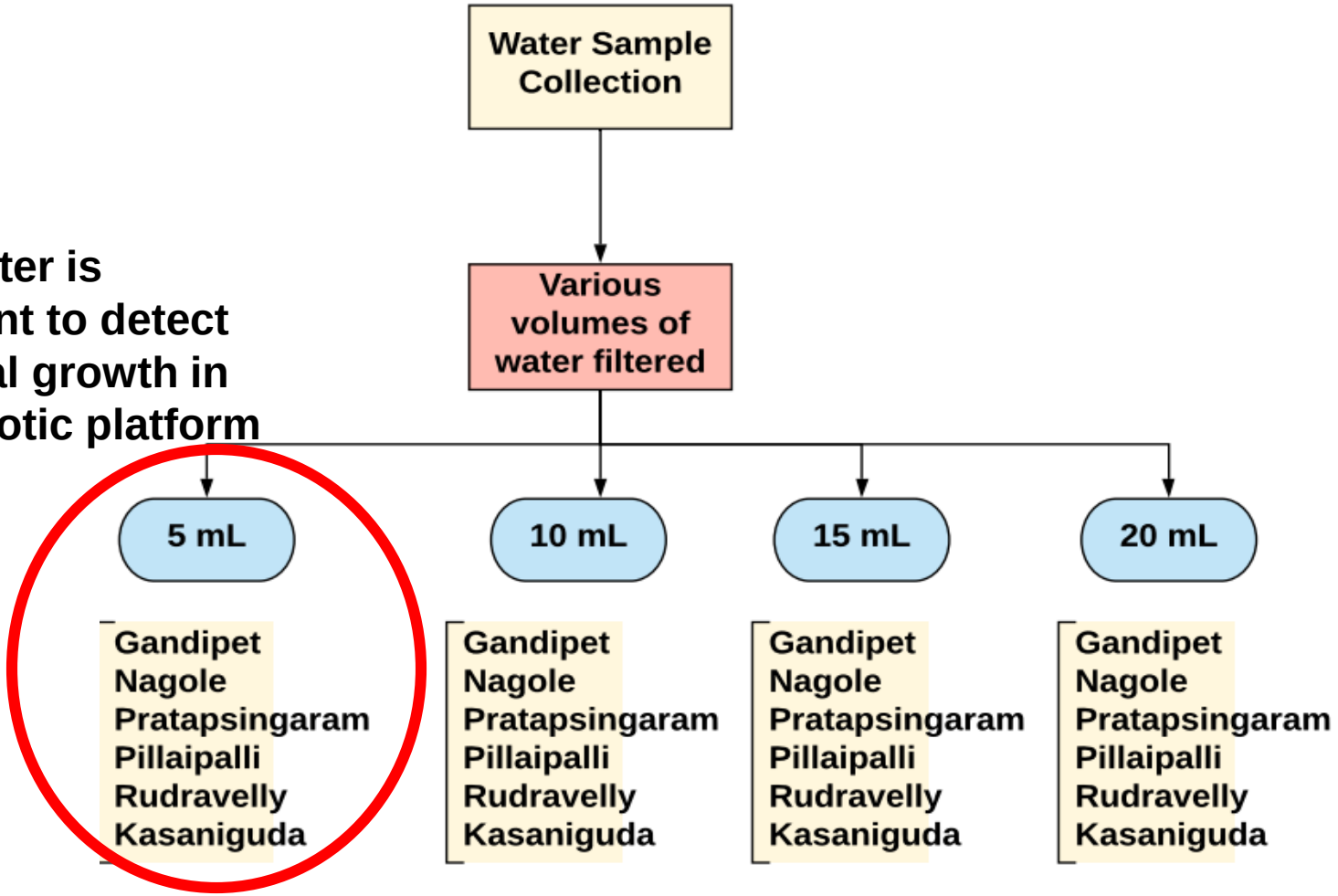
Antimicrobial resistance pattern of various bacterial strains



All the stains of Staphylococcus were resistant to all the tested antibiotics

Optimization of water volume required for RightBiotic Assay

5 ml water is sufficient to detect bacterial growth in RightBiotic platform



Optimization of minimum volume required to perform RightBiotic assay in the field

Comparison of AST profile between RightBiotic and Kirby Bauer Disc Diffusion Method

Date	9/5/19	24/5/19	13/6/19	26/6/19	9/7/19	23/07/19
Gandipet	100% (1)	(0)	(0)	(0)	73% (2)	(0)
Nagole	57% (3)	67% (3)	67% (4)	61% (3)	45% (3)	37% (4)
Pratapsingham	83% (2)	83% (3)	92% (4)	45% (3)	50% (3)	53% (3)
Pillaipalli	100% (1)	100% (3)	100% (3)	50% (3)	52% (3)	100% (2)
Rudravelly	84% (3)	100% (4)	100% (3)	56% (3)	65% (3)	54% (4)
Kasaniguda	NA (0)	100% (3)	100% (3)	95% (3)	94% (3)	100% (2)
Musi at Wadapally	(0)	(0)	(0)	(0)	(0)	(0)
Krishna at Wadapally (BC)	(0)	(0)	(0)	(0)	(0)	(0)
Musi + Krishna at Wadapally (AC)	(0)	(0)	(0)	(0)	(0)	(0)

Conclusions

- *E. coli*, *Klebsiella*, *Enterococcus*, *Pseudomonas* and *Staphylococcus* were detected

- Extensive MDR (resistance to 2 or more,) has bee was observed against frontline antibiotics. (29 to 93%, of the 14 antibiotics tested)

Competitive Advantage

6 tims faster

Lower Escalation

VITEK 2	MicroPro BCS	RightBiotic
Growth based method	Turbidity based method	Growth & turbidity based method
Turbidity needs to be adjusted-human intervention	Turbidity needs to be adjusted --human intervention	Not required
Accessory Instruments required: Centrifuge and laminar flow	Accessory Instruments: Laminar flow	Accessory Instruments required: None
Infrastructure: Air-conditioned labs	Infrastructure: Air-conditioned labs	None
Not Portable	Not portable	Portable
Cost of equipment: Rs 15-29L	Cost of equipment: Rs 06L	Cost of equipment: Rs 04L
Cost/Test: Rs 600-800	Cost/Test: Rs 500-600	Cost/Test: Rs 550
Total time required: ~ 26-29hrs	Total time required: ~ 23hrs	Total time required: 4-5hrs only

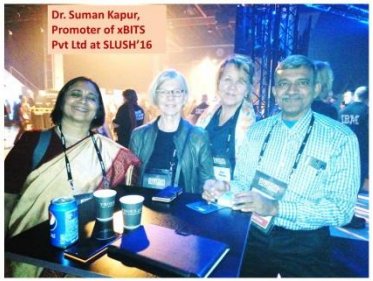
Laurels earned by this technology

MARICO FOUNDATION AWARD FUNCTION 2016:

Prof. Suman Kapur with Mr. Sam Balsara, Founder, Chairman and Managing Director of Madison World and Madison Communications at the award function of Marico Foundation in March 2016

RICOH EDUCATION EXCELLENCE AWARDS 2016:

xBITS is the winner of Ricoh Education Excellence Award that was held Feb' 2016. The event received an overwhelming response and was atten over 150 dignitaries and wide range of jury members from various instit



TiE Regionals(ASIA) Award 2016:

Xcellence in Bio Innovations and TechnologieS

Laurels earned by this technology

Receiving the National Technology Startup Award for 2018 bestowed by TDB (potential for commercialization) on May 11th '18

RightBiotic Differentiators

1. Rapid assay
2. Obliterates the need for long wait
3. Leads to specific and appropriate treatment
4. Allows evaluation of multiple antibiotics
5. Provides immediate, on-spot results (~5 hours)
6. Minimizes human error
7. Reports Intermediate sensitivity also
8. No need for any specialized equipment or training
9. Works on mixed strain consortium
10. Most importantly It is a “Made in India” Technology

News » India News » Superbug-related death spurs drug regulator warning

Superbug-related death spurs drug regulator warning

Sushmi Dey| TNN | Updated: Jan 18, 2017, 03.16 AM IST

A- A+

Representative image of a superbug. (Reuters Photo)

HIGHLIGHTS

- Drugs Controller General of India (DCGI) has asked companies to carry specified warnings to avoid antimicrobial resistance.
- To check irrational use of antibiotics, the government has introduced a 'red line' differentiating high-end antibiotics from other drugs.
- Govt is running campaigns against irrational prescriptions

THANK YOU