Cost-effectiveness of hand hygiene promotion to reduce nosocomial infection

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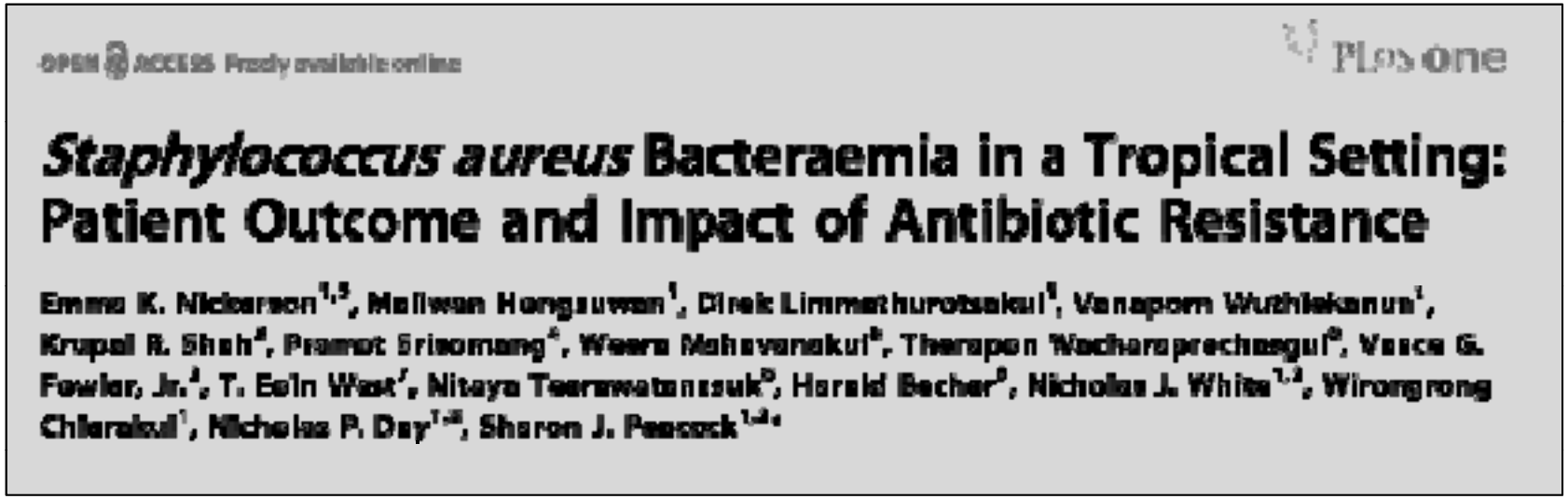
Background



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PLoS one

Staphylococcus aureus Bacteraemia in a Tropical Setting: Patient Outcome and Impact of Antibiotic Resistance

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PloS One 2009

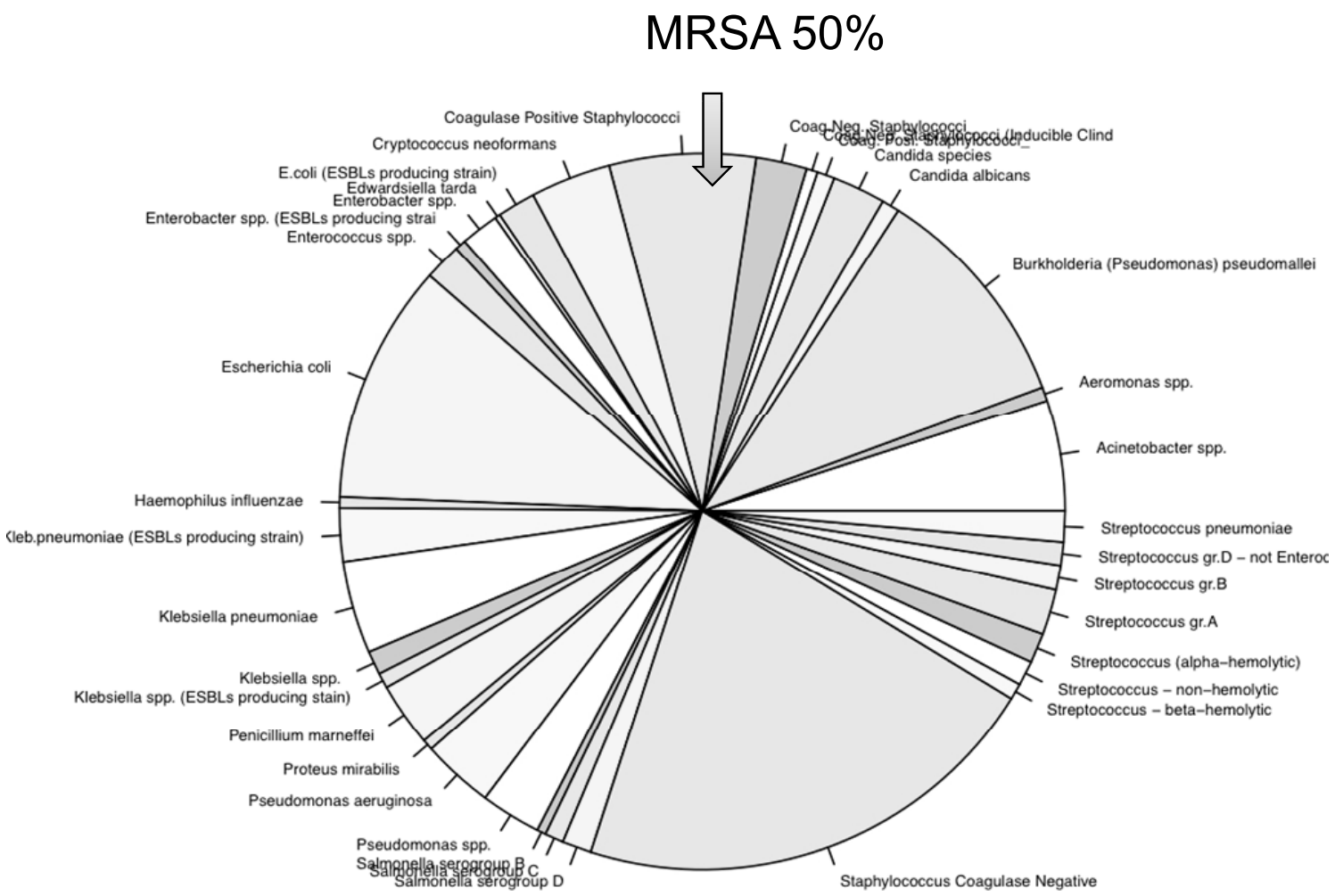
Conclusions: *S. aureus* is a significant pathogen in northeast Thailand, with comparable clinical manifestations and a similar endocarditis prevalence but higher mortality than industrialised countries. *S. aureus* bacteraemia is frequently associated with exposure to healthcare settings with MRSA causing a considerable burden of disease. Further studies are required to define setting-specific strategies to reduce mortality from *S. aureus* bacteraemia, prevent MRSA transmission, and to define the burden of S. aureus disease and emergence of drug resistance throughout the developing world."

Aims

- To analyse cost-effectiveness of hand hygiene promotion in resource-limited setting compared to no intervention.

- To explore the maximum level of investment for hand hygiene improvement that would be cost-effective to prevent infection with MRSA

5-year data of bloodstream infections



Background

- Economic burden of nosocomial infection in Thailand estimated in 1995 to be 1.5 – 2.5 billion baht per year

  ($50 million USD) by Ramasoot et al. [1]

- Danchaivijitr et al.[2] demonstrated that the average cost of antibiotic treatment for one event of Nosocomial Infection (NI) is about 6,000 baht ($200 USD), year 2001.

- Cost of antibiotic used due to NI at 1,000 bed regional hospital, NE of Thailand is about 13 million baht per year ($430,000 USD) in 2009 [3]

1. Ramasoot, T., *Nosocomial infection.* J Med Assoc Thai 1995. **78**(Suppl 1): p. 57-8.
2. Danchaivijitrmd, S., et al., *Prevalence and impacts of nosocomial infection in Thailand 2001.* J Med Assoc Thai, 2005. 88 Suppl 10: p. S1-9.
3. Hospital annual report, 2009

Background

Am J Infect Control. 2010 Aug;38(6):449-55.

Effectiveness of a catheter-associated bloodstream infection bundle in a Thai tertiary care center: A 3-year study

Anucha Apisarnthanarak, MD,[a] Kanokporn Thongphubeth, RN,[a] Chananart Yuekyen, RN,[a] David K. Warren, MD,[b] and Victoria J. Fraser, MD[b]
Pratumthani, Thailand, and St Louis, Missouri

Results: In period 1, 88 episodes of CA-BSI (14 cases per 1000 catheter-days) were recorded. During period 2, the CA-BSI rate decreased by 54.1 % (6.4 cases per 1000 catheter-days; P ,.001). Compared with period 1(8% adherence), hand hygiene adherence was improved in period 2 (24%; P ,.001) and period 3 (54%; P ,.001). The CA-BSI rate was further decreased by 78% (1.4 cases per 1000 catheter-days; P ,.001) during period 3.

Cost-effectiveness of hand hygiene promotion to reduce nosocomial infection

Methods

- Model based analysis
- Economic Evaluation

Methods

Population: A Regional Hospital in North East of Thailand 1,000 beds

Hospital wards:

2 Intensive Care Units (ICU) wards

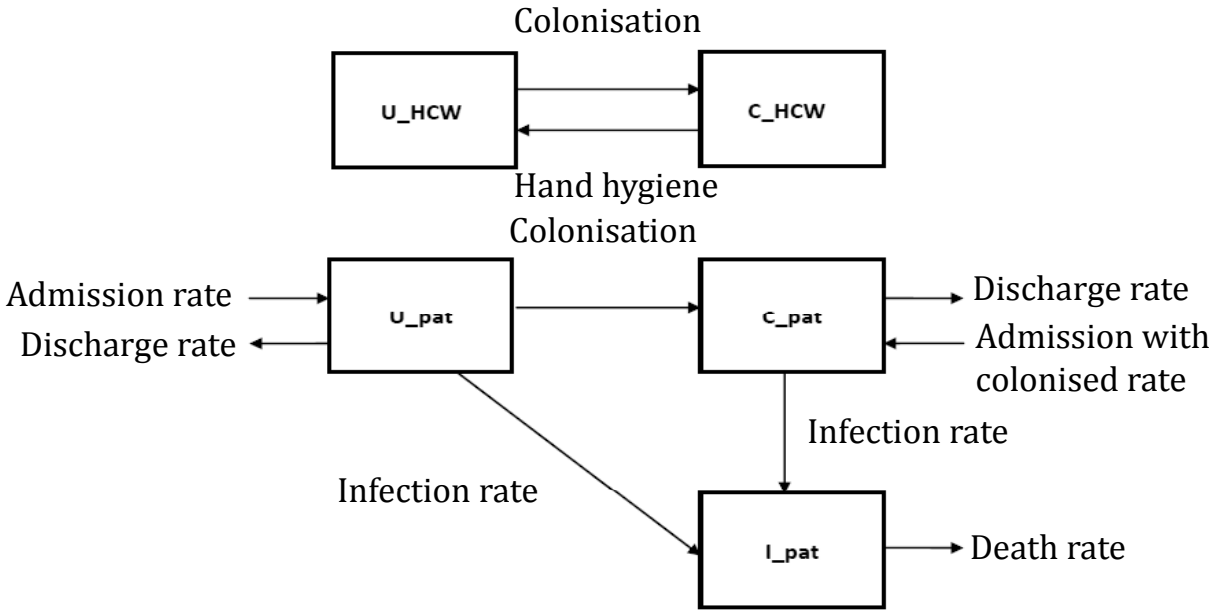
Pediatric intensive care unit (PICU)

Surgical intensive care unit (SICU)

	PICU	SICU
No of Patients	15	12
No of Staffs	4	4
Median age of patients	10	73
Median length of stay	6	3

Methods

Dynamic model of MRSA transmission in an ICU



- All transmission assumed to be from HCWs.
- Increasing HH compliance will reduce infection rate and death
- These results will be converted to QALYs and costs due to infections

Methods

Outcomes: Quality Adjusted Life Year (QALY)

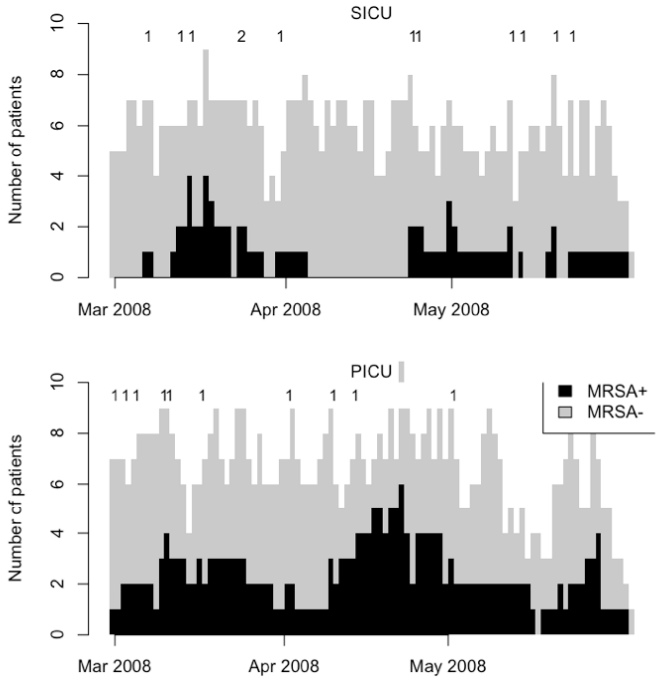
(QALY = Quantity of life and Quality of life)

Willingness to pay: 100,000 Baht per QALY gained* in Thai setting

* WHO recommendation, GDP per capita

Input Parameters

Input parameters	**Value**	**Reference**
Cost of MRSA infection per case	6,978.83	Danchaivijitr 01
Expected quality of life after ICU discharge	0.71	Ylipalosaari 07
Life expectancy of Thai population	Age specific	WHO 2008
Transitions	**PICU**	**SICU**
Proportion of admission with colonised	0.12	0.05
Daily risk of bacteraemia of MRSA colonised patient	0.004	0.011
Mortality in patient with MRSA bacteraemia	44%	
Patient/HCW contact per day	50	



Model Outputs

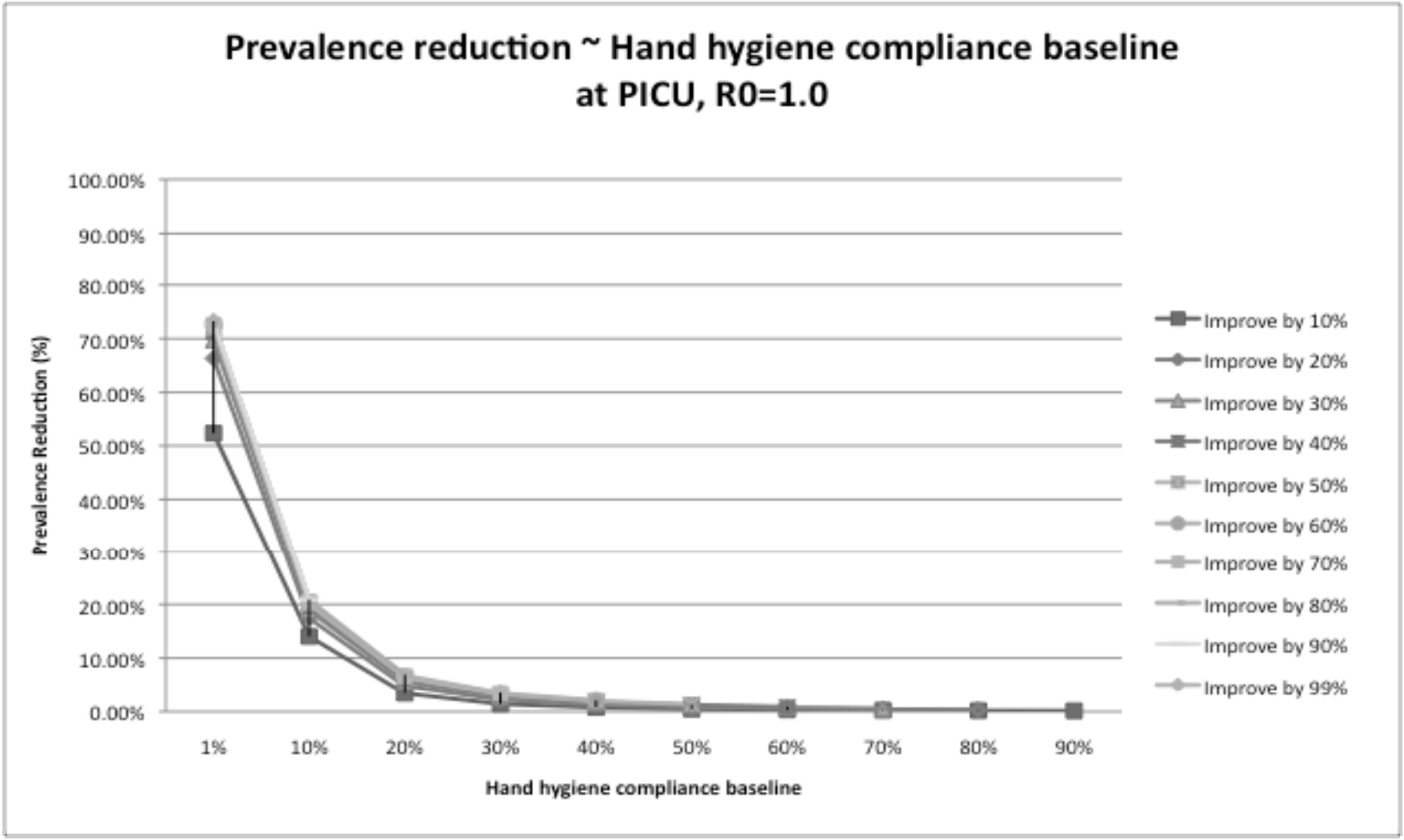
1. **Prevalence reduction due to Hand Hygiene Compliance Improvement**

2. **QALYs gained due to Hand Hygiene Compliance Improvement**

3. **The maximum level of investment for hand hygiene improvement that would be cost-effective to prevent infection with MRSA**

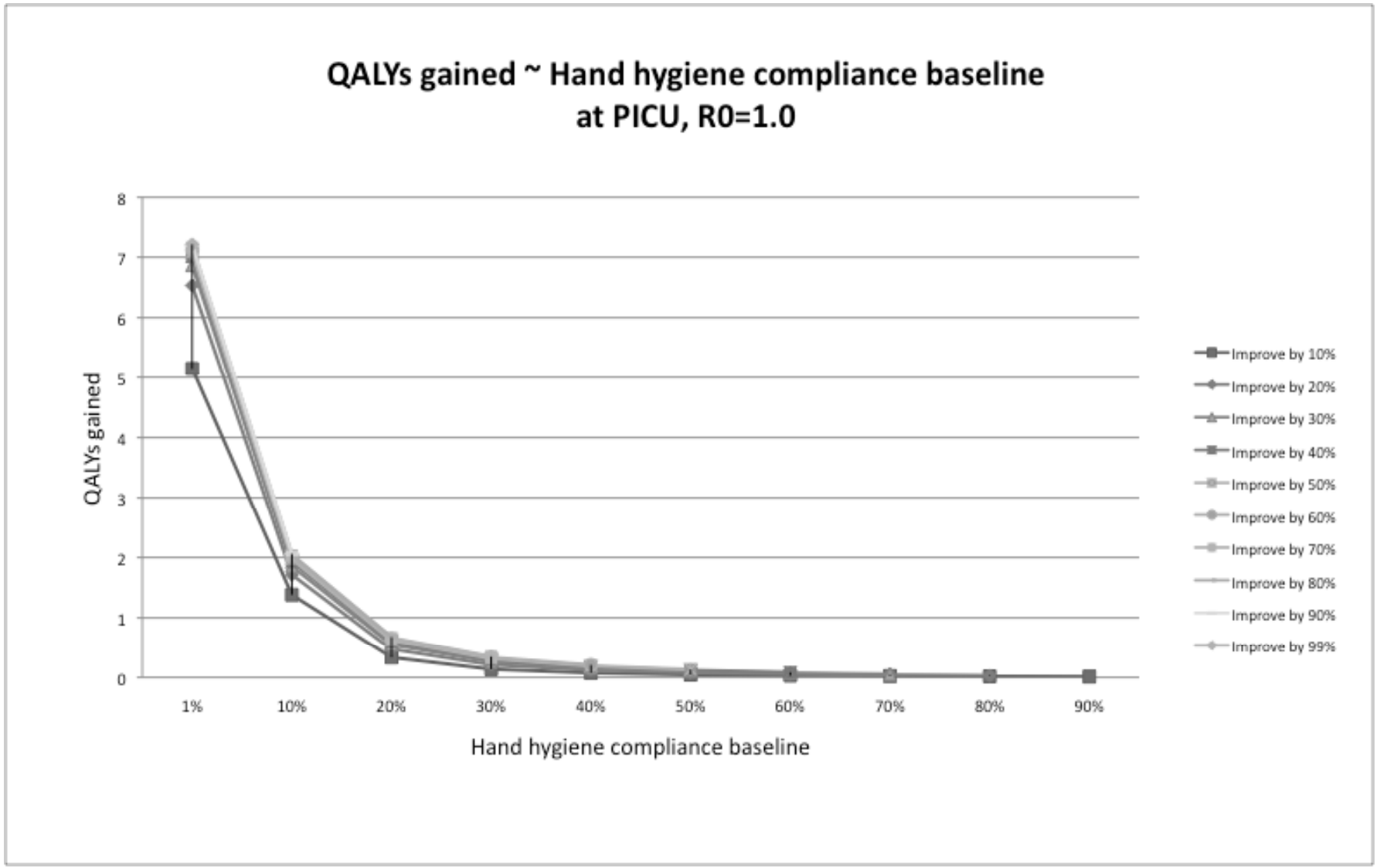
$$\Delta \text{ Cost of Intervention} \leq \text{WTP} * \Delta\text{QALYs} - \Delta\text{Cost of Infection}$$

Results: PICU

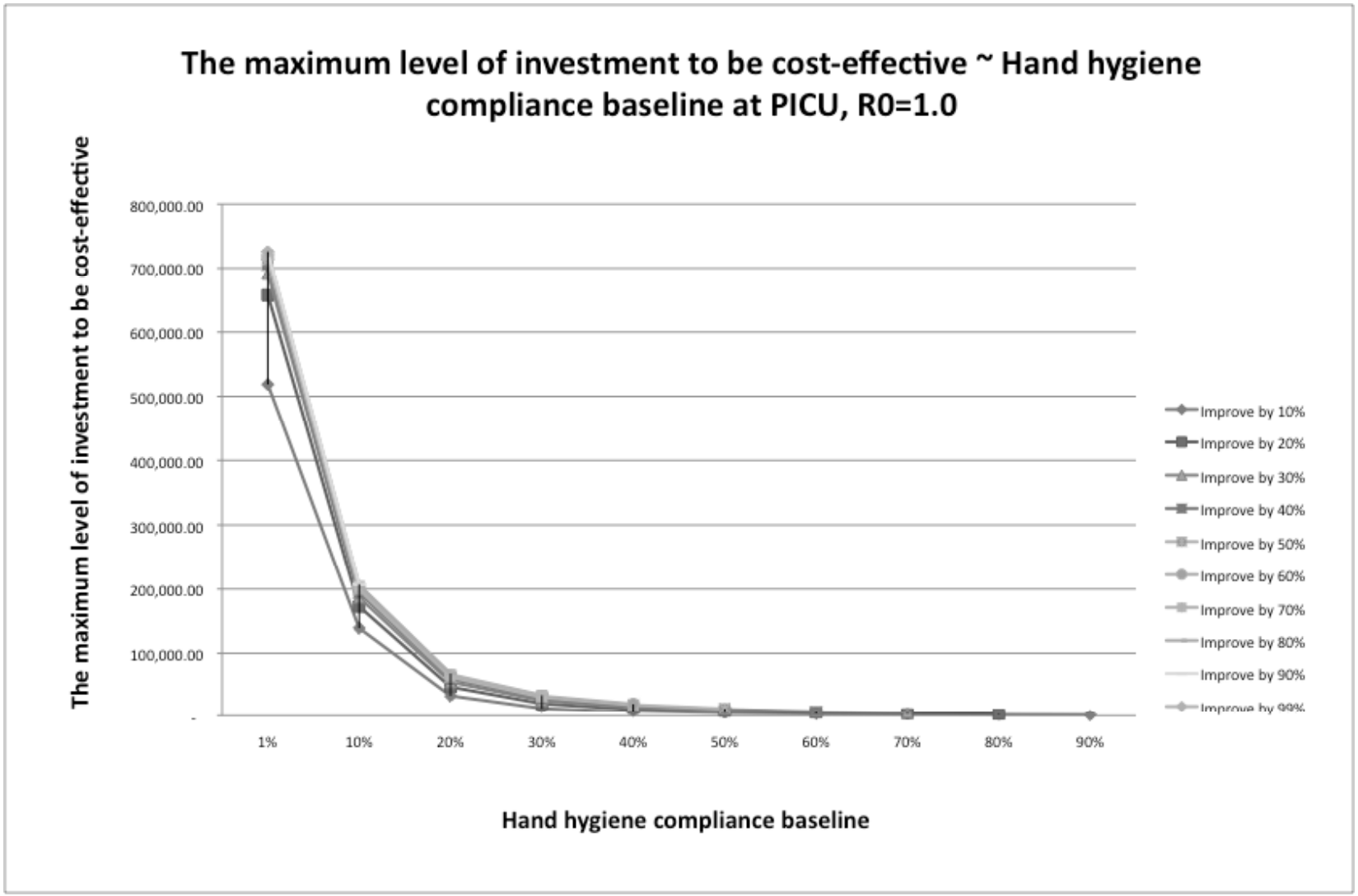


When baseline compliance is low, improving by small amount can get a huge benefit

PICU

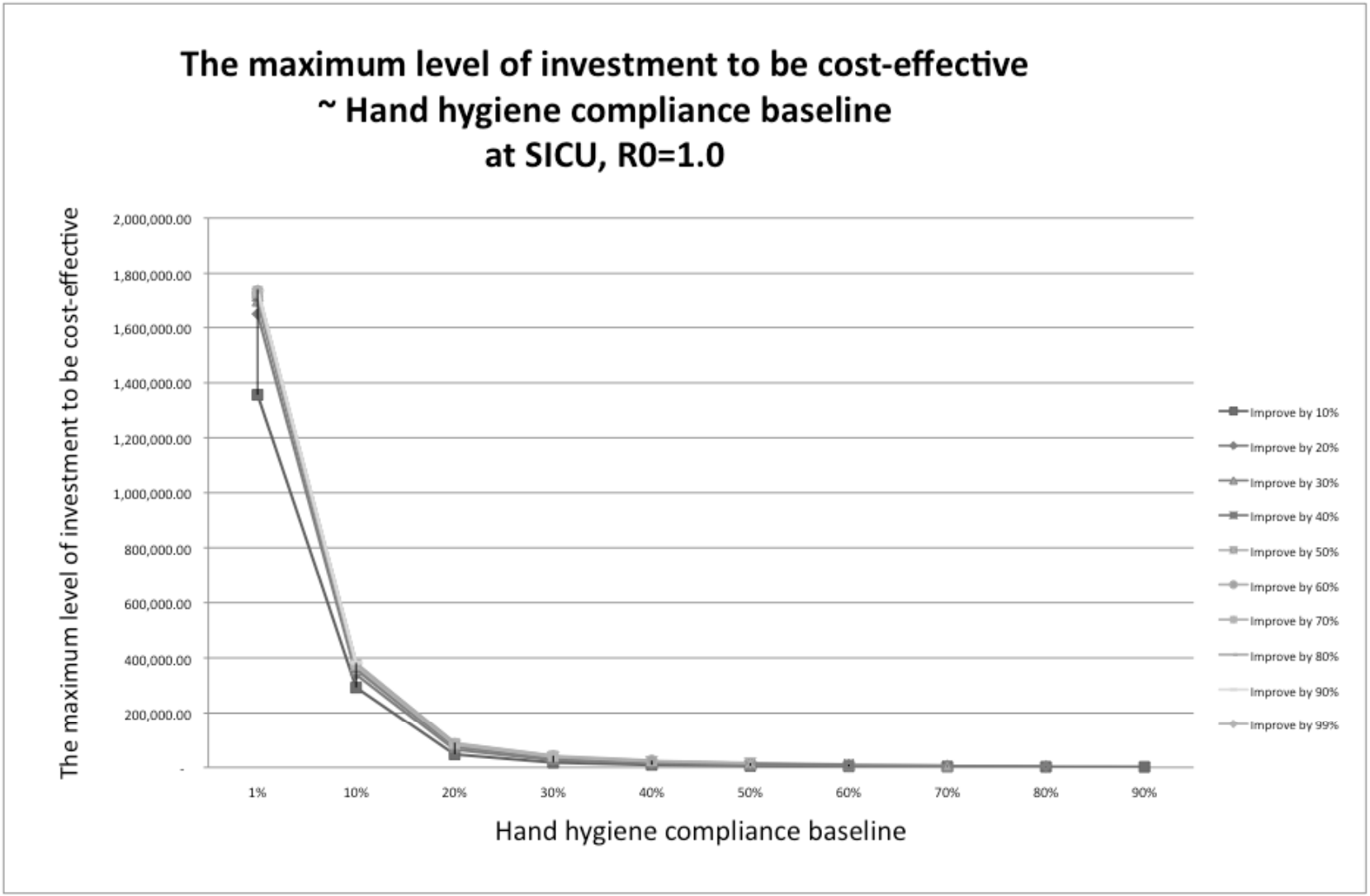

QALYs gained ~ Hand hygiene compliance baseline at PICU, R0=1.0
QALYs gained
0
1
2
3
4
5
6
7
8
1%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Hand hygiene compliance baseline
Improve by 10%
Improve by 20%
Improve by 30%
Improve by 40%
Improve by 50%
Improve by 60%
Improve by 70%
Improve by 80%
Improve by 90%
Improve by 99%

PICU



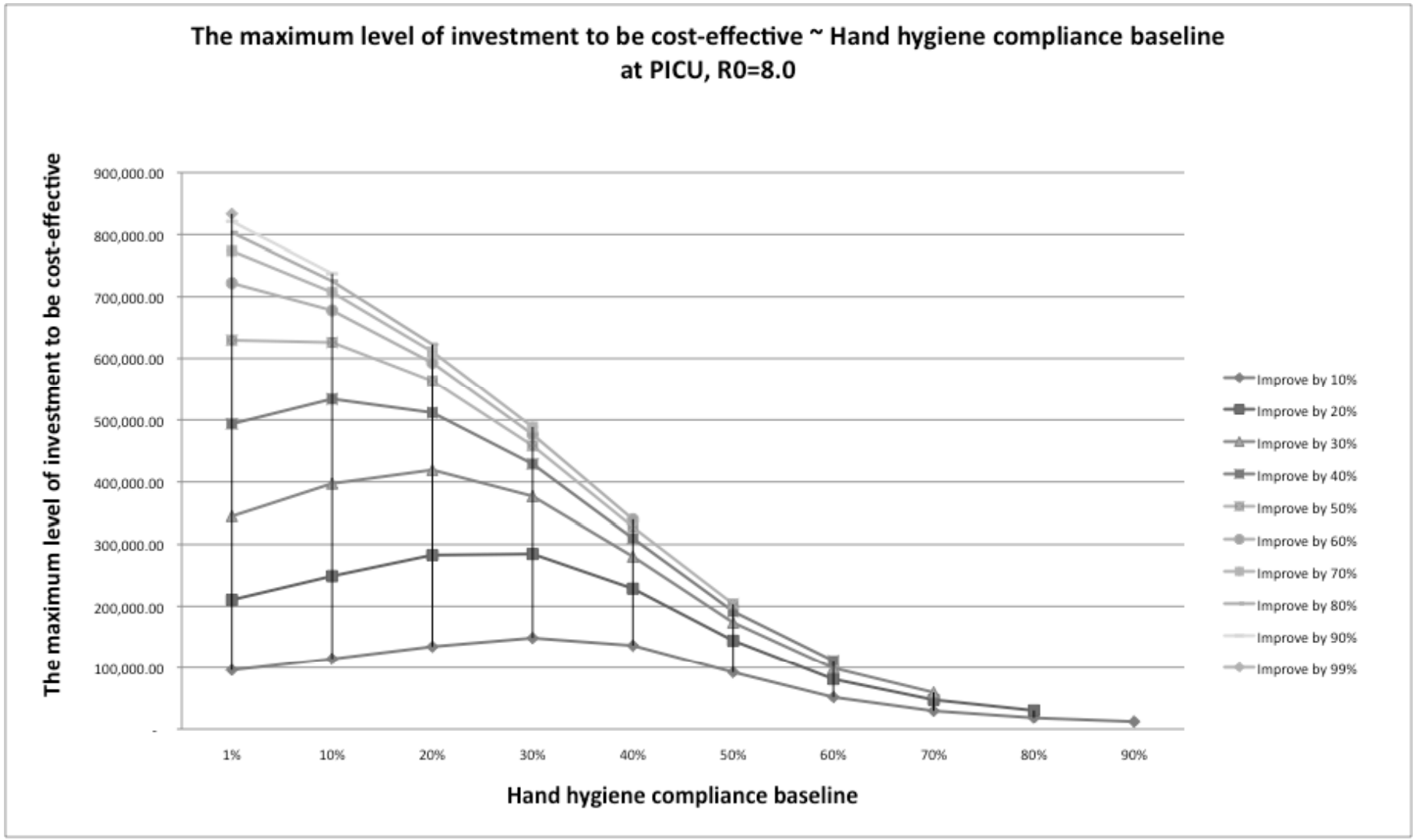
When baseline compliance between 1 and 10%,
it would be worth investing up to 0.5 to 1 million baht/ward/year for 10 % improvement

SICU



The increase of maximum level of investment is due to the higher daily risk of bacteraemia In MRSA colonised patients and also the lower proportion colonised at admission.

Extreme case scenario for the very high transmissibility



When the baseline of hand hygiene compliance increase, the maximum level of investment to be cost effective increases to a certain level then decreases at the higher baseline.

Conclusion

- At very low hand hygiene compliance, increasing hand hygiene compliance is likely to be very cost-effective even looking at only the MRSA bacteraemias.

Limitations/Further works

- This study considered only the MRSA bacteraemia.

  In fact, the total benefits from improving hand hygiene will be larger than our estimate. Accounting for other infections and other organisms will require further work.

- Our results are based on a simulation model.

  We will collect primary data on costs and outcomes from a trial of hand hygiene promotion intervention.

Acknowledgement

Ben Cooper

Yoel Lubell

Direk Limmathurotsakul

Maliwan Hongsuwan

Thank you

wellcome trust

MORU

Mahidol Oxford

WELLCOME TRUST - MAHIDOL UNIVERSITY - OXFORD
TROPICAL MEDICINE RESEARCH PROGRAMME

$$ICER = \frac{\text{Total costs of HH promotion - Total costs of no intervention}}{\text{Outcomes of HH promotion - Outcomes of no intervention}}$$

Analyses

Appropriate level of investment in hand hygiene promotion

Δ Cost of Intervention ≤ WTP * ΔQALYs - ΔCost of Infection

Estimated outcomes of the intervention from a certain level of investment

$$\textbf{\textit{ΔQALY}} \geq \frac{\Delta\text{Cost of Intervention} + \Delta\text{Cost of Infection}}{\text{WTP}}$$

Life Year x Utility (QOL) = QALY

With intervention, the cases of HAI will be smaller and mortality rate will be lower. Average patient can life longer. Take the different no of year living longer multiplied by quality of life each year, we will get QALY gained

Life year lost due to infection (Life Expectancy – Admission/Infected age*[Nikerson])

70 - 39 = 31 years per patient

31 * 0.7 = 21.7 QALYs per patient

With intervention There are 17 patients with S and C, therefore total QALYs are 21.7*17

QALY after discharge

Final population

With intervention S = , C= , I=

W/O intervention S = , C= , I=

Analyses: With two approaches

Cost per QALY gained

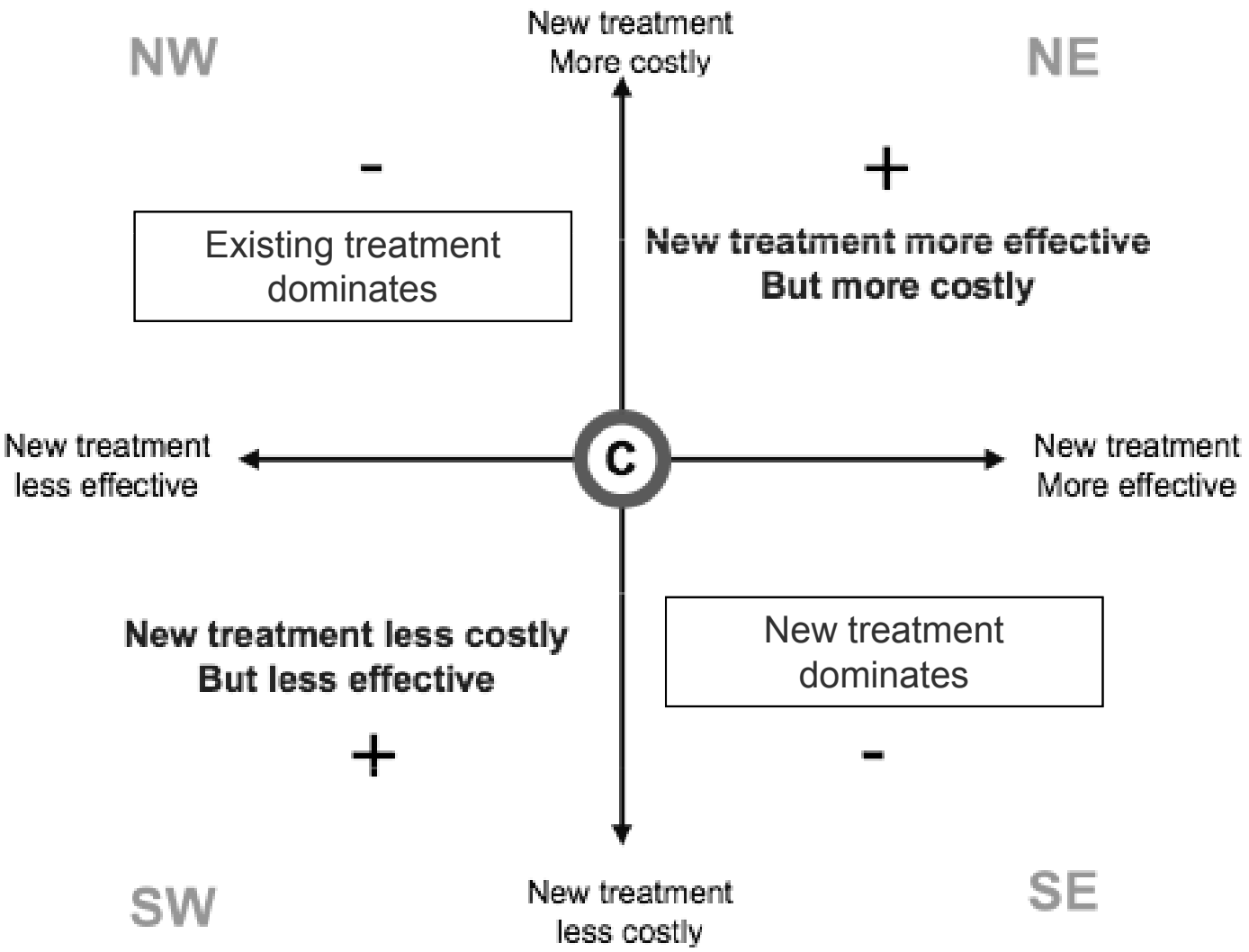
Expected QALYs gained from an appropriate budget

Results: Cost per QALY gained, Cost per infected cases averted, Cost per life

Discussion /Conclusion

- This is a conservative analysis employing only b
- Investing in hand hygiene promotion should consider the prevalence R0 and also the baseline of hand hygiene compliance at particular setting.

Cost - effectiveness Plane



Knowing the appropriate level of investment on hand hygiene which can be applied to all countries by setting different level of threshold.

Understand the dynamic of infection at hosp and also the effectiveness of HHP

Outline

- Background
- Economic Evaluation
- Methodology
- Q&A

Strategies for hospital infection control (Alternative interventions)

General approaches

- Hand hygiene promotion
- Quality improvement programme*
- Antibiotic stewardship

Target to specific pathogen approaches

- Screening and Decolonising or Isolating

"Search and Destroy policy"

* Apisarnthanarak, A., K. Thongphubeth, et al. (2007). "Effectiveness of Multifaceted Hospitalwide Quality Improvement Programs Featuring an Intervention to Remove Unnecessary Urinary Catheters at a Tertiary Care Center in Thailand " Infection Control and Hospital Epidemiology **28(7): 791-798.**

Cost-effectiveness of hand hygiene promotion to reduce nosocomial infection

Study Objectives:

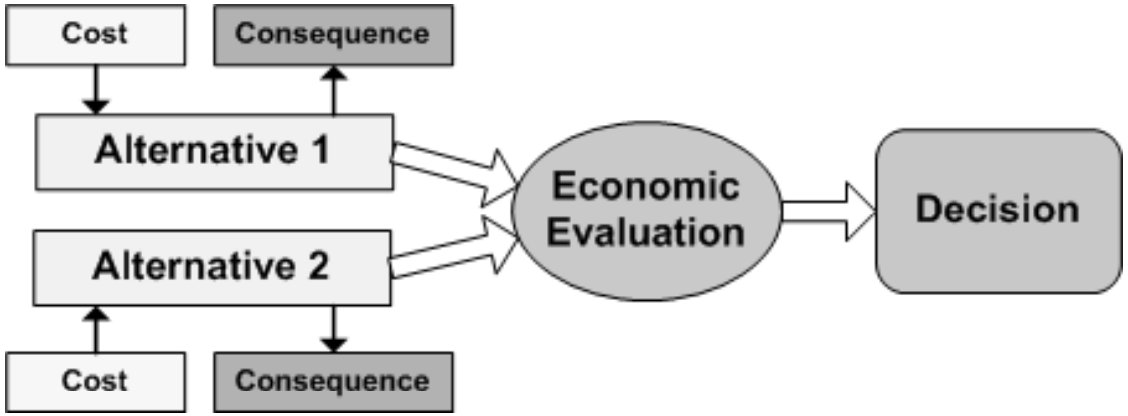
- To measure the effectiveness of hand hygiene promotion such as infection rate, mortality rate.
- To analyse cost-effectiveness of hand hygiene promotion or other strategies in resource-limited setting compared to no intervention.
- To explore the appropriate level of investment on the effective interventions for hand hygiene improvement.

Limitation and Research gap

- Appropriate level of investment on Hand Hygiene promotion

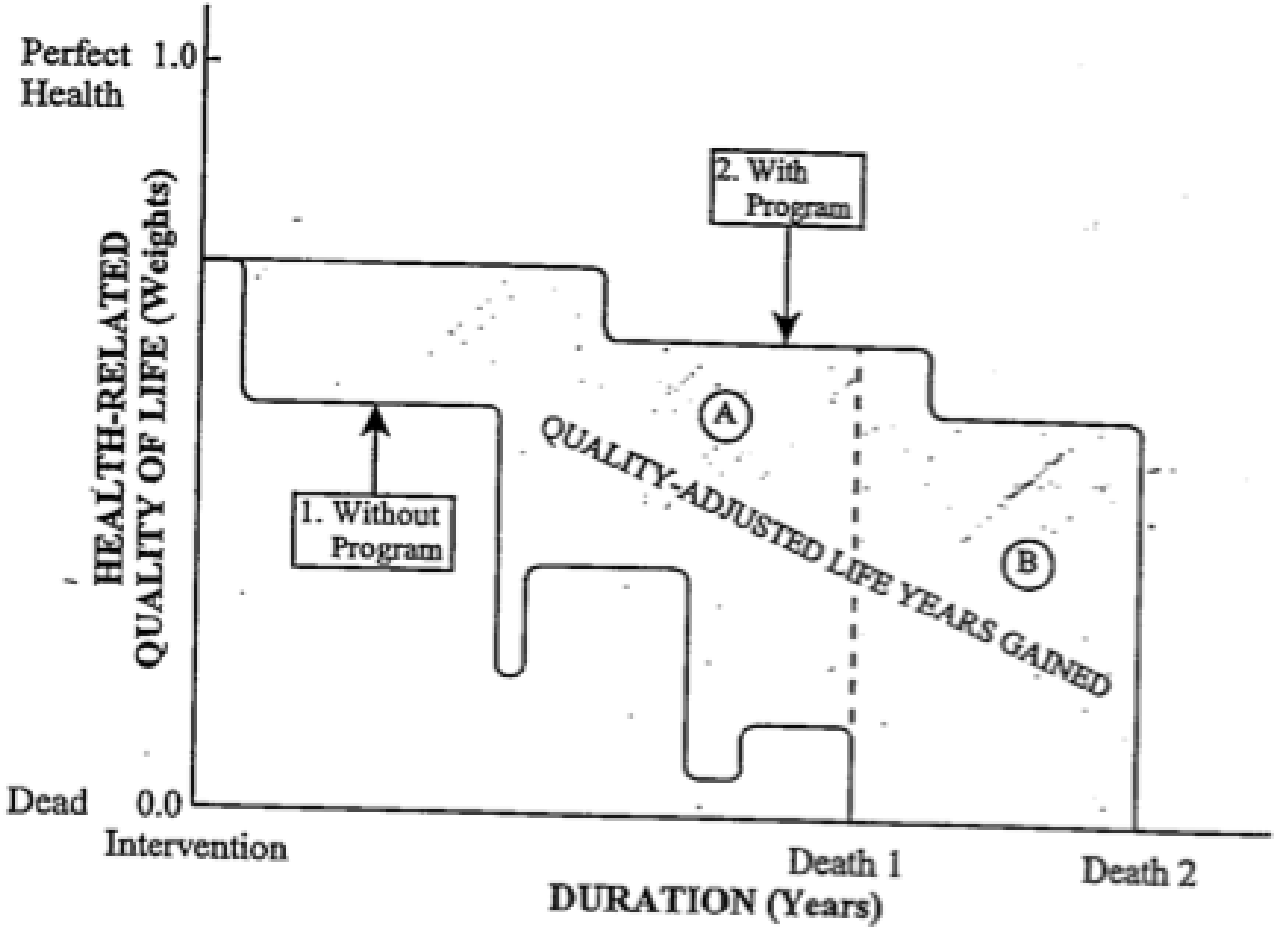
Economic Evaluation is…

- " The comparative analysis of alternative courses of action in terms of both their costs and consequences in order to assist policy decisions" (Drummond et al,1997)



- Economic evaluation is ***not*** "choosing the cheapest".

Quality adjusted life year gained from intervention



- There is no ‘magic’ cut-off number that establishes whether or not an intervention is ‘**cost-effective**’.

- The ceiling ratio can be inferred from the amount that decision-makers are **willing to pay.**

- To make a decision:

If ICER of the program ≤ ceiling ratio → adopt the program
If ICER of the program > ceiling ratio → do not adopt the program

- **Thaliand** **3,300-10,000$ per QALY gained**
(100,000 - 300,000 Baht)

* GDP per capita recommended by WHO

Background: Previous studies

J Med Assoc Thai. 2005 Dec;88 Suppl 10:S155-60.

Strategies to improve hand hygiene practices in two university hospitals.

Danchaivijitr S, Pichiensatian W, Apisamthanarak A, Kachintorn K, Cherdrungsi R.

Department of Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok. sisdc@mahidol.ac.th

SUMMARY: After intervention, significant improvement on handwashing was observed in both the invasive procedure (p<0.001) and non-invasive procedures (p<0.001) at Siriraj Hosptial. Significant improvement on handhygiene practice was also observed among participants at Maharaj Nakorn Chiang Mai Hosptial (p=0.001).

Picheansathian W, Pearson A, Suchaxaya P. *International Journal of Nursing Practice* 2008; 14: 315–321

The effectiveness of a promotion programme on hand hygiene compliance and nosocomial infections in a neonatal intensive care unit

This quasi-experimental study aimed to identify the impact of a promotion programme on hand hygiene practices and its effect on nosocomial infection rates in a neonatal intensive care unit of a university hospital in Thailand. The study populations were 26 nursing personnel. After implementing a hand hygiene promotion programme, compliance with hand hygiene among nursing personnel improved significantly from 6.3% before the programme to 81.2% 7 months after the programme. Compliance rate did not correlate with the intensity of patient care. Nosocomial infection rate did not decrease after the intervention, probably because of the multifactorial nature of infections. All participants agreed that promotion programme implemented in this project motivated them to practise better hand hygiene. This study indicated that multiple approaches and persistent encouragement are key factors leading to a sustained high level of appropriate hand hygiene practices among nursing personnel.

Measuring costs and outcomes

Cost :

Cost of Bacteremia Treatment

- Cost of antibiotics

*All costs were measured in Thai currency (Baht)

Outcomes : Quality adjusted life years (QALYs)

QALYs = Expected Life Year * Quality of life (Alive people)

QALY gained = Total QALYs (intervention) – Total QALYs (current)

QALY 2 sentences for explaining
Thai setting 100,000 baht per QALY gained has been set

We use this model to predict the QALY gained from the HH improvement
We don't know the cost of HH but we know the result on QALY gained, then we Estimate the appropriate level of investment from Willingness to pay per QALY

$$\Delta \textit{ Cost of Intervention} \leq \text{WTP} * \Delta\text{QALYs} - \Delta\text{Cost of Infection}$$

- Background
- Methods
- Results
- Discussion
- Q&A