

The Budget Impact of Introducing a Rapid Test for the Screening of Carbapenemase-Producing Organisms Among Hospitalized Patients in China

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BACKGROUND

- According to national statistics in China, the mortality rate of hospitalized patients with Carbapenemase-Producing Organisms (CPO) was 33.5%, including 43.1% bacteremia related cases, 26.0% intra-abdominal infection related cases, 34.8% lower respiratory tract infection related cases, and 30.4% urinary tract infection related case in 2015.
- Patients with CPO are at higher risk for longer hospitalization and intensive care unit (ICU) stays. The median length of stay (LOS) among CPO-infected patients was 29 days, with 56.9% of patients being transferred to ICU.
- Another study has shown that the treatment costs for patients with CPO were ¥78,900, much higher than the treatment costs among patients without CPO (¥64,078).

OBJECTIVE

- To estimate the economic impact of introducing a rapid test to screen CPO from a hospital's perspective and a patient's perspective in China.

METHODS

Overview

- The model estimates assess the differences in total hospital costs and per patient per year (PPPY) healthcare costs before and after introducing a rapid test to screen CPO among hospitalized patients in China.
- The model includes the status quo, modified carbapenem inactivation method (mCIM), and rapid test.
- Healthcare costs associated with CPO diagnostics were calculated based on:
 - Epidemiology of CPO in hospital
 - CPO screening fee
 - Anti-infection medication costs
 - Hospitalization costs and other laboratory tests during hospitalization
 - Labor costs of doctors, nurses, laboratory technicians
 - Other hospital operating costs

Model Inputs

- Epidemiology inputs from literature were used to estimate the monthly number of patients with CPO for 1-year in a hospital.
- The screening costs were based on assumption; anti-infection medication, test reporting and handle time, additional hospitalization time and other laboratory tests during hospitalization were estimated based on literature.
- Labor costs of doctors, nurses, and laboratory technicians were based on literature, while other hospital costs were based on assumption. (Table 1)

METHODS (continued)

Table 1. Model inputs

Parameters	Model inputs	Reference
Patients with CPO in hospital	11.4%	Yu Y., et al 2021
CPO screening fee	- Status quo: ¥0 - mCIM: ¥400 - Rapid test: ¥500 - CPO resistant diagnostic fee: ¥200	Assumption based on market research and expert opinion
CPO single sample handling time and reporting time (hours)	- Status quo: -; - - mCIM: 19 hrs; 1 hr - Rapid test: 1 hr; 0.1 hr	Single sample handling time: data on file; Reporting time: Yu H., et al, 2020
Anti-infection medication costs and other laboratory tests during hospitalization (whole disease course)	- Patients without CPO infections: ¥122; ¥1,389 - Patients with regular CPO infections: ¥4,820; ¥4,649 - Patients with drug-resistant CPO infections: ¥8,907; ¥6,329	Meng X et al, 2017
Additional CPO associated hospitalization time (days)	- Status quo: 27 ds - mCIM: 26 ds - Rapid test: 25ds	Liu X., 2018
Hospitalization costs (per day)	¥971	Liu X., 2018
Labor costs of doctor, nurse, and technician (per day)	¥423; ¥317; ¥350	Dang, W., et al 2020
Other hospital operating costs (per day)	¥2,000	Assumption based on expert opinion

RESULTS

Figure 1. Budget Impact Results – Total Hospital Costs per Year

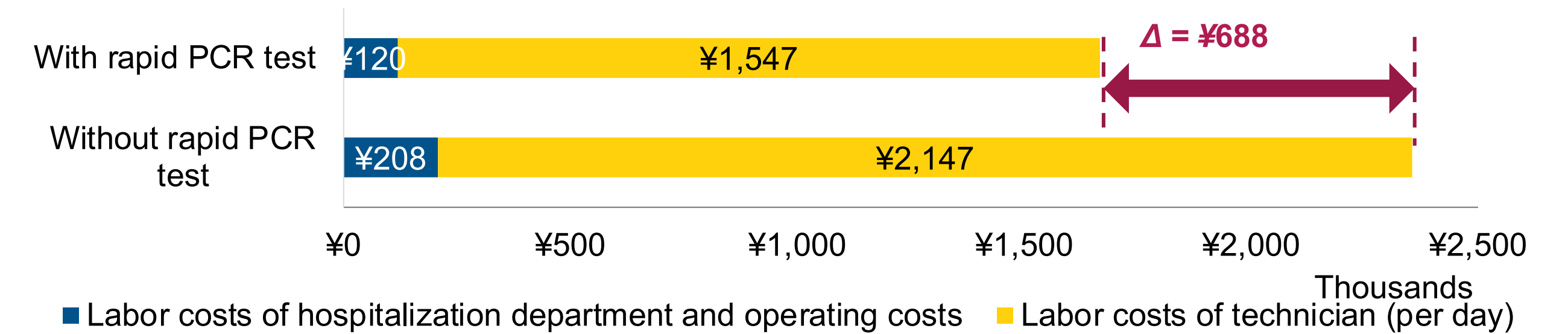
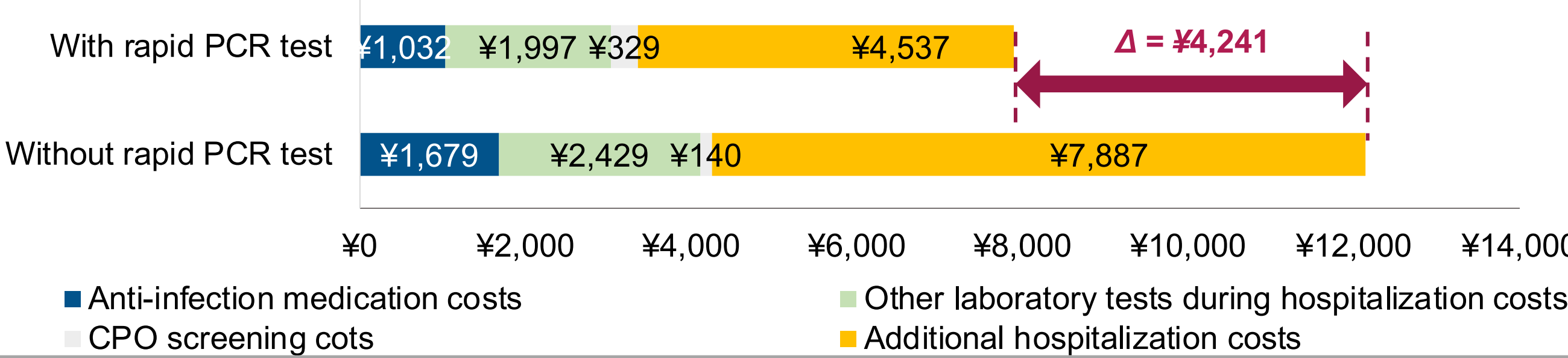


Figure 2. Budget Impact Results – PPPY



RESULTS (continued)

- In the base case, 80% of hospitalized patients are required to undergo CPO screening in a hypothetical population of 24,000.
- The rapid test to screen CPO among hospitalized patients decreased the healthcare budget by ¥ 0.69 billion from a hospital's perspective (Figure 1) and reduced the healthcare budget by ¥ 4,241 PPPY. (Figure 2)
- The hospital budget decrease was mainly due to the decreased inpatient days, which resulted in lower labor costs for laboratory technicians.
- Similarly, the PPPY budget decrease was mainly due to the reduced hospitalization costs because of the reduced inpatient days.
- The total hospital costs and PPPY healthcare budget were most sensitive to the CPO incidence.

CONCLUSION

The introduction of a rapid test to screen CPO among hospitalized patients decreases the healthcare budget from both a hospital's perspective and a patient's perspective in China.

Disclosure

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References

- Zhang, Y., Wang, Q., Yin, Y., Chen, H., Jin, L., Gu, B., Xie, L., Yang, C., Ma, X., Li, H. and Li, W., 2018. Epidemiology of carbapenem-resistant Enterobacteriaceae infections: report from the China CRE Network. Antimicrobial agents and chemotherapy, 62(2), pp.e01882-17.
- Meng, X., Liu, S., Duan, J., Huang, X., Zhou, P., Xiong, X., Gong, R., Zhang, Y., Liu, Y., Fu, C. and Li, C., 2017. Risk factors and medical costs for healthcare-associated carbapenem-resistant Escherichia coli infection among hospitalized patients in a Chinese teaching hospital. BMC infectious diseases, 17(1), pp.1-9.
- Yu Y., Liu Y., Wang M., 2021. Expert consensus on diagnosis, treatment and prevention of carbapenem-resistant Enterobacteriaceae infections in China.
- Yu H., Xu X., Li M., Yang Q., Yang Q., Zhang R., Zhe Y., Shan B., Guo D., Hu Z., and Jian C., 2020. Expert consensus on laboratory testing and clinical reporting specifications for Enterobacteriaceae carbapenemases. Chinese Journal of Infection and Chemotherapy. 0(6), pp.671-680.
- Liu X., 2018. Study on the direct economic burden of nosocomial infections caused by drug-resistant bacteria in tertiary public hospitals in Hubei Province
- Dang Wangwang, & Wang Zhen. (2020). A Comparative Study of Doctors' Income Gap between OECD Countries and China. China's Health Economy.