Health Economic Evidence Book

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Health Economic Evidence

Table of Contents

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Healthcare Associated Infections

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Impact of rapid screening for discontinuation of methicillin-resistant *Staphylococcus aureus* contact precautions

Shenoy ES, Lee H, Cotter JA, Ware W, Kelbaugh D, Weil E, Walensky RP, Hooper DC

American Journal of Infection Control, 2016

ABSTRACT

BACKGROUND

A history of methicillin-resistant *Staphylococcus aureus* (MRSA) is a determinant of inpatient bed assignment.

METHOD

We assessed outcomes associated with rapid testing and discontinuation of MRSA contact precautions (CP) in a prospective cohort study of polymerase chain reaction (PCR)-based screening in the Emergency Department (ED) of Massachusetts General Hospital. Eligible patients had a history of MRSA and were assessed and enrolled if documented off antibiotics with activity against MRSA and screened for nasal colonization (subject visit). PCR-negative subjects had CP discontinued; the primary outcome was CP discontinuation. We identified semiprivate rooms in which a bed was vacant owing to the CP status of the study subject, calculated the hours of vacancy, and compared idle bed hours by PCR results. Program costs were compared with predicted revenue.

RESULTS

There were 2864 eligible patients, and 648 (22.6%) subject visits were enrolled. Of these, 65.1% (422/648) were PCR-negative and had CP discontinued. PCR-negative subjects had fewer idle bed hours compared with PCR-positive subjects (28.6 25.2 vs 75.3 70.5; P <.001). The expected revenues from occupied idle beds and averted CP costs ranged from $214,160 to $268,340, and exceeded the program costs.

CONCLUSION

A program of targeted PCR-based screening for clearance of MRSA colonization resulted in expected revenues and decreased CP costs that outweighed programmatic costs.

Multidrug-resistant bacteria - nightmare for the hospital (finances): detect, contain and reduce LOS

Kersting T, Haustein R, Irps S

EAHM, 2013

ABSTRACT

BACKGROUND

Multidrug-resistant (MDR) bacteria have become a global health problem and their containment one of the most challenging tasks for hospital managers. In Germany alone, the incidence of hospital acquired MDR infections is estimated to be 60 - 90,000 cases per year [1,2]. We performed a health services research analysis to evaluate the impact of MDR infections on length of stay (LOS) and overall costs depending on different patient management approaches.

METHOD

DRG and cost routine data of 2011 from a benchmark-group of 27 German hospitals were analyzed. For a subgroup of hospitals, LOS and readmission rates were compared for hospitals with traditional screening methods and hospitals using rapid PCR screening technology.

RESULTS

Costs derived from DRGs in patients with MDR bacteria were significantly higher than for DRG in patients without. A strong correlation of costs of DRG and LOS was found, indicating that LOS was the main driver for increased costs.

CONCLUSION

The later the presence of MDR bacteria was identified, the higher were the costs. Increased costs could be attributed to isolation, medical treatment and prolonged length of stay. Hospitals utilizing rapid PCR technology for early detection of MDR bacteria had lower costs, shorter LOS and readmission rates.

1. Gastmeier P, Behnke M, Breier AC, Piening B, Schwab F, Dettenkofer M, Geffers C (2012): Nosokomiale Infektionsraten: Messen und Vergleichen. Erfahrungen mit dem Krankenhaus-Infektions-Surveillance-System (KISS) und anderen Surveillance-Systemen. Bundesgesundheitsbl 2012 , 55:1363-1369
2. Braun B (2013): hkk Gesundheitsreport 2013. Multiresistente Erreger im Krankenhaus. http://www.hkk.de/fileadmin/doc/berichte/hkk-Gesundheitsreport_Bericht_MRSA_final_20130521.pdf (last 09/29/2013)

Hospital-acquired infections: a comparison of the economic impact on French and German hospitals

Grube R, Wilke M, Schenker M

EAHM, 2013

ABSTRACT

BACKGROUND

Hospital acquired infections (HAI), e.g. with *Clostridium difficile* (*C. diff*) or with multi-resistant pathogens, such as MDR gram-negative organisms, methicillin-resistant *Staphylococcus aureus* (MRSA) or vancomycin-resistant Enterococci (VRE) increase healthcare costs.

OBJECTIVE

The objective of this study is to evaluate the economic impact of HAI in France and Germany.

METHOD

Hospital reimbursement in Germany and France is based on classification systems called Groupes homogènes de maladies (GHM) in France and German Diagnosis Related groups (G-DRG). To compare the reimbursement level in France and in Germany, index cases were built reflecting common clinical constellations. The reimbursement level for the same cases with MRSA, VRE and *C. diff* was determined and the resulting payment with and without coding an infection was calculated. Average costs of the cases were retrieved to calculate gain or loss.

RESULTS

In most cases correct coding of HAIs leads to higher reimbursement levels in France and Germany. Hospital costs for patients with HAIs are found to systematically exceed reimbursement levels.

CONCLUSION

Detecting and appropriately coding serious infections leads to higher payment levels in France and in Germany, but to even higher costs. All activities to prevent, rapidly detect, to reduce transmission, and rational use of antibiotics could pay off.

Rapid on demand screening for MRSA and isolation of MRSA positive patients reduces overall hospital costs in a German emergency hospital

Walter M, Hallak G, Gorzelniak K, Pfüller R, Ekkernkamp A

EAHM, 2013

ABSTRACT

OBJECTIVE

This study was conducted to determine if on demand rapid MRSA screening of all high-risk patients with immediate contact isolation can reduce the frequency of hospital-acquired MRSA infections and, if so, if this measure is cost-effective in a German emergency hospital.

METHOD

A two-step interventional study was performed. In period 1, high-risk in-patients (as defined by RKI guidelines) were screened upon admission, using conventional microbiology. In period 2, a rapid on demand test was used, followed by conventional microbiology. In both periods all MRSA-positive patients were placed in contact isolation immediately after obtaining the 1st laboratory result.

RESULTS

The nosocomial MRSA infection, MRSA colonization rates, the hospital MRSA days and the number of MRSA cases per 1000 patient days were markedly reduced and further decreased post-study in period 2, compared to period 1. Cost for preventive measures were higher in period 2 versus period 1 while overall financial burden was higher using conventional surveillance methods.

CONCLUSION

Time to result is critical for an effective MRSA screening program in a German emergency hospital. Together with immediate contact isolation, it has a positive impact on the frequency of hospital-acquired MRSA infections and may have a positive financial impact for the hospital.

Improvements to patient management in an emergency admissions unit by use of the Xpert MRSA PCR Assay for point-of-care screening

Mulla R, Patel S, Hussain S, Walters A, Adcock S, Corkett C

ECCMID, 2013

ABSTRACT

BACKGROUND

All hospital emergency admissions in the UK are screened for MRSA in line with national requirements. Current laboratory based testing provides a clinical turn around time of 2-3 days. During this delay patients are managed according to their risk factors and are often moved once their true status is known. This can result in wasted resources and delayed treatment.

OBJECTIVE

We piloted the Xpert MRSA® PCR as a point-of-care screening test in the emergency admissions unit (EAU) at Luton and Dunstable Hospital, UK in order to measure the impact on patient care, hospital resources and costs.

METHOD

During February to July 2011 when the Xpert MRSA® PCR test was performed on the Emergency Assessment Unit at L&D hospital, the 2 min test set up on GenXpert® system was performed by nurses as part of the patient admission process. Results were available in 72 mins and transferred automatically to the Laboratory Information system (LIS) and the Electronic Patient Records (EPR) after the 72 min run. Analysis of the clinical intervention was performed and data for clinical turn around time, time of test, MRSA screening compliance, length of stay (LOS) in isolation, time to treatment were collected and compared for the POC testing period and for 6 months previously. Costs analysis included materials, staff time, bed days, barrier nursing and decolonisation treatment.

RESULTS

Clinically actionable MRSA screening results were avaiable within 2-6 hrs for 80% of patient admissions in EAU, at least 42 hours faster than laboratory-based testing. Nurses performed testing 24/7 and MRSA screening compliance increased to 97% from 86%. The LOS in isolation was reduced by 3 days with POC testing and new positive patients were isolated and treated 3 days earlier. Cost saving from avoiding unessecary isolation as a result of risk-based patient management was calcualted as £642,000 annually with a return on the investment of £283,000.

CONCLUSION

The Xpert MRSA® assay and GeneXpert® technology was successfully piloted for POC testing in a busy hospital admission ward. MRSA results in 2-6 hours from admission allowed clinicians to make evidence-based decisions prior to patients being moved to their medical wards resulting in improved bed management, patient safety and reduced the time to treatment compared with the previous risk-based strategy necessary in the absence of results. The impact was to reduce LOS in isolation, days of missed treatment and provide cost savings.

Cost-effectiveness of supplementing a broth-enriched culture test with the Xpert meticillin-resistant *Staphylococcus aureus* (MRSA) assay for screening inpatients at high risk of MRSA

Li J, Ulvin K, Biboh H, Kristiansen IS.

Journal of Hospital Infection, 2012

ABSTRACT

BACKGROUND

Meticillin-resistant *Staphylococcus aureus* (MRSA) represents a considerable challenge for health care in terms of complications and costs. Whilst bacteriological culture remains the most common method for detecting MRSA, the polymerase-chain-reaction based Xpert MRSA assay was introduced to Ulleval Oslo University Hospital, Norway in 2009.

OBJECTIVE

The objective of this study was to estimate the cost-effectiveness of supplementing a broth-enriched culture test with the Xpert MRSA assay in comparison with using the culture test alone as part of an active surveillance strategy.

METHOD

A decision-tree model was developed to compare the current strategy (broth-enriched culture test) with two new strategies using the Xpert MRSA assay (daytime and 24h). Costs and outcomes (length of preemptive isolation, number of unavailable room hours, quality of life) were measured.

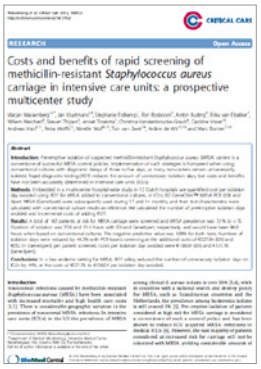
RESULTS

The current strategy was more expensive (NOK16,984 per patient) than the daytime Xpert strategy and 24h Xpert strategy (NOK7360 and NOK3690 per patient, respectively). The new strategies reduced the length of pre-emptive isolation per patient (by 43.9h and 57.5h for the daytime Xpert strategy and 24h Xpert strategy, respectively), and also the number of unavailable room hours per case (by 57.1h and 77.7h, respectively). The improvement in patients' quality-adjusted life years (QALYs) was nominal (2.4*104 and 3.0*104 QALYs per patient for the daytime Xpert strategy and 24h Xpert strategy, respectively). The sensitivity analyses indicated that these results were robust to reasonable changes in the model parameters.

CONCLUSION

The 24h Xpert strategy appears to be the best strategy for active surveillance as it reduces costs and unfavourable outcomes compared with the other strategies, while improving favourable outcomes under reasonable assumptions.

Costs and benefits of rapid screening of methicillin-resistant *Staphylococcus aureus* carriage in intensive care units: a prospective multicenter study



Wassenberg M, Kluytmans J, Erdkamp S, Bosboom R, Buiting A, van Elzakker E, Melchers W, Thijsen S, Troelstra A, Vandenbroucke-Grauls C, Visser C, Voss A, Wolffs P, Wulf M, van Zwet T, de Wit A, Bonten M.

Critical Care, 2012

ABSTRACT

BACKGROUND

Preemptive isolation of suspected methicillin-resistant *Staphylococcus aureus* (MRSA) carriers is a cornerstone of successful MRSA control policies. Implementation of such strategies is hampered when using conventional cultures with diagnostic delays of three to five days, as many non-carriers remain unnecessarily isolated. Rapid diagnostic testing (RDT) reduces the amount of unnecessary isolation days, but costs and benefits have not been accurately determined in intensive care units (ICUs).

METHOD

Embedded in a multi-center hospital-wide study in 12 Dutch hospitals we quantified cost per isolation day avoided using RDT for MRSA, added to conventional cultures, in ICUs. BD GeneOhm™ MRSA PCR (IDI) and Xpert MRSA (GeneXpert) were subsequently used during 14 and 17 months, and their test characteristics were calculated with conventional culture results as a reference. We calculated the number of pre-emptive isolation days avoided and incremental costs of adding RDT.

RESULTS

A total of 163 patients at risk for MRSA carriage were screened and MRSA prevalence was 3.1% (n = 5). Duration of isolation was 27.6 and 21.4 hours with IDI and GeneXpert, respectively, and would have been 96 hours when based on conventional cultures. The negative predictive value was 100% for both tests. Numbers of isolation days were reduced by 44.3% with PCR-based screening at the additional costs of €327.84 (IDI) and €252.14 (GeneXpert) per patient screened. Costs per isolation day avoided were €136.04 (IDI) and €121.76 (GeneXpert).

CONCLUSION

In a low endemic setting for MRSA, RDT safely reduced the number of unnecessary isolation days on ICUs by 44%, at the costs of €121.76 to €136.04 per isolation day avoided.

Rapid MRSA test in exposed persons: costs and savings in hospitals


Rapid MRSA test in exposed persons: Costs and savings in hospitals

Andersen BM, Tollefsen T, Seljordslia B, Hochlin K, Syversen G, Jonassen TØ, Rasch M, Sandvik L.

Journal of Infection, 2010

ABSTRACT

OBJECTIVE

To study a rapid Xpert polymerase chain reaction (PCR) method in detecting methicillin-resistant *Staphylococcus aureus* (MRSA) in patients and healthcare workers (HCW) exposed to MRSA, and to estimate savings associated to isolation or work restriction.

METHODS

A test set of four double (one for the growth and one for the rapid test) pre-wet swab from the nose, throat, hands/wrists and perineum was studied by a growth method and by the Xpert MRSA test.

RESULTS

The total correspondence between the growth and the rapid test was 92.8%. The overall sensitivity, specificity, positive and negative predictive values were for the Xpert MRSA test: 87%, 99.6%, 68.5% and 99.9%, and for the growth test: 76%, 100%, 100%, and 99.8%, assuming a prevalence of MRSA of 0.01%. Among the MRSA positive persons, the Xpert and growth tests detected MRSA in 44.6% and 40% of nose samples, respectively, 38.2% and 45.5% throat samples, 30.8% and 11.5% hands/wrists samples, 44% and 38% perineum samples, and in 81.8% and 77.3% wound samples, respectively. By combining four anatomical sites, the detection rate increased to 87.5% by both methods. The cost for each Xpert and growth test was V50 and V6.25, respectively. The rapid test would save at least V925 per exposed HCW and V550 per patient that were MRSA negative.

CONCLUSION

The MRSA Xpert test is easy to perform, has a high negative predictive value, and may be used to control healthcare workers and patients exposed to MRSA. Sampling from multiple anatomical locations is recommended. Still, more then 10% of MRSA positive cases may not be found.

Reduced costs for *Staphylococcus aureus* carriers treated prophylactically with mupirocin and chlorhexidine in cardiothoracic and orthopaedic surgery


Reduced Costs for *Staphylococcus aureus* Carriers Treated Prophylactically with Mupirocin and Chlorhexidine in Cardiothoracic and Orthopaedic Surgery

van Rijen MM, Bode LG, Baak DA, Kluytmans JA, Vos MC

PLoS One, 2012

ABSTRACT

BACKGROUND

A multi-centre double-blind randomised-controlled trial (M-RCT), carried out in the Netherlands from 2005–2007, showed that hospitalised patients with *S. aureus* nasal carriage who were treated prophylactically with mupirocin nasal ointment and chlorhexidine gluconate medicated soap (MUP-CHX) had a significantly lower risk of healthcare associated *S. aureus* infections than patients receiving placebo (3.4% vs. 7.7%, RR 0.42, 95% CI 0.23–0.75).

OBJECTIVE

The objective of the present study was to determine whether treatment of patients undergoing elective cardiothoracic or orthopaedic surgery with MUP-CHX (screen-and-treat strategy) affected the costs of patient care.

METHOD

We compared hospital costs of patients undergoing cardiothoracic or orthopaedic surgery (n = 415) in one of the participating centres of the M-RCT. Data from the 'Planning and Control' department were used to calculate total hospital costs of the patients. Total costs were calculated including nursing days, costs of surgery, costs for laboratory and radiological tests, functional assessments and other costs. Costs for personnel, materials and overhead were also included. Mean costs in the two treatment arms were compared using the t-test for equality of means (two-tailed). Subgroup analysis was performed for cardiothoracic and orthopaedic patients.

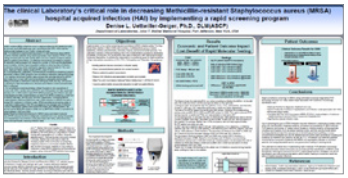
RESULTS

An investigator-blind analysis revealed that costs of care in the treatment arm (MUP-CHX, n = 210) were on average J1911 lower per patient than costs of care in the placebo arm (n = 205) (J8602 vs. J10513, p = 0.01). Subgroup analysis showed that MUP-CHX treated cardiothoracic patients cost J2841 less (n = 280, J9628 vs J12469, p = 0.006) and orthopaedic patients J955 less than non-treated patients (n = 135, J6097 vs J7052, p = 0.05).

CONCLUSION

In conclusion, for patients undergoing cardiothoracic or orthopaedic surgery, screening for *S. aureus* nasal carriage and treating carriers with MUP-CHX results in a substantial reduction of hospital costs.

The clinical laboratory's critical role in decreasing methicillin-resistant *Staphylococcus aureus* (MRSA) hospital acquired infection (HAI) by implementing a rapid screening program



Uettwiller-Geiger DL

AACC, 2010

ABSTRACT

BACKGROUND

Invasive MRSA infections occur in approximately 94,000 people annually and cause as many as 9,000 deaths per year, according to the CDC. In the United States, HAIs cost between 4 and 5 billion dollars annually.

OBJECTIVE

To implement a rapid screening program to cost effectively detect MRSA colonized and/or infected patients using rapid polymerase chain reaction (PCR) in real time providing clinicians with key test results within one hour instead of days to reduce MRSA patient-to-patient transmission. An effective interventional surveillance program along with laboratory testing support will reduce the number of HAIs and the associated morbidity and mortality, thereby improving patient safety by reducing risks of infection and other adverse outcomes, while meeting the regulatory requirements for the Joint Commission, National Patient Safety Goals (NPSF), Goal 07.03.01.

METHOD

A comprehensive, integrated, multi-disciplinary surveillance screening program was implemented in March 2008 using the new surveillance laboratory testing technology of PCR. The Cepheid GeneXpert System uses a single test cartridge delivering MRSA test results in less than an hour with minimal handling by a laboratory technologist. MRSA testing is provided on demand in real time during any shift, any day and around the clock, allowing for fast interventions by clinicians and infection control preventionists when MRSA is detected.

RESULTS

Our surveillance screening strategy initially focused on risk populations of intensive care units (ICU), cardiac care unit (CCU), and Orthopedics and later expanded to the telemetry unit. In 2007, before rapid PCR MRSA screening, the infection rate was .90/1000 discharges and after implementation of rapid PCR MRSA screening in 2008 and 2009 the infection rate was .59/1000 and .29/1000, respectively. Comparing MRSA infection rates between 2008 and 2009 there was a 50% reduction in MRSA HAI with a corresponding 50% reduction in infection costs. MRSA surveillance screening costs in 2009 for Laboratory testing were $104,769 and based on the average cost of infection incurred during hospitalized medical care of $35,000 dollars per infected patient, we decreased the cost by $920,500 dollars in 2008 and by $847,000 in 2009, or almost $1.8 million dollars between 2007 and 2009.

CONCLUSION

Rapid surveillance screening for MRSA using automated molecular diagnostics of PCR reduces the time to diagnosis, treatment and cure, saving thousands of dollars in hospitalization and infection costs associated with HAIs, while enhancing patient safety and significantly reducing infection rates.

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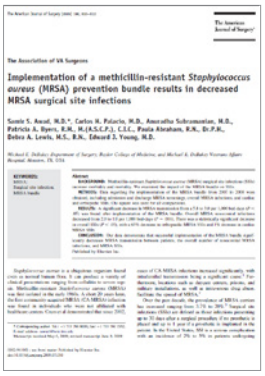
Implementation of a methicillin-resistant *Staphylococcus aureus* (MRSA) prevention bundle results in decreased MRSA surgical site infections



Awad SS, Palacio CH, Subramanian A, Byers PA, Abraham P, Lewis DA, Young EJ.

American Journal of Surgery, 2009

ABSTRACT

BACKGROUND

Methicillin-resistant *Staphylococcus aureus* (MRSA) surgical site infections (SSIs) increase morbidity and mortality. We examined the impact of the MRSA bundle on SSIs.

METHOD

Data regarding the implementation of the MRSA bundle from 2007 to 2008 were obtained, including admission and discharge MRSA screenings, overall MRSA infections, and cardiac and orthopedic SSIs. Chi-square was used for all comparisons.

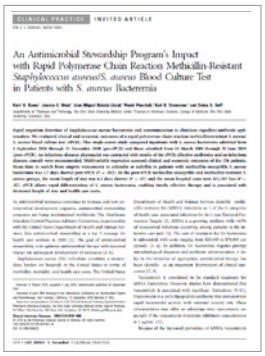
RESULTS

A significant decrease in MRSA transmission from a 5.8 to 3.0 per 1,000 bed days ($P < .05$) was found after implementation of the MRSA bundle. Overall MRSA nosocomial infections decreased from 2.0 to 1.0 per 1,000 bed days ($P<.016$). There was a statistically significant decrease in overall SSIs ($P<.05$), with a 65% decrease in orthopaedic MRSA SSIs and 1% decrease in cardiac MRSA SSIs.

CONCLUSION

Our data demonstrate that successful implementation of the MRSA bundle significantly decreases MRSA transmission between patients, the overall number of nosocomial MRSA infections, and MRSA SSIs.

An antimicrobial stewardship program's impact with rapid polymerase chain reaction methicillin-resistant *Staphylococcus aureus/S. aureus* blood culture test in patients with *S. aureus* bacteremia



Bauer KA, West JE, Balada-Llasat JM, Pancholi P, Stevenson KB, Goff DA.

Clinical Infectious Diseases, 2010

ABSTRACT

BACKGROUND

Rapid organism detection of *Staphylococcus aureus* bacteremia and communication to clinicians expedites antibiotic optimization. We evaluated clinical and economic outcomes of a rapid polymerase chain reaction methicillin-resistant *S. aureus*/*S. aureus* blood culture test (rPCR).

METHOD

This single-center study compared inpatients with *S. aureus* bacteremia admitted from 1 September 2008 through 31 December 2008 (pre-rPCR) and those admitted from 10 March 2009 through 30 June 2009 (post-rPCR). An infectious diseases pharmacist was contacted with results of the rPCR; effective antibiotics and an infectious diseases consult were recommended. Multivariable regression assessed clinical and economic outcomes of the 156 patients.

RESULTS

Mean time to switch from empiric vancomycin to cefazolin or nafcillin in patients with methicillin-susceptible *S. aureus* bacteremia was 1.7 days shorter post-rPCR (P = .002). In the post-rPCR methicillin- susceptible and methicillin-resistant *S. aureus* groups, the mean length of stay was 6.2 days shorter (P = .07) and the mean hospital costs were $21,387 less (P = .02). rPCR allows rapid differentiation of *S. aureus* bacteremia, enabling timely, effective therapy and is associated with decreased length of stay and health care costs.

Impact of rapid methicillin-resistant *Staphylococcus aureus* polymerase chain reaction testing on mortality and cost effectiveness in hospitalized patients with bacteraemia: a decision model


ORIGINAL RESEARCH ARTICLE

Impact of Rapid Methicillin-Resistant *Staphylococcus aureus* Polymerase Chain Reaction Testing on Mortality and Cost Effectiveness in Hospitalized Patients with Bacteraemia

A Decision Model

Abstract

Brown J and Paladino JA

Pharmacoeconomics, 2010

ABSTRACT

BACKGROUND

Patients hospitalized with *Staphylococcus aureus* bacteraemia have an unacceptably high mortality rate. Literature available to date has shown that timely selection of the most appropriate antibacterial may reduce mortality. One tool that may help with this selection is a polymerase chain reaction (PCR) assay that distinguishes methicillin (meticillin)-resistant *S. aureus* (MRSA) from methicillin-susceptible *S. aureus* (MSSA) in less than 1 hour. To date, no information is available evaluating the impact of this PCR technique on clinical or economic outcomes.

OBJECTIVE

To evaluate the effect of a rapid PCR assay on mortality and economics compared with traditional empiric therapy, using a literature derived model.

METHOD

A literature search for peer-reviewed European (EU) and US publications regarding treatment regimens, outcomes and costs was conducted. Information detailing the rates of infection, as well as the specificity and sensitivity of a rapid PCR assay (Xpert MRSA/SA Blood Culture PCR) were obtained from the peer-reviewed literature. Sensitivity analysis varied the prevalence rate of MRSA from 5% to 80%, while threshold analysis was applied to the cost of the PCR test. Hospital and testing resource consumption were valued with direct medical costs, adjusted to year 2009 values. Adjusted life-years were determined using US and WHO life tables. The cost-effectiveness ratio was defined as the cost per life-year saved. Incremental cost-effectiveness ratios (ICERs) were calculated to determine the additional cost necessary to produce additional effectiveness. All analyses were performed using TreeAge Software (2008).

RESULTS

The mean mortality rates were 23% for patients receiving empiric vancomycin subsequently switched to semi-synthetic penicillin (SSP) for MSSA, 36% for patients receiving empiric vancomycin treatment for MRSA, 59% for patients receiving empiric SSP subsequently switched to vancomycin for MRSA and 12% for patients receiving empiric SSP for MSSA. Furthermore, with an MRSA prevalence of 30%, the numbers of patients needed to test in order to save one life were 14 and 16 compared with empiric vancomycin and SSP, respectively. The absolute mortality difference for MRSA prevalence rates of 80% and 5% favoured the PCR testing group at 2% and 10%, respectively, compared with empiric vancomycin and 18% and 1%, respectively, compared with empiric SSP. In the EU, the cost-effectiveness ratios for empiric vancomycin- and SSP-treated patients were €695 and €687 per life-year saved, respectively, compared with €636 per life-year saved for rapid PCR testing. In the US, the cost-effectiveness ratio was $US898 per life-year saved for empiric vancomycin and $US820 per life-year saved for rapid PCR testing. ICERs demonstrated dominance of the PCR test in all instances. Threshold analysis revealed that PCR testing would be less costly overall, even at greatly inflated assay prices.

CONCLUSION

Rapid PCR testing for MRSA appears to have the potential to reduce mortality rates while being less costly than empiric therapy in the EU and US, across a wide range of MRSA prevalence rates and PCR test costs.

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Cost and impact on patient length of stay of rapid molecular testing for *Clostridium difficile*


Cost and Impact on Patient Length of Stay of Rapid Molecular Testing for *Clostridium difficile*

ABSTRACT

Sewell B, Rees E, Thomas I, Ch'ng CL, Isaac M, Berry N

Infectious Diseases and Therapy, 2014

ABSTRACT

BACKGROUND

A study was performed to assess the cost of a rapid molecular assay (PCR) for diagnosis of *Clostridium difficile* infection (CDI) and the impact of its routine use on patient length of stay (LOS) in comparison with cell culture cytotoxin neutralization assay (CCNA).

METHOD

From March 2011 to September 2011, Xpert® *C. difficile* (Cepheid, Sunnyvale, CA, USA) PCR was used on patients with suspicion of CDI in two acute care hospitals in Abertawe Bro Morgannwg University Health Board, Swansea, Wales, UK. Test results were used for patient management. LOS and time to reportable result were compared for negative and positive prospective patients tested by PCR and historic control patients tested by CCNA during March 2010 to September 2010. Tests were priced using micro-costing and a cost comparison analysis was undertaken.

RESULTS

In total, 506 patients were included. Time to reportable result for PCR samples was 1.53h compared to 46.54 h for CCNA negatives and 22.45h for CCNA positives. Patients tested by CCNA stayed 4.88 days longer in hospital compared to PCR patients if they tested positive and 7.03 days if tests were negative. The mean reduction in LOS observed in our study has the potential to generate cost savings of up to £2,292.62 for every patient with suspected CDI, if samples were to be tested routinely with PCR instead of CCNA.

CONCLUSION

A rapid molecular test for *C. difficile* in an acute hospital setting produced quick results that led to a decrease in LOS compared to historic CCNA control patients. This could result in considerable savings through reduced excess inpatient days.

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Economic evaluation of laboratory testing strategies for hospital-associated *Clostridium difficile* infection

Schroeder LF, Robilotti E, Peterson LR, Banaei N, Dowdy DW.

Journal of Clinical Microbiology, 2014

ABSTRACT

BACKGROUND

Clostridium difficile infection (CDI) is the most common cause of infectious diarrhea in health care settings, and for patients presumed to have CDI, their isolation while awaiting laboratory results is costly. Newer rapid tests for CDI may reduce this burden, but the economic consequences of different testing algorithms remain unexplored.

OBJECTIVE

We used decision analysis from the hospital perspective to compare multiple CDI testing algorithms for adult inpatients with suspected CDI, assuming patient management according to laboratory results. CDI testing strategies included combinations of on-demand PCR (odPCR), batch PCR, lateral-flow diagnostics, plate-reader enzyme immunoassay, and direct tissue culture cytotoxicity. In the reference scenario, algorithms incorporating rapid testing were cost-effective relative to nonrapid algorithms.

RESULTS

For every 10,000 symptomatic adults, relative to a strategy of treating nobody, lateral-flow glutamate dehydrogenase (GDH)/odPCR generated 831 true-positive results and cost $1,600 per additional true-positive case treated. Stand-alone odPCR was more effective and more expensive, identifying 174 additional true-positive cases at $6,900 per additional case treated. All other testing strategies were dominated by (i.e., more costly and less effective than) stand-alone odPCR or odPCR preceded by lateral-flow screening. A cost-benefit analysis (including estimated costs of missed cases) favored stand-alone odPCR in most settings but favored odPCR preceded by lateral-flow testing if a missed CDI case resulted in less than $5,000 of extended hospital stay costs and<2 transmissions, if lateral-flow GDH diagnostic sensitivity was >93%, or if the symptomatic carrier proportion among the toxigenic culture-positive cases was>80%.

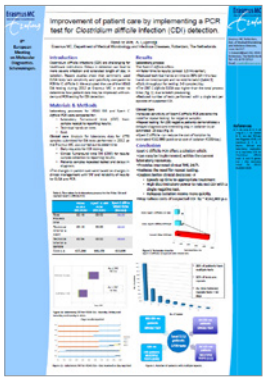
CONCLUSION

These results can aid guideline developers and laboratory directors who are considering rapid testing algorithms for diagnosing CDI.

Improvement of patient care by implementing a PCR test for *Clostridium difficile* infection (CDI) detection

te Witt R and Luijendijk A

EMMD, 2013



ABSTRACT

BACKGROUND

In 2012, 1776 enzyme immune assay (EIA) tests for *Clostridium difficile* were performed for 1152 patients at Erasmus medical centre, including 598 repeat tests, many of them due to low sensitivity and specificity of the technology.

METHOD

28% of patients were not diagnosed within the first analysis, and 32% of the tests had to be repeated. The average time between repeat testing was 13 days. The typical turn-around-time for the laboratory process is 2 hours and 18 minutes, with hands-on time of 16 minutes per sample. In addition, batch processing and restriction in working hours causes an average clinical turn-around-time of 14 hours, Monday to Friday and 39.7 hours over the weekend.

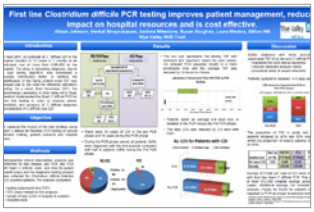
RESULTS

We investigated what would be the impact of on-demand Xpert *C. difficile* PCR testing of patient samples on laboratory processing and infection control.

The high sensitivity and specificity of the PCR method has a twofold effect:

1. *On the laboratory side, the amount of requested repeat testing would be minimized laboratory staff time reduced by 90% and the ease of use would allow to improve the service to 24 hours, 7 days a week.*
2. *On the clinical side Xpert C. difficile testing improves reliability of results and speeds up the clinical turn-around time to 2 hours, leading to earlier treatment of CDI positive cases, potentially reducing severity and risk of transmission. For CDI negative cases, unnecessary patient isolation can be avoided, hence preventing bed blockages. An increase of the reagent budget of approx. 14,000 € per year is significantly outweighed by an estimated saving of approx. 162,000 € in avoided isolation days alone.*

First line *Clostridium difficile* PCR testing improves patient management, reduces impact on hospital resources and is cost effective



Johnson A, Sivaprakasam V, Milestone A, Vaughan S, Weston L, Hill G

ECCMID, 2013

ABSTRACT

OBJECTIVE

In April 2011, an outbreak of *C. difficile* 027 in the hospital resulted in 16 cases in 3 months and estimated cost of more than £100,000. The delay in laboratory diagnosis, due to a dual testing algorithm, was considered a possible contributory factor. As a result, from November 2011, Wye Valley NHS Trust, Hereford implemented the Xpert *C. difficile*® PCR for first line testing in order to improve speed, sensitivity, and accuracy of C difficile diagnosis. The impact of the new strategy on clinical decision making, patient management and hospital costs was measured.

METHOD

Retrospective clinical intervention analysis was performed for two periods; pre PCR from November 2009 to March 2010 with dual testing algorithm (toxin Enzyme Immune Assay (EIA) and confirmation of positives with Xpert *C difficile* PCR®) and frontline PCR from November 2011 to March 2011. Data collected for turnaround time (TAT), repeat testing, time to treatment/ isolation, length of stay (LOS), department and antibiotic use for all CDI patients was compared. Cost effectiveness analysis included laboratory costs, bed days, isolation and treatment.

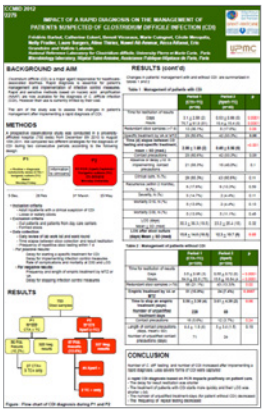
RESULTS

No significant difference was found for the number of CDI cases in the two phases. However, CDI cases from surgical and acute medical wards decreased by 40% and 60% respectively with frontline PCR testing. Consequently CDI cases in geriatric medicine increased by 45%. The test TAT reduced to 2.3 hrs with PCR from 8.49 hrs. In the pre PCR period, (4/12) of CDI cases were only detected in the second sample submitted for testing, a number of days after the onset of symptoms, compared with 1/16 patients diagnosed with frontline PCR. The total average LOS was 2 days shorter and moreover patients required 4.5 days less of isolation. Antibiotic treatment with vancomycin, used only for most severe cases, was used for 4 less patients. Considering costs of laboratory testing, hospital days, isolation, barrier nursing, and antibiotics, front line Xpert *C difficile* PCR® showed £906 saving per case of CDI and an estimated £57,000 annually.

CONCLUSION

Frontline CDI testing with Xpert *C difficile*® PCR improved speed, sensitivity and accuracy. Patients are diagnosed, managed and treated appropriately earlier. Infections are prevented from becoming more severe and symptoms resolve 4.5 days sooner. The cost savings of £57,000 is for positive cases only. Greater impact may be found if negative CDI diagnosis was included in the analysis.

Impact of a rapid diagnosis on the management of patients suspected of *Clostridium difficile* infection



Barbut F, Eckert C, Visseaux B, Cuingnet M, Mesquita C, Pradier N, Surgers L, Thiriez A, Aït-Ammar N, Aifaoui A, Grandsire E, Lalande V*

ECCMID, 2012

ABSTRACT

OBJECTIVE

Clostridium difficile (CD) is a major agent responsible for healthcare-associated diarrhea. Rapid diagnosis is essential for patient's management and implementation of infection control measures. Our objective was to assess the changes in patient's management after implementing a rapid diagnosis of *C. difficile* infection (CDI) by PCR.

METHOD

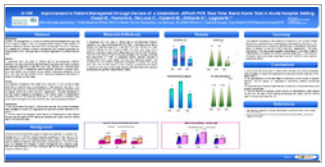
A prospective time-series study comparing two 3-month periods was performed in a 750-bed university-affiliated hospital. During P1 CD diagnosis was based on both the cytotoxicity assay and the toxigenic culture and during P2 the diagnosis was performed by real-time PCR (Xpert *C. difficile*, Cepheid). During these 2 periods, information on isolation days and empiric treatment were collected among patients suspected of CDI. CD lab results were reviewed daily, ward rounds were made to determine isolation days, and charts reviewed for diarrheal symptoms and treatment. The following criteria were used to assess quality of patients' management: - time for result restitution and frequency of repeat testing within 7 days - for patients with CDI: time elapse between stool collection and beginning of treatment, mortality at D10 and D30, - for patients without CDI: frequency and length of preemptive (empiric) treatment for *C. difficile*

RESULTS

733 stool samples (P1 n=359 and P2 n=374) were studied : 36 (10.0%) were positive during P1 and 47 (12.6%) during P2. Time for result restitution was 75 +/- 62 and 15 +/- 15 hours for P1 and P2, respectively (p<0001). Frequency of redundant stool samples within 7 days was lower in P2 compared to P1 (7.4% vs 15.8%, p=0.02). Patients with CDI were more frequently treated by vancomycine or metronidazole during P2 (93.3% vs 80.8%, p=0,08) and treatment was started earlier (0.49 +/- 0.5 day vs 2.0 +/- 1.7 day, p<0.001) as compared to patients during P1. Crude mortality at D10 and D30 was not significantly different during the 2 periods but length of hospital stay following the diagnosis of CDI was longer in P1 as compared to P2 (median : 10.5 days vs 8 days, p=0.05). Empiric therapy among patients without CDI decreased from 15.8% during P1 to 7.4% during P2 (p=0.0007). Number of unnecessary treatment-days was 228 and 65 for P1 and P2, respectively.

CONCLUSION

A rapid CDI diagnosis based on PCR impacts positively on patient care.



Improvement in patient management through the use of a *Clostridium difficile* PCR real-time stand alone test in acute hospital setting

Casari E, Ferrario A, De Luca C, Calabrò M, Allibardi S, Lagioia M

ICAAC, 2012

ABSTRACT

BACKGROUND

Currently the management of *C.difficile* infected patients represents a high cost for the hospital budget in term of increasing patient length of stay, isolation of positive cases and decontamination procedures. The aim of this study is to assess the changes in patient management and Hospital costs after the implementation of a molecular test for the rapid diagnosis of C.difficile Infection (CDI).

METHOD

In December 2011 the Xpert *C. difficile* test on the GeneXpert Platform (Cepheid, CA) was implemented as PCR Real Time stand alone test to replace the diagnostic algorithm in use (EIA Toxin A/B, Techlab VA). Unformed stool specimens (n°=198) of suspected positive patients collected in January-March 2012 were tested. We compared the two different diagnostic strategies during 2010, 2011 and the first quarter of 2012 (making a prospective simulation) in terms of in-lab and out-lab costs.

RESULTS

We observed increasing in-lab costs with a reduction in the number of tests performed by patients due to a decreasing in test repetition rate (tab.1). We noted a cost reduction in antibiotic treatment and in decreasing of isolation days (13 versus 18 and 25 in 2010 and 2011 respectively). The data highlighted in the first quarter suggest a decreasing in the overall costs of hospitalization compared with the previous years (tab.1), the reduction of isolation days would lead to savings of up to $20.751 for every positive suspected patient.

CONCLUSION

1. The routine use of the Xpert *C. difficile* test reduces the number of repeated tests necessary to obtain CDI diagnosis for a rapid and a better treatment of the patient;
2. The end results is a general overall saving of Hospitalization costs despite the fact that the costs of PCR testing per samples are higher than the method used in the previous years.

	2010	2011	2012
no Positive Patients	106	108	100
nº tests	2.841	2.746	792
Therapy Costs	$46.243	$65.437	$30.841
In-lab Costs	$28.375	$27.425	$39.022
Decontaminations Costs	$117.256	$165.929	$79.891
Hospitaiization Costs	$2.680.511	$3.793.177	$1.826.344
Overall Hospitalization Costs	$2.872.383	$4.051.967	$1.976.765

Cepheid® A better way.

Rapid detection of glycopeptide-resistant enterococci: impact on decision-making and costs

Birgand G, Ruimy R, Schwarzinger M, Lolom I, Bendjelloul G, Houhou N, Armand-Lefevre L, Andremont A, Yazdanpanah Y, Lucet JC.

Antimicrobial Resistance and Infection Control, 2013

ABSTRACT

BACKGROUND

According to French national recommendations, the detection of a patient colonized with glycopeptide-resistant enterococci (GRE) leads to interruption of new admissions and transfer of contact patients (CPs) to another unit or healthcare facility, with weekly screening of CPs.

METHOD

We evaluated the medical and economic impact of a pragmatic adaptation of national guidelines associated with a real-time PCR (RTP) (Cepheid Xpert™ vanA/vanB) as part of the strategy for controlling GRE spread in two medical wards. Screening was previously performed using chromogenic selective medium (CSM). Turn around time (TAT), costs of tests and cost of missed patient days were prospectively collected.

RESULTS

In February 2012, the identification of GRE in one patient in the diabetology ward led to the screening of 31 CPs using CSM; one secondary case was identified in a CP already transferred to the Nephrology ward. Awaiting the results of SCM (median TAT, 70.5h), 41 potential patient days were missed, due to interruption of admissions. The overall cost (screening tests + missing patient days) was estimated at 14,302.20 €. The secondary case led to screening of 22 CPs in the Nephrology ward using RTP. Because of a short median TAT of 4.6h, we did not interrupt admissions and patients' transfers. Among 22 CPs, 19 (86%) were negative for vanA, 2 were positive for vanB and 3 had invalid results needing CSM. The overall cost of the strategy was estimated at 870.40 € (cost of screening tests only), without missing patient days.

CONCLUSION

The rapid PCR test for vanA-positive GRE detection both allowed rapid decision about the best infection control strategy and prevented loss of income due to discontinuation of patient transfers and admissions.

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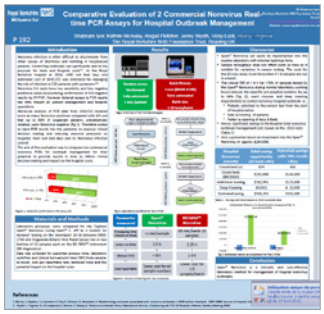
Comparative evaluation of two commercial Norovirus real-time PCR assays for hospital outbreak management



Iyer S, McAulay K, Fletcher A, Wyeth J, Lock V, Virgincar N

FIS, 2013

ABSTRACT

BACKGROUND

Norovirus infection is often difficult to discriminate from other causes of diarrhoea and vomiting in hospitalised patients. Controlling outbreaks can significantly add to the hospital costs and increase seasonal pressure on beds. At the Royal Berkshire hospital in 2010, this additional cost was estimated to be £645,972 for managing the risk of infection in 538 patients with symptoms (1). Norovirus EIA tests have low sensitivity and negative predictive value necessitating confirmation of EIA-negative results by RT-PCR and, delayed access to PCR results has little impact on patient management and hospital operations. However retrospective PCR data shows that up to 66% of patients are negative and access to rapid PCR results can prevent additional pressure on hospitals.

OBJECTIVE

The aim here was to compare two commercial PCRs for their potential to provide results in time to inform clinical decision making and impact on and hospital costs.

METHOD

Laboratory processes were compared for the Cepheid Xpert® Norovirus testing on demand on the GeneXpert 16-16 from 9-5pm and Diagenode enteric virus assay run in two batches on the BD MAX™ instrument (BD diagnostics). Data was collected for process time, laboratory workflow and result turn-around time, cost per reportable, technical time and the impact on clinical management and hospital costs.

RESULTS

The process for the Xpert® Norovirus was 2,5hours faster and required 1 hour 30mins less hands on time daily for 2 BD MAX™ runs. The turn-around-time (from sample-to-result) was less than 6 hours for 71% of the samples tested by the Xpert® Norovirus compared with 38% for the BD MAX™ Diagenode assay. For the BD MAX Diagenode assay, the cost per reportable result was dependent on batch size which was comparable with the Xpert Norovirus when seven or more samples were run together.

CONCLUSION

Xpert Norovirus is a clinically-and cost-effective laboratory method for management of hospital norovirus outbreaks.

Critical Infectious Diseases

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Cost-benefit analysis of Xpert MTB/RIF for tuberculosis suspects in German hospitals

Diel R, Nienhaus A, Hillemann D, Richter E.

European Respiratory Journal, 2016

ABSTRACT

OBJECTIVE

Our objective was to assess the cost-benefit of enhancing or replacing the conventional sputum smear with the real-time PCR Xpert MTB/RIF method in the inpatient diagnostic schema for tuberculosis (TB).

METHOD

Recent data from published per-case cost studies for TB/multidrug-resistant (MDR)-TB and from comparative analyses of sputum microscopy, mycobacterial culture, Xpert MTB/RIF and drug susceptibility testing, performed at the German National Reference Center for Mycobacteria were used. Potential cost savings of Xpert MTB/RIF, based on test accuracy and multiple cost drivers, were calculated for diagnosing TB/MDR-TB suspects from the hospital perspective.

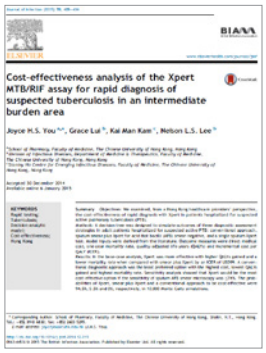
RESULTS

Implementing Xpert MTB/RIF as an add-on in smear-positive and smear-negative TB suspects saves on average €48.72 and €503, respectively, per admitted patient as compared with the conventional approach. In smear-positive and smear-negative MDR-TB suspects, cost savings amount to €189.56 and €515.25 per person, respectively. Full replacement of microscopy by Xpert MTB/RIF saves €449.98.

CONCLUSION

In the probabilistic Monte-Carlo simulation, adding Xpert MTB/RIF is less costly in 46.4% and 76.2% of smear-positive TB and MDR-TB suspects, respectively, but 100% less expensive in all smear-negative suspects. Full replacement by Xpert MTB/RIF is also consistently cost-saving. Using Xpert MTB/RIF as an add-on to and even as a replacement for sputum smear examination may significantly reduce expenditures in TB suspects.

Cost-effectiveness analysis of the Xpert MTB/RIF assay for rapid diagnosis of suspected tuberculosis in an intermediate burden area



You JH, Lui G, Kam KM, Lee NL

Journal of Infection, 2015

ABSTRACT

OBJECTIVE

We examined, from a Hong Kong healthcare providers' perspective, the cost-effectiveness of rapid diagnosis with Xpert in patients hospitalized for suspected active pulmonary tuberculosis (PTB).

METHOD

A decision tree was designed to simulate outcomes of three diagnostic assessment strategies in adult patients hospitalized for suspected active PTB: conventional approach, sputum smear plus Xpert for acid-fast bacilli (AFB) smear-negative, and a single sputum Xpert test. Model inputs were derived from the literature. Outcome measures were direct medical cost, one-year mortality rate, quality-adjusted life-years (QALYs) and incremental cost per QALY (ICER).

RESULTS

Sensitivity analysis showed that Xpert would be the most cost-effective option if the sensitivity of sputum AFB smear microscopy was 74%. The probabilities of Xpert, smear plus Xpert and a conventional approach to be cost-effective were 94.5%, 5.5% and 0%, respectively, in 10,000 Monte Carlo simulations.

CONCLUSION

In the base-case analysis, Xpert was more effective with higher QALYs gained and a lower mortality rate when compared with smear plus Xpert by an ICER of USD99. A conventional diagnostic approach was the least preferred option with the highest cost, lowest QALYs gained and highest mortality rate.

Cost-effectiveness of Xpert MTB/RIF for diagnosing pulmonary tuberculosis in the United States

Choi HW, Miele K, Dowdy D, Shah M

International Journal of Tuberculosis and Lung Disease, 2013

ABSTRACT

SETTING

Conventional approaches to tuberculosis (TB) diagnosis and resistance testing are slow. The Xpert® MTB/RIF assay is an emerging molecular diagnostic assay for rapid TB diagnosis, offering results within 2 hours. However, the cost-effectiveness of implementing Xpert in settings with low TB prevalence, such as the United States, is unknown.

OBJECTIVE

We evaluated the cost-effectiveness of incorporating Xpert into TB diagnostic algorithms in the United States compared to existing diagnostics.

METHOD

A decision-analysis model compared current TB diagnostic algorithms in the United States to algorithms incorporating Xpert. Primary outcomes were the costs and quality-adjusted life years (QALYs) accrued with each strategy; cost-effectiveness was represented using incremental cost-effectiveness ratios (ICER).

RESULTS

Xpert testing of a single sputum sample from TB suspects is expected to result in lower total health care costs per patient (US2673) compared to diagnostic algorithms using only sputum microscopy and culture (US2728) and improved health outcomes (6.32 QALYs gained per 1000 TB suspects). Compared to existing molecular assays, implementation of Xpert in the United States would be considered highly cost-effective (ICER US39992 per QALY gained).

CONCLUSION

TB diagnostic algorithms incorporating Xpert in the United States are highly cost-effective.

Cepheid® A better way.

Rapid molecular testing for TB to guide respiratory isolation in the U.S.: a cost-benefit analysis

Millman AJ, Dowdy DW, Miller CR, Brownell R, Metcalfe JZ, Cattamanchi A, Davis JL.

PLoS One, 2013

ABSTRACT

BACKGROUND

Respiratory isolation of inpatients during evaluation for TB is a slow and costly process in low-burden settings. Xpert MTB/RIF (Xpert) is a novel molecular test for tuberculosis (TB) that is faster and more sensitive but substantially more expensive than smear microscopy. No previous studies have examined the costs of molecular testing as a replacement for smear microscopy in this setting.

METHOD

We conducted an incremental cost–benefit analysis comparing the use of a single negative Xpert versus two negative sputum smears to release consecutive adult inpatients with presumed TB from respiratory isolation at an urban public hospital in the United States. We estimated all health-system costs and patient outcomes related to Xpert implementation, diagnostic evaluation, isolation, hospitalization, and treatment. We performed sensitivity and probabilistic uncertainty analyses to determine at what threshold the Xpert strategy would become cost-saving.

RESULTS

Among a hypothetical cohort of 234 individuals undergoing evaluation for presumed active TB annually, 6.4% had culture-positive TB. Compared to smear microscopy, Xpert reduced isolation bed utilization from an average of 2.7 to 1.4 days per patient, leading to a 48% reduction in total annual isolation bed usage from 632 to 328 bed days. Xpert saved an average of $2,278 (95% uncertainty range $1582–4570) per admission, or $533,520 per year, compared with smear microscopy.

CONCLUSION

Molecular testing for TB could provide substantial savings to hospitals in high-income countries by reducing respiratory isolation usage and overall length of stay.

Screening and rapid molecular diagnosis of tuberculosis in prisons in Russia and Eastern Europe: a cost-effectiveness analysis

Winetsky DE, Negoescu DM, DeMarchis EH, Almukhamedova O, Dooronbekova A, Pulatov D, Vezhnina N, Owens DK, Goldhaber-Fiebert JD.

PLoS Med, 2012

ABSTRACT

BACKGROUND

Prisons of the former Soviet Union (FSU) have high rates of multidrug-resistant tuberculosis (MDR-TB) and are thought to drive general population tuberculosis (TB) epidemics. Effective prison case detection, though employing more expensive technologies, may reduce long-term treatment costs and slow MDR-TB transmission.

METHOD

We developed a dynamic transmission model of TB and drug resistance matched to the epidemiology and costs in FSU prisons. We evaluated eight strategies for TB screening and diagnosis involving, alone or in combination, self-referral, symptom screening, mass miniature radiography (MMR), and sputum PCR with probes for rifampin resistance (Xpert MTB/RIF). Over a 10y horizon, we projected costs, quality-adjusted life years (QALYs), and TB and MDR-TB prevalence.

RESULTS

Using sputum PCR as an annual primary screening tool among the general prison population most effectively reduced overall TB prevalence (from 2.78% to 2.31%) and MDR-TB prevalence (from 0.74% to 0.63%), and cost US$543/QALY for additional QALYs gained compared to MMR screening with sputum PCR reserved for rapid detection of MDR-TB. Adding sputum PCR to the currently used strategy of annual MMR screening was cost-saving over 10y compared to MMR screening alone, but produced only a modest reduction in MDR-TB prevalence (from 0.74% to 0.69%) and had minimal effect on overall TB prevalence (from 2.78% to 2.74%). Strategies based on symptom screening alone were less effective and more expensive than MMR-based strategies. Study limitations included scarce primary TB time-series data in FSU prisons and uncertainties regarding screening test characteristics.

CONCLUSION

In prisons of the FSU, annual screening of the general inmate population with sputum PCR most effectively reduces TB and MDR-TB prevalence, doing so cost-effectively. If this approach is not feasible, the current strategy of annual MMR is both more effective and less expensive than strategies using self-referral or symptom screening alone, and the addition of sputum PCR for rapid MDR-TB detection may be cost-saving over time.

Rapid diagnosis of tuberculosis with the Xpert MTB/RIF assay in high burden countries: a cost-effectiveness analysis

Vassall A, van Kampen S, Sohn H, Michael JS, John KR, den Boon S, Davis JL, Whitelaw A, Nicol MP, Gler MT, Khaliqov A, Zamudio C, Perkins MD, Boehme CC, Cobelens F.

PLoS Med, 2011

ABSTRACT

BACKGROUND

Xpert MTB/RIF is a promising new rapid diagnostic technology for tuberculosis (TB) that has characteristics that suggest large-scale roll-out. However, because the test is expensive, there are concerns among TB program managers and policy makers regarding its affordability for low- and middle-income settings.

METHOD

We estimated the impact of the introduction of Xpert on the costs and cost-effectiveness of TB care using decision analytic modelling, comparing the introduction of Xpert to a base case of smear microscopy and clinical diagnosis in India, South Africa, and Uganda. The introduction of Xpert increases TB case findings in all three settings; from 72%-85% to 95%-99% of the cohort of individuals with suspected TB, compared to the base case. Diagnostic costs (including the costs of testing all individuals with suspected TB) also increases: from US$28-US$49 to US$133-US$146 and US$137-US$151 per TB case detected when Xpert is used “in addition to” and “as a replacement of” smear microscopy, respectively.

RESULTS

The incremental cost effectiveness ratios (ICERs) for using Xpert “in addition to” smear microscopy, compared to the base case, range from US$41-$110 per disability adjusted life year (DALY) averted. Likewise the ICERS for using Xpert “as a replacement of” smear microscopy range from US$52-$138 per DALY averted. These ICERs are below the World Health Organization (WHO) willingness to pay threshold.

CONCLUSION

Our results suggest that Xpert is a cost-effective method of TB diagnosis, compared to a base case of smear microscopy and clinical diagnosis of smear-negative TB in low- and middle-income settings where, with its ability to substantially increase case finding, it has important potential for improving TB diagnosis and control. The extent of cost-effectiveness gain to TB programmes from deploying Xpert is primarily dependent on current TB diagnostic practices. Further work is required during scale-up to validate these findings.

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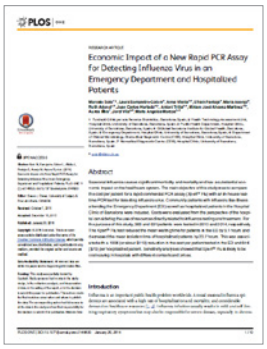
Economic impact of a new rapid PCR assay for detecting influenza virus in an emergency department and hospitalized patients



Soto M, Sampietro-Colom L, Vilella A, Pantoja E, Asenjo M, Arjona R, Hurtado JC, Trilla A, Alvarez-Martínez MJ, Mira A, Vila J, Marcos MA.

PLoS One, 2016

ABSTRACT

OBJECTIVE

Seasonal influenza causes significant morbidity and mortality, and has a substantial economic impact on the healthcare system. The objective of this study is to compare the cost per patient for a rapid commercial PCR assay (Xpert1 Flu) with an in-house real-time PCR test for detecting influenza virus. We made this comparison using the perspective of the hospital considering the use of resources directly related to influenza testing and treatment.

METHOD

For the purpose of this study, 366 and 691 patients were tested in 2013 and 2014, respectively. We compared the cost per patient for a rapid commercial PCR assay (Xpert1 Flu) with an in-house real-time PCR test for detecting influenza virus. Community patients with influenza like-illness attending the Emergency Department (ED) as well as hospitalized patients in the Hospital Clínic of Barcelona were included.

RESULTS

The Xpert1 Flu test reduced the mean waiting time for patients in the ED by 9.1 hours and decreased the mean isolation time of hospitalized patients by 23.7 hours. This was associated with a 103€ (or about $113) reduction in the cost per patient tested in the ED and 64€ ($70) per hospitalized patient. Sensitivity analyses showed that the Xpert1 Flu is likely to be cost-saving in hospitals with different contexts and prices.

CONCLUSION

The economic benefit of incorporating use of rapid PCR-based influenza testing for ED patients at risk of developing influenza-related complications depends on influenza prevalence; treatment guided by physician diagnosis or rapid testing, and treatment of all patients is more effective and less costly than no treatment.

Cost-utility of rapid polymerase chain reaction-based influenza testing for high-risk emergency department patients

Dugas AF, Coleman S, Gaydos CA, Rothman RE, Frick KD.

Annals of Emergency Medicine, 2013

ABSTRACT

OBJECTIVE

We evaluate the cost-effectiveness of polymerase chain reaction (PCR)-based rapid influenza testing and treatment for influenza in adult emergency department (ED) patients who are at high risk for or have evidence of influenza-related complications.

METHOD

We developed a cost-utility decision analysis model that assessed adult patients presenting to the ED with symptoms of an acute respiratory infection, who met the Centers for Disease Control and Prevention criteria for recommended antiviral treatment. Analysis was performed from the societal perspective, with incremental comparisons of 4 influenza testing and treatment strategies: treat none, treat according to provider judgment, treat according to results of a PCR-based rapid diagnostic test, and treat all.

RESULTS

Treating no patients with antivirals was dominated by all other strategies that increased in both cost and benefit in the following order: treat according to provider judgment, treat according to results of a PCR-based rapid diagnostic test, and treat all. As influenza prevalence increases, treating all patients eventually dominated all other options.

CONCLUSION

The economic benefit of incorporating use of rapid PCR-based influenza testing for ED patients at risk of developing influenza-related complications depends on influenza prevalence; treatment guided by physician diagnosis or rapid testing, and treatment of all patients is more effective and less costly than no treatment.

Rapid detection of enterovirus in cerebrospinal fluid by a fully-automated PCR assay is associated with improved management of aseptic meningitis in adult patients

Giulieri SG, Chapuis-Taillard C, Manuel O, Hugli O, Pinget C, Wasserfallen JB, Sahli R, Jaton K, Marchetti O, Meylan P.

Journal of Clinical Virology, 2015

ABSTRACT

BACKGROUND

Enterovirus (EV) is the most frequent cause of aseptic meningitis (AM). Lack of microbiological documentation results in unnecessary antimicrobial therapy and hospitalization.

OBJECTIVE

To assess the impact of rapid EV detection in cerebrospinal fluid (CSF) by a fully-automated PCR (GeneXpert EV assay, GXEA) on the management of AM.

METHOD

Observational study in adult patients with AM. Three groups were analyzed according to EV documentation in CSF: group A = no PCR or negative PCR (n = 17), group B = positive real-time PCR (n = 20), and group C = positive GXEA (n = 22). Clinical, laboratory and health-care costs data were compared.

RESULTS

Clinical characteristics were similar in the 3 groups. Median turn-around time of EV PCR decreased from 60h (IQR (interquartile range) 44-87) in group B to 5h (IQR 4-11) in group C ($p < 0.0001$). Median duration of antibiotics was 1 (IQR 0-6), 1 (0-1.9), and 0.5 days (single dose) in groups A, B, and C, respectively ($p < 0.001$). Median length of hospitalization was 4 days (2.5-7.5), 2 (1-3.7), and 0.5 (0.3-0.7), respectively ($p < 0.001$). Median hospitalization costs were $5458 (2676-6274) in group A, $2796 (2062-5726) in group B, and $921 (765-1230) in group C ($p < 0.0001$).

CONCLUSION

Rapid EV detection in CSF by a fully-automated PCR improves management of AM by significantly reducing antibiotic use, hospitalization length and costs.

Rapid enterovirus molecular testing in cerebrospinal fluid reduces length of hospitalization and duration of antibiotic therapy in children with aseptic meningitis

Huizing KM, Swanink CM, Landstra AM, van Zwet AA, van Setten PA.

Pediatric Infectious Disease Journal, 2011

ABSTRACT

METHOD

We studied the potential benefits of introducing a rapid enterovirus molecular test in children with enterovirus meningitis. The 2 groups of pediatric patients were comparable with respect to clinical and laboratory data, but differed in availability of enterovirus test results. In the control group, the results were available within 3 to 7 days, whereas in the study group, rapid enterovirus molecular test results were available within 3 to 24 hours.

RESULTS

The median duration of hospitalization and the duration of antibiotics were significantly reduced to, respectively, 2 days and 1 day in the study group when compared with the control group ($P < 0.001$). Mean costs per patient calculation showed an average reduction of more than US $1450 ($P < 0.001$).

Sexual Health/Women's Health

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Cost and effectiveness of intrapartum group B *streptococcus* polymerase chain reaction screening for term deliveries


Cost and Effectiveness of Intrapartum Group B Streptococcus Polymerase Chain Reaction Screening for Term Deliveries

El Helali N, Giovangrandi Y, Guyot K, Chevet K, Gutmann L, Durand-Zaleski I.

Obstetrics & Gynecology, 2012

ABSTRACT

OBJECTIVE

To estimate the cost and consequences of intrapartum polymerase chain reaction (PCR) screening on early-onset group B streptococcal (GBS) disease compared with the antenatal lower vagina culture screening recommended in France.

METHOD

This was a single-institution study comparing the intrapartum PCR screening strategy implemented in 2010 with antenatal culture strategy in place in 2009. Early-onset GBS disease in newborns was monitored exhaustively. We estimated direct costs, including screening test costs and hospital costs, for deliveries of healthy newborns compared with those infected with GBS. Costs in 2009 and 2010 were compared on an intention-to-treat basis.

RESULTS

Term deliveries were 2,761 and 2,814 in 2009 and 2010, respectively. Among the screened mothers, the vaginal GBS colonization rate was 11.7% based on antenatal GBS culture screening in 2009 compared with 16.7% in 2010 using the intrapartum PCR testing. The overall probabilities of neonatal GBS disease were 0.9% compared with 0.5%, and the average total cost per delivery was $1,759±1,209 in 2009 compared with $1,754±842 in 2010 (P=.9) in antenatal and intrapartum screening strategies, respectively. The number and severity of cases of early-onset GBS disease and the resulting hospital costs were higher in 2009.

CONCLUSION

Polymerase chain reaction intrapartum screening strategy was cost-neutral when compared with the 2009 antenatal lower vagina culture screening, with a significant decrease in early-onset GBS disease.

Mapping patient pathways and estimating resource use for point of care versus standard testing and treatment of chlamydia and gonorrhoea in genitourinary medicine clinics in the UK


BMJ Open Mapping patient pathways and estimating resource use for point of care versus standard testing and treatment of chlamydia and gonorrhoea in genitourinary medicine clinics in the UK

Adams EJ, Ehrlich A, Turner KM, Shah K, Macleod J, Goldenberg S, Meray RK, Pearce V, Horner P.

British Medical Journal, 2014

ABSTRACT

OBJECTIVE

We aimed to explore patient pathways using a chlamydia/gonorrhoea point-of-care (POC) nucleic acid amplification test (NAAT), and estimate and compare the costs of the proposed POC pathways with the current pathways using standard laboratory-based NAAT testing.

METHOD

Workshops were conducted with healthcare professionals at four sexual health clinics representing diverse models of care in the UK. They mapped out current pathways that used chlamydia/gonorrhoea tests, and constructed new pathways using a POC NAAT. Healthcare professionals' time was assessed in each pathway. The proposed POC pathways were then priced using a model built in Microsoft Excel, and compared to previously published costs for pathways using standard NAAT-based testing in an off-site laboratory.

RESULTS

Pathways using a POC NAAT for asymptomatic and symptomatic patients and chlamydia/gonorrhoea-only tests were shorter and less expensive than most of the current pathways. Notably, we estimate that POC testing as part of a sexual health screen for symptomatic patients, or as stand-alone chlamydia/gonorrhoea testing, could reduce costs per patient by as much as £16 or £6, respectively. In both cases, healthcare professionals' time would be reduced by approximately 10 min per patient.

CONCLUSION

POC testing for chlamydia/gonorrhoea in a clinical setting may reduce costs and clinician time, and may lead to more appropriate and quicker care for patients. Further study is warranted on how to best implement POC testing in clinics, and on the broader clinical and cost implications of this technology.

An early evaluation of clinical and economic costs and benefits of implementing point-of-care NAAT tests for *Chlamydia trachomatis* and *Neisseria gonorrhoea* in genitourinary medicine clinics in England

Turner KM, Round J, Horner P, Macleod J, Goldenberg S, Deol A, Adams EJ.

Sexually Transmitted Infections, 2013

ABSTRACT

OBJECTIVE

The objective of this study was to estimate the costs and benefits of clinical pathways incorporating a point-of-care (POC) nucleic acid amplification test (NAAT) for chlamydia and gonorrhoea in genitourinary medicine (GUM) clinics compared with standard off-site laboratory testing.

METHOD

We simulated 1.2 million GUM clinic attendees in England. A simulation in Microsoft Excel was developed to compare existing standard pathways of management for chlamydia and gonorrhoea with a POC NAAT. We conducted scenario analyses to evaluate the robustness of the model findings. The primary outcome was the incremental cost-effectiveness ratio. Secondary outcomes included the number of inappropriate treatments, complications and transmissions averted.

RESULTS

The baseline cost of using the point of POC NAAT was £103.9 million compared with £115.6 million for standard care. The POC NAAT was also associated with a small increase of 46 quality adjusted life years, making the new test both more effective and cheaper. Over 95,000 inappropriate treatments might be avoided by using a POC NAAT. Patients receive diagnosis and treatment on the same day as testing, which may also prevent 189 cases of pelvic inflammatory disease and 17,561 onward transmissions annually.

CONCLUSION

Replacing standard laboratory tests for chlamydia and gonorrhoea with a POC test could be cost saving and patients would benefit from more accurate diagnosis and less unnecessary treatment. Overtreatment currently accounts for about a tenth of the reported treatments for chlamydia and gonorrhoea and POC NAATs would effectively eliminate the need for presumptive treatment.

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