Clinical Utility of Multiplex PCR Syndromic testing

Compendium of scientific literature
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Abstract

Background: Limited data is available about the etiology of influenza like illnesses (ILIs) in Qatar.

Objectives: This study aimed at providing preliminary estimates of influenza and other respiratory infections circulating among adults in Qatar.

Methods: We retrospectively collected data of about 44,000 patients who visited Hamad General Hospital clinics, sentinel sites, and all primary healthcare centers in Qatar between 2012 and 2017. All samples were tested for influenza viruses, whereas about 38,000 samples were tested for influenza and a panel of respiratory viruses using Fast Track Diagnostics (FTD) RT-PCR kit.

Results: Among all ILIs cases, 20,278 (46.5%) tested positive for at least one respiratory pathogen. Influenza virus was predominating (22.6%), followed by human rhinoviruses (HRVs) (9.5%), and human coronaviruses (HCoVs) (5%). A detection rate of 2–3% was recorded for mycoplasma pneumonia, adenoviruses, human parainfluenza viruses (HPIVs), respiratory syncytial virus (RSV), and human metapneumovirus (HMPV). ILIs cases were reported throughout the year, however, influenza, RSV, and HMPV exhibited strong seasonal peaks in the winter, while HRVs circulated more during fall and spring. Elderly (>50 years) had the lowest rates of influenza A (13.9%) and B (4.2%), while presenting the highest rates of RSV (3.4%) and HMPV (3.3%). While males had higher rates of HRVs (11.9%), enteroviruses (1.1%) and MERS CoV (0.2%), females had higher proportions of influenza (26.3%), HPIVs (3.2%) and RSV (3.6%) infections.

Conclusion: This report provides a comprehensive insight about the epidemiology of ILIs among adults in the Qatar, as a representative of Gulf States. These results would help in improvement and optimization of diagnostic procedures, as well as control and prevention of the respiratory infections.

Read the full article: http://www.fast-trackdiagnostics.com/human-line/resources/publications/
Role of multiplex PCR analysis in children with febrile seizures


Abstract

Background: The aim of this study was to assess multiplex PCR analysis in detecting causative viruses in children with febrile seizures.

Methods: The study was a retrospective analysis comparing data from a pre-multiplex era (2009) with a period after the introduction of routine respiratory multiplex analysis (2010-2013) in children with febrile seizures.

Results: We included 200 children with febrile seizures (mean age: 29.5 ± 1.4 months; 104 male) in the study. In 2009, in 10 out of 49 (20%) children, microbiology testing (bacterial/fungal) was positive compared with a rate of 74 out of 151 (49%) children during 2010-2013 (p < 0.01). The rate of positive virological studies increased from 10 (20%) in 2009 to 73 (48.3%) in the period 2010-2013 (p < 0.01). Multiplex PCR analysis confirmed viral infections in 52 of 73 cases (71.2%).

Conclusion: Routine multiplex PCR analysis fosters the detection of respiratory viruses in children with febrile seizure. The precise role of multiplex analysis in the management of these children awaits further clarification.

To evaluate the role of multiplex PCR analysis in children with febrile seizures, FTD Respiratory pathogens 21 was used to analyse respiratory samples of children admitted to University Children’s Hospital.

FTD Respiratory pathogens 21 simultaneously detects 18 viruses and 1 bacterium involved in respiratory track infections. More information on FTD Respiratory pathogens 21 on page 18.

Read the full article: http://www.fast-trackdiagnostics.com/human-line/resources/publications/
Genotyping of human rhinovirus in adult patients with acute respiratory infections identified predominant infections of genotype A21

Lili Ren, Donghong Yang, Xianwen Ren, Mingkun Li, Xinlin Mu, Qi Wang, Jie Cao, Ke Hu, Chunliang Yan, Hongwei Fan, Xiangxin Li, Yusheng Chen, Ruiqin Wang, Fucheng An, Shuchang An, Ming Luo, Ying Wang, Yan Xiao, Zichun Xiang, Yan Xiao, Li Li, Fang Huang, Qi Jin, Zhancheng Gao, and Jianwei Wang

Scientific Reports, (2017), 7(41601).

Abstract

Human rhinovirus (HRV) is an important causative agent of acute respiratory tract infections (ARTIs). The roles of specific HRV genotypes in patients suffering from ARTIs have not been well established. We recruited 147 adult inpatients with community-acquired pneumonia (CAP) and 291 adult outpatients with upper ARTIs (URTIs). Respiratory pathogens were screened via PCR assays. HRV was detected in 42 patients, with 35 species A, five B and two C. Seventeen genotypes were identified, and HRV-A21 ranked the highest (9/42, 21.4%). The HRV-A21-positive infections were detected in four patients with CAP and in five with URTIs, all without co-infections. The HRV-A21 genome sequenced in this study contained 12 novel coding polymorphisms in viral protein (VP) 1, VP2 EF loop, VP3 knob and 3D regions. The infections of HRV-A21 virus obtained in this study could not be neutralized by antiserum of HRV-A21 prototype strain (VR-1131), indicating remarkable antigenic variation. Metagenomic analysis showed the HRV-A21 reads were dominant in bronchoalveolar lavage fluid of the three HRV-A21-positive patients with severe CAP, in which two dead. Our results highlight an unexpected infection of genotype HRV-A21 in the clinic, indicating the necessity of precise genotyping and surveillance of HRVs to improve the clinical management of ARTIs.

Read the full article: http://www.fast-trackdiagnostics.com/human-line/resources/publications/
Detection of enterovirus D68 in patients hospitalised in three tertiary university hospitals in Germany, 2013 to 2014

S Böttcher, C Prifert, B Weißbrich, O Adams, S Aldabbagh, AM Eis-Hübinger, and S Diedrich


Abstract

Enterovirus D68 (EV-D68) has been recognised as a worldwide emerging pathogen associated with severe respiratory symptoms since 2009. We here report EV-D68 detection in hospitalised patients with acute respiratory infection admitted to three tertiary hospitals in Germany between January 2013 and December 2014. From a total of 14,838 respiratory samples obtained during the study period, 246 (1.7%) tested enterovirus-positive and, among these, 39 (15.9%) were identified as EV-D68. Infection was observed in children and teenagers (0–19 years; n=31), the majority (n=22) being under five years-old, as well as in adults > 50 years of age (n=8). No significant difference in prevalence was observed between the 2013 and 2014 seasons. Phylogenetic analyses based on viral protein 1 (VP1) sequences showed co-circulation of different EV-D68 lineages in Germany. Sequence data encompassing the entire capsid region of the genome were analysed to gain information on amino acid changes possibly relevant for immunogenicity and revealed mutations in two recently described pleconaril binding sites.

Read the full article: http://www.fast-trackdiagnostics.com/human-line/resources/publications/
Standardization of Laboratory Methods for the PERCH Study

Clinical Infectious Diseases (2017), 64(S3), pp. 245–252.

Abstract
The Pneumonia Etiology Research for Child Health study was conducted across 7 diverse research sites and relied on standardized clinical and laboratory methods for the accurate and meaningful interpretation of pneumonia etiology data. Blood, respiratory specimens, and urine were collected from children aged 1–59 months hospitalized with severe or very severe pneumonia and community controls of the same age without severe pneumonia and were tested with an extensive array of laboratory diagnostic tests. A standardized testing algorithm and standard operating procedures were applied across all study sites. Site laboratories received uniform training, equipment, and reagents for core testing methods. Standardization was further assured by routine teleconferences, in-person meetings, site monitoring visits, and internal and external quality assurance testing. Targeted confirmatory testing and testing by specialized assays were done at a central reference laboratory.

The multiplex PCR FTD Respiratory pathogens 33 kit was used in the PERCH study, one of the largest pneumonia etiology studies ever undertaken.

FTD Respiratory pathogens 33 simultaneously detects 11 bacteria, 1 fungus and 19 viruses potentially involved in respiratory track infections.

More information on FTD Respiratory pathogens 33 on page 20.
Abstract

Objectives: The aim of the study was assessment of the usefulness of multiplex real-time PCR tests in the diagnostic and therapeutic process in children hospitalized due to pneumonia and burdened with comorbidities.

Methods: The study group included 97 children hospitalized due to pneumonia at the Karol Jonscher Teaching Hospital in Poznan, in whom multiplex real-time PCR tests (FTD Respiratory pathogens 33; Fast Track Diagnostics) were used.

Results: Positive test results of the test were achieved in 74 patients (76.3%). The average age in the group was 56 months. Viruses were detected in 61 samples (82% of all positive results); bacterial factors were found in 29 samples (39% of all positive results). The presence of comorbidities was established in 90 children (92.78%). On the basis of the obtained results, 5 groups of patients were established: viral etiology of infection, 34 patients; bacterial etiology, 7 patients; mixed etiology, 23 patients; pneumocystis, 9 patients; and no etiology diagnosed, 24 patients.

Conclusions: Our analysis demonstrated that the participation of viruses in causing severe lung infections is significant in children with comorbidities. Multiplex real-time PCR tests proved to be more useful in establishing the etiology of pneumonia in hospitalized children than the traditional microbiological examinations.

Evaluation of the performance of FTD Respiratory pathogens 33 in comparison to microbiological culture tests on throat and nasal swabs of children hospitalized due to pneumonia.

FTD Respiratory pathogens 33 proved to be more useful in establishing the etiology of pneumonia in hospitalized children than the traditional microbiological examinations.

FTD Respiratory pathogens 33 simultaneously detects 11 bacteria, 1 fungus and 19 viruses potentially involved in respiratory track infections.

More information on FTD Respiratory pathogens 33 on page 20.
Respiratory Multiplex Polymerase Chain Reaction: An Important Diagnostic Tool in Immuno-compromised Patients

Amarjeet Kaur, Navin Kumar, Sharmila Sengupta, and Yatin Mehta


**Abstract**

**Objectives:** Viruses and atypical pathogens can cause significant respiratory illness in immunocompromised patients. Multiplex polymerase chain reaction (MPCR) has improved the diagnostic yield of pathogens, and it is easier to identify the co-infections also. The present study was done to evaluate the performance of MPCR on bronchoalveolar lavage (BAL) samples in immunocompromised patients.

**Methods:** A total of 177 BAL specimens collected over a 19 months period from immunocompromised patients with respiratory illness were analyzed with the MPCR and aerobic culture. Patients were divided into four according to the pathogens. Category V (only viral), Category NV (nonviral, i.e., bacteria and atypical), Category M (mixed, i.e., both viral and nonviral pathogen), and Category UK (unknown etiology).

**Results:** MPCR identified the causative pathogen in 59.3% of patients while culture could identify only in 37.8% of patients. Most frequent etiological agent was *Klebsiella pneumoniae* (32%), followed by cytomegalovirus (21%), and *Pneumocystis jirovecii* (10%). Numbers of patients in each category were Category V (9.6%), Category NV (43.5%), Category M (19.8%), and Category UK (27.1%). Mortality was significantly higher in patients of Category M having mixed infections.

**Conclusion:** MPCR is highly sensitive and rapid tool which can be considered in the routine diagnostic algorithm of respiratory illness in immunocompromised patients.

Evaluation of quantitative FTD Pneumocystis jirovecii kit for Pneumocystis infection diagnosis

Gautier Hoarau, Solène Le Gal, Patricia Zunic, Patrice Poubeau, Emmanuel Antok, Julien Jaubert, Gilles Nevez, and Sandrine Picot


Abstract

We evaluated the Fast Track Diagnostics (FTD) Pneumocystis jirovecii kit, targeting the mitochondrial large subunit ribosomal RNA gene (mtLSU rRNA) of Pneumocystis jirovecii (P. jirovecii). A hundred and thirty-three patients were prospectively enrolled. Respiratory specimens were examined using both microscopy and the PCR assay.

Twenty-six patients led to P. jirovecii detection. Fourteen patients presented with Pneumocystis pneumonia (PCP) whereas 12 patients were considered to be colonized. The median copy numbers in bronchoalveolar lavage fluid were significantly different in the PCP and colonization groups (1.35×10⁵/ml vs. 1.45×10⁶/ml, P <0.0001).

Lower and upper cut-off values of 3.9×10⁵ copies/ml and 3.2×10⁶ copies/ml allowed differentiating PCP and colonization. The FTD Pneumocystis jirovecii assay was secondarily compared to an in-house reference PCR assay targeting the mtLSU rRNA gene. A concordance rate of 97.5% was observed (Cohen’s kappa coefficient χ=0.935). The FTD Pneumocystis jirovecii PCR kit showed good performance and represents an alternative method to diagnose P. jirovecii infections.
Cluster of human parechovirus infections as the predominant cause of sepsis in neonates and infants, Leicester, United Kingdom, 8 May to 2 August 2016


*Euro Surveillance* (2016), 21(34), pii=30326.

**Abstract**

We report an unusually high number of cases (n = 26) of parechovirus infections in the cerebrospinal fluid (CSF) of neonates and infants admitted with sepsis in the United Kingdom during 8 May to 2 August 2016. Although such infections in neonates and infants are well-documented, parechovirus has not been routinely included in many in-house and commercial PCR assays for CSF testing. Clinicians should consider routine parechovirus testing in young children presenting with sepsis.

In this study the **FTD EPA** kit was internally validated for CSF testing.

**FTD EPA** is used for detection of enterovirus, human adenovirus and human parechovirus.

More information on **FTD EPA** on page 22.

Letter to the editor: Human parechovirus cluster in the UK, 8 May–2 August 2016—sequence analysis

JW Tang, CW Holmes, DJ Allen, S Bandi, S Rahman


Dear Editor,

We recently described an unexpected cluster of human parechovirus (HPEV) cases involving hospitalised neonates and infants (n = 26) presenting with symptoms of sepsis in the Midlands, UK.

Briefly, HPEV usually causes self-limiting, mild gastroenteritis and respiratory infections, though more severe neurological and cardiovascular complications are possible. In this population, HPEV RT-PCR testing on cerebrospinal fluid (CSF) was part of the routine septic work-up for any neonate or infant admitted to hospital presenting with any combination of fever, lethargy and drowsiness, rash, poor-feeding, tachycardia or irritability. In this cluster occurring between May and August 2016 there were 15 male and 11 female, neonatal or infant cases (aged 8–197 days, median 47 days). The CSF PCR testing was performed using a combination of multiplex PCR assays: a commercial polymerase chain reaction (PCR) assay for the detection of enterovirus and HPEV (FTD EPA, Fast Track Diagnostics Ltd., Sliema, Malta), and in-house assays for the other targets (herpes simplex virus 1 and 2, varicella zoster virus). No other viral CNS infections were detected in any of the HPEV-positive cases.

Since then we have sequenced a region of the HPEV genome covering the VP3–VP1 junction from those samples with sufficient concentration of viral RNA to allow PCR amplification of this region, using a previously described protocol.

In total seven (3 males, 4 females) of the 26 CSF samples were successfully sequenced (GenBank accession numbers MF136612 to MF136618). Three of the HPEV sequences from cases in our cluster formed a monophyletic clade with good branch support (SH-like test support value 0.94). Three HPEV virus sequences clustered with 2015 CSF HPEV sequences from an outbreak in neonates with fever and diarrhoea in Queensland, Australia, and the remaining sequence clustered with a diagnostic 2014 serum HPEV sequence from Austria, which also included some older 2010 CSF HPEV sequences from Scotland. All of these viruses belonged to HpeV genotype 3, which is the genotype most commonly associated with human disease in this age group.

This and other studies clearly demonstrate the importance of HPEV as a cause of neonatal and infant sepsis, and this virus should be screened for (along with enteroviruses) routinely in such cases presenting hospital. Commercial kits are now available for such testing. Many of these cases are diagnosed of CSF samples but stool and blood samples are also useful clinical samples types to detect HPEV infection, which may also be taken routinely as part of the septic work-up in these very young children. Although the management of such cases is mainly supportive, there are no specific antivirals (though intravenous immunoglobulin may be helpful), a diagnosis of HPEV infection as the cause of sepsis, where no other pathogen is detected, may reduce the use of unnecessary antimicrobials. In addition, due to the mostly self-limiting nature of HPEV infections, early discharge home is possible once a diagnosis of HPEV infection has been made, as was the case in our cluster.
Systematic application of multiplex PCR enhances the detection of bacteria, parasites, and viruses in stool samples

Gary N. McAuliffe, Trevor P. Anderson, Mary Stevens, Jacqui Adams, Robyn Coleman, Patalee Mahagamasekera, Sheryl Young, Tom Henderson, Maria Hofmann, Lance C. Jennings, and David R. Murdoch


Abstract

Objectives: To determine whether systematic testing of faecal samples with a broad range multiplex PCR increases the diagnostic yield in patients with diarrhoea compared with conventional methods and a clinician initiated testing strategy.

Methods: 1758 faecal samples from 1516 patients with diarrhoea submitted to two diagnostic laboratories were tested for viral, bacterial, and parasitic pathogens by Fast Track Diagnostics multiplex real-time PCR kits and conventional diagnostic tests.

Results: Multiplex PCR detected pathogens in 530 samples (30%): human adenovirus (51, 3%), human astrovirus (95, 5%), norovirus (172, 10%), rotavirus (3, 0.2%), Campylobacter jejuni/coli (85, 5%), Salmonella spp. (22, 1%), Clostridium difficile (72, 4%), verocytotoxin-producing E. coli (21, 1%), Cryptosporidium spp. (3, 0.2%), Entamoeba histolytica (1, 0.1%), and Giardia lamblia (59, 3%). In contrast, conventional testing detected a pathogen in 324 (18%) samples.

Conclusions: Using a systematic approach to the diagnosis of gastroenteritis improved diagnostic yield. This enhanced detection with PCR was achieved by a combination of improved detection of individual pathogens and detection of pathogens not requested or unable to be tested by conventional tests. This approach also allowed earlier identification for most pathogens and created a workflow which is likely to adapt well for many diagnostic laboratories.

Read the full article: http://www.fast-trackdiagnostics.com/human-line/resources/publications/
Prevalence of 7 sexually transmitted organisms by multiplex real-time PCR in Fallopian tube specimens collected from Saudi women with and without ectopic pregnancy

Ahmed Mohamed Ashshi, Sarah Abdullah Batwa, Seham Yahia Kutbi, Faizah Ahmed Malibary, Mohamed Batwa, and Bassem Refaat

BMC Infectious Diseases (2015), 15:56.

Abstract

**Background**: Ectopic pregnancy (EP) is associated with maternal morbidity and occasionally mortality during the first trimester. A history of sexually transmitted infection (STI) and pelvic inflammatory disease have been implicated as major risk factors for EP. Our aim was to measure the prevalence of *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, Mycoplasma genitalium, Ureaplasma parvum/urealyticum, *Gardnerella vaginalis*, *Trichomonas vaginalis* and herpes simplex virus (HSV)-1&2 in Fallopian tubes collected from EP and the results were compared with those obtained from total abdominal hysterectomy (TAH) and tubal ligation.

**Methods**: This was a prospective case–control study and tubal samples were collected from 135 Saudi women recruited from 3 centres in the Western region as follow: 84 EPs, 20 TAH and 31 tubal ligations. Multiplex TaqMan PCR was performed using an IVD CE kit for the simultaneous detection of candidate pathogens following DNA extraction.

**Results**: Infections were detected in 31.8 % of the 135 participants either as single (11.1 %) or co-infections (20.7 %) and the frequencies were significantly higher in EP (42.85 %) compared with control (13.72 %). […]

**Conclusions**: STIs are frequent in the upper genital tract of Saudi women during the reproductive age and *C. trachomatis*, *M. genitalium* and HSV-1/2 were more prevalent in EP. The observed high rates of co-infection advocate the necessity of establishing national guidelines and/or screening program utilising multiplex PCR approach for the detection of common STIs among high risk groups in the kingdom. Further studies are needed to measure the adverse reproductive outcomes associated with STIs in Saudi Arabia.

Read the full article: http://www.fast-trackdiagnostics.com/human-line/resources/publications/
Acute viral infections of the central nervous system, 2014-2016, Greece

Papa A, Papadopoulou E


**Abstract**

In order to investigate the viral etiology of acute infections of central nervous system (CNS), multiplex and single PCRs combined with serology for arboviruses were applied on samples from 132 hospitalized patients in Greece during May 2014-December 2016. A viral pathogen was detected in 52 of 132 (39.4%) cases with acute CNS infection. Enteroviruses predominated (15/52, 28.8%), followed by West Nile virus (9/52, 17.3%). Phleboviruses, varicella-zoster virus, and Epstein-Barr virus accounted for 15.4%, 13.5%, and 11.5% of the cases, respectively. The study gives an insight into the etiology of viral CNS infections in a Mediterranean country, where arboviruses should be included in the differential diagnosis of acute CNS infections.

*FTD Neuro 9* was used to analyse the prevalence of pathogens during acute central nervous system infections.

*FTD Neuro 9* simultaneously detects 11 viruses potentially involved in CNS infections.

More information on *FTD Neuro 9* on page 26.

Read the full article: http://www.fast-trackdiagnostics.com/human-line/resources/publications/
Coxsackievirus A6 (CV-A6) Encephalomyelitis in an immuno-compromised child - A case report and brief review of the literature

S Aswathyraj, Sasidharanpillai Sabeena, Kamalakshi G Bhat, Kiran Chandra Bharani, Ramachandran Sanjay, and Govindakarnavar Arunkumar


**Abstract**

Coxsackievirus A6 (CV-A6) has recently emerged as the predominant circulating enterovirus strain causing Hand Foot and Mouth Disease (HFMD) worldwide. CV-A6 is a single-stranded RNA virus; belonging to the family Picornaviridae and genus Enterovirus. Enteroviruses such as EV-A71 and CV-A16 are more often associated with neurological manifestations mainly among children below the age of five years. Here we report a fatal case of CV-A6-associated encephalomyelitis in a four-year-old child with acute lymphatic leukemia (ALL).

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**FTD Viral meningitis** was used to detect enterovirus in cerebrospinal fluid.

**FTD Viral meningitis** provides an efficient solution for detection of 6 viruses potentially involved in meningitis.

More information on **FTD Viral meningitis** on page 27.

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FTD Respiratory pathogens 21

Overview
Five tube multiplex for detection of influenza A virus, influenza A(H1N1) virus (swine-lineage), influenza B virus, human rhinovirus, human coronaviruses NL63, 229E, OC43 and HKU1, human parainfluenza viruses 1, 2, 3 and 4, human metapneumoviruses A/B, human bocavirus, human respiratory syncytial viruses A/B, human adenovirus, enterovirus, human parechovirus, *Mycoplasma pneumoniae* and internal control

Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

Targets

| 1. Primer/probe mix | influenza A virus
|                     | influenza B virus
|                     | influenza A(H1N1) virus (swine-lineage)
|                     | human rhinovirus
| 2. Primer/probe mix | human coronavirus NL63
|                     | human coronavirus 229E
|                     | human coronavirus OC43
|                     | human coronavirus HKU1
| 3. Primer/probe mix | human parainfluenza virus 2
|                     | human parainfluenza virus 3
|                     | human parainfluenza virus 4
|                     | internal control
| 4. Primer/probe mix | human parainfluenza virus 1
|                     | human metapneumoviruses A/B
|                     | human bocavirus
|                     | *Mycoplasma pneumoniae*
| 5. Primer/probe mix | human respiratory syncytial viruses A/B
|                     | human adenovirus
|                     | enterovirus
|                     | human parechovirus

Specimen
This test is for use with extracted nucleic acids from respiratory samples (throat/nasal/nasopharyngeal swabs, bronchoalveolar lavage and sputum) of human origin.

Compatibility
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the "Resources" area on FTD website or support-ftd.team@siemens-healthineers.com

Format
Lyophilised
Liquid

FTD proposes 19 kits detecting the most clinically relevant respiratory pathogens
FTD Respiratory pathogens 21 plus

Overview
Six tube multiplex for detection of influenza A virus, influenza A(H1N1) virus (swine lineage), influenza B virus, human rhinovirus, human coronavirus NL63, 229E, OC43 and HKU1, parainfluenza 1, 2, 3 and 4, human metapneumoviruses A/B, human bocavirus, human respiratory syncytial viruses A/B, human adenovirus, enterovirus, human parechovirus, Mycoplasma pneumoniae, Chlamydia pneumoniae, Staphylococcus aureus, Streptococcus pneumoniae, Haemophilus influenzae B and internal control.

Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology.

Targets

<table>
<thead>
<tr>
<th>1. Primer/probe mix</th>
<th>influenza A virus</th>
<th>influenza B virus</th>
<th>influenza A(H1N1) virus (swine-lineage)</th>
<th>human rhinovirus</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Primer/probe mix</td>
<td>human parainfluenza 2</td>
<td>human parainfluenza 3</td>
<td>human parainfluenza 4</td>
<td>internal Control</td>
</tr>
<tr>
<td>4. Primer/probe mix</td>
<td>human parainfluenza 1</td>
<td>human metapneumoviruses A/B</td>
<td>human bocavirus</td>
<td>Mycoplasma pneumoniae</td>
</tr>
<tr>
<td>5. Primer/probe mix</td>
<td>human respiratory syncytial viruses A/B</td>
<td>human adenovirus</td>
<td>enterovirus</td>
<td>human parechovirus</td>
</tr>
<tr>
<td>6. Primer/probe mix</td>
<td>Chlamydia pneumoniae</td>
<td>Streptococcus pneumoniae</td>
<td>Haemophilus influenzae B</td>
<td>Staphylococcus aureus</td>
</tr>
</tbody>
</table>

Specimen
This test is for use with extracted nucleic acids from respiratory samples (throat/nasal/nasopharyngeal swabs, bronchoalveolar lavage and sputum) of human origin.

Compatibility
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the "Resources" area or support-ftd.team@siemens-healthineers.com.

Format
Lyophilised
Liquid

FTD proposes 19 kits detecting the most clinically relevant respiratory pathogens.
**Overview**


*does not include Bordetella parapertussis

**Principle**

Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

**Targets**

| 1. Primer/probe mix | influenza A virus  
influenza B virus  
influenza A(H1N1) virus (swine-lineage)  
human rhinovirus |
|---------------------|------------------|
| 2. Primer/probe mix | human coronavirus NL63  
human coronavirus 229E  
human coronavirus OC43  
human coronavirus HKU1 |
| 3. Primer/probe mix | human parainfluenza virus 2  
human parainfluenza virus 3  
human parainfluenza virus 4  
internal control |
| 4. Primer/probe mix | human parainfluenza virus 1  
human metapneumoviruses A/B  
human bocavirus  
*Mycoplasma pneumoniae* |
| 5. Primer/probe mix | human respiratory syncytial viruses A/B  
human adenovirus  
enterovirus  
human parechovirus |
| 6. Primer/probe mix | *Chlamydophila pneumoniae*  
*Streptococcus pneumoniae*  
*Haemophilus influenzae*  
*Staphylococcus aureus* |
| 7. Primer/probe mix | *Klebsiella pneumoniae*  
*Legionella pneumophila*/longbeachae*  
*Salmonella* spp.  
*Pneumocystis jirovecii* |
| 8. Primer/probe mix | *Moraxella catarrhalis*  
*Bordetella* spp. (except *Bordetella parapertussis*)  
*Haemophilus influenzae*  
influenza C virus |

**Specimen**

technology

Targets

Specimen technology

This test is for use with extracted RNA and DNA from respiratory samples (throat/nasal swabs, bronchoalveolar lavage and sputum) of human origin

**Compatibility**

To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the "Resources" area on FTD website or support-ftd.team@siemens-healthineers.com

**Format**

Lyophilised

Liquid

FTD proposes 19 kits detecting the most clinically relevant respiratory pathogens
**FTD MERS-CoV**

**Overview**
Two-tube multiplex - two separate targets - for detection AND confirmation of MERS-CoV and internal control

**Principle**
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

**Targets**

<table>
<thead>
<tr>
<th>1. Primer/probe mix</th>
<th>MERS-CoV target 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Internal control</td>
</tr>
<tr>
<td>2. Primer/probe mix</td>
<td>MERS-CoV target 2</td>
</tr>
</tbody>
</table>

**Specimen**
This test is for use with extracted RNA from respiratory samples (throat/nasal swabs, bronchoalveolar lavage and sputum) of human origin

**Compatibility**
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the "Resources" area or support-ftd.team@siemens-healthineers.com

**Format**
Lyophilised
Liquid

FTD proposes 19 kits detecting the most clinically relevant respiratory pathogens
FTD Pneumocystis jirovecii

Overview
One tube multiplex for detection AND quantification of *Pneumocystis jirovecii* and internal control

Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

Targets

| 1. Primer/probe mix | *Pneumocystis jirovecii* | internal control |

Specimen
This test is for use with extracted nucleic acid from respiratory samples (throat/nasal swabs, bronchoalveolar lavage and sputum) of human origin.

Compatibility
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the “Resources” area on FTD website or support-ftd.team@siemens-healthineers.com

Format
Liquid

FTD proposes 19 kits detecting the most clinically relevant respiratory pathogens
### FTD EPA

**Overview**
One tube multiplex for detection of enterovirus, human parechovirus, human adenovirus and internal control

**Principle**
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

**Targets**

<table>
<thead>
<tr>
<th>1. Primer/probe mix</th>
<th>enterovirus</th>
<th>human parechovirus</th>
<th>human adenovirus</th>
<th>internal control</th>
</tr>
</thead>
</table>

**Specimen**
This test is for use with nucleic acid from CSF, blood, throat swabs, sputum and stool of human origin.

**Compatibility**
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the “Resources” area on FTD website or support-ftd.team@siemens-healthineers.com

**Format**
Lyophilised
Liquid

**FTD proposes 9 kits detecting the most relevant pathogens causing fevers and rashes**
# FTD Viral gastroenteritis

## Overview
Two tube multiplex plus add-on singleplex for detection of norovirus GI and GII, human astrovirus, rotavirus, human adenovirus, sapovirus and internal control

## Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

## Targets

<table>
<thead>
<tr>
<th></th>
<th>Primer/probe mix</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Primer/probe mix</td>
<td>norovirus GI, norovirus GII, internal control</td>
</tr>
<tr>
<td>2</td>
<td>Primer/probe mix</td>
<td>human adenovirus, human astrovirus, rotavirus</td>
</tr>
<tr>
<td>3</td>
<td>Primer/probe mix</td>
<td>sapovirus*</td>
</tr>
</tbody>
</table>

**Specimen**
This test is for use with extracted nucleic acid from stool samples of human origin.

**Compatibility**
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the “Resources” area on FTD website or support-ftd.team@siemens-healthineers.com

**Format**
Lyophilised
Liquid

FTD proposes 6 kits detecting the most clinically relevant pathogens causing gastroenteritis

*kindly note that the lyophilised mastermix for the detection of sapovirus has been removed from the kit FTD Viral Gastroenteritis*
FTD Bacterial gastroenteritis

Overview
Two tube multiplex for detection of *Salmonella* spp., *Shigella*/enteroinvasive *E. coli*, *Yersinia enterocolitica*, *Clostridium difficile*, *Campylobacter coli/jejuni/lari*, verocytotoxin-producing *E. coli* and internal control

Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

Targets

| 1. Primer/probe mix | *Campylobacter coli/jejuni/lari*  
|                     | verocytotoxin-producing *E. coli*  
|                     | internal control |
| 2. Primer/probe mix | *Salmonella* spp.  
|                     | *Shigella*/enteroinvasive *E. coli*  
|                     | *Yersinia enterocolitica*  
|                     | *Clostridium difficile* |

Specimen
This test is for use with extracted nucleic acid from stool samples of human origin.

Compatibility
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the “Resources” area on FTD website or support-ftd.team@siemens-healthineers.com

Format
Lyophilised  
Liquid

FTD proposes 6 kits detecting the most clinically relevant pathogens causing gastroenteritis
FTD Stool parasites

Overview
One tube multiplex for detection of *Entamoeba histolytica*, *Cryptosporidium* spp., *Giardia lamblia* and internal control

Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

Targets

| 1. Primer/probe mix | *Entamoeba histolytica* |
|                     | *Cryptosporidium* spp. |
|                     | *Giardia lamblia*       |
|                     | internal control        |

Specimen
This test is for use with extracted nucleic acid from stool samples of human origin.

Compatibility
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the “Resources” area on FTD website or support-ftd.team@siemens-healthineers.com

Format
Lyophilised
Liquid

FTD proposes 6 kits detecting the most clinically relevant pathogens causing gastroenteritis
**FTD Neuro 9**

**Overview**
Four tube multiplex for detection of human cytomegalovirus, Epstein-Barr virus, human adenovirus, herpes simplex virus 1 and 2, varicella zoster virus, enterovirus, human parechovirus, human herpesvirus 6 and 7, human parvovirus B19 and internal control

**Principle**
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

**Targets**

<table>
<thead>
<tr>
<th>Primer/probe mix</th>
<th>Targets</th>
</tr>
</thead>
</table>
| 1. Primer/probe mix | human adenovirus  
                       Epstein-Barr virus  
                       internal control  |
| 2. Primer/probe mix | herpes simplex virus 1  
                       herpes simplex virus 2  
                       varicella zoster virus  
                       internal control  |
| 3. Primer/probe mix | enterovirus  
                       human parechovirus  
                       internal control  |
| 4. Primer/probe mix | human herpesvirus 6  
                       human herpesvirus 7  
                       human parvovirus B19 |

**Specimen**
This test is for use with nucleic acid from CSF and blood.

**Compatibility**
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the “Resources” area or support-ftd.team@siemens-healthineers.com

**Format**
Liquid

**FTD proposes 4 kits detecting the most clinically relevant pathogens causing meningitis**
FTD Viral meningitis

Overview
Two tube multiplex for detection of herpes simplex virus 1 and 2, varicella zoster virus, mumps virus, enterovirus, human parechovirus and internal control

Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

Targets

| 1. Primer/probe mix | herpes simplex virus 1  
|                     | herpes simplex virus 2  
|                     | mumps virus  
|                     | varicella zoster virus  |
| 2. Primer/probe mix | enterovirus  
|                     | human parechovirus  
|                     | internal control  |

Specimen
This test is for use with nucleic acid from CSF and blood.

Compatibility
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the “Resources” area or support-ftd.team@siemens-healthineers.com

Format
Lyophilised
Liquid

FTD proposes 4 kits detecting the most clinically relevant pathogens causing meningitis
FTD STD9

Overview
Two tube multiplex for detection of *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Mycoplasma genitalium*, *Trichomonas vaginalis*, *Ureaplasma urealyticum/parvum*, *Gardnerella vaginalis*, herpes simplex virus 1/2 and internal control.

Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology.

Targets

| 1. Primer/probe mix       | Chlamydia trachomatis |
|                          | Neisseria gonorrhoeae |
|                          | Mycoplasma genitalium |
|                          | internal control      |
| 2. Primer/probe mix       | Trichomonas vaginalis |
|                          | Gardnerella vaginalis |
|                          | Ureaplasma urealyticum/parvum |
|                          | herpes simplex virus 1/2 |

Specimen
This test is for use with nucleic acid from (“first catch”) urine samples, genital and rectal swabs of human origin.

Compatibility
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the “Resources” area on FTD website or support-ftd.team@siemens-healthineers.com.

Format
Liquid

FTD proposes 8 kits detecting the most clinically relevant sexually transmitted pathogens.
FTD Gonorrhoea confirmation

Overview
One tube multiplex - two separate targets - for detection AND confirmation of *Neisseria gonorrhoeae* and internal control

Principle
Multiplex real-time PCR for detection of pathogen genes by TaqMan® technology

Targets

| 1. Primer/probe mix | *Neisseria gonorrhoeae* target 1 | *Neisseria gonorrhoeae* target 2 | internal control |

Specimen
This test is for use with extracted nucleic acid from urine, endocervical and rectal swabs of human origin.

Compatibility
To find out if the extraction method or qPCR thermocycler available in your facility is compatible with FTD assays, please see our full and detailed compatibility list under the "Resources" area on FTD website or support-ftd.team@siemens-healthineers.com

Format
Liquid

FTD proposes 8 kits detecting the most clinically relevant sexually transmitted pathogens

FTD offers more than 70 syndromic real-time PCR multiplexing kits, find out more on FTD website.
Fast Track Diagnostics
Syndromic real-time PCR
multiplexing kits

Fast Track Diagnostics assays are CE-marked for IVD use in the EU.

For Fast Track Diagnostics assays, please see the compatibility list to learn more about our compatible instruments.

Customer is responsible for validating the assay on instruments listed in the compatibility list.

www.fast-trackdiagnostics.com