



WHO recommendations on the use of rapid testing for influenza diagnosis

1. General information

Influenza outbreaks and epidemics pose ongoing risks to global human public health. Recently, human infections with A/H5N1 avian influenza viruses have heightened the potential for the emergence of an influenza A virus with pandemic potential. In response, the World Health Organization (WHO) is working to strengthen influenza surveillance (<http://www.who.int/csr/disease/influenza/influenzanelwork/en/index.html>) and increase laboratory capacity for the diagnosis of influenza and the early detection of emerging pandemic strains.

Laboratory identification of human influenza virus infections is commonly performed using direct antigen detection, virus isolation in cell culture, or detection of influenza-specific RNA by reverse transcriptase-polymerase chain reaction (RT-PCR). In recent years commercial influenza rapid diagnostic tests have become available. These are mostly antigen detection tests, which can produce results within 30 minutes. They can provide results in a clinically relevant time frame to complement the use of antiviral medications for treatment and chemoprophylaxis of influenza. Their wide availability has resulted in their increasing application to clinical situations, which may be inappropriate or where scientific data are lacking.

Recommendations in this document are intended for laboratories receiving requests to test specimens from patients with suspected influenza, in situations where influenza surveillance may or may not be active, and in countries where there may be evidence of infrequent human infections by avian influenza viruses. They are intended to complement the *Recommended laboratory tests to identify avian influenza A virus in specimens from humans* (http://www.who.int/csr/disease/avian_influenza/guidelines/labtests/en/).

2. Rapid diagnostic tests for influenza

Commercially available rapid diagnostic tests are screening tests for influenza A and B virus infections, which can provide results within 30 minutes. These tests are largely immunoassays which detect influenza viral antigen, while one test detects viral neuraminidase activity. They may also be referred to as near patient or point-of-care tests. Tests either detect and distinguish between influenza A and influenza B infections, detect but do not distinguish between influenza A and B or detect influenza A only. They vary in their complexity, the type of respiratory specimens acceptable for testing and the time needed to produce results. A list of these tests is included in Annex 1.

Acceptable respiratory specimens

Most tests can be used on a variety of respiratory specimen types, however not all specimen types yield equivalent results, and other factors can influence specimen quality. Nasal aspirates, nasal washes, sputa and nasopharyngeal swabs, especially those specimens containing cellular material, are preferable to nasal swabs and throat swabs. They should be collected as close to the onset of symptoms as possible and not after 4–5 days in adults as virus shedding typically diminishes. In young children, viral shedding may occur for longer periods, and the collection of specimens for testing after 5 days of illness may still be useful. There are very limited data on the shedding of avian influenza viruses in human infections. For guidelines on human specimen collection and handling see *WHO guidelines for the collection of human specimens for laboratory diagnosis of avian influenza infection* (http://www.who.int/csr/disease/avian_influenza/guidelines/humanspecimens/en/).

Influenza A and B reactivity

All rapid tests have been demonstrated to have reactivity with a range of recent human influenza A and B strains. These tests detect a common antigen of all influenza A viruses or B viruses; however, rapid tests cannot distinguish between influenza A subtypes. Some manufacturers have evaluated their test kits for reactivity with some animal influenza viruses. No study has been performed to assess the accuracy of rapid tests to detect human infection with avian influenza viruses.

Test complexity

Rapid tests vary in complexity with the number of steps required to perform each test ranging from 2–8. The United States is currently the only country to categorize their complexity. The rapid diagnostic tests, which are easy to use and interpret, are waived from approval by the Food and Drug Administration, for use in a clinical/office setting, while others are classified as moderately complex and must be used in a diagnostic laboratory setting. Other countries may require specific agency approval for rapid test use. Training in the use of rapid diagnostic tests is highly recommended because of their varying complexity and the importance of specimen type and quality (Thomas Y et al, 2003).

Clinical accuracy

The accuracy of an influenza diagnostic test is determined by the sensitivity and specificity of the test to detect an influenza virus infection compared with a “gold” standard (usually culture) and the prevalence of influenza in the community (Uyeki TM, 2003).

Sensitivity is the percentage of “true influenza cases” detected as positive by a test.

Specificity is the percentage of “true non-influenza cases” detected as being negative by a test.

Positive predictive value (PPV) of a test is the percentage of test positive cases that have influenza.

Negative predictive value (NPV) is the percentage of test negative cases that do not have influenza.

In general, the sensitivity of rapid tests is variable (median 70–75%) and lower than that of cell culture, while their specificity is high (median 90–95%). Because of the low sensitivity, false negative results are a major concern with these tests.

Unlike sensitivity and specificity, the PPV and NPV are affected by disease prevalence. Thus, an influenza rapid test will have:

- During peak influenza activity: the highest PPV with positive results more likely to be true and lowest NPV, with false-negative results more likely.
- During low influenza activity: the lowest PPV with false-positive tests more likely, and highest NPV, with negative results more likely to be true.

Accuracy of clinical diagnosis and other laboratory tests

Clinical diagnosis: The positive predictive value of any adult influenza case definition has ranged from 18–87% compared with laboratory confirmed influenza. During periods of influenza prevalence, clinical diagnosis (based on the acute onset of high fever and cough) can be highly predictive of influenza (PPV 79–87%; NPV 39–75%). The probability of a patient having confirmed influenza increases with increasing fever and acute presentation (within 36–48 hours of onset) (Gavin PJ, Thomson RB.2003).

Immunofluorescent antibody staining: The sensitivity of influenza antigen detection in respiratory specimens by immunofluorescent staining in comparison to cell culture ranges between 70–100%; specificity, 80–100%; PPV, 85–94%; NPV, 96–100%.

Viral culture: Considered the “gold standard”.

Polymerase chain reaction: RT-PCR assays detect both viable and non-viable influenza virus RNA and are in general more sensitive than culture. Improved detection rates over culture may be between 2–13%.

3. The role of rapid tests for influenza: clinical considerations

Influenza is associated with high morbidity and mortality, is preventable by vaccination and chemoprophylaxis and is treatable by specific antivirals. In general, rapid diagnostic testing for influenza should be carried out when the results will influence a clinical decision.

Patient management: The laboratory diagnosis of influenza can help guide the clinical management of influenza patients in a hospital or other health care setting. Patients with lower respiratory tract illness, especially children and adults with medical conditions increasing their risk for developing complicated influenza, should be considered for rapid influenza virus diagnostic testing during their outpatient triage. A rapid diagnostic test performed within 48 hours of the onset of symptoms can have important case management implications, specifically allowing the use of influenza antivirals. Other benefits may include the isolation and cohorting of confirmed cases preventing nosocomial outbreaks, and the reduction of the inappropriate use of antibiotics. The use of rapid tests which provide timely evidence of influenza virus infection should be considered, however, test performance is primarily dependent on the prevalence of influenza in the community. Confirmatory diagnostic testing using immunofluorescence, viral culture or PCR should always be considered.

Institutional outbreak management: All countries can experience institutional outbreaks of influenza during periods of high or low influenza activity in local communities. Confirmation of influenza within these institutions can help control such outbreaks. Rapid testing in combination

with IFA, viral culture and/or PCR of suspected influenza cases can facilitate early intervention and control. The use of rapid tests is encouraged.

Semi-closed community outbreak management: Semi-closed communities, such as passengers on cruise ships may experience outbreaks of influenza at any time of the year. Such communities may have passengers and crew members from many different countries where influenza viruses are circulating or may visit destinations with local influenza activity. Confirmation of influenza within these communities using rapid testing can assist the control of these outbreaks and help direct external public health advice.

Travellers: International travellers with suspected influenza may or may not have come from a country with known influenza activity. The rapid testing and viral culture of such individuals is encouraged.

Surveillance: Confirmation of influenza in the community provides information, which can enhance the accuracy of clinical diagnoses. Surveillance can provide an “early warning” system for a change in influenza activity, this being the purpose of the WHO Global Influenza Surveillance Network, comprising more than 100 National Influenza Centres (<http://www.who.int/csr/disease/influenza/surveillance/en/>). In some countries rapid tests have been applied to the surveillance of influenza and guidelines have been developed (Thomas Y et al., 2003). They have been used as a screening test prior to sample collection for viral culture. The WHO Global Influenza Programme requires human influenza virus isolates for antigenic analysis and the routine use of rapid tests alone for surveillance purposes is not recommended.

4. The use of rapid tests

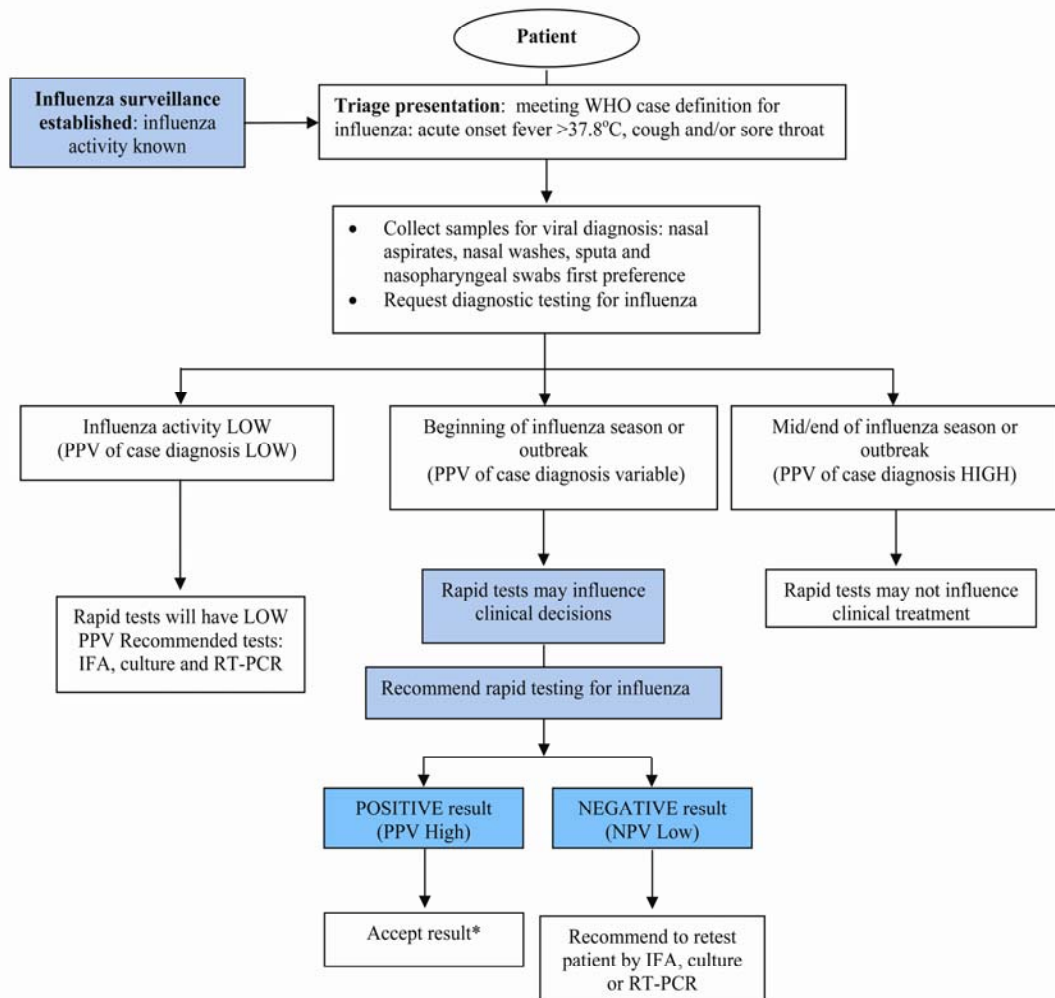
The use of rapid tests in countries with influenza surveillance in place

In countries where influenza surveillance is established, the seasonality of influenza is known.

Recommendations

- Influenza surveillance should be used to guide the optimal use of rapid tests.
- During periods of low influenza activity, if rapid tests are used, positive results must be interpreted with caution and confirmed by immunofluorescence assay (IFA), viral culture or RT-PCR.
- At the beginning of the influenza season or an influenza outbreak, rapid tests may influence clinical decisions and contribute to clinical awareness.
- During periods of high influenza activity, it is impractical to test every individual meeting an influenza case definition. Clinical judgment and local influenza surveillance data should be used for case management in the first instance. Rapid tests are recommended to be used only when they can influence timely patient management.
- Because of the differing complexity of rapid tests, education of laboratory personnel about methods and limitations prior to their use is essential.

The use of rapid tests during the seasonal occurrence of A/H1, A/H3 and B virus infections.



*Culture of rapid test positive samples should be considered for surveillance purposes.

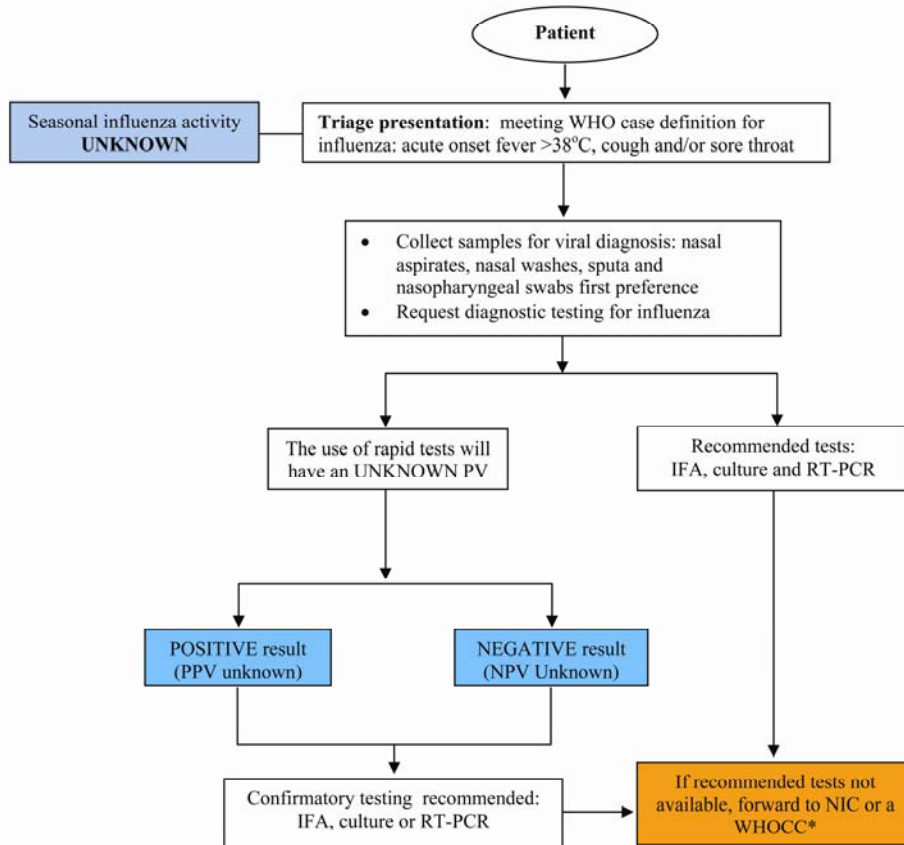
The use of rapid tests in countries without influenza surveillance

In countries where influenza surveillance has not been established, the seasonal prevalence of influenza is unknown. Clinical differentiation of influenza is likely to be confounded by other infectious pathogens that can cause influenza-like illness.

Recommendations

- Where influenza surveillance is not available and influenza activity is likely to be unknown, the use of rapid tests for the diagnosis of human influenza is in general not recommended. Rapid test predictive values will be unknown.
- Should rapid tests be used, then both positive and negative test results should be confirmed by IFA, culture or RT-PCR.
- Where laboratory capacity does not exist for confirmatory testing, forward specimens to the National Influenza Centre (NIC) in the country (<http://www.who.int/csr/disease/influenza/centres/en/index.html>) or a WHO Collaborating Centre for Reference and Research of Influenza (WHOCC) (<http://www.who.int/csr/disease/influenza/collabcentres/en/>).

The use of rapid tests when the occurrence of A/H1, A/H3 and B virus activity is unknown.



*A list of WHO Collaborating Centres can be found at (<http://www.who.int/csr/disease/influenza/collabcentres/en/>)

The use of rapid tests in countries with avian influenza activity identified or suspected

In countries where avian influenza activity has been identified, human avian influenza infections may occur against a background of human A/H1, A/H3 and B infections. The clinical differentiation of influenza is also likely to be confounded by other infectious pathogens that can cause influenza-like illness.

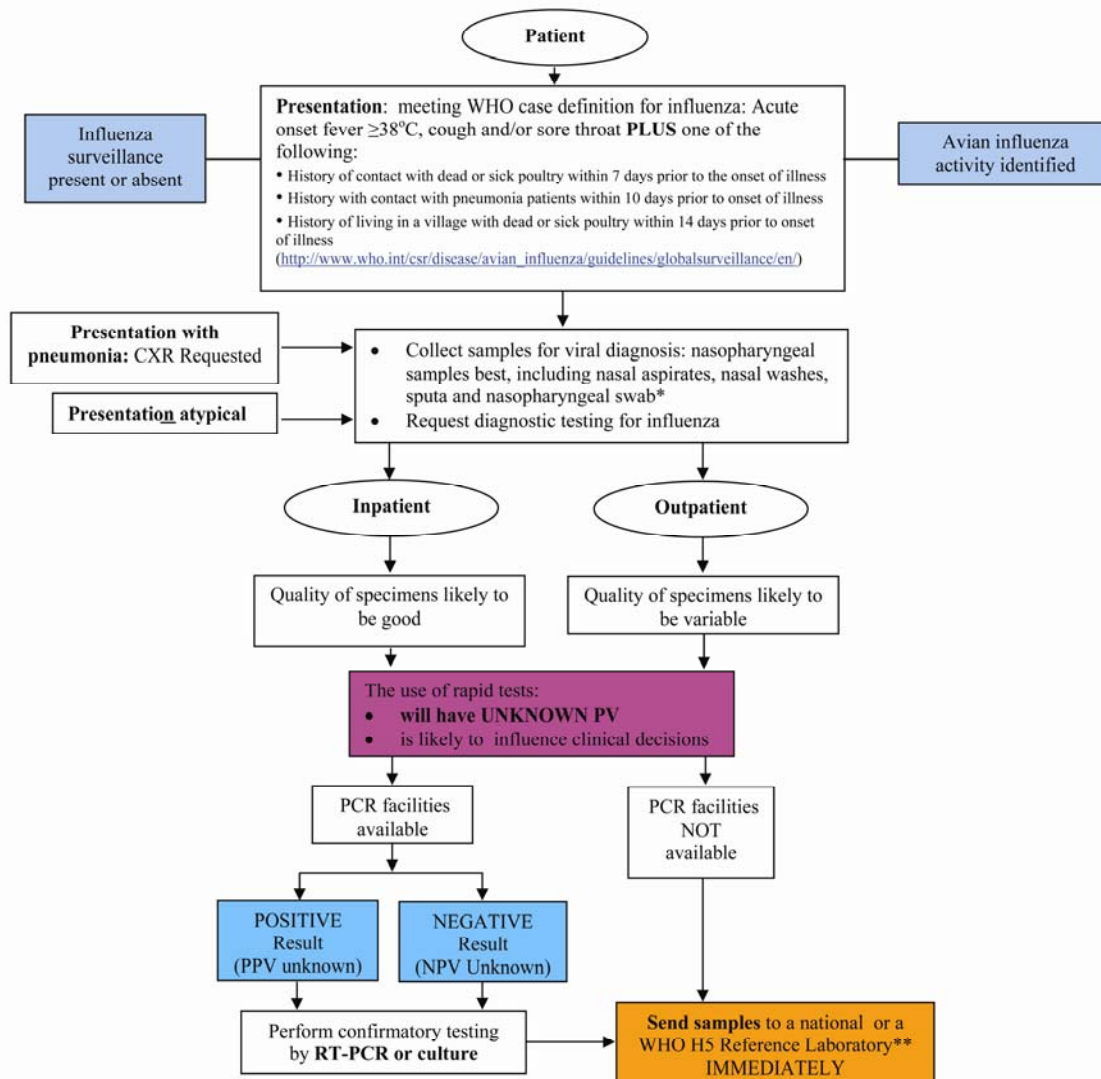
The confirmation of influenza infection in suspected human avian influenza patients can assist early antiviral treatment, appropriate patient management including isolation and infection control, and epidemiological investigation. The use of rapid tests may rapidly identify influenza A or B virus infection, however they will not differentiate between human and avian influenza A virus subtypes. Therefore specimens must be forwarded to a national or a WHO H5 Reference Laboratory (http://www.who.int/csr/disease/avian_influenza/guidelines/referencelabs/en/) for confirmatory testing.

Very limited data exist about shedding of avian influenza virus in infected humans. Therefore different types of respiratory specimens should be collected on multiple days for testing. Because of the limitations of rapid tests, the use of rapid tests for the diagnosis of avian influenza infection should be in combination with clinical findings and exposure history. Clinicians should understand the limitations of rapid tests.

Recommendations

- The use of rapid tests for the detection of human infections of avian influenza is in general not recommended. The clinical accuracy of rapid tests for the detection of avian influenza infections in humans is unknown, and if the test result is positive, differentiation between influenza A subtypes is not possible and confirmatory tests must be done by RT-PCR or viral culture. A negative rapid test result does not exclude human infection with avian influenza viruses.
- In situations where avian influenza infection is clinically suspected, rapid tests should only be used for testing patients:
 1. Where clinical guidelines exist (http://www.who.int/csr/disease/avian_influenza/guidelines/globalsurveillance/en/), **and**
 2. When confirmatory RT-PCR tests are accessible, as they are essential to assist with the rapid test result interpretation, **or**
 3. When confirmatory testing is not easily accessible, prior arrangements for testing should be made immediately with a national or a WHO H5 Reference Laboratories (http://www.who.int/csr/disease/avian_influenza/guidelines/referencelabs/en/) (http://www.who.int/csr/disease/avian_influenza/guidelines/transport/en/).
- The optimal specimen type and collection timing are unknown for human avian influenza infections. The collection of different kinds of respiratory specimens on multiple days from the same patient for confirmatory testing and for forwarding to a national or a WHO H5 Reference Laboratory (http://www.who.int/csr/disease/avian_influenza/guidelines/referencelabs/en/) is highly recommended.

The use of rapid tests in patients with suspected avian influenza infections



* The collection of different respiratory specimens on multiple days from the same patient is recommended.

** A list of WHO H5 Reference Laboratories can be found at (http://www.who.int/csr/disease/avian_influenza/guidelines/referencelabs/en/)

References

Gavin PJ, Thomson RB (2003). Review of rapid diagnostic tests for influenza. *Clinical and Applied Immunology Reviews*, 4:151–172.

Uyeki TM (2003). Influenza diagnosis and treatment in children: a review of studies on clinically useful tests and antiviral treatment for influenza. *The Pediatric Infectious Disease Journal*, 22:164–177.

Thomas Y, Kaiser L, Wunderli W et al. (2003). The use of near patient tests in influenza surveillance: Swiss experience and EISS recommendations. *EURO Surveillance*, 8:240-246.

Annex 1. Commercially available influenza rapid diagnostic tests

A list of commercially available influenza rapid diagnostic tests

Test Name*	CLIA Status**	Manufacturer	Influenza Type Detected	Differentiate Between A and B?	Storage Requirements; Storage Life	Acceptable Specimens	Assay Time	Technician Attendance Time	General Ease of Use	Erase of Interpretation	Sensitivity	Specificity	Positive Predictive Value (PPV)	Negative Predictive Value (NPV)	Nasal Asp/Swab Sensitivity	Nasal Asp/ Swab Specificity	Nasal Asp/Swab PPV & NPV	Throat Swab Sensitivity	Throat Swab Specificity	Animal Viruses Detected	
Binax NOW Flu A and Flu B	CLIA waived	Binax Inc., Portland, ME. www.binax.com	A and B	Yes	(1) 15-30 degrees C, 1 year	(1) Nasal wash, nasal aspirates, nasopharyngeal swabs	(1) 15 min	2 min	Easy	Easy	(1) A: 78-82% B: 58-71% (2) A: 52% B: 54% (3) A: 73% B: 100%	(1) A:92-94% B: 58-71% (2) 93% Combined (3) A: 95% B: 100%	(3) 93% combined	(3) 89% combined	(1)A:62-90% B:56-99	(1) A: 96-99% B:93-99%.			N/A		
Binax Now Influenza A & B	CLIA waived	Binax Inc., Portland, ME.	A and B	Yes	(1) 15-30 degrees C, 1 year	(1) Nasal wash, nasal aspirates, nasopharyngeal swabs	(1) 15 min		Easy	Easy	(1) A: 100% B:92-100%	(1) A: 92-93% B:94-99%			(1) A: 82% B: 71%	(1) A: 94% B: 97%			N/A		
Directigen Flu A	CLIA Moderate	Becton Dickinson, Franklin Lakes, NJ. www.bd.com	A	Detects A only	(1) 15-30 dgrs C, twelve months	(1) Nasopharyngeal wash, nasopharyngeal aspirate, nasopharyngeal swab, pharyngeal swab	(1) 15 min	5 min	Moderate	Easy	(1) 67-96% (4-8) 75-100%	(1) 88-100% (4-8) 92-100%	(4-8) 92-100%	(4-8) 89-100%	(4-8) 75-100%	(4-8) 91-100%	(4-8) PPV 62-100% NPV 89-100%	(6,9) 39-62%		(10) Yes	
Directigen Flu A+B	CLIA Moderate	Becton Dickinson, Franklin Lakes, NJ. www.bd.com	A and B	Yes	(1) 2-25 degrees C, twelve months	(1) Nasopharyngeal wash, nasopharyngeal aspirate, nasopharyngeal swab, lower nasal swab, throat swab, bronchoalveolar lavage	(1) 15 min	12 min	Moderate	Easy	(1) A: 96% B: 88%(3,11,14,16) A: 55-100% B:62-88% (3) 29% (11-15) 55-88%	(1) A: 99.6% B 96.8%. (3,11,14,15) A:99% B:93-100% (3,11-15) 93-100%	(1) A: 96%. B: 80% (11-14) 74.89% (14,15) A:81% B:90-100% (3) 93% combined	(1) Flu A: 99.6%. Flu B: 98%. (11-14) 93-98% (14,15) A:99% B:97% (3) 85% combined	(11,12) 75-87% (16) 52%	(11,12) 93-97%	(11,12) PPV 74-80% NPV 93-98%				
Flu OIA	CLIA waived	Biostar, Inc., Boulder, CO www.biostar.com	A and B	No	(1) 2-8 degrees C, 1 year	(1) Throat swabs, nasopharyngeal swabs, nasal aspirates, sputum	20 min	15 min	Moderate	Moderate	(1,17) 62-88% (18-20,22) 46-64% (21) 48-100%	(1,17) 52-80% (18-20,22) 74-97% (22) 93-97%	(18-19) 73-91%	(18-19) 56-77%	(17-23) 88-100%	(17-23) 69-100%		(17-23) 25-83%	(17-23) 51-94%	(1) Yes	
QuickVue Influenza Test	CLIA waived	Quidel, San Diego, CA. www.quidel.com	A and B	No	(1) 15-30 degrees C, 2 years	(1) Nasal swab, nasal wash, nasal aspirate	(1) 10 min		Easy	Easy	(1) AB:73-81% (13-14,24-28) AB:55-91%	(1) AB:96-99% (13-14,24-28) AB:83-99%	(1) AB: 92-96% (13-14,24-25,28) AB:55-93%	(1) AB: 85-93% (13-14,25-25,28) AB:77-99%	(1) AB:73-81% (25) AB:55%	(1) AB:96-99% (25) AB:99%	(1) PPV:AB: 92-96% NPV:85-93% (25) AB:PPV:55% NPV:99%	(28) AB:76%	(28) AB:93%		
QuickVue Influenza A+B	CLIA waived	Quidel, San Diego, CA. www.quidel.com	A and B	Yes	(1) 15-30 degrees C, 2 years	(1) Nasal swab, nasal wash, nasal aspirate	(1) 10 min	2 min	Easy	Easy	(1) A:72-77%. B: 73-82%	(1) A: 96-99%. B: 96-99%.	(1) A: 87-91%. B: 80-90%.	(1)A:90-96%. B: 94-97%.	(1) A:72-77%. B: 73-82%	(1)A:96-99%. B: 96-99%	(1) PPV A:87-91% B: 80-90% NPV A:90-96% B: 94-97%				
Influ AB Quick		Denka Seiken Co., Ltd. Japan www.denka-seiken.co.jp	A and B	Yes	(1) 2-30 degrees C, 10 months	(1) Nasal swab, nasal aspirate	(1) 15 min		Easy	Easy	(1) A: 90-93%. B: 92-93%. (15) A:55-58%. B: 63-67%	(1) A: 98-99%. B: 98-99%. (15) 100%. B: 99.6%.	(15) 91%	(15) 98%							
Quick S-Influ A/B "Seiken"		Denka Seiken Co., Ltd. Japan www.denka-seiken.co.jp	A and B	Yes	(1) 2-30 degrees C, 10 months	(1) Nasal swab, nasal aspirate	(1) 25 min	5-10 min	Easy	Easy	(1) A: 90-93%. B: 92-93%. (29)A:81% B:88%	(1) A: 98-99%. B: 98-99%. (29)A:96% B:99%									
Xpect Flu A & B	CLIA moderate	Remel Inc., Lenexa, KS, USA www.remelinc.com	A and B	Yes	(1) 2-25 degrees C, 12 months	(1) Nasal wash, Nasopharyngeal swabs, throat swabs, tracheal aspirates, sputum, bronchoalveolar wash	(1) 15 min	<1 min	Moderate	Easy	(1) A: 89-100% B: 93-100% (30) A: 92-94% B: 98%	(1) A: 100% B: 100% (30) A: 100% B: 100%	(28) A: 100%. B: 100%	(30) A: 98-99%. B: 99.7%							

Wampole Clearview Flu A/B		Fisher Scientific, USA www.fishersci.com	A and B	Yes	(1) 2-25 degrees C, 12 months	(1) Nasal wash, Nasopharyngeal swabs, throat swabs	(1) 15 min		Easy		(1) A:92% B:98%	(1) A:100% B:100%								
ZstatFlu-II test	CLIA waived	Zyme Tx, Inc., Oklahopma City, OK. www.zymetx.com	A and B	No		Throat swab	(1) 30 min		Easy	Easy	(4-7,12,23,31-32) 65-96% A:76% B: 41%	(4-5,31-32) 77-98%	(4-5,31) 59-76%	(4-5,31) 90-98%	(4-7,12,23,31) 70-96%	(4-7,12,23,31) 77-92%	(4-7,12,23,31) PPV: 898-98% NPV: 59-76%	(4-7,12,23,31) 62%	(4-7,12,23,31) 99%	
Influ-A Respi-Strip		Coris BioConcept, Belgium www.corisbio.com	A	No	(5) 4-37 degrees C, 12 months	Nasopharyngeal swabs	(5) 5-15 min		Easy	Easy	(1) A: 91%	(1) A: 86%	(1)A: 94%	(1)A: 80%						
Influ-A&B Respi-Strip		Coris BioConcept, Belgium www.corisbio.com	A and B	Yes	(1) 4-37 degrees C	Nasopharyngeal aspirates, washings or swabs	(1) 5-15 min		Easy	Easy	(1)A: 99% B: 72.2%	(1)A:88% B:100%	(1)A: 78% B: 100%	(1)A:99% B:98%						
Espline Influenza A&B-N		Fujirebio Inc., Tokyo, Japan www.fujirebio.co.jp	A and B	Yes		Nasal aspirates/ swabs, Throat swabs	(33) 15 mins				(33-34) A:85-100% B:72-91	(33-34) A/B:98-100%		(1)A:95-97% B:88-91	(1) A/B:98-100%			(1)A:85% B:72%	(1) A/B:100%	
Capila FluA,B		Tauns Co., Ltd., Japan	A and B	Yes		Nasal aspirate/swab, pharyngeal swab	(1) 15 mins		Easy		(1) A:69-94% B: 81-96%, (35) A/B:75-82%	(1) A:93-95% B: 96-99% (35) A/B:94-100%		(1) A:88-95% B: 81-96% (1) A/B:75-83%	(1) A:93-95% B: 98-99% (1) A/B:95-100%			(1) A:69% B: 91% (1) A/B:80%	(1) A:94% B: 96% (1) A/B:94%	
RapidTesta FLU AB		Daichi Pure Chemicals Co., Tokyo, Japan	A and B	Yes	(1) 2-30 degrees C, 12 months	Nasal aspirates/ swabs	(36) 10 mins				(36)A:82-83% B:80-83%	(36)A:98-99% B:98%		(1) A: 82-83% B: 80-83%	(1) A:98-99% B:98%					
SAS Influenza A Test		SA Scientific Inc, USA	A and B	Yes		Nasal wash/aspirate	(1) 30 mins		Moderate											
ImmunoCard STAT! Flu A&B		Meridian Bioscience, Inc	A and B	Yes	(1) 2-25 degrees C, 12 months	Nasal wash, Nasopharyngeal aspirate/swabs, nasal swabs	(1) 15-20 min		Easy	Easy	(1) A:83% B:100%	(1) A:98% B:100%								

(*) Details for each test included where available from manufacturer's information or published literature.

(**) CLIA: Clinical Laboratory Improvement Amendments of 1988. In the USA the Food and Drug Administration categorizes diagnostic tests as CLIA waived, moderate complexity or high complexity.

Influenza rapid test references

Product Information

1. Manufacturer's Product Information or product insert.

Binax

2. Landry ML, Cohen S, Ferguson D. Comparison of Binax NOW and Directigen for rapid detection of influenza A and B. *Journal of Clinical Virology*, 2004, 31:113–115.
3. Weinberg A and Walker M. Evaluation of three immunoassay kits for rapid detection of influenza A and B. *Clinical and Diagnostic Laboratory Immunology*, 2005, 12:367–370.

Directigen Flu A

4. Dominguez EA, Taber LH, Couch RB. Comparison of rapid diagnostic techniques for respiratory syncytial virus and influenza A virus respiratory infections in young children. *Journal of Clinical Microbiology*, 1993, 31:2286–2290.
5. Noyla DE, Clark B, O'Donnell FT et al. Comparison of a new neuraminidase detection assay with an enzyme immunoassay, immunofluorescence, and culture for rapid detection of influenza A and B viruses in nasal wash specimens. *Journal of Clinical Microbiology*, 2000, 38:1161–1165.
6. Ryan-Poirier KA, Katz JM, Webster RG, Kawaoka Y. Application of Directigen FLU-A for the detection of influenza A virus in human and nonhuman specimens. *Journal of Clinical Microbiology*, 1992, 30:1072–1075.
7. Waner JL, Todd SJ, Shalaby et al. Comparison of Directigen FLU-A with viral isolation and direct immunofluorescence for the rapid detection and identification of influenza A virus. *Journal of Clinical Microbiology*, 1991, 29:479–482.
8. Leonardi GP, Leib H, Birkhead GS, Smith C et al. Comparison of rapid detection methods for influenza A and their value in health-care management of institutionalized geriatric patients. *Journal of Clinical Microbiology*, 1994, 32:70–74.
9. Johnston SL, Bloy H. Evaluation of a rapid enzyme immunoassay for detection of influenza A virus. *Journal of Clinical Microbiology*, 1993, 31:142–143.
10. Yuen KY, Chan PKS, Peiris M et al. Clinical features and rapid viral diagnosis of human disease associated with avian influenza A H5N1 virus. *Lancet*, 1998, 351:467–471.

Directigen Flu A+B

3. Weinberg A and Walker M. Evaluation of three immunoassay kits for rapid detection of influenza A and B. *Clinical and Diagnostic Laboratory Immunology*, 2005, 12:367–370.
11. Chan KH, Maildis N, Pope W et al. Evaluation of the Directigen FluA+B test for rapid diagnosis of influenza virus type A and B infections. *Journal of Clinical Microbiology*, 2002, 40:1675–1680.
12. Hamilton MS, Abel DM, Ballam YJ, Otto MK, et al. Clinical evaluation of the ZstatFlu-II test: a chemiluminescence rapid diagnostic test for influenza virus. *Journal of Clinical Microbiology*, 2002, 40:2331–2334.
13. Ruest A, Michaud S, Deslandes S, Frost EH. Comparison of the Directigen Flu A+B test, the QuickVue Influenza test, and clinical case definition to viral culture and reverse transcription-PCR for rapid diagnosis of influenza virus infection. *Journal of Clinical Microbiology*, 2003, 41:3487–3493.
14. Cazacu AC, Greer J, Taherivand M, Demmler GJ. Comparison of lateral-flow immunoassay and enzyme immunoassay with viral culture for rapid detection of influenza virus in nasal wash specimens from children. *Journal of Clinical Microbiology*, 2003, 41:2132–2134.
15. Dunn JD, Gordon GL, Kelley C, Carroll KC. Comparison of the Denka-Seiken INFLU A-B Quick and BD Directigen Flu A+B kits with fluorescent-antibody staining and shell vial culture methods for rapid detection of influenza viruses. *Journal of Clinical Microbiology*, 2003, 41:2180–2183.
16. Landry ML and Ferguson D. Suboptimal detection of influenza virus in adults by the Directigen Flu A+B enzyme immunoassay and correlation of results with the number of antigen-positive cells detected by cytospin immunofluorescence. *Journal of Clinical Microbiology*, 2003, 41:3407–3409.

Flu OIA

17. Covalciuc KA, Webb KH, Carlson CA. Comparison of four clinical specimen types for detection of influenza A and B viruses by optical immunoassay (FLU OIA test) and cell culture methods. *Journal of Clinical Microbiology*, 1999; 37:3971–3974.
18. Boivin G, Hardy I, Kress A. Evaluation of a rapid optical immunoassay for influenza viruses (FLU OIA test) in comparison with cell culture and reverse transcription-PCR. *Journal of Clinical Microbiology*, 2001, 39:730–732.
19. Hindiyeh M, Goulding C, Morgan H et al. Evaluation of Biostar FLU OIA assay for rapid detection of influenza A and B viruses in respiratory specimens. *Journal of Clinical Virology*, 2000, 17:119–126.
20. Schultze D, Thomas Y, Wunderli W. Evaluation of an optical immunoassay for the rapid detection of influenza A and B viral antigens. *European Journal of Clinical Microbiology & Infectious Diseases*, 2001, 20:280–283.

21. Tucker SP, Cox C, Steaffens J. A flu optical immunoassay (ThermoBioStar's FLU OIA): a diagnostic tool for improved influenza management. *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences*, 2001, 356: 1915–1924.
22. Herrmann B, Larsson C, Zwegyberg BW. Simultaneous detection and typing of influenza viruses A and B by a nested reverse transcription-PCR: Comparison to virus isolation and antigen detection by immunofluorescence and optical immunoassay (FLU OIA). *Journal of Clinical Microbiology*, 2001, 39:134–138.
23. Rodriguez WJ, Schwartz RH, Thorne MM. Evaluation of diagnostic tests for influenza in a pediatric practice. *Pediatric Infectious Disease Journal*, 2002, 21:193–196.

QuickVue Influenza

13. Ruest A, Michaud S, Deslandes S, Frost EH. Comparison of the Directigen Flu A+B test, the QuickVue Influenza test, and clinical case definition to viral culture and reverse transcription-PCR for rapid diagnosis of influenza virus infection. *Journal of Clinical Microbiology* 2003, 41:3487–3493.
14. Cazacu AC, Greer J, Taherivand M, Demmler GJ. Comparison of lateral-flow immunoassay and enzyme immunoassay with viral culture for rapid detection of influenza virus in nasal wash specimens from children. *Journal of Clinical Microbiology*, 2003, 41:2132–2134.
24. Bellei N, Benfica D, Perosa AH et al. Evaluation of a rapid test (QuickVue) compared with the shell vial assay for detection of influenza virus clearance after antiviral treatment. *Journal of Virological Methods*, 2003, 109:85–88.
25. Pregliasco F, Puzelli S, Mensi C et al. Influenza virological surveillance in children: the use of the QuickVue rapid diagnostic test. *Journal of Medical Virology*, 2004, 73:269–273.

QuickVue A + B

26. Quach C, Newby D, Daoust G et al. QuickVue influenza test for rapid detection of influenza A and B viruses in a pediatric population. *Clinical and Diagnostic Laboratory Immunology*, 2002, 9:925–926.
27. Yamazaki M, Mitamura K, Kimura K et al. Clinical evaluation of an immunochromatography test for rapid diagnosis of influenza. *Kansenshogaku Zasshi* 2001, 75: 1047–1053.
28. Kawakami C, Shimizu H, Watanabe S et al. Evaluation of immunochromatography method for rapid detection of influenza A and B viruses. *Kansenshogaku Zasshi*, 2001, 75:792–799.

Denka-Seiken

15. Dunn JD, Gordon GL, Kelley C, Carroll KC. Comparison of the Denka-Seiken INFLU A-B Quick and BD Directigen Flu A+B kits with fluorescent-antibody staining and shell vial culture methods for rapid detection of influenza viruses. *Journal of Clinical Microbiology*, 2003, 41:2180–2183.

Denka-Seiken A/B

29. Fujieta T. Evaluation of new rapid influenza virus detection kit- QUICK S-INFLU A/B "SEIKEN". *Japanese Journal of Medicine & Pharmacological Science*, 2004, 51:127–130.

Xpect Flu A & B

30. Cazacu AC, Demmler GJ, Neuman MA, et al. Comparison of a new lateral-flow chromatographic membrane immunoassay to viral culture for rapid detection and differentiation of influenza A and B viruses in respiratory specimens *Journal of Clinical Microbiology*, 2004, 42:3661–3664.

ZstatFlu-II test

4. Dominguez EA, Taber LH, Couch RB. Comparison of rapid diagnostic techniques for respiratory syncytial virus and influenza virus respiratory infections in young children. *Journal of Clinical Microbiology*, 1993, 31:2286–2290.
5. Noyla DE, Clark B, O'Donnell FT et al. Comparison of a new neuraminidase detection assay with an enzyme immunoassay, immunofluorescence, and culture for rapid detection of influenza A and B viruses in nasal wash specimens. *Journal of Clinical Microbiology*, 2000, 38:1161–1165.
6. Ryan-Poirier KA, Katz JM, Webster RG, Kawaoka Y. Application of Directigen FLU-A for the detection of influenza A virus in human and nonhuman specimens. *Journal of Clinical Microbiology*, 1992, 30:1072–1075.
7. Waner JL, Todd SJ, Shalaby et al. Comparison of Directigen FLU-A with viral isolation and direct immunofluorescence for the rapid detection and identification of influenza A virus. *Journal of Clinical Microbiology*, 1991, 29:479–482.
12. Hamilton MS, Abel DM, Ballam YJ, Otto MK, et al. Clinical evaluation of the ZstatFlu-II test: a chemiluminescence rapid diagnostic test for influenza virus. *Journal of Clinical Microbiology*, 2002, 40:2331–2334.
23. Rodriguez WJ, Schwartz RH, Thorne MM. Evaluation of diagnostic tests for influenza in a pediatric practice. *Pediatric Infectious Disease Journal*, 2002, 21:193–196.
31. Noyola DE, Paredes AJ, Clark B, Demmler GJ. Evaluation of a neuraminidase detection assay for the rapid detection of influenza A and B virus in children. *Pediatric and Developmental Pathology*, 2000, 3:162–167.

32. Rawlinson WD, Waliuzzaman ZM, Fennell M et al. New point of care test is highly specific but less sensitive for influenza A and B in children and adults. *Journal of Medical Virology*, 2004, 74:127–131.

Espline

33. Mitamura K, Yamazaki M, Ichikawa M et al. Evaluation of an immunochromatography test using enzyme immunoassay for rapid detection influenza A and B viruses. *Kansenshogaku Zasshi*, 2004, 78:597–603.
34. Hara M, Takao S, Fukuda S et al. Comparison of three rapid diagnostic kits using immunochromatography for detection of influenza A viruses. *Journal of the Japanese Association for Infectious Diseases*, 2004, 78:935–942.

Capilia

35. Kubo N, Ikematsu H, Nabeshima S, et al. Evaluation of an immunochromatography test kit for rapid diagnosis of influenza. *Kansenshogaku Zasshi*, 2003, 77:1007–10014.

RapidTesta

36. Yamazaki M, Mitamura K, Ichikawa M et al. Evaluation of flow-through immunoassay for rapid detection of influenza A and B viruses. *Kansenshogaku Zasshi*, 2004, 78:865–871.