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Swine influenza (novel H1N1): algorithms and common sense

Madam,

Algorithms (derived from the name of the ninth century Arab mathematician al-Khwarizmi)[1] in infectious diseases are developed to facilitate and standardise disease management. It is a mechanical procedure for solving problems using a finite sequence of instructions, which in clinical medicine may start with case definition. Algorithms are never infallible and blind pursuit of them without taking into account overall clinical perspective or infection control implications can lead to major errors in hospital and community settings. The recent events surrounding the novel H1N1 influenza virus which puts emphasis on fever with one or more respiratory symptoms (rhinorrhoea, sore throat, cough, shortness of breath) in the case definition underlines importance of clinical judgement while using swine flu algorithms.

Fever (i.e. body temperature $>38\,^{\circ}$C) is subject to a number of biological (diurnal variation, temperature changes with menstrual cycle), clinical (hypothermia of sepsis, immunocompromised or those receiving anti-inflammatory agents or dialysis) and technical variables (mechanical problems of temperature record, aural vs armpit temperature). Moreover some diseases or conditions may lead to an elevated temperature (endocrinopathy, high environmental temperature, drugs) even in the absence of a true 'fever'.

The secondary criteria, which use a number of respiratory or systemic manifestations, can be present with or without fever in a number of other diseases [hay fever, exacerbation of chronic obstructive pulmonary diseases, cytomegalovirus, Epstein—Barr virus, parvovirus, other influenza viruses, respiratory syncytial virus (RSV), parainfluenza virus, rhinovirus, coronavirus, human metapneumovirus, enterovirus].[2–4] For example, influenza A/H1N1 2009 infections were detected in 91 (7%) of the 1385 self-sampled telephone callers to the NHS (National Health Service) Direct in Birmingham, UK.[3] Eight cases of influenza A/H3 infection and two cases of influenza B infection were detected.[3] In a previous study in 2008 from the same region, 16.2% of samples from NHS Direct callers who had influenza-like illness were found to be positive for the previous influenza viruses (H3N2 and old H1N1) and 5.6% for RSV.[4]

Bacterial infections such as Group A streptococcal pharyngitis, pneumonia due to *Streptococcus pneumoniae* and tuberculosis may also have presentations that would fulfil the case definitions. The infection control and community health implications of many of these conditions are as important as the prevention of infection caused by a novel agent.

With the inclusion of diarrhoea and vomiting or any severe life-threatening illness within the case definition, the situation has become more complicated with potential of referral coming from both acute medicine (viral gastroenteritis) as well as from cases under specialist care ('postinfectious' encephalopathy, myocarditis). The question is not whether a clinical algorithm has limitations but how it could be used prudently so as to utilise resources in the most effective way.

In the hospital environment, identification of a patient as a suspected case of swine flu often generates lot of attention because of obvious resource implication with respect to use of expensive diagnostic tests, potential for development of antiviral resistance through indiscriminate use of oseltamivir, human capital use (dedicated nursing, infection control nursing time), and consumable use [personal protective equipment (PPE)]. Rapid diagnosis is often not possible at the point of care because of centralisation of diagnostic facilities. This creates pressure on human and material

resources besides causing inconvenience to patients (staying indoors in an isolation room, visitor restriction, and potential breach of personal confidential clinical information).

In view of the above limitations of clinical algorithms and the consequences its implementation may generate, it is imperative that a rational approach is adopted with regard to resource utilisation and infection control needs. Infection control teams of most hospitals are under significant pressure to prevent nosocomial infections to patients, visitors and staff. Understandably under these circumstances it is not uncommon for a safety-first attitude to be adopted, leading to over-utilisation of available resources. Novel swine influenza should not blind us to the fact that there are many other old infections which are equally important and worthy of prevention. The latest data from the World Health Organization show that the basic reproduction rate (R_0: mean number of secondary cases a single case will cause) of the novel H1N1 influenza virus is <2 in most European countries and in the USA, which is significantly less than for many common diseases such as measles (R_0: 12−18) and mumps (R_0: 4−7).[5] Although the preventive measures to contain swine flu are justified (e.g. use of FFP3 mask for aerosol-generating procedures such as endotracheal intubation or suctioning), it is unreasonable not to take such measures for other diseases with potentially serious consequences (e.g. intubation of a patient suspected to have chickenpox or measles).

Case definitions are like diagnostic tests. Since case definitions act as a screening tool they are designed to have a high level of sensitivity at the expense of specificity. However, like other diagnostic tests the test for swine flu is likely to have a number of false-negative and false-positive results. It is important that users are aware of its limitations so that when one or more of certain symptoms are absent or additional symptoms/signs are present, the context within which the case definition is being applied is considered. If the consequence of spread of H1N1 virus is higher (inpatient, pregnancy, intubation), a higher level of caution is reasonable, and testing patients or using PPE or other infection control measures can be justified. Clinical algorithms are not tablets of stone. They are rather guide maps akin to the global positioning system. Keeping eyes and ears open is as important as the ability to read these maps.

Conflict of interest statement
None declared.

References

1. Nelson D. *The Penguin dictionary of mathematics*. 3rd ed. London: Penguin; 2003.
2. Zambon MC, Stockton JD, Clewley JP, Fleming DM. Contribution of influenza and respiratory syncytial virus to community cases of influenza-like illness: an observational study. *Lancet* 2001;**358**:1410−1416.
3. Elliot AJ, Powers C, Thornton A, *et al*. Monitoring the emergence of community transmission of influenza A/H1N1 2009 in England: a cross sectional opportunistic survey of self sampled telephone callers to NHS Direct. *Br Med J* 2009;**339**:b3403.
4. Cooper DL, Smith GE, Chinemana F, *et al*. Linking syndromic surveillance with virological self-sampling. *Epidemiol Infect* 2008;**136**:222−224.
5. World Health Organization. Mathematical modelling of the pandemic H1N1 2009. *Weekly Epidemiol Rec* 2009;**84**: 341−352.

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H1N1 2009 influenza among healthcare workers in a tertiary care hospital in Thailand

Madam,

During April 2009, a novel influenza A (H1N1) virus was detected in California and was subsequently recognised to be the cause of a major outbreak in Mexico and worldwide.[1,2] In Thailand, the influenza outbreak began in June 2009, in parallel with the decision of the World Health Organization to raise the pandemic to the highest level. This posed many medical challenges, especially to healthcare workers (HCWs) who are at high risk. We aim to describe findings in HCWs who had H1N1 2009 influenza during the early epidemic in Thailand.