Evaluation of triage methods used to select patients with suspected pandemic influenza for hospital admission

Evaluation of triage methods used to select patients with suspected pandemic influenza for hospital admission: cohort study

S Goodacre,[1]* K Challen,[1,2] R Wilson[1] and M Campbell[1]

[1]School of Health and Related Research, University of Sheffield, Sheffield, UK
[2]University Hospital of South Manchester, Manchester, UK

*Corresponding author

Executive summary

Health Technology Assessment 2010; Vol. 14: No. 46
DOI: 10.3310/hta14460-03

Health Technology Assessment
NIHR HTA programme
www.hta.ac.uk

Executive summary

Background

The UK influenza pandemic contingency plan published in 2007 predicted around 750,000 excess emergency department attendances and 82,500 excess hospitalisations during a pandemic. Clinicians working in the emergency department need a rapid and reliable method for determining each patient's risk of adverse outcome. Prior to the emergence of the 2009 H1N1 pandemic, Health Protection Agency (HPA) guidance, supported by the British Thoracic Society and British Infection Society, recommended the use of the CURB-65 (a risk prediction score for pneumonia, based on confusion, urea level, respiratory rate, blood pressure and age over 65 years) pneumonia score for adults. Department of Health guidelines on surge capacity in a pandemic also considered use of a physiological–social score [Pandemic Modified Early Warning Score (PMEWS)] for adults. National guidance produced in response to the emergence of H1N1 influenza included a new swine flu hospital pathway for emergency department management with seven criteria based upon a Community Assessment Tool (CAT) for adults and children. These potential triage methods have not been widely validated and, in particular, have not been tested in the setting of pandemic influenza.

Objectives

We aimed to use the initial waves of the 2009 H1N1 pandemic to evaluate existing emergency department triage methods for predicting severe illness or death in patients presenting with suspected pandemic influenza, and to determine whether an improved triage method could be developed. Our specific objectives were to determine:

1. the discriminant value of the CURB-65 score, PMEWS and the swine flu hospital pathway for predicting severe illness or death in adults presenting with suspected pandemic influenza and the discriminant value of the swine flu hospital pathway for predicting severe illness or death in children
2. the independent predictive value of presenting clinical characteristics and routine tests for severe illness or death in patients presenting with suspected pandemic influenza
3. whether the discriminant value of emergency department triage can be improved by developing two new triage methods based upon (1) presenting clinical characteristics alone and (2) presenting clinical characteristics, electrocardiogram, chest radiograph and routine blood test results.

Methods

We undertook a prospective cohort study of patients presenting to the emergency department of four hospitals with suspected pandemic influenza during the second wave of the 2009 H1N1 pandemic. Emergency department staff identified patients with suspected pandemic influenza and then completed a standardised assessment form that included the elements of the CURB-65 score, PMEWS, the swine flu hospital pathway and any other measures that could be routinely recorded in the emergency department.

Outcome assessment was based on researcher review of hospital computer records and case notes. Patients who died or required respiratory, cardiovascular or renal support during the 30-day follow-up were defined as having a poor outcome. Patients who survived to 30 days without requiring respiratory, cardiovascular or renal support were defined as having a good outcome. We also recorded whether they were treated with antiviral agents or antibiotics, and the length and location of any hospital stay.

We planned to assess CURB-65, PMEWS and the swine flu clinical pathway by calculating the area under the receiver–operator characteristic curve (*C*-statistic) for discriminating between cases with and without a poor outcome. We also planned to use multivariable logistic regression to determine the independent predictive value of presenting clinical characteristics and routine tests and to develop two new triage scores: one based on

initial assessment only and the other based on all emergency department data.

Results

The 2009 H1N1 pandemic was much smaller and less severe than predicted. Data were collected and analysed from 481 cases across three hospitals in the second wave of the pandemic. Most of the cases were children, with 347 out of 481 (72%) aged 16 years or less. There were only five poor outcomes according to our definition: two deaths and three survivors who required respiratory support. We therefore lacked sufficient data to determine the independent predictive value of presenting clinical characteristics and routine tests or develop any new triage methods.

The five patients with poor outcomes had CURB-65 scores of zero, one (three cases) and two, and PMEWS scores of one, five, six, seven and eight. The swine flu hospital pathway was positive in three out of five cases. The *C*-statistic for each method was CURB-65 0.78 [95% confidence interval (CI) 0.58 to 0.99], PMEWS 0.77 (0.55 to 0.99) and the swine flu hospital pathway 0.70 (0.45 to 0.96).

Patients with a higher CURB-65 score were more likely to be admitted ($p < 0.001$): 25 out of 101 (25%) with a score of zero, 11 out of 24 (46%) with a score of one, 7 out of 8 (88%) with a score of two, and the patient with a score of three were admitted. Admitted patients had a higher mean PMEWS score (4.6 vs 2.0, $p < 0.001$). The *C*-statistics for CURB-65, PMEWS and the swine flu hospital pathway in adults in terms of discriminating between those admitted and discharged were 0.65 (95% CI 0.54 to 0.76), 0.76 (95% CI 0.66 to 0.86) and 0.62 (95% CI 0.51 to 0.72) respectively.

Conclusions

We can draw no reliable conclusions from the data available other than raise potential concerns about the use of existing triage methods for patients with suspected pandemic influenza. Our very limited data suggest these methods may fail to discriminate between patients who will have an adverse outcome and those with a benign course. Furthermore, clinicians in our study did not generally appear to admit or discharge on the basis of these tools, despite being recommended for use in the pandemic.

Implications for practice

In the absence of evidence for the use of these triage tools, emergency department clinicians should continue to base triage decisions for patients with suspected pandemic influenza upon their clinical judgement.

Recommendations for research

Further research is required to evaluate existing triage tools and develop new triage methods for suspected pandemic influenza. This may require evaluation in surrogate conditions, such as pneumonia or seasonal influenza. Research is also required to determine the feasibility and acceptability to patients of undertaking research during a pandemic using confidential patient information without consent.

Publication

Goodacre S, Challen, K, Wilson R, Campbell M. Evaluation of triage methods used to select patients with suspected pandemic influenza for hospital admission: cohort study. *Health Technol Assess* 2010;**14**(46):173–236.

How to obtain copies of this and other HTA programme reports
An electronic version of this title, in Adobe Acrobat format, is available for downloading free of charge for personal use from the HTA website (www.hta.ac.uk). A fully searchable DVD is also available (see below).

Printed copies of HTA journal series issues cost £20 each (post and packing free in the UK) to both public **and** private sector purchasers from our despatch agents.

Non-UK purchasers will have to pay a small fee for post and packing. For European countries the cost is £2 per issue and for the rest of the world £3 per issue.

How to order:

– fax (with **credit card details**)
– post (with **credit card details** or **cheque**)
– phone during office hours (**credit card** only).

Additionally the HTA website allows you to either print out your order or download a blank order form.

Contact details are as follows:

Synergie UK (HTA Department)
Digital House, The Loddon Centre
Wade Road
Basingstoke
Hants RG24 8QW

Email: orders@hta.ac.uk

Tel: 0845 812 4000 – ask for 'HTA Payment Services' (out-of-hours answer-phone service)

Fax: 0845 812 4001 – put 'HTA Order' on the fax header

Payment methods

Paying by cheque
If you pay by cheque, the cheque must be in **pounds sterling**, made payable to *University of Southampton* and drawn on a bank with a UK address.

Paying by credit card
You can order using your credit card by phone, fax or post.

Subscriptions

NHS libraries can subscribe free of charge. Public libraries can subscribe at a reduced cost of £100 for each volume (normally comprising 40–50 titles). The commercial subscription rate is £400 per volume (addresses within the UK) and £600 per volume (addresses outside the UK). Please see our website for details. Subscriptions can be purchased only for the current or forthcoming volume.

How do I get a copy of *HTA on DVD*?

Please use the form on the HTA website (www.hta.ac.uk/htacd/index.shtml). *HTA on DVD* is currently free of charge worldwide.

The website also provides information about the HTA programme and lists the membership of the various committees.

The National Institute for Health Research

The National Institute for Health Research (NIHR) has been established as a part of the Government's strategy, 'Best Research for Best Health'. It provides the framework through which the research staff and research infrastructure of the NHS in England is positioned, maintained and managed as a national research facility.

The NIHR provides the NHS with the support it needs to conduct first-class research funded by the Government and its partners alongside high-quality patient care, education and training. Its aim is to support outstanding individuals (both leaders and collaborators), working in world-class facilities (both NHS and university), conducting leading-edge research focused on the needs of patients.

This themed issue of the *Health Technology Assessment* journal series contains a collection of research commissioned by the NIHR as part of the Department of Health's (DH) response to the H1N1 swine flu pandemic. The NIHR through the NIHR Evaluation Trials and Studies Coordinating Centre (NETSCC) commissioned a number of research projects looking into the treatment and management of H1N1 influenza.

NETSCC managed the pandemic flu research over a very short timescale in two ways. Firstly, it responded to urgent national research priority areas identified by the Scientific Advisory Group in Emergencies (SAGE). Secondly, a call for research proposals to inform policy and patient care in the current influenza pandemic was issued in June 2009. All research proposals went through a process of academic peer review by clinicians and methodologists as well as being reviewed by a specially convened NIHR Flu Commissioning Board.

The final reports from these projects have been peer reviewed by a number of independent expert referees before publication in this journal series.

Criteria for inclusion in the HTA journal series

Reports are published in the HTA journal series if (1) they have resulted from work for the HTA programme, and (2) they are of a sufficiently high scientific quality as assessed by the referees and editors.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search, appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

The research reports in this themed issue were funded through the Cochrane Collaboration; the Health Services Research programme (HSR); the Health Technology Assessment programme (HTA); the Policy Research Programme (PRP); the Public Health Research programme (PHR); and the Service Delivery and Organisation Programme (SDO).

The Cochrane Collaboration is an international not-for-profit and independent organisation, dedicated to making up-to-date, accurate information about the effects of health care readily available worldwide. It produces and disseminates systematic reviews of health-care interventions and promotes the search for evidence in the form of clinical trials and other studies of interventions. Cochrane reviews and the Cochrane Central Register of Controlled Trials are published and updated in *The Cochrane Library* (www.cochranelibrary.com).

The HSR programme aims to lead to an increase in service quality and patient safety through better ways of planning and providing health services. It funds both primary research and evidence syntheses, depending on the availability of existing research and the most appropriate way of responding to important knowledge gaps.

The HTA programme produces high-quality research information on the effectiveness, costs and broader impact of health technologies for those who use, manage and provide care in the NHS. 'Health technologies' are broadly defined as all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care.

The PRP provides the evidence base for policy development on public health and social care issues. It funds research in three main ways: 5-year programmes of research in 16 research units, a primary-care research centre, a public health research consortium, and a surveillance unit; programmes of interlinked studies on key policy initiatives; and single projects and literature reviews.

The PHR programme evaluates public health interventions, providing new knowledge on the benefits, costs, acceptability and wider impacts of non-NHS interventions intended to improve the health of the public and reduce inequalities in health. The scope of the programme is multi-disciplinary and broad, covering a range of interventions that improve public health.

The SDO programme commissions research evidence that improves practice in relation to the organisation and delivery of health care. It also builds research capability and capacity amongst those who manage, organise and deliver services – improving their understanding of the research literature and how to use research evidence.

The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report. The views expressed in this publication are those of the authors and not necessarily those of the NIHR or the Department of Health.

ISSN 1366-5278

Published by Prepress Projects Ltd, Perth, Scotland (www.prepress-projects.co.uk), on behalf of NETSCC, HTA.