

# A proposed Primary Health Early Warning Score (PHEWS) with emphasis on early detection of sepsis in the elderly

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## ABSTRACT

There are several secondary care early warning scores which alert for severe illness including sepsis. None are specifically adjusted for primary care. A Primary Health Early Warning Score (PHEWS) is proposed which incorporates practical parameters from both secondary and primary care.

**KEYWORDS:** Emergency medical services; acute care; sepsis; early intervention

## Introduction

Many early warning scores (EWS) have been created to help clinicians recognise very ill adults who present to emergency departments or deteriorate in hospital beds. Currently however, there is no generic primary health EWS directed to help primary care workers.

In the UK, the Royal College of Physicians assessed 33 differing hospital EWS scores and created the National Early Warning Score (NEWS)<sup>1</sup> for standardized use in NHS hospitals. In New Zealand the Physiologically Unstable Patient (PUP) score<sup>2</sup> is a similar secondary care tool used in some hospitals. The Systemic Inflammatory Response Syndrome (SIRS) score<sup>3</sup> is a tool for assessing septic shock in emergency departments. The CRB65 score<sup>4</sup> is used to assess the severity and management of community pneumonia. The UK Sepsis Trust General Practice Toolkit<sup>5</sup> advises General Practitioners (GPs) on the identification of SIRS and Sepsis, and uses NEWS measures for the assessment of severe sepsis.

GPs and community nurses are daily faced with adult patients who could be in the earliest stages of an illness. There can be vague, non-specific symptoms and signs which progress into serious consequences when patients are out of sight for

a few days. Our oldest patients, who may have multiple morbidities and a reduced immune response, have the highest risk of misdiagnosis in serious illness (often infection). Unlike hospital clinicians, primary care clinicians do not have rapid access to urgent blood tests and diagnostic procedures. We are not equipped to undertake continuing measurements for a prolonged length of time and must rely on clinical assessment, background information, and sometimes intuition to determine whether patients should be admitted to hospital urgently. Our questions include: Who can we handle safely? Is this the early presentation of a serious illness? Do we have the time and facilities to investigate the illness or do we need to send the patient to hospital?

## PHEWS

An ideal primary healthcare early warning score (PHEWS) (Table 1) would be simple and make use of the same physiological measurements of illness used in a secondary care EWS, discarding measures that are impractical in the community setting. It would incorporate the validated CRB65 score measurements. It would use our advantages of prior continuity of care and known health data from practice medical records to weight additional red flag factors. It needs to score for red flag symptoms that are early and

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insidious because this is how the elderly, especially, may present. It would not be needed for the many acute presentations that our clinical judgement is capable of dealing with, but would act as a reference and safety net when we are struggling with the above questions.

### Physiological measurements

Both NEWS and PUP highlight extreme measurement scores that are so outside the normal that any one of them merits urgent action. These scores would also apply to most adults in the community with the rare exception of some parameters in the clinically very fit and the very anxious.

NEWS provides most of the physiological measurements in my proposed PHEWS but I have changed the respiratory rate spread and extreme score to correlate with CRB65. I removed the extreme score for a systolic BP > 220 mmHg, because an isolated reading of  $\geq 220$  mmHg no longer requires automatic admission to hospital in well looking patients. Also the extra loading two point score applied in NEWS for a patient already

on oxygen would not apply in a community assessment because if we are administering oxygen we are usually also arranging hospital admission.

NEWS mentions that O<sup>2</sup> saturation is often physiologically irrelevant in patient's with severe chronic respiratory disease, where they suggest saturations of 88–92% could be a patient's normal. Competent decision makers may 'reset' the score if they consider < 92% as being not as severe as it seems. Who could be more competent than patients' own GPs? The NEWS working group declined to include parameters like age, co-morbidities, immunosuppression and the presence of confusion. They felt that their physiological parameters were so generic for illness that they would reflect these factors. From the primary care perspective, I disagree. These factors must be included in a PHEWS.

### Red flag background data suggested for inclusion

1. You know or do not know the patient from previous medical contact and/or there are

Table 1. PHEWS: Primary Healthcare Early Warning System

Measurements	3	2	1	0	1	2	3
<b>Respiratory Rate</b>	$\leq 8$		9–11	12–20	21–25	26–29	$\geq 30$
<b>Temperature</b>	$\leq 35.0$		35.5–36.0	36.1–38.0	38.1–39.0	$\geq 39.1$	
<b>Systolic BP</b>	$\leq 90$	91–100	101–110	111–220			
<b>Heart Rate</b>	$\leq 40$		41–50	51–90	91110	111130	$\geq 131$
<b>O<sup>2</sup> Sat</b>	$\leq 91\%$	92–93%	94–95%	$\geq 96\%$			
<b>Level of consciousness</b>				A			V P U
<b>Red flag background data</b>		<b>0</b>	<b>1</b>	<b>2</b>			
<b>Continuity or Notes</b>		Yes to either	No to either				
<b>Age</b>		< 65	65–80	> 80			
<b>Morbidities</b>		0–1	2–4	> 4			
<b>Immunosuppressants</b>		No	Yes				
<b>Family support</b>		Yes	No				
<b>Red flag symptoms</b>		<b>0</b>	<b>1</b>				
<b>New confusion</b>		No	Yes				
<b>Diarrhoea with or without vomiting</b>		No	Yes				

Level of consciousness = Alert; Responds to Voice; responds to Pain; Unconscious.

The score does not apply to pregnant women or people aged < 16 years.

O<sup>2</sup> sats may not be reliable in severe CORD unless the previous baseline is known.

good patient notes, or there are no relevant notes.

2. Patient age is < 65, ≥ 65–80, or > 80 years.
3. There are 0–1, 2–4, or > 4 major morbidities.
4. The patient is or is not taking immuno-suppressant drugs.
5. Family support is good or poor, in respect to home treatment and monitoring.

### Red flag patient presenting symptoms suggested for inclusion

1. Diarrhoea (with or without vomiting).
2. New confusion or an increase in previous confusion.

### Rationale for the additional community scores

Casual, unknown patients can be dangerous patients. Personal knowledge of patients is immensely helpful in knowing when they look ill. Continuity of care is one of the prime features of quality in general practice.<sup>6</sup> This, together with the health data in good practice notes, is the major assessment advantage GPs and rural nurses possess over A+E, hospital, or Emergency Department (ED) doctors.

The weighting for an age score is somewhat arbitrary, but a recent paper confirmed increased prognostic value for death from sepsis in older patients using an age adjusted NEWS.<sup>7</sup> Increasing age with associated decreasing immune responses contributes to worse outcomes in serious illness, including sepsis.<sup>8,9</sup> Weighting for the number of morbidities can be argued, but multiple major morbidities (diabetes, cardiovascular, respiratory, and renal impairment, etc) are associated with worse outcomes.<sup>10</sup> The CRB65 score specifically relates to pneumonia whereas PHEWS is aimed at all illness in the community.

A modified CRB65 score has shown extended prognostic accuracy with the addition of O<sub>2</sub> saturation measures and five chronic disease conditions.<sup>11</sup> In a hospital ED, influenza presentations were assessed for pneumonia risk by an EWS plus age > 65, morbidities including immunosuppression,

social isolation, and functional capacity. This assessment proved more predictive than CRB65 for hospital admissions but not for mortality.<sup>12</sup> This modified pandemic EWS was recommended for community use in influenza outbreaks. Increasing numbers of patients now take immunosuppressant drugs such as prednisone, methotrexate, and some of the \*\*\*umabs and \*\*\*imabs. In the absence of a quick blood count, PHEWS factors in the extra risk of severe outcomes in patients on immunosuppressants.

Family or community support has to be included because hospital admissions are indicated if there is poor home or rest home support. We cannot manage patients without sensible communication systems, reliable illness monitoring, and treatment compliance.

Diarrhoea can be the most insidious of red flag symptoms presenting in early community sepsis, especially in the elderly. Up to 8% of cases of pneumococcal septicaemia can present this way.<sup>13</sup> There are multiple non-gastroenteritic infectious illnesses where diarrhoea is a non-specific presenting symptom.<sup>14</sup>

I have been deceived by the presenting complaint of mild diarrhoea without any vomiting in two fatal cases of sepsis, and I firmly believe this is easier to misconstrue than acute vomiting with diarrhoea. My patients' physiological measurement scores were '1' and probably '2', respectively. Applying the proposed red flag background data would have provided the necessary safety net for them both.

It is well known that a recent onset or increase in confusion can be a classic sign of sepsis, especially in the elderly who may also be afebrile.<sup>15</sup>

### The PHEWS score

If there is a single 3-point severe score in any of the measurements or an aggregated score of 3 or more, then hospital admission is indicated.

If there are 2 points in measurements, ≥ 1 point in Symptoms, and ≥ 2 points in Background Data then hospital admission is indicated.

If there is 1 point in Measurements,  $\geq 1$  point in Symptoms, and  $\geq 4$  points in Background Data then hospital admission is urged unless mandatory rapid blood tests and very close monitoring with follow up are possible.

### Validity and weighting of PHEWS

PHEWS physiological measurements have been validated in existing clinical EWS scores. The Septic Toolkit reports that unpublished data of hospital presentations with a NEWS score of 3 or more, diagnosed 94% of severe sepsis. Some UK GPs are evaluating NEWS, presumably in its original form. I hope that a working PHEWS would help diagnose 100% of sepsis patients. It should not over-predict illness and send every elderly patient to hospital. It would need to be trialled in primary care settings to validate the community red flag scores and confirm the appropriate trigger levels needed for secondary care referral.

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