

Health Service Research

## NEWS2 to assess suspected COVID-19 in the community: a service evaluation of a primary care assessment centre

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### Abstract

**Background:** Primary care has played a central role in the community response to the coronavirus disease-19 (COVID-19) pandemic. The use of the National Early Warning Score 2 (NEWS2) has been advocated as a tool to guide escalation decisions in the community. The performance of this tool applied in this context is unclear.

**Aim:** To evaluate the process of escalation of care to the hospital within a primary care assessment centre (PCAC) designed to assess patients with suspected COVID-19 in the community.

**Design and setting:** A retrospective service evaluation of all adult patients assessed between 30 March and 22 April 2020 within a COVID-19 primary care assessment centre within Sandwell West Birmingham CCG.

**Method:** A database of patient demographics, healthcare interactions and physiological observations was constructed. NEWS2 and CRB65 scores were calculated retrospectively. The proportion of patients escalated was within risk groups defined by NHSE guidelines in place during the evaluation period was determined.

**Results:** A total of 150 patients were identified. Following assessment 13.3% ( $n = 20$ ) patients were deemed to require escalation. The proportion of patients escalated with a NEWS2 greater than or equal to 3 was 46.9% (95% CI 30.8–63.6%). The proportion of patients escalated to secondary care using NHSE defined risk thresholds was 0% in the green group, 22% ( $n = 4$ ) in the amber group, and 81.3% ( $n = 13$ ) in the red group.

**Conclusion:** Clinical decisions to escalate care to the hospital did not follow initial guidance written for the COVID-19 outbreak but were demonstrated to be safe.

### Lay Summary

In most cases, coronavirus disease-19 (COVID-19) is a mild illness that resolves on its own. Some patients develop severe disease requiring hospital treatment. Identifying which patients are likely to need hospital treatment is a challenge. Many GP practices have developed specific services designed to assess patients with suspected COVID-19 and establish whether hospital treatment is necessary. We evaluated a service providing this function in Birmingham. We examined the care pathway of 150 patients assessed within the service to established factors associated with the need for hospital assessment. We found a national decision tool designed to aid the process was a poor descriptor of what happened in practice.

## Key Messages

Remote assessment is effective in triaging patients with suspected COVID-19.  
The majority of patients assessed in primary care can be managed safely in the community.  
NEWS2 may be useful for risk stratification.

**Key words:** Community medicine, COVID-19, Early Warning Scores, emergency medicine/urgent care, MeSH headings, primary care, primary health care, respiratory diseases, risk assessment, telemedicine.

## Introduction

The emergence of coronavirus disease-19 (COVID-19) has necessitated a large-scale reorganization of existing acute care pathways. COVID-19 has a wide spectrum of severity, in the vast majority of cases infection results in a self-limiting illness that can be managed in the community without specific medical intervention, however, the need for escalated treatment in hospital is associated with a significant increase in mortality. (1,2). The risk of adverse outcomes is not equally distributed across the population; age, gender, ethnicity and social deprivation are known to be important prognostic factors (3).

Our understanding of COVID-19 is, for the most part, derived from studies focussed on hospitalized patients, however, for the majority of patients, COVID-19 can be managed entirely in the community. Developing strategies to identify patients at risk of deterioration and escalate care appropriately is pivotal to optimizing COVID care pathways. Primary care has rapidly implemented novel models of care to facilitate risk stratification. These new care models have needed to accommodate stringent infection control measures, limited access to personal protective equipment and viral testing capability and incorporate a degree of redundancy in relation to workforce planning. The traditional face-to-face consultations have been replaced by remote triage wherever possible (4). Guidance regarding the provision of face-to-face consultations in the context of suspected or confirmed COVID-19 has been provided by NHS England (NHSE) (5). A common approach designed to deliver face-to-face assessments in patients with a high clinical probability of COVID-19 has been to create designated hubs, allowing multiple practices to centralize direct consultations in one location.

The decision to escalate to hospital care in the presence of suspected COVID-19 can be challenging. Clinical assessment occurs at a fixed point in a dynamic illness and anticipating the likely trajectory is difficult. Tools designed to aid risk stratification of community-acquired pneumonia such as the CRB65 score are not validated in populations where the prevalence of COVID-19 is high (6).

NHSE have created a coronavirus assessment tool to guide decisions to escalate care within the primary care and emergency department (ED) setting (7). The tool uses the National Early Warning Score 2 (NEWS2) developed by the Royal College of Physicians to identify patients at risk of deterioration (8). NEWS2 combines six physiological variables: respiratory rate, oxygen saturation, temperature, systolic blood pressure, heart rate and level of consciousness; each scored between zero and three. The need for supplemental oxygen requires the addition of two points. Individual scores are summed to provide an aggregate score, with higher scores associated with increased severity of physiological derangement (8). The NHSE guidelines recommend escalation of care from the community to the hospital in patients with suspected COVID-19 and a NEWS2 of 3 or greater.

The NHSE tool defines three risk groups based on peripheral oxygen saturations, NEWS2 and the severity of dyspnoea, green (low risk, NEWS2 < 3, saturations  $\geq$  95%), amber (medium risk, NEWS2 3 or 4, saturations 93% or 94%) and red (high risk, marked dyspnoea, NEWS2  $\geq$  5, saturations  $\leq$  92%) to aid assessment in the ED. The guidelines recommend inpatient admission for patients in the red risk group. The decision to admit to the amber group should be based on a full assessment by a senior clinician suggesting equipoise in this group. The predictive performance and calibration of the tool are unclear. While the use of NEWS2 is well evidenced in the hospital setting its utility in the community setting is not well understood (9).

The Sandwell and West Birmingham Primary Care Assessment Centres (PCAC) were developed to provide enhanced triage and face-to-face consultations to patients with suspected COVID-19. The service was accessed after remote triage and referral by the patients' usual general practitioner.

An evaluation of the services was performed in order to better define the nature of the work undertaken, the processes employed and the associated outcomes. A specific objective of the evaluation was to evaluate the relationship between NEWS2 recorded during the face-to-face assessment and the decision to escalate care from the community to the hospital.

## Methods

A service evaluation was undertaken of all patients from Sandwell and West Birmingham CCG assessed between 30 March 2020 and 22 April 2020. Patients aged 16 years or under were excluded from the analysis.

Patients were referred to the PCAC by their usual GP. The PCAC was designed to facilitate the assessment of patients with suspected COVID-19, where uncertainty existed regarding the diagnosis or the need for escalation of care. The PCAC provided a central location at which clinical examination could take place with the necessary personal protective equipment and physiological observations could be recorded to aid risk stratification. Following referral, a clinician located within the PCAC undertook a second telephone triage. Based on the outcome of this triage, a face-to-face or video assessment was arranged. For patients deemed too unwell or unable to attend the clinic, an onward referral was made to a home visiting service or patients were escalated directly to secondary care. The Public Health England case definition was used to define cases of probable COVID-19 (10).

A database was constructed to record basic demographic, relevant comorbidity and recent healthcare interactions for prospective data collection. Physiological observations were recorded for all patients assessed face to face. The observations were used to calculate a NEWS2 retrospectively (8). For the purposes of NEWS2

calculation, all patients were assumed not to have hypercapnic respiratory failure. The NEWS2 was not routinely calculated contemporaneously to influence escalation decisions. The proportion of patients within each risk group escalated to the hospital following face-to-face assessment was determined. An NHSE risk category could not be assigned to the group assessed remotely as physiological observations were not obtained. In patients without a full set of physiological observations, the peripheral oxygen saturations were used to assign a risk group in patients where the NEWS2 from available observations was  $\leq 3$ .

For the purposes of evaluating the utility of existing primary care respiratory infection tools, a CRB65 score was calculated retrospectively. A CRB-65 score is a validated tool that can be used to risk-stratify community-acquired pneumonia (7). The score awards one-point each to new confusion, a respiratory rate of 30 breaths a minute or greater, a systolic blood pressure of 90 mmHg or less or diastolic blood pressure of less than 60 mmHg and age over 65 years. A score of 1 or greater defines a group at increased risk of death in whom escalation to the hospital is recommended. The CRB-65 was not used routinely used in contemporaneous clinical decision making. The immediate disposition and subsequent healthcare interactions were recorded. Mortality and the need for delayed escalation of care were determined at 14 days after contact with the service. Outcomes were assessed by directly accessing the primary care record. Complete 14 days follow up was achieved.

### Statistical analysis

For continuous variables, mean and standard deviation are reported for normally distributed data and median and interquartile range for non-normally distributed. Discrete variables are reported as absolute counts and proportions. Non-normally distributed data is compared using the Mann–Whitney *U* test. *P*-values are provided for the purposes of intra-group comparisons rather than general inference. Statistical analysis was performed using the R statistical package.

### Ethical approval

The project registered as a service evaluation with Sandwell and West Birmingham Clinical Commissioning Group. Formal ethical approval was deemed not to be required.

## Results

### Patients

The PCAC received referrals from 72 general practices. A total of 150 patient contacts were undertaken between 30 March and 22 April. The median age of participants was 44 [interquartile range (IQR) 35.3–53.0]. Of those that accessed the service, 74.0% ( $n = 99$ ) were female. The majority of patients referred to the service were from the Black, Asian or Minority Ethnic (BAME) community (79.3%,  $n = 119$ ). The mortality at 14 days was 2.0% ( $n = 3$ , 95% CI 3.6–4.7). A table of demographic characteristics of the cohort is provided in Table 1. Two patients died following face-to-face assessments, both patients were in the red risk group with NEWS2  $>7$ . Care was escalated following an assessment in both cases. One patient died following a remote assessment, the patient was deemed safe to be managed at home and provided safety netting advice. The patient called an Ambulance 8 hours after the initial assessment.

The median duration of symptoms prior to the initial assessment was 11.0 days (IQR 7.0–18.0). The most common isolated symptom reported was cough (65.3%,  $n = 98$ ). The majority of patients, 84.0% ( $n = 126$ ) had multiple symptoms consisting of either a cough, shortness of breath or fever. The frequency of individual symptoms and the co-occurrence of symptoms are shown in Figure 1.

The case definition of probable COVID-19 as defined by Public Health England criteria in place during the study period was met by 78.0% ( $n = 117$ , 95% CI 77.2–89.0) of the patients assessed (8).

The most common reported co-morbidity was asthma, present in 22.0% ( $n = 33$ , 95% CI 16.1–29.3). Type 2 diabetes was reported in 19.3% ( $n = 29$ , 95% CI 13.8–29.3) of patients.

### Process of care

The PCAC undertook a face-to-face assessment in 60.0% ( $n = 90$ ) of referrals from patients' usual GP and undertook assessment by phone or video in the remaining 40.0% ( $n = 60$ ). Following assessment 13.3% ( $n = 19$ , 95% CI 8.3–18.9) were recommended for escalation to secondary care with suspected COVID-19, this included 20.0% ( $n = 17$ , 95% CI 12.1–28.1) of patients assessed face-to-face and 3.3% ( $n = 2$ , 95% CI 0.9–11.4) assessed remotely. Three patients were recommended to attend the hospital for further assessment but declined, of these patients, one patient self-presented to the

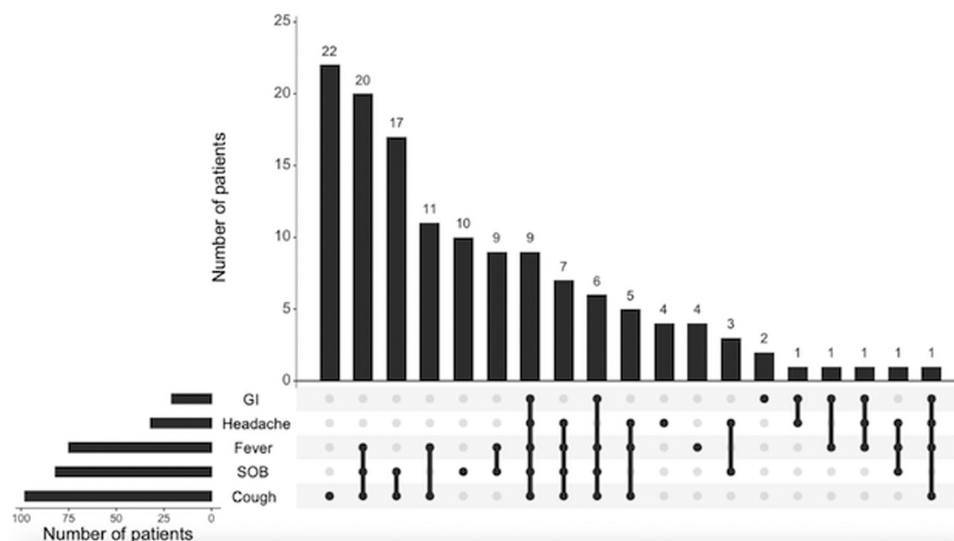


Figure 1. Upset plot showing symptom profile of all 150 patients assessed within the primary care assessment centre (2020).

emergency department (ED) a short time later. Of the patients escalated to secondary care, 95.0% ( $n = 18$ , 95% CI 76.4–99.7) required medical admission following an assessment in the ED.

Following an assessment in the PCAC, 9.4% ( $n = 12$ , 95% CI 5.4–15.4) of patients self-presented to the ED after an initial decision to manage in the community, three were given a discharge diagnosis of COVID-19 and the remainder had a non-COVID-19 related diagnosis documented at discharge. None of these patients required in-patient admission following an assessment in the ED. A number of patients, 3.3% ( $n = 5$ ) re-attended the PCAC or contacted 111 (3.3%,  $n = 5$ , 95% CI 1.4–7.6) for review of un-resolving symptoms.

## Observations

A full set of physiological observations were recorded in the majority of patients (91.0%,  $n = 82$ ) attending for a face-to-face assessment. Six patients had single missing values (four patients' blood pressure and two patients respiratory rate). One patient had two missing values (blood pressure and respiratory rate) and one patient had three missing variables. All could be assigned an NHSE risk group based on the available observations. When classified using the NHSE thresholds, 62.9% ( $n = 56$ ) of patients were categorized as green, 20.0% ( $n = 18$ ) as amber and 17.8% ( $n = 16$ ) as red. The median NEWS2 of patients referred to secondary care was 6.5 (IQR 5–7) compared with 1 (IQR 0–2) in patients managed in the community ( $P$  value < 0.001). The proportion of patients escalated to secondary care using NHSE defined risk thresholds was 0% in the green group, 22% ( $n = 4$ ) in the amber group, and 81.3% ( $n = 13$ ) in the red group. The proportion of patients escalated with a NEWS2 greater than or equal to 3 was 46.9 (95% CI 30.8–63.6). The disposition of patients in relation to NHSE escalation guidance is shown in Figure 2.

The median peripheral oxygen saturations were 98% (IQR 96–98%). Peripheral oxygen saturations were significantly lower in those referred to secondary care as compared to those managed in the community, 93% (IQR 92–96%) compared with 98% (IQR 97–98%,  $P$  value < 0.001). The median CRB65 score in the cohort was 0. There was no statistical difference in CRB65 score between patients referred to a hospital or managed in the community.

## Discussion

We provide the first description of a primary care assessment centre designed to assess patients face-to-face following initial triage and referral by their usual GP. The service was designed to meet anticipated

increases in demand during the first phase of the viral outbreak. The majority of patients assessed had symptoms consistent with the case definition for COVID-19 in place during the evaluation period (10). The observed mortality in the cohort was 2%, this is higher than estimates of mortality derived from population-level studies of primary care electronic health record data and significantly lower than estimates of mortality in hospitalized patients (1,2).

The median duration between assessment and symptom onset was 11 days. This time point is typically associated with the peak of illness severity in hospitalized patients (1). Guidelines in place during the evaluation period recommended patients with a NEWS2 of 3 or above should be referred for assessment in the hospital (6). Less than half of patients meeting this criterion were escalated following assessment. No patients within the low-risk group defined by NHSE were deemed to require immediate escalation of care to the hospital. There were no reported deaths in this group. This provides a degree of reassurance that community treatment in this group is safe. GPs operating in the PCAC had a higher threshold for admission and tolerated a greater degree of a physiological disturbance than recommended by national guidance in place at the time. Most patients within the amber risk group were managed in the community without the need for immediate radiological and laboratory investigations available in the ED.

## Strengths and limitations

Our evaluation provides a summary of the process and outcomes associated with a novel service designed in unparalleled circumstances and under considerable time constraints. The service was evaluated during the initial response to COVID-19, during which PCR testing was not routinely recommended. As a result, the true proportion of patients with symptoms attributable to COVID-19 assessed within the services is unclear. The relatively small number of patients evaluated and the low rate of death within the cohort precludes a more detailed understanding of the optimal criteria for escalation to secondary care to be established. A small number of patients did not have a full set of observations recorded preventing the calculation of a NEWS2 in all cases. The available physiological observations allowed the assignment of an NHSE risk group in all patients assessed face to face. It is unlikely that the missing values materially affected our main findings.

## Comparison with existing literature

Early warning scores, such as NEWS2 were originally designed as a tool to monitor medical inpatients for signs of deterioration as a means to identify deterioration early and alter the trajectory of decline by triggering protocolised responses (11). NEWS2 has been endorsed by NHSE and NHS Improvement for use in acute and ambulance settings (12). The use of early warning scores to identify patients in need of escalation in the community and communicate physiological risk across the community-hospital interface is a relatively new application (13). The use of NEWS2 is yet to be validated in primary care settings. The use of NEWS2 as a standardized tool to communicate physiological risk allowing the downstream care pathway to prioritize resources and monitor for deterioration provides a strong argument to calculate and record a NEWS2 in patients being conveyed acutely to the hospital. A clear association has previously been demonstrated between elevated NEWS in the community and 5- and 30-day all-cause mortality in a patient group in which the decision to escalate care had already been made (14). The use of NEWS2 thresholds to identify patients in the community

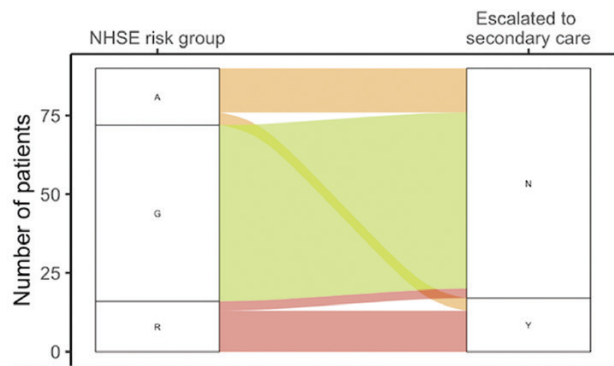


Figure 2. Alluvial diagram displaying care pathways of 150 patients attending the primary care assessment centre (2020).

**Table 1.** Demographics of 150 study participants stratified by mode of assessment, NHSE risk group and escalation of care to hospital following primary care assessment centre (2020).

Characteristics	All patients (n = 150)	Face-to-face assessment			Remote assessments (n = 60)	Care escalated to hospital (n = 19)
		Green n = 56	Amber n = 18	Red n = 16		
Mean age (years)	45.1 (SD 13.3)	47.6 (SD 14.3)	41.8 (SD 10.7)	43.0 (SD 10.7)	44.5 (SD 13.6)	44.4 (SD 13.1)
Gender (female)	66.0% (n = 99)	61.4% (n = 35)	66.7% (n = 12)	62.5% (n = 10)	70.0% (n = 42)	68.0% (n = 13)
Ethnicity						
White	17.3% (n = 26)	14.3% (n = 8)	11.1% (n = 2)	18.8% (n = 3)	21.7% (n = 13)	10.5% (n = 2)
Mixed /multiple ethnic groups	2.7% (n = 4)	0.0%	5.6% (n = 1)	0.0%	5.0% (n = 3)	0.0% (n = 0)
Asian/Asian British	51.3% (n = 77)	57.1% (n = 32)	50.0% (n = 9)	56.3% (n = 9)	45.0% (n = 27)	57.9% (n = 11)
Black/African/Caribbean/Black British	23.3% (n = 35)	25.0% (n = 14)	27.8% (n = 5)	18.8% (n = 3)	21.7% (n = 13)	26.2% (n = 5)
Other ethnic group	2.0% (n = 3)	0.7% (n = 1)	0.0% (n = 0)	6.3% (n = 1)	1.7% (n = 1)	0.0% (n = 0)
Unknown	3.3% (n = 5)	0.7% (n = 1)	5.6% (n = 1)	0.0% (n = 0)	5.0% (n = 3)	5.3% (n = 1)
Comorbidities						
Hypertension	17.3% (n = 26)	14.3% (n = 8)	16.7% (n = 3)	25.0% (n = 4)	18.3% (n = 11)	21.1% (n = 4)
Type 2 diabetes	18.7% (n = 28)	21.4% (n = 12)	22.2% (n = 4)	12.5% (n = 2)	16.7% (n = 10)	15.8% (n = 3)
Ischaemic heart disease	3.3% (n = 5)	8.9% (n = 5)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)
Obesity	7.3% (n = 11)	3.6% (n = 2)	16.7% (n = 3)	6.3% (n = 1)	8.3% (n = 5)	10.5% (n = 2)
Asthma	22.0% (n = 33)	23.2% (n = 13)	5.6% (n = 1)	12.5% (n = 2)	28.3% (n = 17)	10.5% (n = 2)
Obstructive airways disease	2.0% (n = 3)	3.6% (n = 2)	0.0% (n = 0)	0.0% (n = 0)	1.7% (n = 1)	0.0% (n = 0)

An upset plot showing symptom profile of all patients is displayed in [Figure 1](#).

who are likely to benefit from escalation to the hospital is more controversial (15). The inherently different risk profile of patients presenting to primary care and the reliance on a single value, rather than serial measurements over time would be expected to significantly affect the discriminatory performance NEWS2 applied in this context. The predictive performance of NEWS2 applied to a population with a high clinical likelihood of COVID-19 is currently unclear.

The disposition of patients within our evaluation did not closely follow NHSE guidance suggesting GPs working with the PCAC had a higher threshold for escalation compared with the approach suggested by NHSE. The threshold of 3 or greater advocated in the NHSE guidelines is more conservative than current RCP and NICE guidance which recommend protocolised responses as NEWS2 of 5 or greater (8,16). A previous study investigating NEWS as a predictor of referral to a hospital found a poor correlation between elevated scores and the decision to escalate to hospital, particularly when assessment took place in a treatment centre (17). As in our evaluation, the individual physiological observations were known to the clinician but the NEWS2 was calculated retrospectively and not routinely used in the decision to escalation. It is unclear whether the decision to manage in the community in patients with elevated NEWS2 reflects the superiority of clinical gestalt or an under-appreciation of risk. Further study is required to clarify the

role of early warning scores in decisions to escalate care from the community.

### Implications for research and practice

We describe a rapidly developed acute care pathway designed to provide a face-to-face assessment by general practitioners in patients with suspected COVID-19. No patients with a low-risk NEWS2 or the green risk group defined by NHSE were deemed to the required escalation of care to the hospital. No patient in this group died or subsequently went on to require inpatient care. Guidance in place at the time of the evaluation was a poor predictor for escalation of care at higher levels of risk suggesting factors other than physiological observations as defined by NEWS2 influenced individual clinical decisions to refer to secondary care. Further study is needed to clarify whether arbitrary NEWS2 thresholds are a useful tool to guide decision making, or whether their use should be confined to situations in which the decision to escalate has been made and the severity of disturbance needs to be conveyed to downstream care providers.

### Declarations

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Ethical approval: Not required.

## Competing interests

None.

## Data availability

The data underlying this article will be shared at reasonable request to the corresponding author.

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