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Competing interests

Clare Gerada was a member of the Independent Inquiry into Drug Testing at Work.

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The use (or otherwise) of pulse oximetry in general practice

The pulse oximeter is a diagnostic tool that enables the indirect measurement of the percentage of oxygenated haemoglobin in a patient's capillary blood.[1] It has been widely used in secondary care for over two decades,[2] especially in peri-operative, paediatric and intensive care patients. Pulse oximetry is often used in emergency departments,[3] but is less well established in general practice.

Pulse oximeters work by measuring the light absorption properties of haemoglobin[1] using a red–infrared light source. The amount of light absorbed varies according to the proportion of oxygenated haemoglobin in the blood, and this is analysed to generate a numerical saturation reading. Readings have an accuracy of +/- 2% although this varies with models[2,5]. Finger probes are generally more accurate than ear probes.[5] Accuracy is reduced during severe desaturation (readings below 70%), haemoglobinopathies, hypotension, hypothermia and reduced perfusion states, and carbon monoxide poisoning (including very heavy smokers, who can achieve up to 10% arterial carboxyhaemoglobin).[1]

In acute illness, patients are primarily assessed either by their GP, or within an Accident and Emergency (A&E) department. Blood gas measurement of arterial saturation (pAO_2) in A&E patients with acute breathlessness[4] found that pulse oximetry showing oxygen saturations (sO_2) of 92% or less have a 100% sensitivity and 86% specificity to detect central hypoxia (pAO_2 <8.1 kPa or <60 mmHg). A higher cut-off of sO_2 of <96% maintains sensitivity of 100%, but specificity decreases to 54%.[8]

Oximeter use has also been studied in US nursing home patients with a documented baseline oximetry sO_2.[5] Patients who went on to develop pneumonia had a mean decrease of 6% in sO_2, and those with a greater than 3% drop in sO_2 had a specificity of 100% and positive predictive value of 100% for the presence of pneumonia, as compared to other sepsis.

Pulse oximetry is commonly used in the assessment of children with asthma and wheezing; not least because of the difficulty in subjecting children to repeated blood gases.[6] In isolation sO_2 is not enough to reliably predict which patients require admission.[7] However, use of a derived clinical severity score (based on wheezing, respiratory rate, and subcostal recession) has shown that sO_2 correlates directly with peak flow rate, and inversely with severity score and heart rate.[8] Children with sO_2 of <92% at presentation in this study were significantly more likely to require admission and multiple nebulisers.

Chronic obstructive pulmonary disease (COPD) has a considerable prevalence within the general practice population, and can cause overnight or exercise hypoxia.[9] Some patients with COPD gain a survival benefit from long-term oxygen therapy (LTOT),[10] usually administered via a home concentrator. Pulse oximetry has been used in general practice to screen COPD patients, identifying those who might benefit from LTOT.[11]

Another chronic disease use for pulse oximetry is in the assessment of patients with venous leg ulcers, where significant vascular disease is a contraindication for compression bandaging. A modified form of pulse oximetry has been proposed as an alternative to the technically difficult ankle-brachial pressure index (ABPI) to select which patients can be safely given compressive treatment of their venous leg ulcers.[12] Although this is a single study in only 39 patients, it raises interesting possibilities for changes in practice which might be reinforced by a larger study.

Modified pulse oximetry has also been studied as a monitoring tool to track vascular disease progression in diabetic patients.[13] ABPI measurements are often inaccurate in those patients with diabetic small-vessel disease (arterial media sclerosis); it may be that oximetry can provide a sensitive tool to detect vascular problems at an early stage and guide specialist referrals. Qualitative work

regarding pulse oximetry is limited; one study[14] examined primary care use of oximeters in 229 patients. The authors reported that in 19% of cases the oximetry reading altered the patients' management plan. In 67% of cases the doctor felt reassured by the reading, and in 61% of cases the patient felt reassured.

The use of pulse oximetry in primary care is still in its infancy. Its advantages are that it is quick, non-invasive, reproducible, accurate in most circumstances, and minimal training is necessary. Its disadvantages are that it needs maintenance, has accuracy limitations in some patients and may not provide a clinical benefit to patient care if used indiscriminately.

Practices who are planning to use oximetry in daily practice need to consider their reaction to an isolated low reading in an otherwise well patient, and in what circumstances readings should be taken.

The implications for an individual general practice depend upon the population demographic and the resources or time used by having an oximeter in the surgery. A portable pulse oximeter costs £300–400 and needs recalibration every 3 years. If a practice considers it appropriate to buy spirometry equipment and electrocardiogram machines then it is reasonable to consider the purchase of an oximeter as well.

The evidence base to support pulse oximetry is limited, but there are several areas where further work may demonstrate benefits from the application of this technology in primary care. The baseline sO_2 of a patient at routine clinic review may add value to its use in acute illness in the same patient.[5] It could also aid sensitivity of diagnosis in patients with chronic respiratory disease in the same way that baseline peak flow readings are useful when assessing asthmatic patients. Quantitative studies involving the rate of admission to hospital of acute respiratory illness might evaluate this device further in acute illness scenarios. Further qualitative studies could examine GP's experiences of the use of portable oximeters. It is conceivable that the oximeter could be used in health promotion, for example in encouraging patients to give up smoking. While no clinician would base treatment solely upon its readings, there is some evidence for the usefulness of pulse oximetry in general practice. It is not yet clear whether its use has any effect on diagnosis or patient defined outcomes.

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Competing interests
None

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