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Temperature scanners: Limited value in detecting employee COVID-19 symptoms? BLOG POST

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Introduction

Many workplaces within the pharmaceutical and healthcare sector have put in place thermographic camera scanners on building entrances in order to reduce employee contact where one employee may have the SARS-CoV-2 virus (the 'coronavirus') and is exhibiting symptoms associated with the disease that the coronavirus can cause – COVID-19. These devices assess the temperature of the skin by taking a computer generated image. Alternatively, or in addition to on-site temperature measurements, many firms are also asking people to take their temperature before travel to work. This requirement has led to an increase in sales of hand-held thermal scanning thermometers.

Is the measurement of temperature useful COVID-19 safety measure? While temperature rises are a sign of symptomatic infection, the method of measurement may not be the most accurate. One reason for this is because thermographic cameras have not been designed to be medical devices and may not have the necessary accuracy. Another reason, and one drawn from recent research, is that the assessment of the temperature of the outer layers of the skin appears to be a poor detector of the actual temperature inside the body. This, and the associated issues around thermograms, are addressed in this IVT article.

Thermographic cameras: Advantages and limitations

While directing a temperature scanner to person's forehead is expedient, it could lead to inaccurate data being generated (a process known as thermography) (1) The basis of measurement is on a specialist camera generating an infra-red image and the reading of the image produced (called a thermogram), based on a proprietary algorithm. Research finds that the now commonplace activity of having people position themselves in front of a scanner in order to have their body temperature assessed is not the most productive COVID-19 prevention measure. This is based on a review of the sizable number of false negatives being generated. This leads to the danger that people with the coronavirus and exhibiting other COVID-19 symptoms can pass into workplaces without adequate detection.

The most applicable standard is ISO 18434, of which parts:

- ISO 18434-1, Condition monitoring and diagnostics of machines – Thermography – Part 1: General procedures
- ISO 18436-7, Condition monitoring and diagnostics of machines – Requirements for qualification and assessment of personnel – Part 7: Thermography

These are the most relevant. This standard is not one for medical devices.

The research makes the general point that temperature alone is not a good indicator of disease. The research has been published in the science journal Experimental Physiology. The research is titled "Myths and methodologies: Degrees of freedom – limitations of infrared thermographic screening for Covid?19 and other infections" (2). Three areas of concern are drawn out within the research:

1. With the coronavirus, a number who have the infection do not, or do not immediately, develop a fever (around 1 in 10 COVID-19 cases are indicated in the research not to develop a fever) (3). It also stands that someone with a high temperature may not have a coronavirus infection, pyrexia being a common symptom of disease (for example, lower respiratory tract infections like bronchitis). A related limitation is the lack of a single agreed-upon upper limit for normal temperature among the medical community, with different opinions for bioregulation outside of the norm expressing values between 37.2 and 38.3°C for the onset of fever. Fevers do not typically go higher than 41 to 42°C.

2. Skin temperature often changes independently of deep body temperature, making skin readings potentially unreliable. Hence, fluctuating skin temperature is not a reliable means to assess core body temperature. Moreover, different readings will be recorded from different body parts based on variations of high and low blood flow (as shown with studies of photoplethysmography).
   To truly understand body temperature (homeothermy) this requires the accurate measurement of the balance between heat production (metabolism) and heat loss or gain mechanisms. Thermography scanners are open to being affected by environmental factors as this influences heat exchange. There are other influencing factors as well, such as moisturizers applied to the skin. Here skin emissivity can be altered by the application of ointments. Emissivity refers to a material's ability to emit thermal radiation and is an optical property of matter (4).

   A further influencing factor is the distance between an individual and the camera. Since it is the formation of pixels that create the image upon which the assessment of temperature is made, the distance from the camera affects image quality and hence the accuracy of the measurement recorded (5).

3. It also stands that most scanners are inaccurate by 1 degree Celsius, so only a temperature rise of 2 degrees can be regarded as clinically significant (6). Thermography scanners assess thermal radiation, represented by wavelengths between 0.1 and 100 ?m on the electromagnetic spectrum. However, the infra-red thermal technology currently available cannot accurately predict a state of pyrexia among individuals, as both comparisons between different instruments and between instrument that use direct touching have indicated (7).

The recent findings have been collated by subject matter experts in physiology. The scientists argue that instead of the standard facial scanning, more meaningful and accurate data can be drawn from measuring temperature readings taken from a person’s fingertip and their eye. This is because measuring skin temperature does not provide accurate estimation of deep body temperature (of the type raised in a fever).

The experimental data suggests that recording two temperature measurements - from a finger and from an eye - provides a more robust indicator of a fever-induced rise with deep body temperature.

Hence, if scanners are not giving an accurate reading, then workplaces run the risk of falsely excluding people from places they may want, or need, to go. Furthermore, this also presents the risk allowing people with the virus to spread the undetected infection they have.

The researchers also recommend that the entire spectrum of symptoms should be considered in addition to temperature: Dry cough, sputum production, shortness of breath, muscle or joint pain, sore throat, headache chills, nausea or vomiting, nasal congestion, and diarrhea.

Summary

In terms of what to make of the findings, while there are more reliable methods for assessing human temperature (8), many of these are time consuming and do not facilitate fast entry into a workplace or permit mass screening. This means that thermography scanners have a role, but the weaknesses can be partly addressed by encouraging employees to take their own temperatures before leaving home using conventional direct measurements as well as requiring personnel to vigilant as to the other signs and symptoms of COVID-19 (such as nausea, headaches, fatigue and loss of taste or smell). In other words, a combination approach probably works best.

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