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COVID-19 Limitations of Infrared Fever Screening

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Many organisations are using non-contact infrared thermometers to test customers and staff for Covid-19 fever symptoms. The National Standards Authority of Ireland (NSAI) are highlighting the complexities of using infrared fever screening to protect against Covid-19 infection.

Temperature screening can, at best, detect those individuals who have a fever but won't necessarily detect all cases of Covid-19 [1].

Normal body temperature varies by person, age, health status, time of day and activity. The average normal body temperature is commonly accepted as between 36.0°C and 36.8°C [2]. Some studies have shown that the 'normal' body temperature can have a wide range, from 36.1°C to 37.2°C. A temperature of 38°C or more is generally deemed to be a fever, however this can also vary [3]. The location of temperature measurement on the body will also significantly affect measurements [4].

The capture and storage of health information, such as body temperature measurements from individuals is also considered personal data and is therefore protected by General Data Protection Regulations (GDPR) [5]. Caution should therefore be applied when establishing a fever screening regime that legislation in this area is adhered to.

Covid Symptoms

Research currently indicates that fever may not be present in the majority of Covid-19 infections [6], including in pre-symptomatic and asymptomatic people. The HSE has not recommend the use of temperature screening as a means of detecting cases of Covid-19 infection in workplaces [7].

There are also many problems with basing a fever diagnosis on elevated skin temperature. Secondary effects of pregnancy, alcohol consumption, exercise, coming in from a hotter environment, and the use of face coverings [8] could result in false positives, leading to the singling out of individuals. Conversely, the use of make-up [9], consumption of antipyretics (e.g. paracetamol), skin moisture (such as perspiration) and coming in from the cold, facial cleansing products (e.g. facial wipes) can lead to false negatives and therefore increased risk of contagion.

Measurement Errors

Users of non-contact thermometers should be aware of how they work and the drawbacks of this approach. These thermometers are optical instruments that rely on the transmission of invisible infrared (IR) light. The intensity of this specific type of light is converted to a temperature value in degrees Celsius.

A number of factors can influence a non-contact temperature measurement. The target subject influences the measurements because most surfaces, including skin, are partially reflective. Non-contact IR thermometers therefore compensate for this reflected light, which has come from the surroundings, by measuring the ambient air temperature. The ambient temperature conditions thus also come into play [10].

Users of IR temperature systems must follow all of the manufacturer's instructions and best practice in order to achieve the rated accuracy (for example ±0.3°C for calibrated clinical thermometers with a genuine CE mark [11]). It is important that the distance, angle of measurement and measurement location on the body, the environmental conditions (ambient temperature range and humidity) are correctly chosen and that the thermometer is correctly set [12].

The IR thermometers and the subjects should also have acclimatised to the setting where measurements will take place (10-30 minutes before it is used). There should be no draughts or stray sources of IR light and the thermometer should be used out of direct sunlight and away from radiant heat sources [13].

Some other issues that will affect IR temperature measurements are:

- Instrument drift, which can be compounded by dust or dirt on the optics or scratches on the lens or heating from use.
- Measurement repeatability, which can be checked by testing if the temperature reading changes when the measurement is repeated on the same subject.

All measuring instruments require traceable calibration. A calibration certificate is only valid if it is issued by a competent laboratory who have followed best practice.

NSAI conducted testing of one commonly available clinical thermometer found that the readings varied by up to 0.9°C upon repeated tests of the same subject over a short time period.

Instrument Quality

- The quality of non-contact temperature measurement technology can vary significantly. In order to be used for a clinical diagnosis, an instrument must have been approved for this purpose, and therefore should display a genuine CE mark and 4 digit notified body code demonstrating compliance with the relevant international standards and regulations. The Health Products Regulatory Authority (HPRA) have published a guide, which details precautions to follow when purchasing a digital thermometer [14].
- Non CE-marked thermometers have an unknown accuracy and therefore cannot be considered a reliable means of measuring temperature. Accuracy claims from manufacturers and distributors of non-CE marked, non-medical device equipment should be treated with caution.
- A CE-marked instrument is only valid for measurement as per its manufacturer's intended use. Any other uses are not validated and therefore not verified as accurate.

Training and Expertise

- Clinical temperature measurements are made in a clinical setting by trained personnel, such as doctors and nurses. Measurements in other settings shouldn't be used to make a diagnosis of a patient.

- In a clinical setting, measurements are taken over a period of time, thereby indicating any variations in body temperature. Therefore, a single temperature measurement won't necessarily detect an abnormal temperature condition for that individual.
- Anyone making temperature measurements – either manually or automatically – should obtain the appropriate training to ensure appropriate use of the various modes and interpretation of the measurements.
- There is the risk of spreading the disease due to the close distance needed to take a person's temperature between the person using the thermometer and the person being assessed. Appropriate training should be obtained to minimize risk of spreading the disease [1].
- The manufacturer's instructions on cleaning between uses must be followed to reduce spread between uses [13].
- Errors of ±2°C or more could be found when temperature is measured with an IR thermometer if it is used incorrectly [15], [16]. In such circumstances a reading of 37°C on the thermometer can only be interpreted as indicating that the measured temperature lies in the range 35°C to 39°C and therefore cannot be relied upon for the purposes of detecting a fever.

Conclusion

Instrument errors or incorrect measurement methods would invalidate any temperature measurements used to screen for fever. If a business decides to proceed with the establishment of a temperature measurement system for screening of individuals, it must consider the errors associated with these measurements as well as GDPR implications for storing temperature measurements of individuals.

There is insufficient scientific evidence to support temperature screening as a reliable method for detection of COVID-19 or other fever conditions, especially if used as the key method of testing [1], [17].

No screening system is a substitute for clinical temperature measurements and should be followed up with a secondary evaluation method.

To avoid a false sense of security against Covid-19 infection, fever screening programmes should be implemented with caution. Fever screening should only be used in addition to the public health advice, namely physical and social distancing, cough etiquette, handwashing and face coverings.

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