

Assessment of clinical deterioration in children with dark-coloured skin: a scoping review protocol

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Abstract

Introduction: Observable signs of clinical deterioration in hospitalised children continue to be missed by health professionals. These signs may present differently in children who have dark-coloured skin. Signs of clinical deterioration caused by hypoperfusion involve the detection of changes in a child's baseline skin appearance, such as mottling, cyanosis and slower capillary refill time. These signs may be difficult to observe in children with dark-coloured skin. Although some literature exists on the clinical assessment considerations for patients with dark-coloured skin, there appears to be a deficit of research about the physical signs of clinical deterioration in children with dark-coloured skin.

Aim: This scoping review aims to explore available information on the assessment of clinical deterioration in children with dark-coloured skin and to identify research deficits.

Methods: An established framework will be used, and reporting will align with the PRISMA Extension for Scoping Reviews checklist. Inclusion and exclusion criteria are pre-defined. Five online databases will be searched for published sources. Grey literature will be searched for on Google, thesis repositories, key organisation websites and select medical and nursing textbooks. Field experts will also be consulted for further sources.

Discussion: Endnote and Microsoft Excel will be used for source selection and data charting. Eligible source data will be charted on a pre-determined data collection tool. Findings will be presented in a tabulated form, and descriptive analysis will be narratively reported. By identifying available knowledge and research deficits, this review will guide further research in the field.

Keywords: dark-coloured skin, paediatrics, deterioration, assessment

Introduction

Background

Children often have observable signs of clinical deterioration prior to becoming critically unwell or dying in hospital.¹⁻³ They may physiologically compensate without early warning signs during the initial stages of illness, then deteriorate rapidly and profoundly if their illness progresses.^{4,5} This potential for rapid deterioration after a period of compensation indicates that vigilance in recognising deterioration is particularly important in paediatric patient cohorts. Although there have been improvements to system-wide healthcare processes, such as implementing early warning systems,⁶ there continue to be cases of paediatric deaths due to missed or delayed responses to clinical deterioration by health professionals (particularly nurses and doctors).^{7,8} Early identification

of clinical deterioration by health professionals can reduce the potential adverse impacts on children and families.^{3,9,10}

In assessing signs of clinical deterioration, nurses consider multiple physiological and cognitive factors. Minimum monitoring requirements for most Australian healthcare settings include the assessment of respiratory rate, oxygen saturation, heart rate, blood pressure, temperature, consciousness and changes in behaviour or confusion levels as per the Australian Commission on Safety and Quality in Health Care¹¹ guidelines. Nurses monitor for changes in these observations, relating them to both the individual patient's baseline and normal range parameters outlined in escalation protocols to identify possible signs of deterioration. In addition to core monitoring requirements, comprehensive clinical assessments include other subjective and objective signs, often identified using a body systems approach (for example the respiratory system or central nervous system).¹² In paediatric contexts, subjective signs will also involve parent and carer input and the child's self-report, if cognitively able.¹³ These clinical cues are used by health professionals in clinical reasoning, a process that involves gathering patient cues, information processing, understanding the clinical problem or situation, devising a plan, implementation, evaluating outcomes and reflection.¹⁴ Clinical reasoning skills enhance the detection and management of clinical deterioration, particularly in unpredictable or uncommon situations.¹⁵

Cardinal signs of clinical deterioration seen in shock or dehydration include skin mottling or cyanosis, sluggish capillary refill time (CRT), and cool peripheral skin temperature.^{16,17} Recognition of such clinical cues rely on assessment of skin and may be difficult to gauge objectively in patients with dark-coloured skin. For example, cyanosis or pallor may present as an eggplant-purple colour in dark-coloured skin,¹⁸ rather than the blue shades more often described in relation to light-coloured skin.¹⁹ Central capillary refill time refers to the time taken for the skin to return to normal colour following light finger pressure on the skin of typically either the sternum or forehead (also known as blanching).^{17,20} Capillary refill time is an important component for assessment of clinical deterioration in children, with particular considerations for assessing children with dark-coloured skin. Of the few published works that have examined the impact of skin colour on capillary refill assessment, there was a view that higher melanin content in dark-coloured skin masks colour changes, which obscures the assessment of CRT.²⁰ The extent to which paediatric nurses and medical practitioners have this knowledge or take this into consideration remains unclear.

Considerations for assessing patients with dark-coloured skin have been expressed in a limited range of adult patient contexts, namely assessment of limb ischemia, pressure injuries, COVID-19, wounds, and dermatological conditions.²¹⁻²⁴ Researchers have attempted to address the impact of skin colour on adult pressure injury assessment, with multiple studies exploring the use of spectroscopy to assess pressure injuries, which would be unaffected by skin colour.^{20,25,26} However, to date, the diagnostic value of spectroscopy is unclear, and the technology is yet to be adopted in practice. In paediatric cohorts, research has been limited to considerations for dermatological conditions in dark-coloured skin.^{27,28} There have also been contradictory findings about the accuracy of arterial blood oxygen saturation measured by pulse oximeters in dark-coloured skin.²⁹⁻³² One systematic review found a possible overestimation of blood oxygen saturation levels by one per cent for hospitalised people with dark-coloured skin, including children.³¹ The overestimation remained within international guidelines for measurement bias and overall accuracy, and the possible clinical impacts of overestimation were not investigated.

In nursing and medical texts, dark-coloured skin appears to be underrepresented compared to light-coloured skin. As little as five per cent of images in dermatology and general medicine texts depicted dark-coloured skin.^{33,34} A case study conducted across five universities in the United Kingdom examined undergraduate nursing education about pressure injuries and reported an

overrepresentation of Caucasian skin types and in-lesson observation of fewer than five minutes spent on cultural issues, ethnicity and skin variations.³⁵ In leading emergency medical journals, between 9.9% and 27.3% of cutaneous disorders were represented in individuals with dark-coloured skin.³⁶ In paediatric dermatology, a descriptive analysis of a visual diagnostic quiz completed by a group of international health professionals suggested that underrepresentation of diverse skin colours in education has led to poor identification skills of common paediatric dermatological conditions in dark-coloured skin.²⁷ There has been a collective call in the literature for more representation of diverse skin colours in health professional education to improve care equity and quality.^{27,33} The lack of diverse skin representation raises questions about how prepared health professionals are to assess and diagnose skin-colour dependent signs of deterioration or illness in patients with dark-coloured skin.

Rationale

Based on the initial search of the literature, there appears to be limited information on the considerations for assessing paediatric patients with dark-coloured skin. This extends to an apparent knowledge gap for paediatric nurses and doctors in recognising clinical deterioration in this cohort. Given the expectation that health professionals deliver care to populations with diverse skin colours, there is an urgent need to address this gap to improve care for children with dark-coloured skin. To guide research in this area, a scoping review will be an appropriate method to map currently available information on how to assess clinical deterioration in children with dark-coloured skin and identify research deficits.³⁷ As minimal peer-reviewed literature addressing this topic was preliminarily found, a scoping review will allow a systematic assessment of material with a greater range of research strategies and source types for a broad topic.^{38,39}

A search for existing protocols or reviews on the topic was conducted on Google Scholar (first 15 pages of results), Joanna Briggs Institute (JBI), Cochrane, Pubmed and Prospero on 20 July 2023. No previous scoping reviews on this topic were identified. Two related systematic review protocols were retrieved through Prospero (Table 1). The main correspondent was contacted for details on the search strategy and relevant sources. Both reviews had been published in the NHS Race and Health Observatory Report in July 2023.⁴⁰ Whilst these systematic reviews had some overlap with the proposed scoping review, they were restricted to a neonatal assessment of Apgar, hypoxia, and jaundice. The proposed scoping review will encompass a wider age range to reflect the paediatric spectrum seen in healthcare settings, and apply a broader concept of clinical deterioration.

Table 1. Retrieved related reviews and protocols

Title	Registration
Experiences of health care professionals providing care for Black or Asian or other ethnic minority neonates in relation to neonatal assessment and practice: a systematic review	PROSPERO 2022 CRD42022344617
Experiences of maternity service users seeking or receiving care for Black or Asian or other ethnic minority neonates in relation to neonatal assessment, specifically Apgar scores, cyanosis and jaundice in developed countries	PROSPERO 2022 CRD42022341604

Objectives

The review will seek to answer the research question: what information is available on the assessment of clinical deterioration in children with dark-coloured skin and what are the gaps in knowledge?

We anticipate the following objectives to be achieved through the scoping review:

- 1) To identify what is reported about the assessment of clinical deterioration for hospitalised children with dark-coloured skin.
- 2) To identify what are the different considerations in the assessment of clinical deterioration in children with dark-coloured skin compared to light-coloured skin.
- 3) To examine how different skin colours have been described.
- 4) To determine the gaps in knowledge.

Methods

Eligibility criteria

Population

The population of interest will be paediatric patients, typically defined as persons who are 18 years of age or younger. To increase the sensitivity of the search, the aim will be to capture paediatric-inclusive sources that may not specify an age range. For example, sources that use terms such as 'patient' or 'person' will be included. This approach was chosen because an extensive preliminary literature search found minimal relevant sources when limited by age. Sources that specify older adults or adults will be excluded. The search will look at patients who are identified as having non-white skin colour, with the intention of including studies that examine a range of skin colours with higher levels of pigmentation. It is expected that throughout the review, the definition of dark-coloured skin will be refined.

Concept

The central concept for the review is clinical deterioration. Clinical deterioration refers to physiological and cognitive changes that indicate a worsening of a child's health status, which may occur over minutes, hours or days.⁴¹ For example, critical signs of clinical deterioration seen in shock or dehydration include skin mottling, cyanosis, and increased capillary refill time. These signs are of interest as they rely on the assessment of changes in skin colour, which may be difficult to objectively gauge in children with dark-coloured skin. Potential confounders for this cohort may include assessment bias due to either the lack of diverse skin representation in health professional education and/or limited exposure of early-stage practitioners to diverse skin colours; socially and professionally.

Context

The context of this review will be any healthcare setting in which assessments and monitoring for clinical deterioration are conducted by a health professional (nurses, midwives, and medical practitioners) in any geographical location. There will be no limit on the perspective of the sources. For example, carer perspectives on signs of clinical deterioration will be considered along with the perspectives of health professionals.

Sources

Due to time and resource constraints, sources will be limited to only those published in English. Sources will be searched from the commencement of the respective database until 31 December 2023. The timeframe for source inclusion will not be limited to allow for a broad search. All source types will be considered, including peer-reviewed studies, editorial or opinion pieces, conference presentations, theses, books, and other grey literature. There will be no restrictions on study design. This broad approach to finding sources is considered necessary due to the possibility of limited published evidence. Studies without full text access will be excluded. For the related systematic reviews identified in the preliminary search, study authors will be contacted for suggested sources.

Search strategy

The proposed scoping review will be conducted in accordance with Arksey and O'Malley's³⁷ framework for scoping reviews, with revisions by Levac et al.⁴² This involves a five-step process of (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarising, and reporting the results. The Preferred Reporting Items of Systematic Reviews extension for Scoping reviews (PRISMA-ScR)³⁹ checklist guided the study protocol and will be used to report the completed review. Publication of this protocol on an open-access forum aims to enhance replicability and transparency.

Databases for the search will include MEDLINE, CINAHL, Web of Science, JBI and Google Scholar. These databases will be searched for peer-reviewed articles and other published sources. An example search string for the Medline database is available in Table 2, and this will be adapted to the other listed databases with librarian input. Subsequently, the references of eligible sources will be searched for further sources. Grey literature will also be included in the search strategy. An advanced Google search will be conducted on the first 10 pages of results for several search strings. Key organisation websites of leading children's hospitals will be searched for policies, guidelines and other information relating to the topic. Theses will be searched for in three thesis repositories, limited to thesis and dissertation results only. Relevant critical care and paediatric nursing and medical textbooks will be identified and searched for key terms. Relevant page numbers will be noted for full text analysis if relevant. Field experts will be contacted for further sources.

Table 2. Proposed Medline search strategy

#	Search terms
1	(patient* or person* or people or neonat* or newborn* or infant* or baby or babies or child* or pediatric* or paediatric* or adolesc* or youth* or teen*).mp.
2	(skin adj10 (dark or black or tone* or brown or colour* or color*)).mp.
3	("people of colour" or "people of color" or "person* of colour" or "person* of color" or "dark-skin*" or "black people*" or "black person*" or negro* or "ethnic divers*" or "racial divers*" or "black patient*" or "fitzpatrick scale" or "fitzpatrick skin" or "fitzpatrick classification").mp.
4	black people/ or blacks/ or negroes/ or african continental ancestry group/ or black or african american/ or african americans/
5	#2 or #3 or #4
6	(deteriorat* or hypoxia or pallor or cyanosis or "capillary refill time" or blanch* or shock or sepsis or apgar or jaundice).mp.
7	(assess* or recogni* or identif*).mp.
8	#1 and #5 and #6 and #7
9	limit 8 to English

* = retrieve unlimited suffix variations

mp = title, book title, abstract, original title, name of substance word, subject heading word, floating subheading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms

adj10 = searches for terms that are a specified number (n=10) of spaces away from each other

/= Medline (Ovid) Medical Subject Headings (MeSH)

Source selection

Data will be collected and managed initially through Endnote™ for source import and de-duplication, and subsequently Microsoft Excel® for source screening. The review will be undertaken by a research team with subject expertise and experience in scoping reviews. Titles, abstracts, and full source texts will be sequentially screened for eligibility and then charted by the lead investigator (CK), with guidance from co-authors. Any uncertainties will be discussed with the research team until a consensus can be reached. Reasons for exclusion of full-text sources will be documented, and the search process will be presented via the PRISMA flowchart.

Extraction of results

Data will be charted using a data-charting tool created *a priori*. The tool will be developed and trialled by the research team on a selection of peer-reviewed and grey sources. Key information collected will include basic source characteristics, outcomes, key findings, descriptors used for skin colour and identified areas of research need. Sources will be assigned a classification score based on the Joanna Briggs Institute Levels of Evidence.⁴³ It is anticipated that during the review process, there may be a need to amend the tool to better suit the eligible sources and meet the study objectives. Any changes will be recorded and reported in the published review.

Data analysis and presentation

Data charted from eligible sources will be presented in a tabular form. This will be accompanied by a descriptive analysis as per PRISMA-ScR guidelines.³⁹ The purpose of this scoping review will be to identify available information and existing knowledge gaps. These aims will be addressed through a narrative description.

Consultation with stakeholders

During the development of the scoping review question, consultation with stakeholders was conducted on nomenclature of skin. A group of people with diverse skin colour and cultural backgrounds agreed that 'dark-coloured skin' was an acceptable term to describe skin of colour, and a high proportion of the group used this term to describe their own skin colour. This terminology was adopted throughout the scoping review protocol.

Discussion

Limitations

Using a language restriction for English-only sources may limit findings in the review. The high variability in language surrounding skin colour, and the historical conflation of skin colour with race or ethnicity may also limit the search. It is anticipated that during the search, new or novel key terms may be found and integrated into the search, to increase search quality. This will be documented in the published review. To reduce potential bias, this scoping review protocol was created prior to commencing the search. We aim to ensure that the resultant review is stringent, replicable and aligns with established frameworks and reporting requirements.

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