

Multimodal Thermal and Fluorescence Imaging in Advanced Wound Care: A Case Series Using an All-In-One Wound Imaging Device

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Key takeaway

In the cases presented, multimodal thermal and fluorescence imaging revealed findings not apparent on standard clinical examination, informing targeted wound management decisions.



Background

- Advances in digital imaging enable more comprehensive wound evaluations and improved patient care over conventional wound assessment methods.
- Fluorescence imaging enables real-time detection of clinically significant bacterial burden (>10⁴ CFU/g) in real time,¹⁻³ while thermal imaging provides a contact-free, non-invasive method to aid in the assessment of tissue perfusion, and inflammation or infection through analysis of skin-surface temperature gradients.^{4,5}
- Integrating these modalities offers complementary insights into bacterial load and tissue physiology, though real-world validation is still needed.

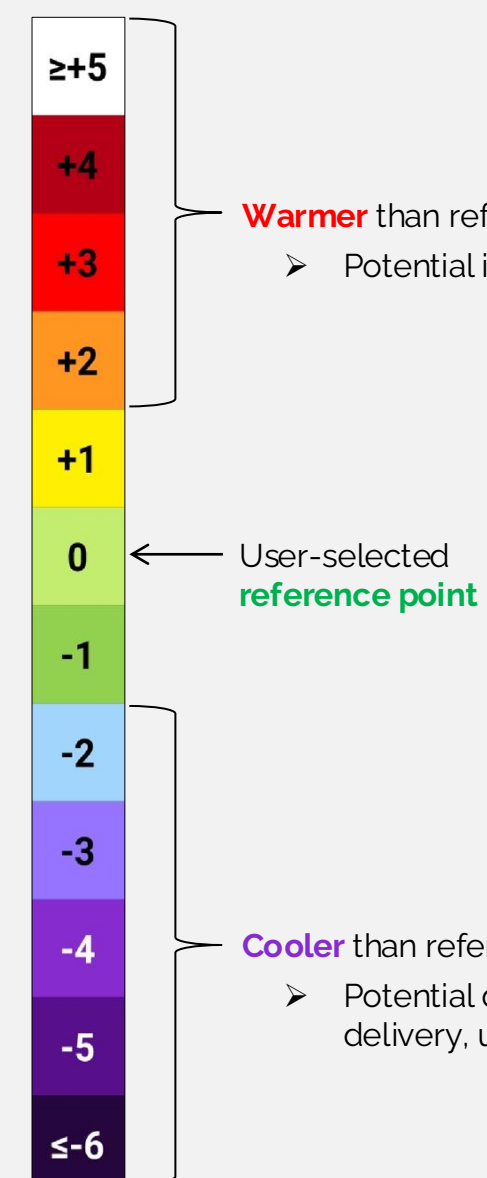
Aims

- To evaluate the clinical utility of combined thermal and fluorescence imaging in the assessment and management of chronic wounds.

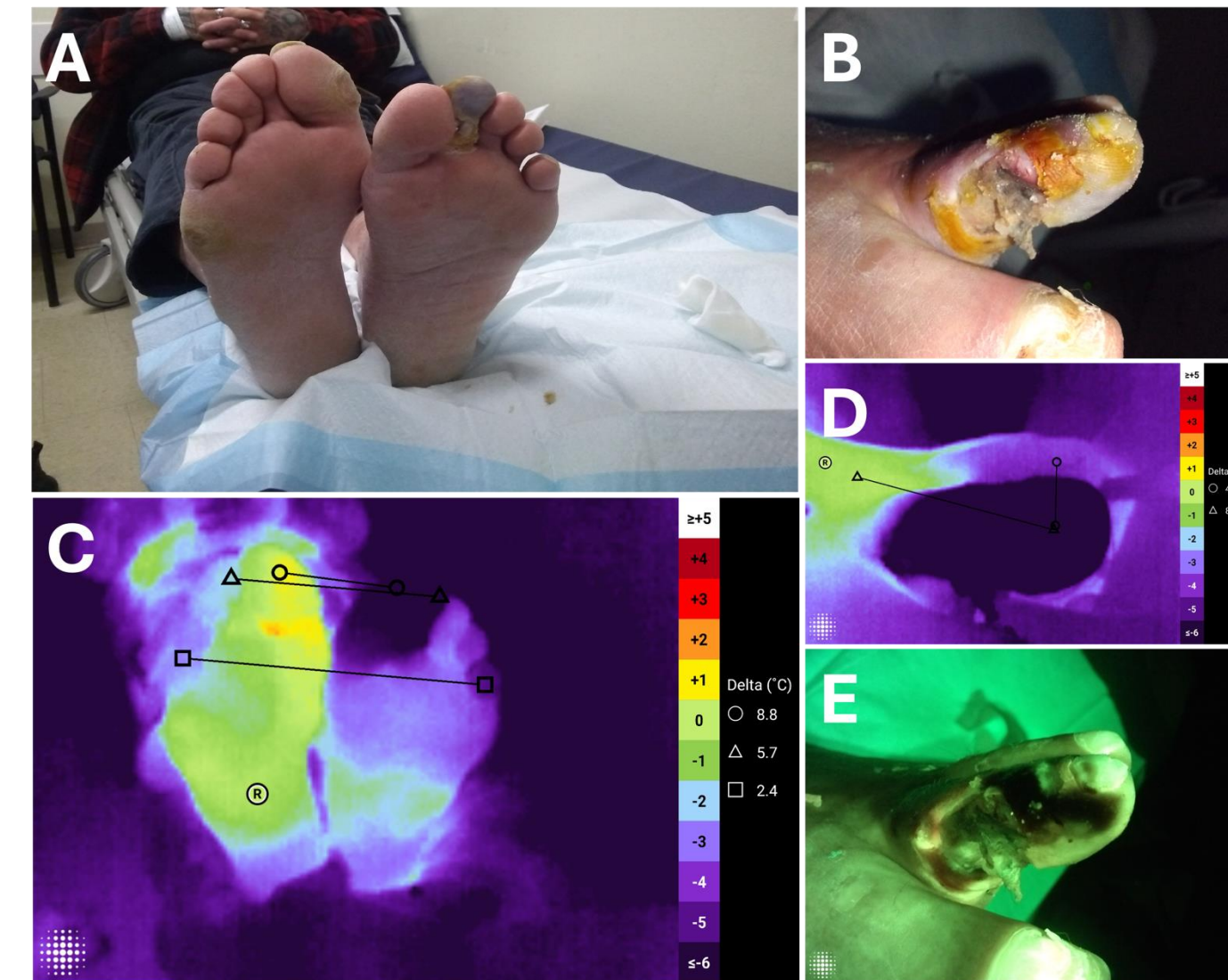
Methods

- Chronic, stalled wounds were imaged using the MolecuLightDX[®]+ imaging device (MolecuLight Inc., Toronto, Ontario, Canada), yielding real-time co-registered standard, fluorescence and thermal images and auto-calculations of temperature differences (ΔT) between two user-selected regions.

Integers along the scale denote differences in temperature (°C) relative to the reference point



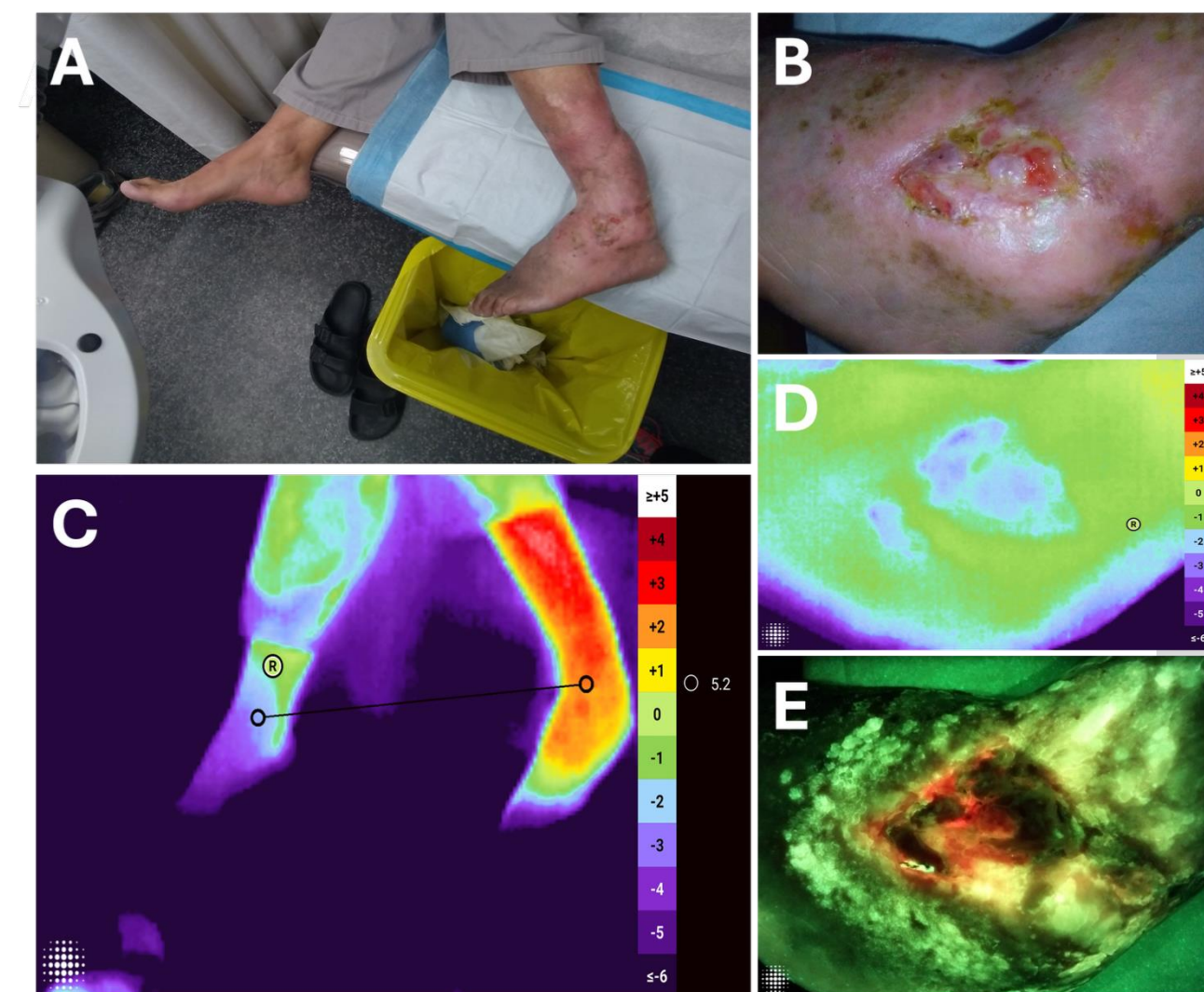
Case 1: Detecting unseen vascular impairment



Case summary: A 60-year-old male with diabetes presented with a 6-week chronic left foot ulcer. Standard assessment showed visible cyanosis of the second toe consistent with ischemia, while the first toe appeared clinically intact (A, B). Thermal imaging showed that the second toe was 5.7°C cooler and the great toe 8.8°C cooler than the contralateral limb (C, D), suggestive of significant blood flow impairment not apparent during the initial clinical assessment. No elevated bacterial signal was detected (E).

Findings: Imaging findings prompted immediate vascular referral and intervention.

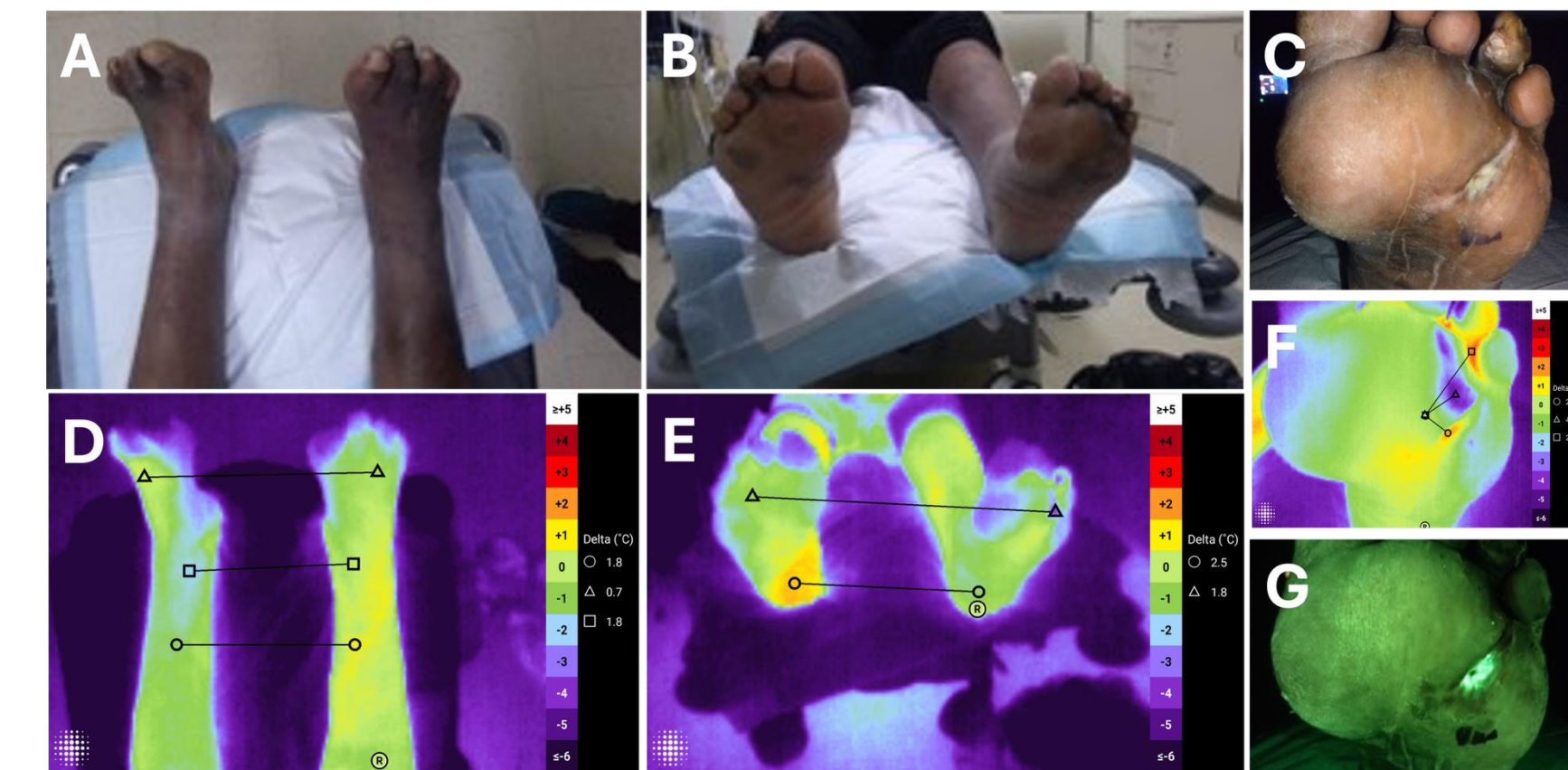
Case 3: Supporting infection detection and treatment response



Case summary: A 62-year-old male with a 35-year chronic traumatic right ankle wound and prior reconstructive surgeries (A, B) underwent multimodal imaging. Thermal imaging showed the affected ankle was 5.2°C warmer than the contralateral limb (C, D), suggestive of infection. Fluorescence imaging revealed red signal along the wound edges (E), consistent with elevated bacterial burden; microbiology confirmed *Staphylococcus aureus*. Systemic antibiotics and a silver dressing were initiated.

Findings: Multimodal imaging supported infection identification and enabled monitoring of treatment response.

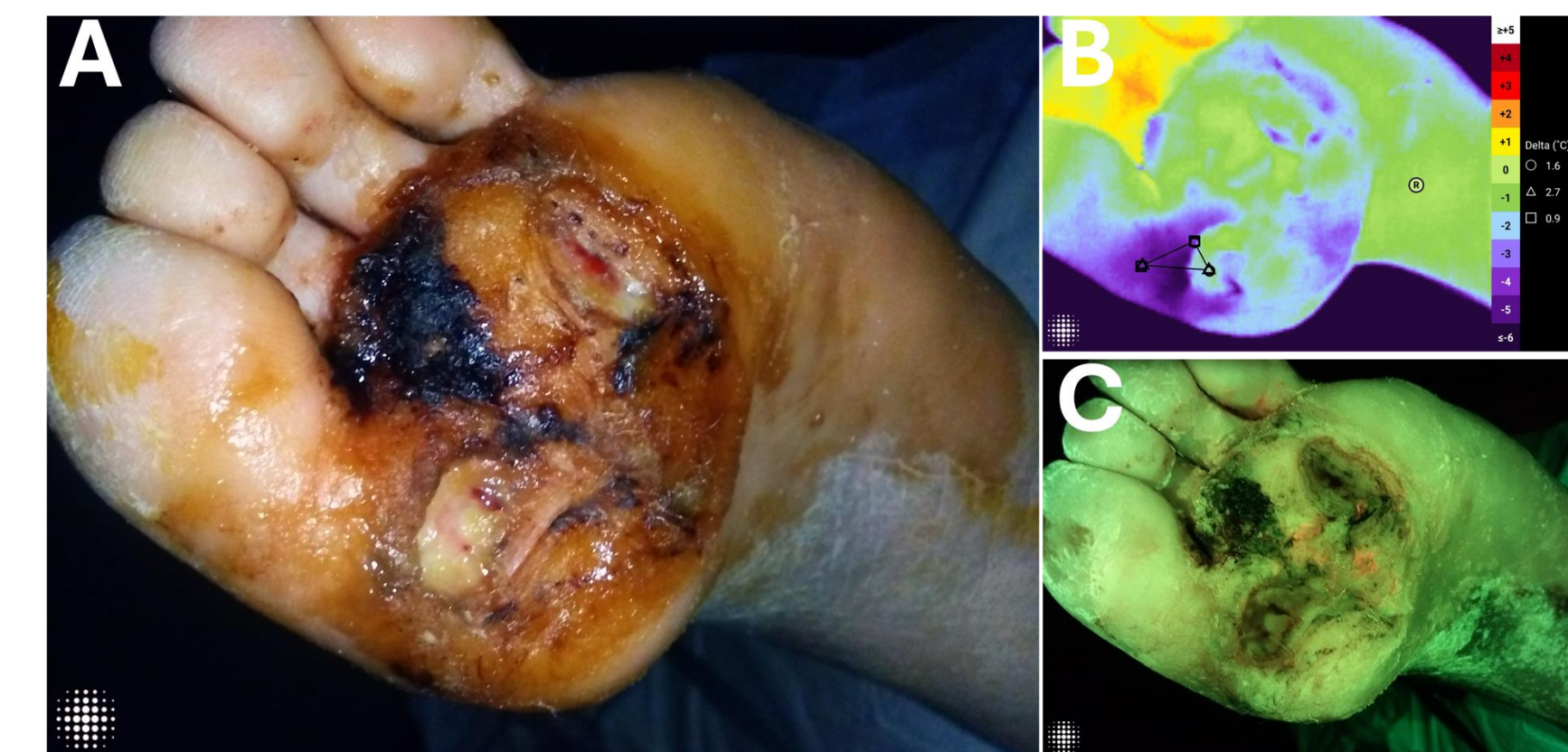
Case 2: Detecting hidden tunneling



Case summary: A 38-year-old male with type 2 diabetes presented with a chronic plantar wound without overt clinical signs of infection (A-C). Thermal imaging showed a small bilateral ΔT (1.8°C) (D, E) but identified a 4.0°C cooler zone within the wound bed (F), suggestive of a deep tunneling tract not evident clinically. Fluorescence imaging revealed cyan signal (G), consistent with *Pseudomonas aeruginosa*, confirmed by microbiology.

Findings: Multimodal imaging identified tunneling and bacterial burden, enabling targeted structural and antimicrobial intervention.

Case 4: Detecting hidden undermining



Case summary: A patient with diabetes, recently hospitalized for myocardial infarction, underwent multimodal wound assessment. Thermal imaging identified a focal cooler region beneath the great toe (B), suggestive of sub-surface undermining. Fluorescence imaging revealed bluish red signal beneath the skin surface (C), consistent with clinically significant bacterial burden. Findings raised concern for possible osteomyelitis, prompting further evaluation while systemic antibiotics continued.

Findings: Multimodal imaging guided targeted management and ongoing monitoring for potential bone infection.

Conclusions

- Together, thermal imaging identified perfusion abnormalities, focal hypothermic zones, and inflammatory temperature gradients; fluorescence imaging detected clinically significant bacterial burden.
- Multimodal imaging findings directly informed assessment and influenced management decisions, including vascular referral, targeted wound packing, antimicrobial therapy, and treatment monitoring.
- These cases illustrate how combined thermal and fluorescence imaging can provide complementary insights in complex wound presentations.

References: [1] Le L, et al. *Adv Wound Care (New Rochelle)*. 2021;10(3):123-136. [2] Johnson J, et al. *J Racial Ethn Health Disparities*. 2024;11(2):1045-1055. [3] Armstrong DG, et al. *Int Wound J*. 2023;20(2):554-566. [4] Rahman S, et al. *Int Wound J*. 2025;22(8):e70741. [5] Maliyar K, et al. *Adv Skin Wound Care*. 2020;33(4):180-185.