

# Bacterial Fluorescence Imaging Affects Wound Management and Engages Patients in Their Care

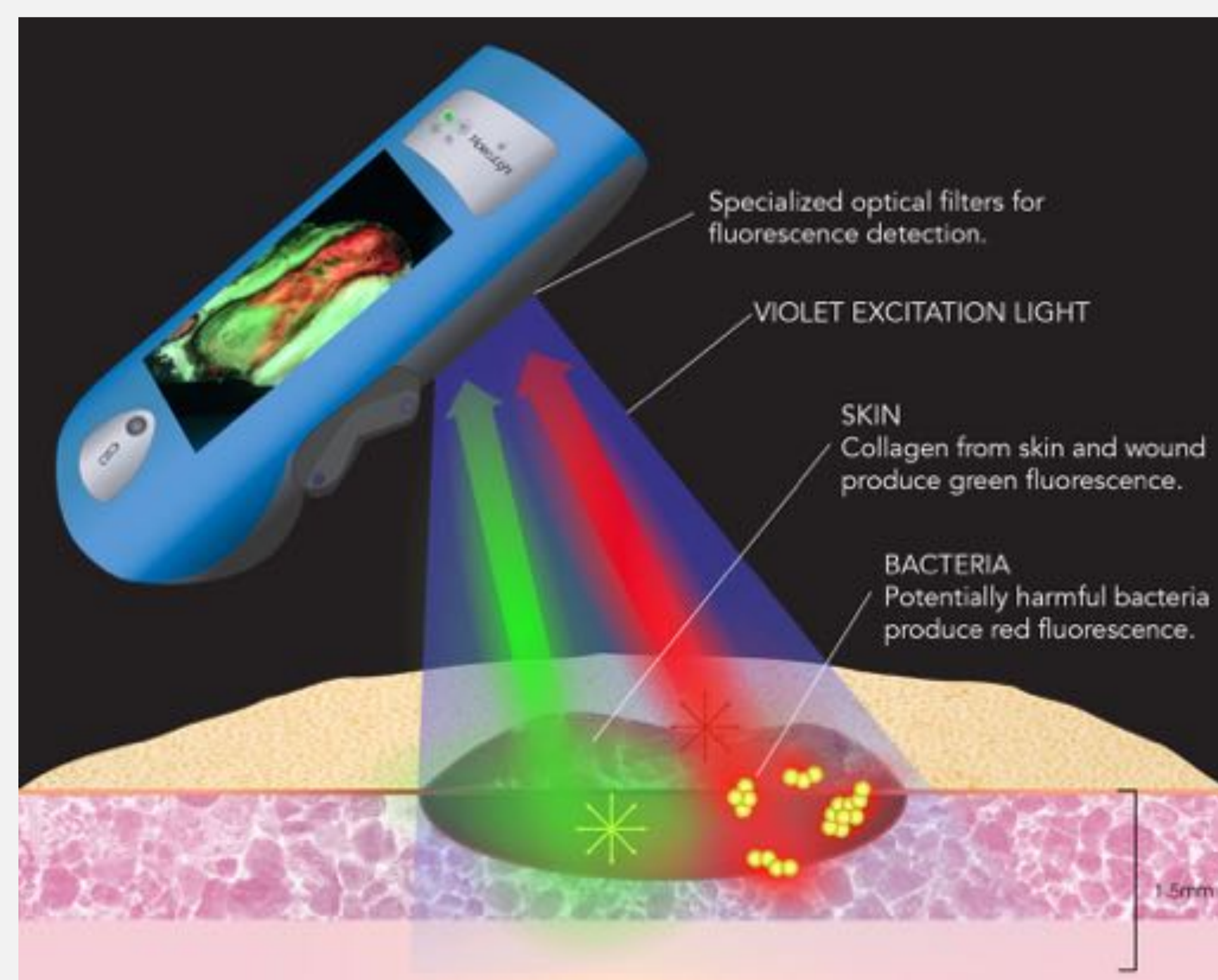
## INTRODUCTION

- Chronic wounds requiring hospitalization often harbor a high bacterial burden that negatively impacts tissue healing.<sup>1</sup>
- Knowledge of a wound's bioburden is currently obtained via culture analysis of wound swabs. This knowledge greatly impacts clinician treatment decisions. However, 24-48 hours can pass before results are available and false negatives rates are high.
- Real-time, point-of-care detection of critical bacterial colonization relies primarily on visual inspection and clinical signs and symptoms. Fluorescence imaging has recently been used to detect bacterial fluorescence in wounds at the bedside. This pilot study aimed to assess its effects on clinician decisions and patient care.
- This 7 week pilot study aimed to assess the effects of bacterial fluorescence images on clinician decisions and patient care.

## METHODS

### Bacterial Fluorescence Imaging (MolecuLight i:X)

- When excited by 405 nm violet light, tissues fluoresce green while bacteria fluoresce red (porphyrin-producers, e.g. *Staphylococcus aureus*) or cyan (pyoverdine-producing *Pseudomonas aeruginosa*).
- This enables real-time, point-of-care detection and localization of bioburden within and around wounds<sup>2-4</sup>.



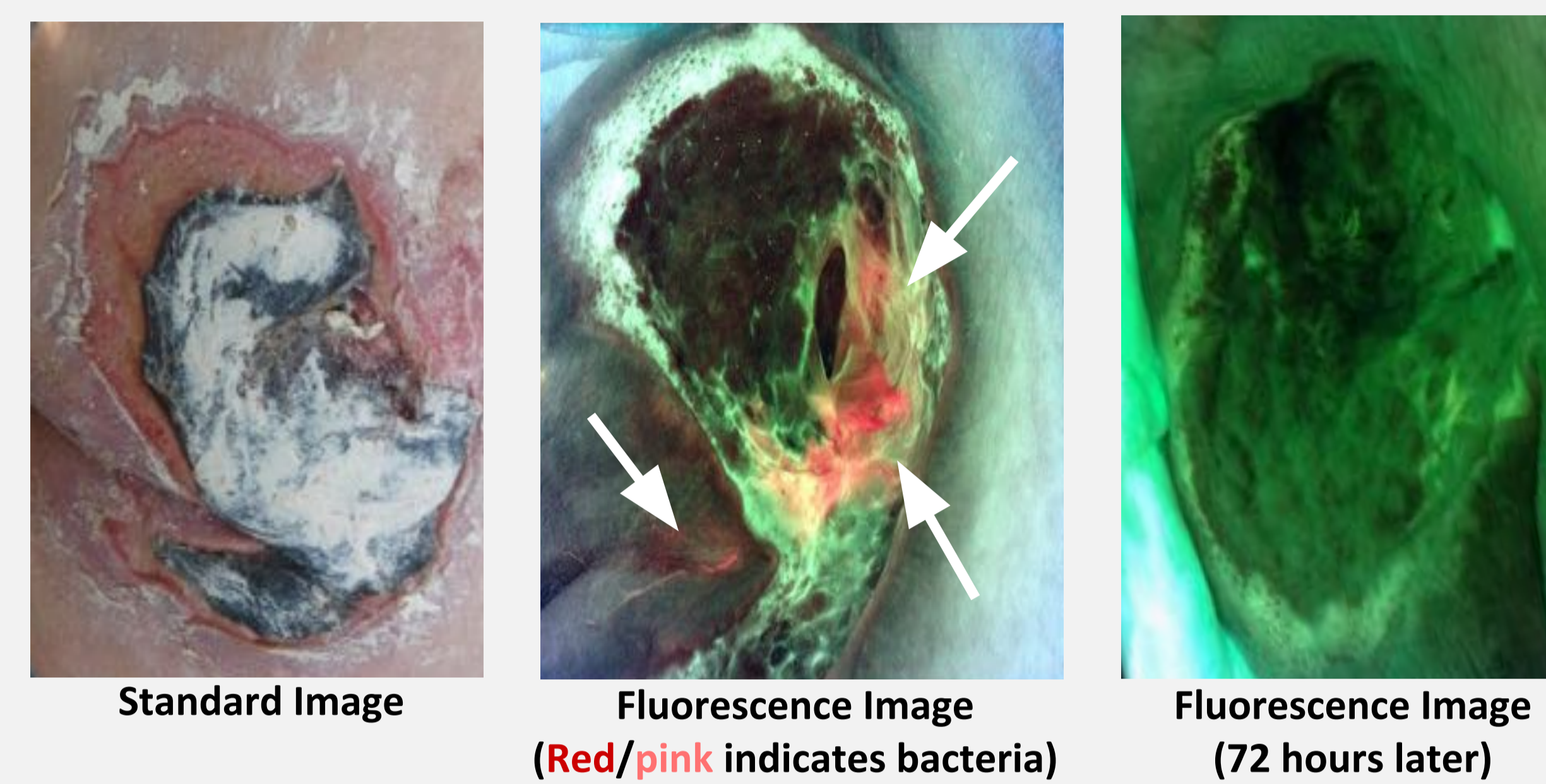
### Pilot Study

- 40 wounds** with diverse etiologies were imaged with the **fluorescence imaging device** at various stages of the wound healing process, over a **7 week period**. Wounds positive for **red or cyan fluorescence** were considered to have clinically significant bacterial loads. Any resulting change in clinician practice or effect on patient care was noted.
- All instances of bacterial fluorescence were confirmed via swab cultures. **All cultured regions of bacterial fluorescence exhibited moderate to heavy pathogenic bacterial growth.**

## RESULTS

### Bacterial Fluorescence Imaging Led Clinicians to target sampling to fluorescence-positive regions

#### Case 1: Pressure Injury - Coccyx



**Patient:** 77 year old male who sustained a right sided Subdural hematoma and was transferred from another hospital. He had been "found down."

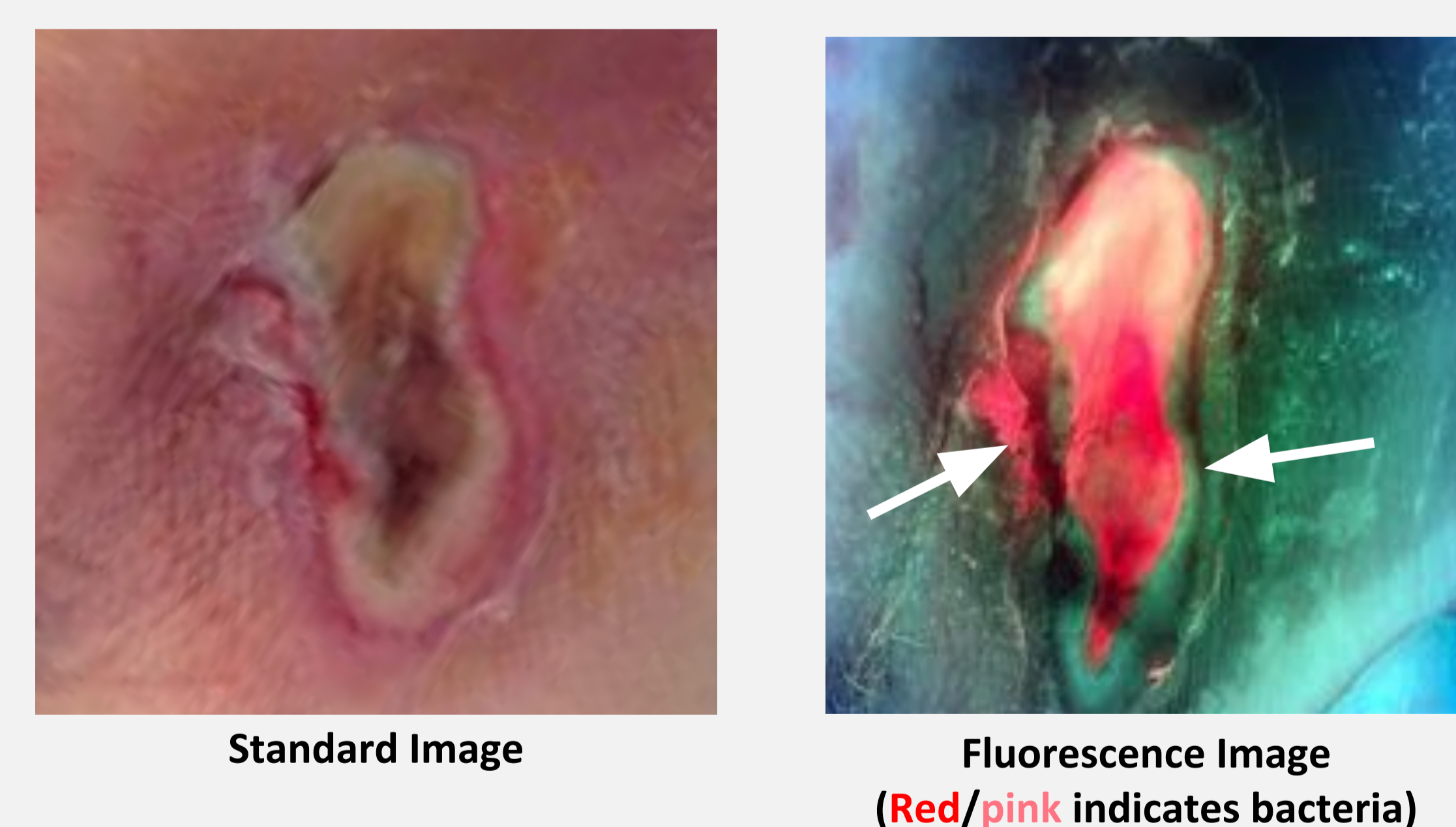
**Past Medical History:** Diabetes Type II

He had sustained a very large pressure injury and originally had a large black eschar in the buttock region. This eschar area was debrided and a week later the area was imaged with fluorescence. There clearly appeared to be an area of bright red fluorescence and this was then debrided.

72 hours later, repeat fluorescence imaging was deemed negative for heavy bioburden and NPWT was commenced.

### Bacterial Fluorescence Imaging Prevented Discharge of Patients Requiring Systemic Antibiotics

#### Case 2: Pressure Injury - Coccyx



**Patient:** A 93 year old living in assisted living, uses a walker. Opting to get out of bed without her walker resulted in a fall where she sustained a fracture to her left hip.

**Past Medical History:** osteoarthritis, chronic anemia, myelodysplastic syndrome, asthma

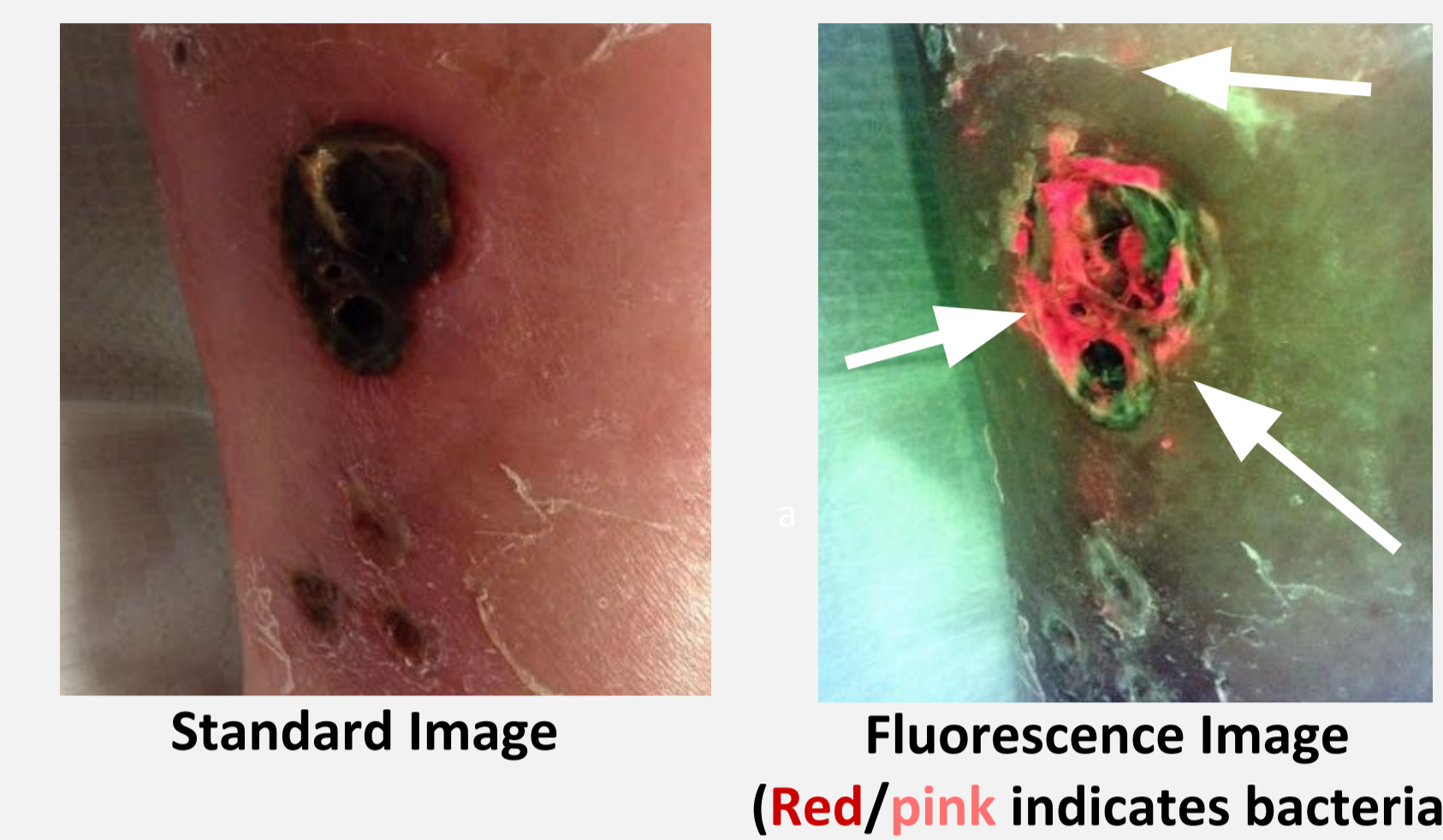
Following surgery there were difficulties with managing on her her sides which resulted in a hospital acquired pressure injury.

At the time of fluorescence imaging, plans were underway to send her to a long term care facility. Imaging resulted in targeted swabbing, systemic antibiotics and remaining in an acute care setting.

Swabs confirmed heavy growth of mixed coliforms, *enterococcus*, heavy growth of mixed anaerobes.

### Bacterial Fluorescence Images Guided selection of antimicrobials and directly influenced antimicrobial stewardship practices

#### Case 3: Cat Bite



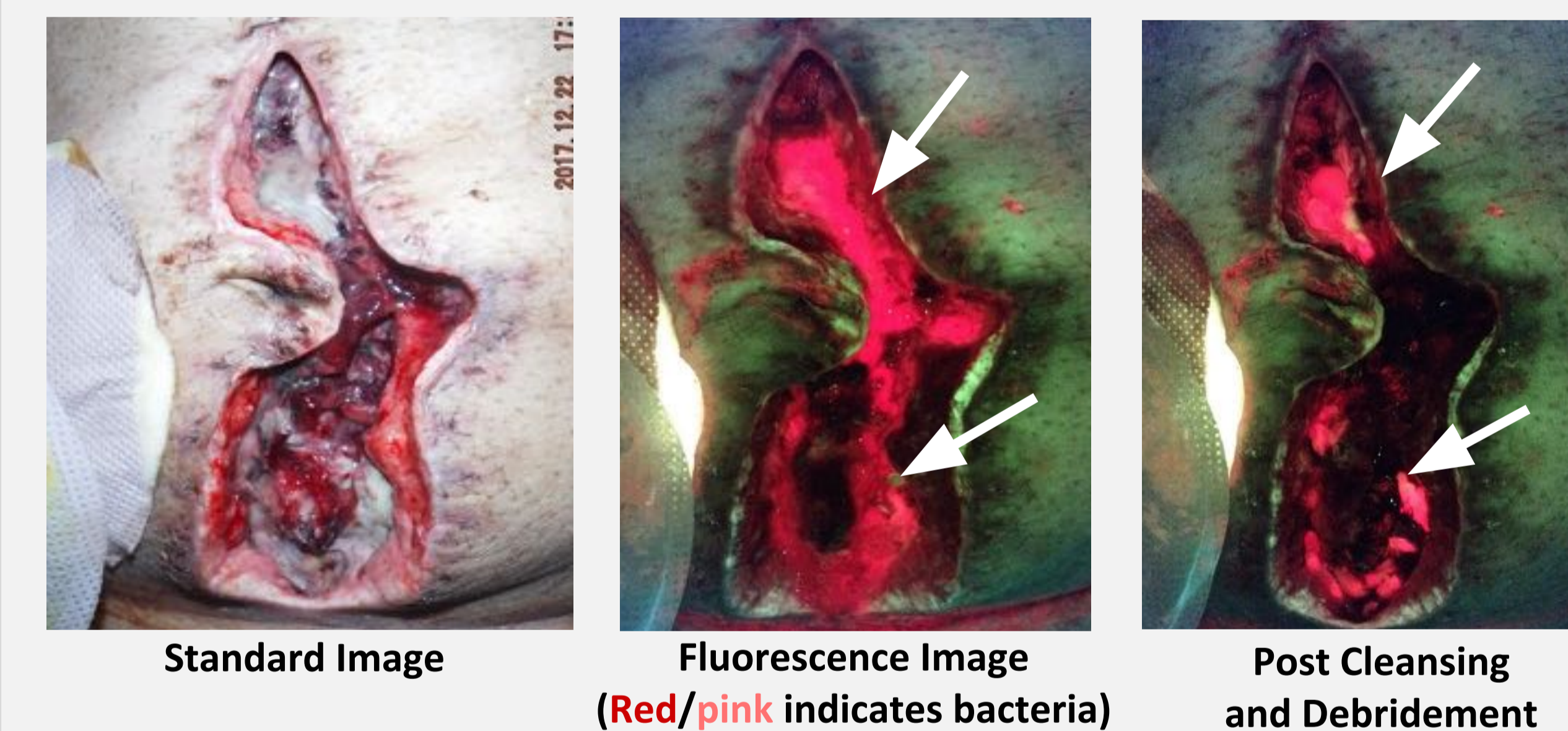
**Patient:** 63 year old male, attempted to pull back his cat as he was about to fight with another cat – and his own cat turned on him and bit him on his lower leg.

**Past Medical History:** unremarkable and no allergies

3 weeks after "cat bite" patient developed a painful right leg wound and abscess development. Cultures taken and immediate antimicrobial wound therapy included daily application of cadexomer iodine. Swabs of red/pink region confirmed heavy growth of *Staph aureus*, *Pasteurella multocida*, mixed anaerobes

### Real-time Bacterial Fluorescence guided the extend and location of wound debridement

#### Case 4: Midline Abdominal Incision Line - Infection



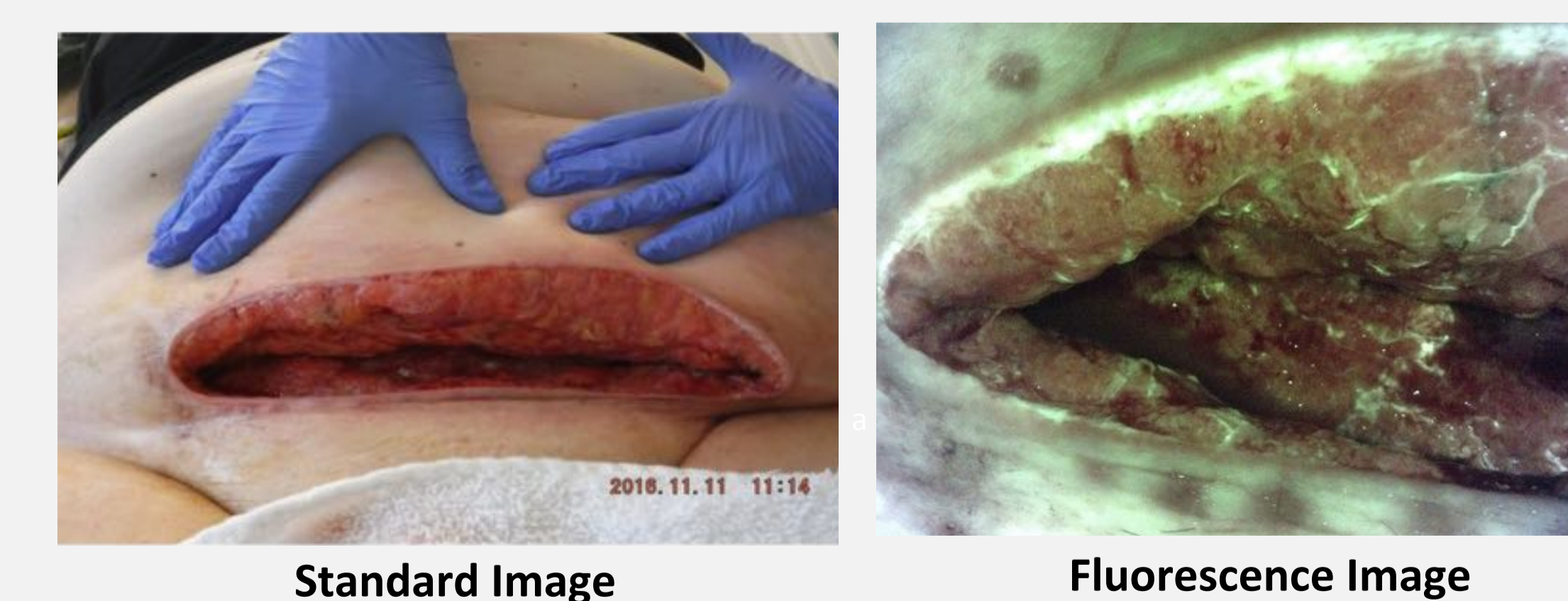
**Patient:** 51 year old male

**Past Medical History:** Diabetes Type II

Following a right hemicolectomy for an obstructing right colon adenocarcinoma, a week later presented with an anastomotic leak and intra-abdominal sepsis. Following Laparotomy and abdominal washout and creation of an ileostomy, he later presented with a dehiscd infected midline incision. Imaging represented following removal of NPWT, then wound hygiene.

### Real-time, bacterial fluorescence imaging engaged patients in their care and offered reassurance

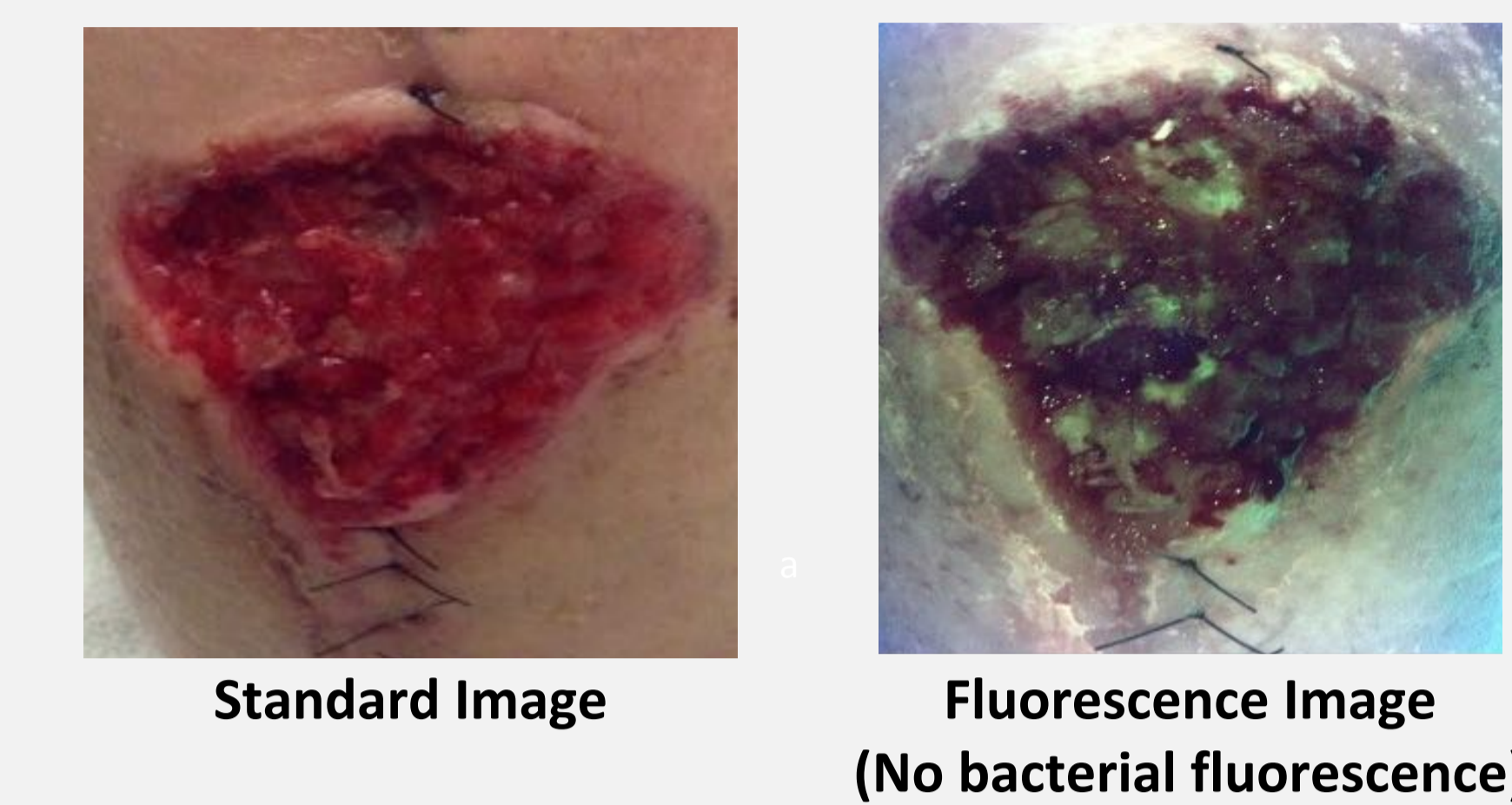
#### Case 5: Surgical Site Infection Abdomen



**Patient:** 60 year old female developed a post surgical site infection after a Total Abdominal Hysterectomy for a large uterine fibroid. Surgical Debridement and washout, with NPWT followed. At first dressing change patient was exceedingly anxious and looked for reassurance that her infection was "gone". Her wound received fluorescence imaging and then the photos were revealed to her which offered reassurance in terms of bacterial burden. This occurred at each dressing change – she stated "I no longer need aivan, as long as you use your wound tool – I am reassured."

### Images Negative for Bacterial fluorescence allowed for confidence with skin grafting

#### Case 6: Skin Graft



**Patient:** 36 year old male, who sustained numerous orthopaedic trauma and injuries. He developed a wound along the ulnar aspect of proximal forearm. The plastic surgeon deemed a skin graft was required.

**Past Medical History:** unremarkable

Fluorescence images were negative for bacterial fluorescence and thus graft applied with confidence within 36 hours. Swabs confirmed "no growth" of bacteria

## CONCLUSIONS

- Positive effects of bacterial fluorescence imaging on patient care and wound management were noted in six areas:
  - Led clinicians to **target sampling** to fluorescence-positive regions, which resulted in heavy growth of one or more pathogenic bacterial species from all swabs **eliminating risk of false negatives**
  - Prevented imminent discharge of patients requiring systemic antibiotics
  - Guided selection of antimicrobials** and directly influenced antimicrobial stewardship practices
  - Guided the extent and location of **wound debridement**, sparing non contaminated tissue
  - Engaged patients in their care** by educating them on caring for wounds and also provided reassurance in cases of wounds without contamination
  - Images negative for bacterial fluorescence allowed for **confidence when skin grafting**
- These results highlight the potential of bacterial fluorescence imaging used in conjunction with best clinical practices, to **positively impact patient care and bacteria management**, guiding clinician **treatment decision** at the point-of-care in cases where bacterial contamination could impede wound healing.

## REFERENCES

- Bowler PG *et al.* Wound Microbiology and associated approaches to wound management. Clinical Microbiology, 2001
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