DATA DRIVEN WOUND CARE

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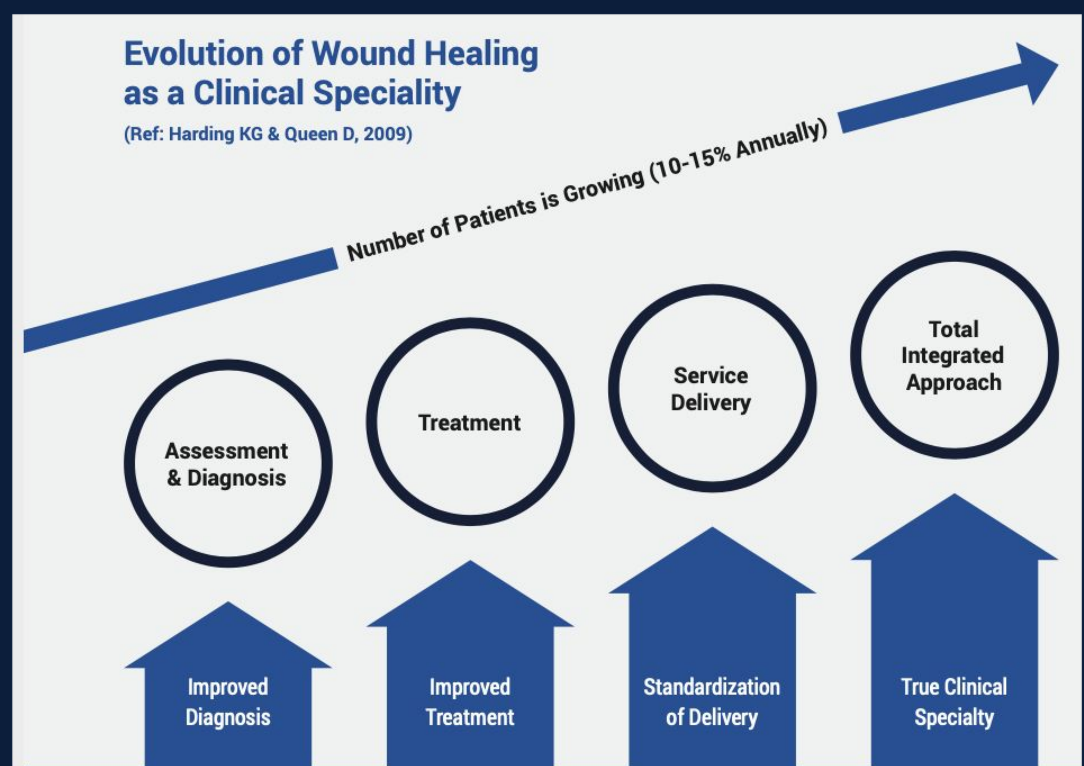
BACKGROUND

The evolution of wound care (Figure 1) as a clinical specialty began around 50 years ago (1). This includes the development of similar but different service models. The evolution has been slow at best (2). Many factors influence this. Wound care service models are essentially based on a similar foundation but may differ subtly due to regional processes and practices within healthcare (3).



THE WOUND CARE CHALLENGE

Wound care is a patient-centric approach with significant complexity due to many factors. Patients are often in multiple care settings, seeing multiple caregivers (Figure 2).

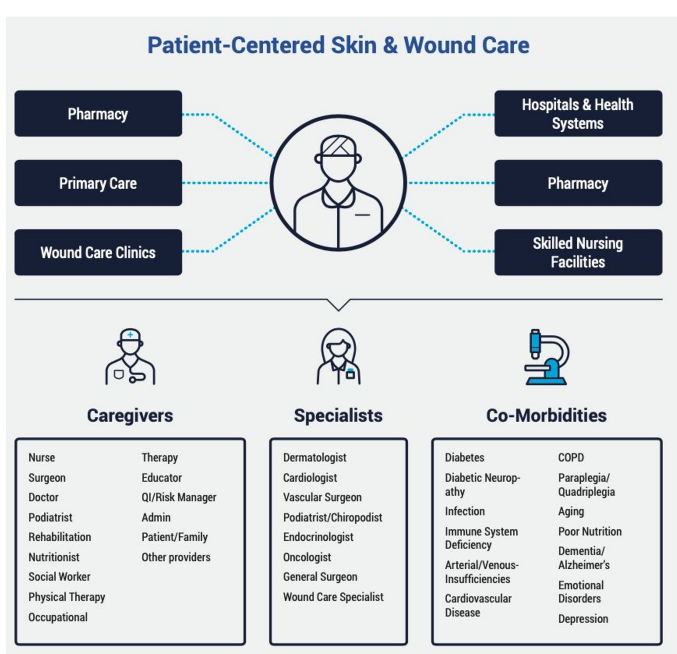


Table 1 - Examples of Multifactorial Assessment Parameters

Physical Tests and Observations (Others)
- Oxygen - e.g. transcutaneous O2 (perfusion)
- Ankle brachial pressure index (ABPI), arterial Doppler, angiography (perfusion, PAD)
- Imaging studies - e.g. X-rays, high freq ultrasound, Duplex scanning (venous disease), CT/MRI scans
- Photoplethysmography (venous disease)
- Nutritional screening/assessment - e.g. body mass index (BMI), mini-nutritional assessment short form (MNA-SF) (malnutrition, obesity)
- Psychological screening - e.g Hospital Anxiety and Depression Scale (HADS) (depression, anxiety)
- Temperature (pyrexia, infection)
- Blood pressure (hypertension)
- Neurological examination (neuropathy)
- Arterial pulses

Biological Tests
- White cell count (infection)
- Erythrocyte sedimentation rate (ESR), (inflammation, infection)

Physical Tests and Observations (Wound)
- Wound dimensions (two or three dimensional)
- Wound or periwound oedema, or erythema/heat
- Wound bed - e.g. type of tissue, presence of exposed bone/tendon, color, odor
- Wound margin - e.g. undermining, rolled edge
- Surrounding skin and wound edge characteristics (e.g. punched out ulcers may be arteria; oedema, pigmentation and induration may indicate venous ulcer)
- Wound site (e.g. sacral wounds may be pressure ulcers, lower leg wounds may be arterial or venous ulcers)
- Colour, odour, viscosity and quantity of exudate
- Presence/level/character of pain

(Bio)Chemical Tests
- Glucose (diabetes melitus)
- Haemoglobin (oxygenation)
- Plasma albumin (malnutrition)
- Lipids (hypercholesterolaemia)
- Urea and electrolytes (renal function)
- HbA1c (long-term control of diabetes)
- Rheumatoid factor, antibodies (rheumatoid arthritis, connective tissue disease)
- C-reactive protein (CRP) (inflammation, infections)

Biological Tests (Wound)
- Microbiological culture - qualitative and quantitative (infection)
- Wound histology and cytology (vasculitis/malignancy)

Consistency of approach and documentation is often an issue and can have a significant impact on clinical outcomes. Wound care is complex and oftentimes suboptimal. A multitude of patient factors can be involved, especially related to comorbidities (Table 1). This information with its collection and computation takes significant experience and skill, and is unlikely to be analyzed for rational clinical human decision-making.

DISCLOSURES & CONTACT INFORMATION

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THE WOUND CARE OPPORTUNITY

Data is a valuable asset in this evolutionary journey towards a wound care specialization (4). Many wound clinicians collect data but are not good at sharing or pooling this data as doing this is complicated and cumbersome. While a multi-disciplinary approach is preached by most, there is an over-protection of local information that may benefit others. Sometimes, this is a system issue rather than an individual issue where there is little or no ability for effective and consistent data capture.

Modern technological approaches can, however, influence both the service delivery and also the data capture and sharing. Artificial Intelligence is fast becoming a norm in healthcare, but many practitioners don't understand its real meaning and, more importantly, potential role in the management of wounds. Essentially it means "data-driven" or "experientially driven". It will be a catalyst for the evolution of more informed wound care practice and therefore help with the specialization of the clinical area.

The possibilities of a data driven approach within the standardisation of practice are many but include:
- Patient engagement in their care
- Workflow improvement for caregiver
- Care connectivity across the health continuum
- Education and awareness
- Symptom management (eg, pain)

Artificial Intelligence models use tens of millions of patient charts, generally stored in electronic health records, with billions of data points. Human analysis is therefore impossible as clinicians may only see a few tens of thousands of patients in their entire career (5). Through this type of approach to wound care can be standardized, made more objective, and augmented.

Such approaches will impact all areas within wound care, prognosis, diagnosis, and treatment. It will also have an impact on workflow efficiency and broadening access to quality care. Engaging with technology will realize the promise of better outcomes for patients through the enhanced delivery of care by their care team.

CONCLUSIONS

- Artificial intelligence married to human intelligence will allow more precise, patient-centric care, resulting in better outcomes. The ability to standardize practice through the many settings of care delivery, and to "up-skill" its delivery, can help relieve the systemic burden of wounds.
- In wound care, data-driven approaches will impact on all areas, from prognosis, diagnosis, and treatment, to workflow efficiency and broadening access to quality care.
- Engaging with technology will realize the promise of better outcomes for patients through the enhanced delivery of care by their care team.

EVOLUTION OF SPECIALTY

Data-driven wound care has the potential to be a catalyst for the evolution of a more informed wound care practice. Today, and in the future, its deliverables are based on broad and extensive datasets, from which the ecosystem learns. Data-driven models today may make decisions with the benefits of tens of millions of patient records, and billions of data-points. Data-driven wound care has the potential to be the catalyst for the continued, but accelerated evolution of the clinical specialty. Humans are simply human, with limited computation capability and inherent human biases. Machines, on the other hand, can handle large data volumes and exhibit much less bias, if any.

Data-driven approaches will "upskill" resources and drive collaboration with specialized clinical skills providing better insight. For example, automatically identifying tissue types and wound stage will remove the human necessity and provide a more consistent and clinically relevant output. Enhanced wound and patient risk measures and prognostic capabilities will multiply the effectiveness of the care team. Machines will provide augmentation of approach rather than replacement of human interaction.

With massive imagery and data sets, the patient and the clinician will benefit from the aggregated knowledge of millions of prior encounters and outcomes. Similar approaches have been successfully applied in other clinical settings, such as radiology and diabetic retinopathy, to streamline clinical diagnosis and improve patient outcomes.

Through the use of technology systems such as mobile skin and wound measurement apps, wound clinicians can collect large volumes of calibrated and structured data. Subsequently, through data analysis (AI) techniques we begin to truly understand the areas of focus and change required to drive the evolution of the specialization.

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