

## From ancient wisdom to modern science: retracing knowledge of mind-body connections in wound healing



Author:  
Nicola Waters

Throughout history, the ways wounds have been understood and managed in relation to the patient's body has altered in line with social trends of the times<sup>[1]</sup>. Today, the need to find efficient and effective ways to address the growing burden of chronic wounds has fuelled unprecedented advances in scientific knowledge of tissue repair and an exponential growth in new technologies designed to speed up this process<sup>[2]</sup>. Despite calls to "assess and treat the whole person and not the hole in the person"<sup>[3]</sup>, the ongoing reductionist approach of Western medicine to treating symptoms, rather than their cause, means that 'quality' wound practice remains heavily oriented towards local wound interventions<sup>[4-6]</sup>. The relationship between patients' emotions, wound occurrence and wound healing is by no means a new concept<sup>[7]</sup>. In recent times, however, as knowledge of this complex interplay is funnelled through the rigid parameters of evidence-based practice (EBP), not only does the requirement to produce rigorous scientific data influence how clinicians approach the topic, it also alters the way historical wound research is interpreted.

### A selective history of wound knowledge

A quick search of the literature produces numerous references to the historical evolution of today's wound work<sup>[8-12]</sup>. Common topics include: primeval clay tablets and scrolls variously depicting people washing wounds with beer and hot water before applying mixtures of herbs and ointments<sup>[10]</sup>; Ancient Egyptians employing the astringent and antiseptic properties of plant resins, honey, salts and metallic compounds; Galen's Roman treatise on the importance of moist wound healing<sup>[9]</sup> and Ambroise Paré's 16th century maggot therapy<sup>[10]</sup>. With the welcome exception of certain short-lived remedies, including dove's dung<sup>[11]</sup> and "moss scraped from a dead man's skull"<sup>[13]</sup>, traces of early wound innovations are clearly visible in the scientific evidence supporting today's advanced therapies. Indeed, one might be forgiven for wondering whether anything new ever happens in wound healing. Yet, a closer review of these historical accounts reveals an interesting phenomenon. Written within and for today's medical establishment, these records

almost invariably comprise a chronological timeline of advances in local wound assessment and treatments. Rarely included are any references to the evolution of knowledge about aspects of healing that occur beyond the wound itself. For those seeking answers on how to approach "the whole person"<sup>[3]</sup>, it seems the evidence, at least from a historical perspective, is conspicuously absent.

### An overview of current mind-body science and wound healing

Clinicians at the frontline of practice are intimately familiar with the life-changing experiences that can occur in individuals living in bodies that are both the cause and the context for wounds<sup>[6]</sup>. Tales of apparently inexplicable occurrences that improved or impaired healing are commonplace, albeit largely dismissed as 'anecdotal'. A small number of qualitative studies<sup>[14-16]</sup> offer considerable insight into the profound personal impact of living with chronic wounds. Common themes include variously described reports of pain, restricted lives and difficulty coping. These reports are vastly outnumbered, however, by laboratory and clinical studies that aim to demonstrate correlational links between psychological and biological mechanisms of wound healing using pre-defined measurements and outcomes.

Attempts to quantify these multidimensional phenomena include health-related quality of life<sup>[17]</sup>, pain scales<sup>[18]</sup> and health behaviours<sup>[19]</sup>. Study populations are frequently delineated by clinically distinguishable wound categories, such as diabetic foot ulcers<sup>[20]</sup> and pressure ulcers<sup>[17]</sup>.

Researchers aiming to establish connections between a range of stressors and cellular level changes have employed diverse methods of wound assessment criteria, all selected for their conduciveness to statistical measurement. Chronic psychosocial stress has been linked to a wide array of health problems associated with chronic inflammation<sup>[21]</sup>, and shown to manifest in wounds as altered cytokine and metalloproteinase expression<sup>[19]</sup>.

Relationships have been demonstrated between delayed wound healing and emotional distress in women caring for a relative with Alzheimer's disease<sup>[22]</sup> and in older leg ulcer patients with elevated anxiety and depression

Nicola Waters is Associate Professor, Thompson Rivers University, Kamloops, Canada

scale scores<sup>[23]</sup>. Short-term stress has produced slower healing times in groups such as healthy adults facing upcoming surgery<sup>[24]</sup>, students with impending exams<sup>[25]</sup> and married couples involved in conflictual interactions<sup>[26]</sup>.

Nonetheless, the intricate links between mind and body that generate each individual's unique context mean the work of controlling for confounding variables is fraught with challenges. Not surprisingly, efforts to demonstrate cellular-level links between wound healing and individual 'health behaviours' have produced inconclusive results<sup>[27]</sup>. The difficulties of isolating specific contributory causes of impaired healing are highlighted in attempts to quantify patients' wound-related pain, while acknowledging myriad compounding factors, such as anxiety, past pain experience, expectations and relationships with caregivers<sup>[18]</sup>, any of which may account for unanticipated responses.

Promising outcomes have been demonstrated for a number of interventions aimed at improving healing through stress-reduction techniques, including expressive writing<sup>[28,29]</sup>, anger expression<sup>[30]</sup> and resilience-building<sup>[31]</sup>. Yet, even when supported by evidence from well-designed randomised controlled trials, these and similar approaches remain effectively relegated to the status of 'alternative' and 'complementary'<sup>[32]</sup>, and are largely omitted from best practice recommendations.

Published guidelines, promoted as systematic reviews of all available data, often emphasise the need to address aspects of patients' lives that may impact healing. Yet algorithms and care pathways are routinely developed on the premise that readily visible endpoints, such as size of wound, time to wound closure and infection rates, are the most valid predictors of healing<sup>[2,33]</sup>. As a result, clinicians' work is increasingly organised around the need to collect information about the physical characteristics of wounds, overlooking other aspects of patients' lives that are less conducive to measurement and categorisation<sup>[6]</sup>. Patients are educated to modify certain behaviours to bring them into line with standardised protocols expected to produce optimal results, but which may have little bearing on the patient's unique circumstances<sup>[6,20,34]</sup>. Not only does this approach discount existing findings that loneliness and dysphoria may compromise people's ability to comply with such advice<sup>[35]</sup>, it also frequently requires patients living with wounds to make near-impossible choices between following clinical advice and fulfilling commitments to

family members or employers<sup>[14,20]</sup>, exacerbating stress that may further impair healing.

## Retracing the history of wound care

It is apparent that there is much to learn about the connections between emotions and wounds, and their potential significance for clinicians and patients alike. Within the relatively new specialty of 'advanced wound care', the question of why exploration of this complex topic often takes a back seat to an intense focus on local wound interventions has rarely come under scrutiny. Interestingly, however, a return to the historical accounts of several key events in the evolution of wound knowledge reveals four common themes that have shaped the way certain information is taken up, while other kinds of knowledge are routinely overlooked. These are:

- Culture — trends in wound care provision have always been determined to a large extent by the cultural values of the time. Practitioners, past and present, are bound by laws and regulations embedded in dominant spiritual, religious or ideological teachings about how people, bodies and illness are understood
- Conflict — many of the greatest wound-related innovations can be directly linked to clashes driven by opposing ideologies and disputed territorial claims. The numerous occasions when these conflicts resulted in physical confrontation provided fertile ground for advancing knowledge of human wounds<sup>[12]</sup>
- Convenience — many innovations arose from improvisation and creative adaptation of readily available materials and techniques
- Criticism — in almost every case, strategies that are today considered fundamental to wound practice were initially met with criticism and dismissed as a threat to prevailing knowledge<sup>[36]</sup>.

Several significant contributions to wound healing knowledge have been attributed to Galen, who was kept busy applying his selective interpretation of Alexandrian and Hippocratic treatments to horrific injuries sustained in Roman gladiatorial arenas<sup>[1,9]</sup>. At a time when few citizens aside from nobles received formal medical care, Galen's status as physician to the emperors afforded him a unique platform from which to promote his barbaric views on bloodletting, cauterisation, purging and fasting that closely aligned with the brutal cultural practices of the day. Competing schools of thought, including the healing powers of baths, naps, wine and pleasurable eating<sup>[37]</sup> were largely subsumed by an almost universal acceptance of Galen's prolific writings, which went uncontested for centuries, often with dire results<sup>[1]</sup>.

The fact that the Middle or Dark ages are often reported as times when few wound care advances were made<sup>[1,10]</sup> is somewhat surprising, as this era saw an exponential increase in international travel and trade that brought together influences from a wide variety of cultures<sup>[12]</sup>. Health practices were strongly influenced by religious teachings about the relationship between the physical and spiritual. In a time when the sick were considered unclean and no formally educated person would contemplate touching a patient, lay healers (often women), performed much of the hands-on work<sup>[8,38]</sup>. With the rare exception of one surviving manuscript from the London of 1392, which clearly outlines the benefits of treating wounds as symptoms of underlying disease, details of successful cures were passed on orally and, as a result, have often been lost or under acknowledged<sup>[39]</sup>. The witch hunts of this period also significantly contributed to the eradication of certain forms of knowledge, with systematic executions of individuals whose practices did not align with the ruling powers<sup>[38]</sup>.

Under religious laws forbidding physicians to shed blood, medicine in 16th century Europe was largely a theoretical occupation that was entirely separate from the surgery undertaken by barbers, whose skill with blades expanded beyond ritual monastic hair cutting to include bloodletting, cupping therapy and pulling teeth<sup>[8,40]</sup>. During the many conflicts taking place, doctors treated nobles while soldiers relied on the services of barber surgeons like Ambroise Paré, who completed his apprenticeship on the battlefields of France<sup>[40]</sup>. In contrast to many of his peers, Paré was literate and articulately recorded his experiences, citing his extensive knowledge of medical texts. In a classic example of necessity being the mother of invention, when the boiling oil commonly used to seal soldier's wounds ran out during a battle, Paré was forced to get creative. He was stunned to see that soldiers treated with "yolks of eggs, oyle of roses and turpentine" fared much better than those cauterised with hot oil.

Paré's quote: "I dressed the wound and God healed it" is frequently cited to symbolise his contribution to today's wound dressing science<sup>[36]</sup>. What is often missing, however, from accounts of Paré's legacy, is his consistent acknowledgement of factors beyond his control that ultimately determined whether soldiers in his care lived or died. As seen in his graphic description below, what fundamentally distinguished Paré's work from that of his contemporaries was his insistence that

providing patients with adequate pain relief and nutrition, and placing them in an environment where they could rest peacefully, likely healed more wounds than any topical application:

"Many died of the diabolical storm of the echo of these engines of artillery, and the vehement agitation and severe shock of the air acting on their wounds; others because they got no rest for the shouting and crying that were made day and night, and for want of good food, and other things needful for their treatment<sup>[40]</sup>."

Paré's lowly status within the medical hierarchy left his ideas open to considerable criticism. Notably, his thoughts on patient care came just as wounds and wound care practices were being swept up in the next pivotal turn in philosophical and scientific thinking. The Renaissance, an era noted for a move away from religious towards more secular doctrines, was a time of significant advances in the understanding of human anatomy. This was also when René Descartes proposed his metaphysical dualism, conceptualising the body as a machine-like entity in which the mind and body are considered independent<sup>[41]</sup>. Parallel discoveries that ailments could be attributed to distinct systems or parts of the body, bolstered the interventionist approach that remains a cornerstone of today's healthcare, in which the diseased area is studied and treated in isolation in the belief that a local cure will benefit the patient as a whole<sup>[42]</sup>.

In the 19th century, as the (re-)discovery of germ theory<sup>[43]</sup> was revolutionising modern medicine, Scottish doctor Joseph Lister first demonstrated reduced wound sepsis through the use of antiseptics in surgery and dressings soaked in carbolic acid. Although his views were initially met with scepticism<sup>[44]</sup>, Lister played a contributory role in the next significant milestone in wound healing practice, the licensing of antiseptic wound dressings for industrial production<sup>[10]</sup>. While there is little question that these pre-antibiotic measures were instrumental in averting infection and saving lives, the mechanistic approaches to wound care that evolved as a result have had an enduring impact on current practice. Caught up in the powerful medical discourse of the day, nurses, who were by now largely responsible for wound care under the direction of physicians, began to focus their attention on the technical aspects of applying dressings and preventing sepsis<sup>[45]</sup>. Even as Florence Nightingale was formulating her view of the 'modern' nurse with her insistence that "what nursing has to do ... is to put the patient in the best condition

for nature to act upon him<sup>[46]</sup>, wound care became a singularly focused task of 'doing a dressing'. Instructions for adhering to regimented sets of orders were passed on verbally, with limited consideration of any factors beyond preventing infection<sup>[45,47]</sup>.

## Recent history — an era of advanced wound care

As in previous periods, lessons learned during major conflicts of the 20th century produced knowledge that has become central to current wound care practice. During World War I, new types of wounds from high-velocity bullet and shrapnel injuries and a concurrent high incidence of gas gangrene drove swift advances in debridement, irrigation and plaster of Paris immobilisation to decrease dressing frequency. These approaches were further refined in World War II, when mobile warfare and bombing raids necessitated the wounded being transported unattended over long distances<sup>[48]</sup>.

Of equal, if not greater, significance is the way in which the care of wounds was swept up in cultural shifts taking place within complex economic, political, technological and commercial discourses reorganising health services. Concurrent with an aging population and increased incidence of chronic disease, health care delivery was becoming inextricably linked to EBP — "arguably the most important contemporary initiative committed to reshaping biomedical reason and practice"<sup>[49]</sup>. Faced with significant changes in the types and numbers of wounds encountered, clinicians came under increasing pressure to demonstrate effective use of available technologies through the development of standardised definitions, decision tools and quality indicators<sup>[2,7]</sup>. To meet funding decision demands for specific evidence criteria, wound experts drew heavily on an unprecedented growth in scientific research conducted with easily measurable endpoints<sup>[33]</sup>.

As practitioners sought to establish advanced wound care as a specialty practice area, non-statistical research methods and expert knowledge of less-quantifiable factors were consigned to the lowest rungs of the widely-adopted hierarchy of evidence<sup>[5,6]</sup>. Availability of interventions and therapies was progressively tied to a rapidly expanding wound product industry, culminating in the appearance of pre-approved 'formularies' of items selected for exclusive use in treatment plans supported by evidence from sponsored effectiveness studies<sup>[50]</sup>.

While EBP has undoubtedly contributed to improvements in many areas of healthcare,

as clinicians have been increasingly subjected to rules and regulations governing its implementation, concerns have also been raised about unanticipated negative consequences<sup>[51]</sup>. Initially promoted as a way to synthesise scientific research, professional expertise and individual patient concerns<sup>[52]</sup>, a lack of consensus on what constitutes 'evidence' in each case has polarised debates about EBP's relevance to frontline work<sup>[51]</sup>. Advocates argue that knowledge synthesis through systematic reviews that privilege large-scale, tightly controlled studies reduces bias in clinical decision-making<sup>[53]</sup>. Critics, on the other hand, contend that a narrow focus on certain forms of scientific evidence leads to an over-generalisation of results that discounts the expertise of clinicians and the preferences of patients who fall outside the rigid criteria on which much of the research depends<sup>[33,51]</sup>.

The historical divide between subjective, experiential modes of knowing as contrasted with abstract, scientific discourse is epitomised in advanced wound care with its well-delineated evidence base and emergence of an associated industry sector. EBP requirements that encompass the presentation of wounds and the wounded in specific ways have important implications, as precise measurement is privileged within the hierarchy of evidence over less-tangible knowledge of healing and emotions. The algorithmic practices that result have been criticised for regulating, rather than supporting, wound work and impeding clinicians' abilities to make informed choices in the best interest of their patients<sup>[4,5,54]</sup>. Fife et al<sup>[34]</sup> contend that sponsored wound care protocols with stringent exclusion criteria do not accurately reflect "the most vulnerable populations such as those with dementia, the disabled, racial minorities, and the very elderly". Patients who are unwilling or unable to comply with what has been deemed 'best' practice, according to standardised protocols, are labelled as 'non-compliant', often with grave consequences<sup>[6]</sup>.

## Looking back and looking forward

Knowledge of wounds has been extensively shaped by shifting cultural trends, times of conflict, convenience of supplies and the ways in which criticism has been received. In recent history, as in times past, it is these factors that have ultimately determined which concepts are lauded and which are stifled. In this article, it is clear that who we are today has been extensively shaped by shifting cultural trends,

times of conflict, convenience of supplies and the ways criticism has been received. In recent history, as in times past, it is these factors that have ultimately determined which concepts are lauded and which are stifled.

Working in today's healthcare systems, constructed within a reductionist philosophy highly dependent on quantifiable outcome measures, presents considerable challenges for wound care clinicians seeking acceptable ways to express reciprocal physical and emotional responses. It also offers a plausible explanation for the comparatively little attention paid to concepts of mind-body connections in historical accounts targeted for today's 'evidence'- hungry audiences.

With this in mind, it is timely to revisit another account of one man's struggles in a time of conflict. During his experience as a physician and prisoner of war, Sir Archibald Cochrane, whose work has been taken up with such profound impact on today's wound care practices, observed that, despite the terrible conditions, the unexpectedly small number of deaths had "of course, nothing to do with the therapy they received or my clinical skill. It demonstrated, on the other hand, very clearly the relative unimportance of therapy in comparison with the recuperative power of the human body"<sup>[55]</sup>.

As the quest to learn more about the complex relationships between psychosocial, cognitive and biological mechanisms continues, Cochrane's observations serve as a powerful reminder to heed calls from the pages of history that run counter to the currently taken-for-granted ways of knowing wounds. Acknowledging past and present experiences of wounds, bodies and the wounded that, as yet, cannot be measured, anticipated or controlled, offers a unique opportunity to reflect on how the kinds of knowledge produced today are shaping not only current practice, but also our legacy for generations to come.

WINT

## References

1. Majno G. *The Healing Hand: Man and Wound in the Ancient World*. Harvard University Press, London, 1975
2. World Union of Wound Healing Societies. *Principles of Best Practice: Diagnostics and Wounds. A Consensus Document*. MEP, London, 2008
3. Keast DH, Orsted H. The basic principles of wound care. *Ostomy Wound Manage* 1998; 44(8): 24–8, 30–1
4. Maylor ME. Don't give me evidence, give me reality! *Br J Nurs* 2007; 16(20): 53–53
5. Cutting K. Should evidence dictate clinical practice or support it? *Journal of Wound Care* 2008;17: 216
6. Waters N. *The Social Organization of Wound Clinic Work: An Institutional Ethnography* (Doctoral dissertation), 2016. Available at: [http://theses.ualgary.ca/bitstream/11023/2868/1/ucalgary\\_2016\\_Waters\\_Nicola.pdf](http://theses.ualgary.ca/bitstream/11023/2868/1/ucalgary_2016_Waters_Nicola.pdf) (accessed 31.01.2016)
7. Knighton D. *The Wisdom of the Healing Wound*. Health Communications, Florida, 2011
8. Forrest RD. Development of wound therapy from the dark ages to the present. *JR Soc Med* 1982; 75: 268–73
9. Ovington LG. The evolution of wound management: Ancient origins and advances of the past 20 years. *Home Healthc Nurse* 2002; 20(10): 652–6
10. Broughton G 2nd, Janis J, Attinger C. A brief history of wound care. *Plast Reconstr Surg* 2006;117(7S): 6S–11
11. Shah JB. The History of Wound Care. *J Am Col Certif Wound Spec* 2011; 3(3): 65–6
12. Dealey C. *The Care of Wounds: A Guide for Nurses*. [4th edn]. Blackwell, Melbourne, 2012
13. Walsh JJ. *Cures: The Story of the Cures that Fail*. D. Appleton, New York, 1924
14. Kinmond K, McGee P, Gough S, Ashford R. 'Loss of self': A psychosocial study of the quality of life of adults with diabetic foot ulceration. *J Tissue Viability* 2003; 13: 6–8, 10, 12
15. Goldberg E, Beitz J.M. The lived experience of diverse elders with chronic wounds. *Ostomy Wound Manage* 2010; 56: 11, 36–46
16. Fagerdahl A, Boström L, Ottosson C, Ulfvarson J. Patients' experience of advanced wound treatment—a qualitative study. *Wounds* 2008; 25(8): 205–11
17. Gorecki C, Brown JM, Nelson EA et al. Impact of pressure ulcers on quality of life in older patients: a systematic review. *J Am Geriatr Soc* 2009; 57: 1175
18. Woo KY. Exploring the effects of pain and stress on wound healing. *Adv Skin Wound Care* 2012; 25(1): 38–44
19. Christian L, Graham J, Padgett D et al. Stress and Wound Healing. *Neuroimmunomodulation* 2006; 13(5–6): 337–46
20. Waters N, Holloway S. Personal perceptions of the impact of diabetic foot disease on employment. *The Diabetic Foot Journal* 2009; 12(3): 119–31
21. Pawelec G, Goldeck D, Derhovanessian E. Inflammation, ageing and chronic disease. *Curr Opin Immunol* 2014; 29: 23–8
22. Kiecolt-Glaser JK, Marucha PT, Malarkey WB et al. Slowing of wound healing by psychological stress. *Lancet* 1995; 346: 1194–6
23. Cole-King A, Harding K.G. Psychological factors and delayed healing in chronic wounds. *Psychosom Med* 2001; 63(2): 216–20
24. Broadbent E, Petrie KJ, Alley PG, Booth RJ. Psychological stress impairs early wound repair following surgery. *Psychosom Med* 2003; 65: 865–9
25. Marucha PT, Kiecolt-Glaser JK, Favagehi M. Mucosal wound healing is impaired by examination stress. *Psychosom Med* 1998; 60: 362–5
26. Kiecolt-Glaser JK, Loving TJ, Stowell JR et al. Hostile marital interactions, proinflammatory cytokine production, and wound healing. *Arch Gen Psychiatry* 2005; 62: 1377–84
27. Ebrecht M, Hextall J, Kirtley L-G et al. Perceived stress and cortisol levels predict speed of wound healing in healthy male adults. *Psychoneuroendocrinology* 2004;

- 29: 798–809
28. Weinman J, Ebrecht M, Scott S et al. Enhanced wound healing after emotional disclosure intervention. *Br J Health Psychol* 2008; 13(Pt 1): 95–102
  29. Koschwanetz HE, Kerse N, Darragh M et al. Expressive writing and wound healing in older adults: a randomized controlled trial. *Psychosomatic Medicine* 2013; 75(6): 581–90
  30. Gouin JP, Kiecolt-Glaser JK, Malarkey WB, Glaser R. The influence of anger expression on wound healing. *Brain Behav Immun* 2008; 22(5): 699–708
  31. Edward KL, Ousey K. The role of resilience in rebuilding lives of injured veterans. *J Wound Care* 2016; 25(10): 571–5
  32. Laforet K, Baron RA, Woodbury MG et al. Alternative and complementary therapies for wound care. In: Krasner DL, Rodeheaver GT, Sibbald RG, Woo KY, (Eds). *Chronic Wound Care: A Clinical Source Book for HealthCare Professionals. Vol.1 (5th edn)*,: HMP Communications, Malvern 2012; 243–52
  33. White R, Maylor M, Iverson C. Evidence is 'in', ignorance is 'out': A dilemma for advanced wound care products. *Wounds UK* 2010; 6: 114–6
  34. Fife CE, Carter MJ, Walker D, Thomson B. Wound care outcomes and associated cost among patients treated in US outpatient wound centers: Data from the US wound registry. *Wounds* 2012; 24, 10–7
  35. Bosch JA, Engeland CG, Cacioppo JT et al. Depressive symptoms predict mucosal wound healing. *Psychosom Med* 2007; 69(7): 597–605
  36. Cohen I. Lessons from the history of wound healing. *Clinics in Dermatology* 2007, 25(1): 3-8.
  37. Wazer C. *The Ancient Romans That Healed Through Pleasure*, 2016. Available at: <http://www.theatlantic.com/health/archive/2016/03/roman-spas-in-antiquity/471399/> (accessed 12.01.2016)
  38. Ehrenreich B, English D. *Witches Midwives Nurses: A History of Women Healers* (2nd edn). Feminist Press, New York, 2010
  39. Naylor IL. Ulcer care in the Middle Ages. *J Wound Care* 1999; 8(4): 208–12
  40. Paré A. *Journeys in Diverse Places*, translated by Stephen Paget. Vol. XXXVIII, Part 2. The Harvard Classics. PF Collier & Son, New York, 1909
  41. Clarke DM. *Descartes's Theory Of Mind*. Oxford University Press, Oxford, 2003
  42. Erickson HL. Philosophy and theory of holism. *Nurs Clin North Am* 2007; 42: 139–63
  43. Karamanou M, Panayiotakopoulos G, Tsoucalas G et al. From miasmas to germs: a historical approach to theories of infectious disease transmission. *Infez Med* 2012; 20(1): 58–62
  44. Cameron HC. Lord Lister And The Evolution Of Wound Treatment During The Last Forty Years. Being The James Watson Lectures Delivered At The Faculty Of Physicians And Surgeons Of Glasgow In February, 1906. *The British Medical Journal* 1907; 1(2414): 789–803
  45. Madsen W, Reid-Searl K. Overcoming tradition: teaching wound management into the twenty-first century. *Collegian* 2007; 14(4): 7–10
  46. Nightingale F. *Notes on Nursing: The Science and the Art*. Dover Publications, New York, 1969
  47. Madsen W. Keeping the lid on infection: Infection control practices of a regional Queensland hospital 1930-50. *Nursing Inquiry* 2000; 7(2): 81–90
  48. MacFarlane JA. Wounds in Modern War. *J Bone Joint Surg Am* 1942; 24: 739–52
  49. Mykhalovskiy E, Weir L. The problem of evidence-based medicine: Directions for social science. *Soc Sci Med* 2004; 59(5): 1059–69
  50. Wounds UK (2008) Best Practice Statement: Development of a Formulary. Available at: [http://www.wounds-uk.com/pdf/content\\_8949.pdf](http://www.wounds-uk.com/pdf/content_8949.pdf) (accessed 12.01.2016)
  51. Greenhalgh T, Howick J, Maskrey N. Evidence based medicine: A movement in crisis? *BMJ* 2014; 348: g3725
  52. Sackett DL, Rosenberg WM, Gray JA et al. Evidence based medicine: What it is and what it isn't. *BMJ* 1996; 312(7023): 71
  53. Centre for Evidence Based Medicine. *Oxford Centre for Evidence-based Medicine – Levels of Evidence* 2009. Available at: <http://www.cebm.net/oxford-centre-evidence-based-medicine-levels-evidence-march-2009/> (accessed 14.02.2017)
  54. Leaper D. Cochrane: Hands off wound care!—Prof David Leaper response. *Int Wound J* 2009; 6(2): 309–10
  55. Cochrane AL. *Effectiveness and Efficiency: Random Reflections on Health Service*. London Royal Society of Medicine, London (Original work published 1972), 1999