

# Transdisciplinary collaboration in wound care research

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## ABSTRACT

The highly complex disorder of chronic wounds is a significant problem. Information is often lacking, dynamically changing, or contradictory and thus acts to impede the progression of research and its translation into clinical care. Transdisciplinary collaboration may play an important role in chronic wound research, permitting key stakeholders with a single, central goal to take a unified approach towards addressing the problem.

While transdisciplinary collaboration is not a new concept, its implementation within chronic wound research is relatively new. This is because the research area is still largely dominated by single-discipline researchers or by multiple disciplines working in isolation. Transdisciplinary research is a transcending approach, requiring a greater level of understanding between disciplines and may represent the next leap forward in wound care research. This approach necessitates a deeper understanding by all team members of the co-disciplines involved; where key stakeholders are better equipped to respond to dynamic changes and problems that arise in chronic wound research. In this paper, we illustrate what a transdisciplinary approach in wound care research may entail, with the ultimate goal of such an undertaking to improve understanding of the complexities of wound care, which could lead to potential benefits in wound management.

*Keywords: Chronic wounds, transdisciplinary collaboration, wound care, research framework.*

## INTRODUCTION

The formation and healing of chronic wounds is a complex problem. In the past, research has been predominantly driven by a discipline-led approach, which has answered many hypotheses but clearly has not solved the problem. Multidisciplinary research and care has

been incorporated into health for some time. However, this has included different disciplines working in relative independence, each with their own disciplinary perspective, and with limited direct interaction<sup>1,2</sup> (Figure 1). Interdisciplinary research then followed, based on any study that was undertaken by professionals from two or more distinct fields, such as clinical and science disciplines<sup>3</sup>. This research then required the perspectives and skills of all involved disciplines throughout different phases of the research process<sup>3</sup>.

## WHAT IS TRANSDISCIPLINARITY?

More recently, there has been a move towards transdisciplinarity, and transdisciplinary approaches, where disciplinary knowledge is transcended with an emerging understanding between disciplines<sup>4</sup>, to better understand factors influencing the repair of chronic wounds. This is due to the multiple perspectives, expertise and knowledge that a collective of disciplines can bring to the whole project.

“Transdisciplinarity transports us: we then ask different questions, we see further, and we perceive the complex world and problems with new insights”<sup>5</sup>, p. 220.

Transdisciplinary thinking and health science has attempted to come to terms with the complexity of factors contributing to the field of wound care<sup>2</sup>. Indeed, transdisciplinary research may be a key catalyst to enable understanding of the underlying mechanisms of chronic wounds and wound healing. This is a research tactic that requires the integration of individuals from multiple disciplines and fields with a focus on a unified approach and open-ended

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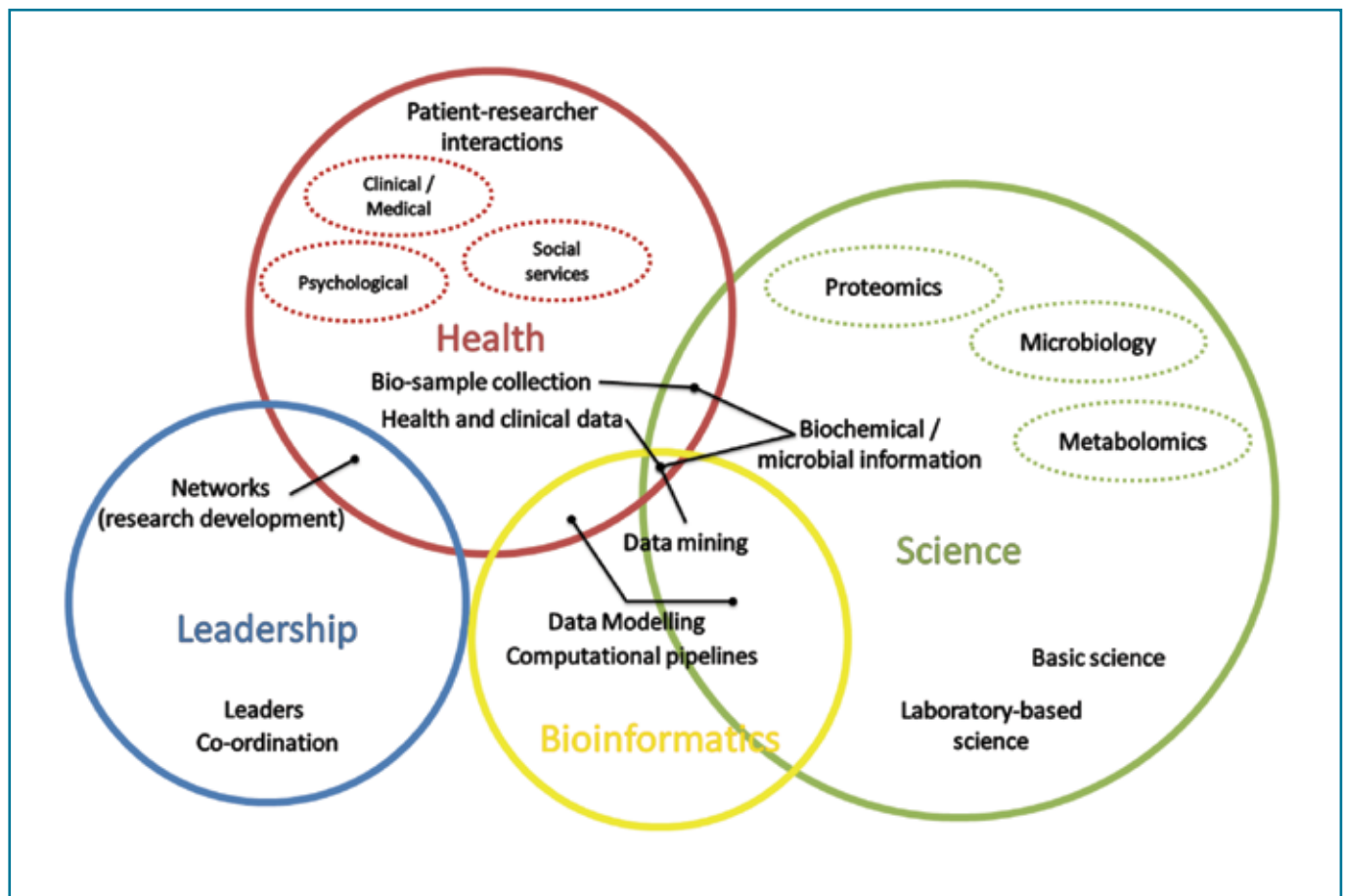


Figure 1: Multidisciplinary research and care in wound healing. Solid circles represent different disciplines with a colour-coded title within each. Black text within each circle represents unique attributes of that discipline. Black text that crosses boundaries represents the multidisciplinary actions that arise from disciplines working together (crossover indicated by the black lines). Within some disciplines there are multiple discrete sub-disciplines, depicted by a broken circle. These discrete disciplines can form multidisciplinary teams in predominantly hypothesis-driven research without direct translational benefit.

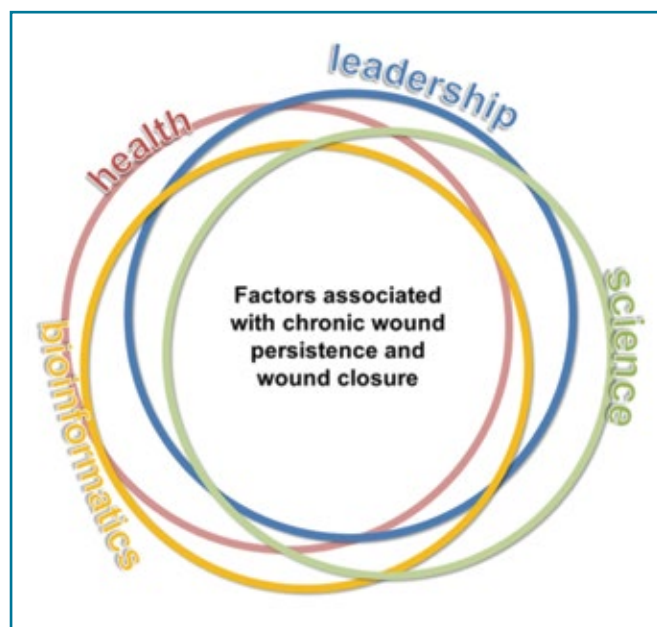
collaboration in order to understand and resolve a common problem<sup>6</sup> (Figure 2). Transdisciplinary teams form as a need to adequately address highly complex problems, such as those often encountered in health research, where a unified approach enables the sharing of both knowledge and resources. A transdisciplinary approach must integrate research with a central goal that is common and requires the participation of all parties. Disciplinary boundaries are blurred, disappear altogether or are 'transcended' as all parties work co-operatively and a new or 'transdisciplinary' way of explaining a problem is created<sup>2</sup>. Importantly, a transdisciplinary team encompasses all relevant areas associated with addressing a problem, from project conception to conclusion. This team may include stakeholders such as clinicians, research scientists, bioinformaticians, industry representatives, and policy change advocates.

## THE PROCESS OF TRANSDISCIPLINARY COLLABORATION

Transdisciplinary collaboration includes three distinct processes: 1) a collaborative problem is identified with a clearly defined and shared framework; 2) constructive input is provided from various

communities of knowledge to ensure that the essential knowledge from all relevant disciplines related to the complex problem is incorporated; and 3) problem analysis then includes the transfer of knowledge from bench to bedside and from bedside to bench, which enables mutual learning between disciplines<sup>6</sup>. A significant barrier to achieving a productive transdisciplinary relationship is the differences in discourse that transcend disciplinary knowledge among participants<sup>4</sup>. This requires a period of translation and mutual learning with development of combined analysis plans. Such collaboration is further aided by clear communication of the benefits associated with crossing disciplinary boundaries. Regular brainstorming sessions, discussion meetings and interactive workshops can enhance effective interaction and integration of knowledge<sup>7</sup>, while ensuring stakeholders remain focussed on a concerted research outcome. Finally, integration and application of data becomes an important element for the implementation of research findings into policy and/or practice<sup>6</sup>.

Transdisciplinary collaboration could play an important role in all areas of wound care research where problems are highly complex. The transdisciplinary project pipeline would remove common



*Figure 2: Transdisciplinary research and care in wound healing. A diverse group of disciplines, illustrated by the circles, integrate together to address a common problem (black text). The overlapping circles are not perfectly aligned as each discipline provides unique expertise and perspectives. Moreover, the boundaries are often blurred as disciplines interact with each other. Each discipline contributes to addressing the problem of chronic wounds in an open-ended, collaborative approach, which provides for cross-discipline learning and innovative thinking.*

research silos (that is, leadership, health, science and bioinformatics as separate entities) and instead would integrate all disciplines at every stage and inherently promote knowledge sharing. A possible representation of this pipeline is illustrated in Figure 3. As an example, clinicians can contribute to studies by way of patient interaction and assessment, collection, analysis, planning and interpretation of clinical data. Data collected may include information on socio-demographics, medical history, wound characteristics, functional ability, social support, depression and quality of life, with this information then entered into a centralised database. Biological scientists with expertise in areas such as proteomics, metabolomics, microbiology and physiology can contribute by way of scientific evaluation of wound swabs, wound fluid samples, blood or tissue biopsies. Thus, they provide meaningful quantitative measures of wound biology and key insight into the microscopic universe of the wound environment. Furthermore, bioinformaticians and biostatisticians contribute to projects through the integration of datasets, developing new models to understand complex systems, and building novel software programs or pipelines to examine trends in the integrated data. The sharing of clinical and biological data and wound sample data is essential to our understanding of how the complexities in wound care possibly fit together.

A combined database that is relevant to all disciplines independently requires the sharing of skills and knowledge by

all researchers within the team. Consequently, this requires a considerable level of communication skill from all stakeholders; however, the synergistic gains, with respect to problem-solving capacity, greatly outweigh the effort required during knowledge transfer and cross-discipline learning. In this way, such integrated databases are easily understood by all disciplines, particularly with regard to esoteric terms used. For example, the use of the Pressure Ulcer Scale of Healing (PUSH) score is commonplace by clinicians as is Enzyme Linked Immuno-Sorbent Assay (ELISA) to biochemists and Generalised Linear Mixed Modelling (GLMM) to bioinformaticians/biostatisticians; however, communication of all disciplines' acronyms is needed to understand the scores and meanings.

Policies and protocols in relation to the appropriate collection of all data, including storage and transport of samples are a necessary requirement at the start of any transdisciplinary project with a bioanalytical aspect, to ensure sample integrity (to avoid biochemical degradation) and data integrity (to account for any variation and ensure robust subsequent bioinformatic analytics). The biochemical analysis of wound samples includes traditional and, through the transdisciplinary collaboration, novel approaches to modelling biochemical profiles with respect to clinical parameters.

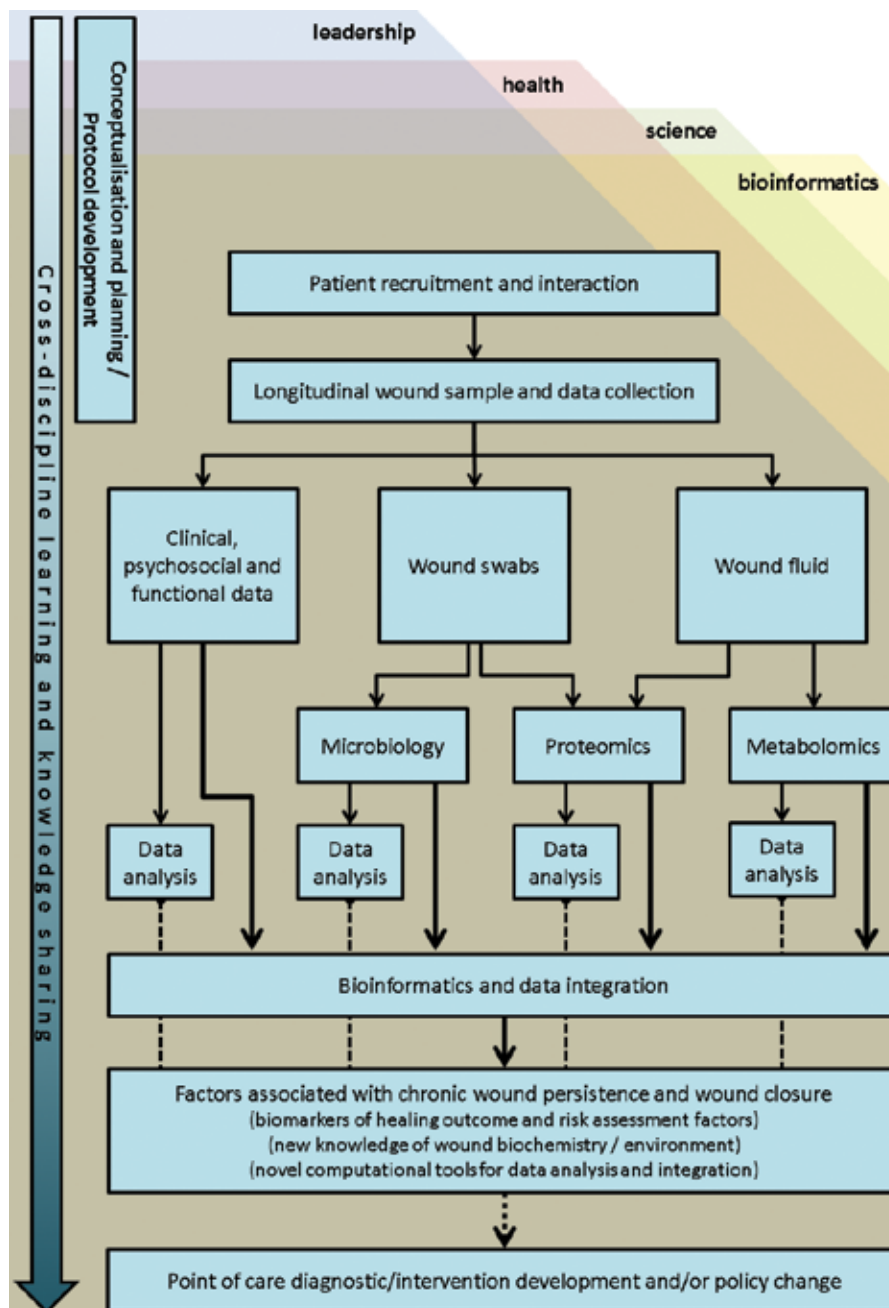
## INTEGRATION OF MULTIPLE DISCIPLINES

The multivariate analysis conducted by the bioinformaticians of clinical and biological data may yield novel results and understanding of underlying biological processes associated with particular symptoms or response to therapies, such as compression, towards the development of improved wound management strategies.

The combination of clinical data with results from proteomic and metabolomic studies could identify significant biological differences between ulcers with healing and non-healing outcomes, but also over time as wounds change in response to best practice therapies. Microbiological studies look to investigate the correlation of specific bacteria with healing outcomes and could measure changes in bacterial abundance with wound closure.

The integration of multiple disciplines offers numerous perspectives of the same problem and, combined with continuous feedback and knowledge sharing, can evolve in a reflective manner to enhance research outcomes while ensuring scientific rigour and the maintenance of clinical relevance. Transdisciplinary initiatives combining expertise from different disciplines provide opportunities for effective translation of science into clinical practice. A transdisciplinary approach to wound research should produce a deeper understanding of the relationships between chronic wound biology and clinical outcomes. Furthermore, there is the future benefit of extensive databases covering clinical and scientific measurements, with corresponding samples in wound tissue bio-banks and/or so-called digitised tissue sample libraries. Importantly, the transdisciplinary approach will enable stakeholders at all levels to drive the research and maintain its

Figure 3



relevance to clinical applications. The outcomes of this type of research approach support a translational model for future wound research. The giving and sharing of knowledge between the different disciplines encourages a community of collaboration and a deeper understanding of how the knowledge of the different disciplines fits together to produce outcomes that could facilitate the improvement of client care.

## CONCLUSION

In conclusion, while single-discipline projects still dominate wound care research, this trend is changing due to the increased perception by funding agencies that combined transdisciplinary research

may lead to bigger breakthroughs and a greater possibility of success<sup>2,8</sup>. Transdisciplinary research, with two or more disciplines and supported by management and leadership, all working towards a common goal seek to make changes locally, nationally and internationally. Early pilot work utilising transdisciplinary collaboration has already shown significant benefits<sup>9-11</sup> and modified clinical practices leading to improved healing rates for patients with chronic wounds. In addition, the possibility of improved healing rates could also lead to cost savings for consumers and health care systems by the translation of clinically relevant research to industry and finally back to the clinic.



## CONFLICTS OF INTEREST

ZU and TP are shareholders in Tissue Therapies Pty Ltd and ZU is a consultant for Tissue Therapies Pty Ltd.

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