Technological advances support improved patient care

> *Professor Emeritus Hiroko Shimizu has been working with a team from Kagawa University developing novel ways to bring comfort to, and improve nursing care of, the vulnerable*

Developments in spiritual-care research

> *Professor Emeritus Hiroko Shimizu has an extensive nursing, training and research career dedicated to meeting the medical, emotional and spiritual needs of her patients*

You are interested in human simulation learning, nursing product development and spiritual-care research. What are some of the developments you have achieved so far?

Human simulation learning was first introduced to our university in 2000. I was then working towards popularising SP training methods and OSCE implementation methods with nursing faculties' members in the Capital Area of Japan. I have promoted the concept of nurses responding to patients' spiritual distress as well as medical needs, leading to the development of a spiritual needs scale. We have made great strides towards improving the quality of patient care, with the Japanese Society of Nursing Education hosting round tables on this area. At Kagawa University in the western region of Japan, we have worked with the professors of medical education to secure funding for joint medical/nursing research. We have also worked with local and national companies to commercialise a general-purpose steam cloth product for use in meeting patients' hygiene and comfort needs.

Can you talk about the other academic researchers involved in your studies?

I work with several highly experienced researchers whose knowledge greatly enhances my own work. Professor Emeritus Tetsuo Touge is a neurophysiologist with whom I have worked for 15 years at Kagawa University. He has demonstrated the relationship between brain waves and psychological imagery in terms of relaxation effects. Professor Ichiro Ishimaru's work on developing techniques to measure substances using mid and near-infrared rays has been invaluable. Together with his student, Mr Yusuke Morimoto, we have worked on and recently announced a normal near-infrared measurement technique to the Japanese Society of Nursing Technology. We expect this method to become the gold standard in measuring human reactions in the nursing field. Professor Kunihide Takao also hopes to further our work on measuring the shape of the skin surface to produce an integrated semiconductor tactile sensor with the sensitivity and performance at least as good as those of human fingertips. My own student, Assistant Professor Hoshina Uehara, has been collaborating with me on various projects focusing on the spiritual needs of patients.

What is the ultimate impact of your work developing the relaxation effect evaluation system?

We aim to explore the possibility of reducing the spiritual pain of patients and disaster victims by providing a relaxing effect through the sensations of the human skin, and to heal deep sadness that people cannot express verbally. I started from the suffering of cancer patients, but cancer patients are not the only ones who suffer before death. We work towards finding ways to alleviate the spiritual and emotional suffering of those in war-torn areas such as the Ukraine, as well as those undergoing medical treatment. Although there is still a long way to go, I believe that dermatological sensory indicators can be expected to become one of the important indicators of 'humanity' in the development of human robots in the future. ●

Information gathering at the International Nursing Conference in Montreal, July 2023

Temperature and humidity sensor measurements before and after wiping

Professor Emeritus Hiroko Shimizu a retired nurse and nurse-trainer now affiliated with Kagawa University, discovered the importance of extra-curricular care needs of patients early in her career. Key learnings during this period related to the spiritual and comfort needs of her patients and have determined the direction of her subsequent research.

A FOCUS ON PATIENT RECOVERY

On completing her nursing training in 1980, Shimizu worked as a cancer nurse. After wiping the patient's body, she found that he became exhausted, and she became determined that nursing care must promote and support patient recovery rather than placing further burdens on already vulnerable people. A relaxing experience with a dry, steam-soaked towel compress at a beauty salon inspired her to further explore this technique for use with patients. 'We found that when we used steam cloths on patients, they experienced reduced pain and relaxation,' Shimizu highlights. She has collaborated with several leading researchers in various fields to compare skin cleaning materials and their impact on brain waves.

The team has developed techniques to accurately measure moisture using near-infrared two-dimensional Fourier spectrometry. They measured moisture smearing on the skin and determined a softening and smoothing effect on the skin. This led to the development of a steam-generating cleaning device that induces relaxation without a towel. 'Our aim was to create something that could warm people affected by disasters and relieve the pain of cancer patients,' she describes.

Shimizu's work has involved the development of new techniques and measurement methods required to verify her findings. The team has also used text analysis of the statements made by test subjects to project their thoughts and attitudes to the care provided, as well as brain waves and images to correlate the results. She hopes to be able to include an analysis of steam volume and moisture, or images with temperature and humidity into her considerations.

APPLIED RESEARCH ON TACTILE SENSING

Part of her studies has involved the development and use of a rare device to measure the shape of the skin surface by co-researcher Professor Kunihide Takao. The development of this device is being carried out through a Japan Science and Technology Agency (JST)-CREST project. 'In this project, we are conducting research with the aim of realising an integrated semiconductor tactile sensor with sensitivity and performance equal to or greater than that of human fingertips,' outlines Shimizu. 'A multiphysics nano-tactile sensor device that realises the ability to visualise various properties of the measurement target with high spatial resolution, such as hardness and coolness, in addition to the spatial distribution of fine irregularities and frictional force, are important for tactile texture which was developed,' says Takao.

By creating this high-performance tactile sensor, a brain-type sensing system has been realised in which artificial intelligence (AI) with high information processing and recognition capabilities and sensors cooperate to reproduce the human tactile sensation, making it possible to identify humans, describe Shimizu and Takao. 'Performance that exceeds cognitive ability is being demonstrated. Based on this result, new applied research on tactile sensing is being developed in various application fields, including medical-engineering collaboration,' outlines Takao.

COMMERCIALISING TECHNOLOGIES

Shimizu's goal has been to bring her work into practical applications, to help patients and other vulnerable people in need of comfort. Her steam-generating cleaning tool has already been commercialised in the process. She believes that it might also have applications with skin sensations in AI robots. 'While scrutinising the data, we would also like to consider post-sending relationships between indicators,' Shimizu elaborates. She intends to continue to research and develop the steam cloth technology and expand its use commercially where it can bring comfort and relaxation to those in need. ●

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