

# Patient Relation with Doctor & Telemedicine and Nanomedicine

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## Opinion

The whole history of medical technology shows the effort to produce ever smaller and more manageable instruments. From the thermometer to the sphygmomanometer, from the scale to the ECG machines, the technique has evolved, creating devices that are increasingly suitable for clinical use and more manageable, and improving their reliability [1]. Today, this trend has further specialized, constructing tools that can significantly affect clinical practice, also transforming the doctor-patient relationship. In these last years, this miniaturizing process has produced hand-free wearable devices, for instance, that can also be worn as accessories, embedded in clothing, implanted in the user's body, or even tattooed on the skin [2]. The development of mobile networks has enabled the improvement of these wearable technology products, which have a broad field of application in medicine and healthcare. Along with the evolution of digital healthcare, the field of wearable electronics has evolved rapidly in recent years and it will further expand, focusing the research on nanomaterials and nanocomposites, which are at the heart of the exploration for new concepts for integration [3]. This second generation of wearable devices, in fact, is moving towards textile-embedded sensors, actuators and therapeutic solutions, based on nanomaterials: one of the challenges of the current research is to reduce the size of the devices, while keeping their functionality intact, combining different qualities like flexibility, user comfort, and fashion.

The next step in research is to enhance this approach with new materials to measure more vital signs for comprehensive medical information needed to diagnose across telemedicine networks. In this perspective, telemedicine and nanotechnologies have found a marked convergence. In addition, the Covid-19 emergency has proposed new intervention strategies, through telemedicine, that have been enriched and detailed over time [4]. Telemedicine constitutes a new method of relationship between the patient and medical staff, placed in different locations [5]. It includes 1) Direct clinical, preventive, diagnostic, and therapeutic services and treatment; 2) Consultative and follow-up services; 3) Remote monitoring of patients; 4) Rehabilitative services; or 5) Patient education [6]. Besides the online meeting between patient and medical staff, there are three levels in telemedicine: Biological signals can be measure by sensors, collected and sent; the data is then analysed and processed. Speed is a very important factor in data transferring, analysing and processing, to provide a quick feedback. The research now focus on the development of new bio-nano sensors that can encourage the development of telemedicine, also to broaden the parameters that can be evaluated through these new methodologies [7]. Potential applications of nanomedicine will foster biopharmaceutics, implantable materials and devices, surgical aids and diagnostic tools, reconceptualising the role of physician. Foucault wrote in 1822 in his *Traité de physiologie appliquée à la pathologie* par F.-J.-V. Broussais, that when Broussais published his *Traite*, that focuses on the sick organism, and on the new way to see it, through the stethoscope, an abrupt

break took place between doctor and patient: the ear of the doctor did not touch the patient's body any more, but there was a medium between them [8].

This has been considered the first step in the deterioration of the clinical relationship, substituting the patient's description of symptoms and the direct touching with a regular physical examination, aimed at discovering the organic matter within the patient's body. However, this interpretation has recently been enriched by other observations, highlighting how physical examination and touching patients were an ancillary part of the desired patient-doctor encounter, as the diagnosis could be based also on an epistolary report: educated patients wrote to the doctor, who replied, providing suggestions and treatments. Regular in-person physical examination as a routine practice and diagnostic technology developed with the new anatomical understanding of disease in the nineteenth century, when the doctor's diagnosis started relying on what he could discover from the patient's inner body, taking advantage from new instruments [1]. With the passing of time, the physical research of the sick part of the body continued to coexist with the concept of telemedicine: in fact, the use of radio and telephone significantly favoured the doctor-patient relationship, as the transmission of an ECG via the phone, and the achievement of tele-psychotherapy during the Covid19 pandemic is perhaps living proof [1].

Today we are paradoxically witnessing a novel circumstance: the doctor enters the patient's body, through a device that is able to replace, at least in part, doctor's hand, ear and eye and the traditional diagnostic instruments. Which are the risks of this situation? The crisis of the doctor-patient fiduciary relationship? The clinical relationship has been based on a fiduciary liaison, which goes beyond the technical competence of the doctor, involving also his/her skill not only to explain (erklären), but also to comprehend (verstehen) and empathize (einfühlen). The use of smart devices has been thought to pave the way to the self-reliance of the patient, possibly compromising the fiduciary nature of the doctor-patient relationship [9]. In addition, it seems to rule out the moral component of the medical act, shifting the emphasis on the disease and on its prevention, without considering the illness and the patient's good in a long-lasting approach [10].

History of medicine shows that self-treatments have always been present in course of time, since only a few could afford access to official medicine and only in the nineteenth century, the medical profession has shaped its monopoly in health care. In reality, the doctor-patient relationship has always been unbalanced, due to the difference in their formation, to the extent that this dual relationship has never really existed. Instead of demonizing this new approach, we must consider it a resource: health literacy, the democratization of access to devices and the involvement of the patient in decisions concerning him/her should be enhanced in the framework of the 4P medicine (Preventive, Participated, Predictive and Personalized). However, this extraordinary opportunity needs the enhancement of computer literacy and the guarantee of an adequate network coverage, even in the most disadvantaged areas. This is the challenge for the future.

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