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52 – Home Care at the Dawn of the 21st Century. Electronic Devices and Telemedicine Facilitate Safe Home Care for Acutely Ill Patients.

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Introduction

The current status of technology, which is available and affordable for widespread use, is already sufficient to permit advanced home care to acutely ill patients (1). However, ongoing technological evolution is even more promising and highlights a big change in healthcare provision (2). It seems that soon, the concept “hospital” will not continue to be considered so much related to the venue itself, but to an overall organization where sophisticated treatment and enhanced patient monitoring can be provided with safety regardless of the place, whether hospital ward or patient’s residence, neutralizing distance barriers (3).

Continually increasing bandwidth in telecommunications, which permits fast and smooth video and data transmission, tablets, smartphones, portable analysers, imaging systems and other diagnostic devices, apparatuses such as electronic infusion pumps and ambulatory monitoring systems including high-tech sensors incorporated into “smart clothes”, are the main contributors in this evolution.

Point of care diagnostic devices.

Portable palm-size analysers can perform a wide range of important measurements including blood gas analysis, basic chemistry, troponin, BNP and PT-INR, at the point of care, within just 2 minutes. There are also portable, small and lightweight automated 5-part WBC haematology analysers, which provide quantitative results in 3 minutes.

Ultrasound portable scanners are equivalent to the stand-alone ones in terms of capability, reliability and accuracy. There are also quite reliable pocket size scanners for prompt emergency testing.

Portable x-ray systems produce high-resolution images in seconds. We use fully equipped vehicles. Digital x-rays, which are performed in a patient’s home, are subsequently developed in the vehicle outside the home. Images are transmitted to radiologists for diagnosis and, concurrently, to other physicians involved in the patient’s treatment.

Telemedicine state of the art.

Digital sound archives which are captured by electronic stethoscopes and transmitted by means of Bluetooth protocol, can undergo frequency and waveform analysis. For example, when an additional tone is heard, graphs can show it’s frequency, duration, time-distance from the 1st to 2nd tone and it’s variation with respiration. This information, which otherwise would need a very experienced cardiologist’s ear, can

be recorded with accuracy through use of an electronic stethoscope and subsequently transmitted for remote interpretation by a specialist.

Flexible cameras can capture images from inside the ear, nose, throat and vagina for evaluation by specialists through remote consultation. Teledermatology has been reported as being practised in various settings (4,5). Fundoscopy can now be carried out by professionals who are not expert cardiologists, with the use of an amazing digital ophthalmoscope.

Videoconference is now becoming progressively more available with the support of 3D, 4D and Wi-Fi technology. With the widespread use of tablets and smart phones, a team of health professionals including nurses, primary care physicians and specialists can virtually “team up” at any time regardless of distance and with considerable reduction in manpower cost.

Inspection is an essential part of physical examination. As a result, videoconference is very important for the remote specialists in order to gain a complete impression of a patient’s condition. With the aid of the visiting health professional’s hands and his or her cooperation, a remote specialist can also recognize abdomen guarding, tenderness, stiffness of joints, tendon reflexes and other signs, which are classified under “palpation”. Percussion sounds can also be heard and evaluated by the remote specialist.

We use Ethernet cameras with pan, tilt and zoom functions to achieve 7/24 observation of very ill patients at home. This not only assists in the continuous monitoring of a patients’ breathing and alertness, but also to monitor the carers’ adherence to given instructions.

Infusion pumps.

In order to guarantee accuracy, safety and nurses’ compliance to regulations, we use multi-functional infusion pumps. Multi-dose function allows administration of medicines in doses, even when a nurse is not present at the time of infusion. Often, a nurse stays with the patient and monitors vital signs, urine output and other parameters. He/she is able to change the pump’s settings, either according to a given protocol, or after a remote specialist’s consultation.

A view into the future.

Flexible technologies and smart clothing are highlighting a new era in the field of telemonitoring. There is ongoing evolution towards the development of miniature, soft and flexible non-invasive sensors, which are incorporated to clothes (6).

Many important parameters regarding metabolism, thermal comfort, skin blood flow, skin hydration, skin thermal conductance, skin infection, muscle activity, autonomic nervous system activity, respiration rate and amplitude, heart rate, blood pressure, position, circadian rhythm, pressure sore detection, heart point detection, etc., can be measured from skin, using non-invasive sensors. A personal area network (7) connects the distributed intelligence of all the items of smart clothing, transmitting data to a computer and a specialist monitoring station, where vital parameters are analysed (8).

Conclusion

Point of care diagnostic capabilities and telemedicine are essential parameters towards a safe shift of the care of acutely ill patients from hospital to home. Yet the treatment of an acutely ill patient also requires uninterrupted responsibility by a clinical team, regular clinical measurements including vital signs, bio-signals and water intake/output balance, frequent and rapid acquisition of testing results, prompt interpretation of the entire clinical information and decision making and high degree of alertness to effectively react in the case of any unforeseen complication or deterioration. Consequently, safe home care for acutely ill patients, apart from the availability of ambulatory testing equipment and telemedicine, also requires special and smoothly operating organizational structures.

Take home messages

- “Hospital” should not continue to be regarded as a venue, but as an organization, which combines concerted teamwork of health professionals, enhanced patient monitoring and sophisticated treatment.
- Point-of-care portable diagnostic apparatuses enable most of the frequently required diagnostic tests to be

rapidly and reliably performed at the patient's home.

- A team of doctors, nurses and other health professionals can be at any time virtually near the patient regardless of distance barriers, with the support of information and communication technology.
- Ongoing technological evolution highlights a new era in the field of telemedicine, which promises to allow safer advanced home medical care in the near future.

Original abstract

<http://www.woncaeurope.org/content/4478-home-care-dawn-21st-century-whats-difference-electronic-devices-and-telemedicine>

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