EDITORIAL

E-Health—a topic for analytical chemists?

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Early in the 1970s, the first project was started in the USA to use computer-based anamnesis of patients. Late in the twentieth century, the term E-Health was coined to refer to the use of computers in healthcare and practitioners' communication with their patients. The focus of the use of computers in healthcare systems was on gathering, storing, exchanging, and managing data. This data was also used to monitor chronic diseases. The first programs that could be used in hospitals gave a kind of decision tree, after inputting self-anamnesis by the patient, for diagnosing a potential disease. Meanwhile, data collection has been discussed as an advantage of health insurance cards, which are helpful in the case of an emergency or when visiting a medical practitioner, with the consequence that in different countries the protection of privacy is being discussed at different levels.

This is the IT part of E-Health. Recently, terms such as telemedicine or online health, cybermedicine, and internet consumer health informatics have been used. However, apart from electronic medical records or IT-driven aims, it started by combining instrumentation in central hospital laboratories with a laboratory information management system (LIMS). This allowed better connection between the results obtained by different analytical methods, resulting in a long list of parameters for disease markers and assisting the doctor.

In parallel to the further development of instrumentation and better compatibility of interfacing it to networks, in developed countries, extensive discussions have started, for example, the E-Health Action Plan in the European Union (EU). The intention is to add to an electronic health record for improved quality of healthcare by evidence-based medicine to support the use of personalized data interpretation and early identification of exceptional situations. Current demographic, economic, and social developments have contributed to an intensive discussion, especially in developed countries, to provide high-quality and efficient health services. Typical outcomes are the topics of ambient assisted living and stratification as an early tool to identify potential diseases at an early stage. The World Health Organization (WHO) states that E-Health should be cost-efficient and requires the secure use of information and communication technologies to promote public health. Accordingly, in many countries, and at the EU level, funding is being directed to such topics. Process-controlled care has changed to personal care, including personalized medicine. Recently, mHealth has even been introduced to include the use of mobile devices (mobile phones, portable diagnostic devices, etc.). The rationale is an improvement in healthcare, in general, and in medical schemes to optimize medical outcomes for each patient.

Present funding from the EU, as a consequence of former funding schemes in Asia and North America, therefore, adds in its calls to the idea of stratification and case studies also many calls for instrumental development in the area of detection of epidemics and pandemics or for improved personal care. An urgent need for new devices was identified to support these aims. Prevention and monitoring form an increasing part of funding in this area. Thus, recently, international E-Health sites and publications have introduced the term "advanced E-Health" to describe future mobile, modular, personalized systems to individually support patients (especially directed to developers of instruments and bioassays).

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Regarding these activities, we could ask to what extent analytics can be part of E-Health platforms, a term recently introduced. They contain

- Highly integrated sensory components with human interfaces placed on the body or clothing (intelligent wireless sensors, wearables)
- Components and infrastructure for communication (body area network, mobiles, wireless in-house networks, home gateways)
- Distributed functions for sensor signal processing or personalized activation of multiparameter acquisition upon request
- Information and expert systems for personalized decisions based on sensor data and exception reporting

Thus, advanced E-Health includes, apart from information, the use of electronic health records and expert systems for diagnosis and emergency treatment as support for medical personnel, as well as instrumentation to measure markers. These new concepts integrate information technologies, such as mobile phones, wearables, W-LAN, and central server systems, with analytical instrumentation for personal care. The intention of the technological development of such devices is either to control the health status of a patient by self-control or to measure the health status with dedicated instrumentation outside of centralized laboratories. Thus, in recent years, the term point-of-care testing (POCT) was introduced. Such instrumentation aims to supply, in addition to central laboratories, the chance for fast information output and short turn-around times (TAT). They are considered to monitor the patient's status at home (e.g., after surgery, monitoring chronic diseases), in ambulances, in hospital wards, or in GP practices to allow fast data transfer and referencing. POCT has come into the focus of those involved in emergency care. The development of devices able to provide data with high quality control and validation are expected to complement high-quality results from central laboratories, in case the time between receiving results and necessary treatment decisions becomes too long. This is not the place to discuss POCT further, although ABC has published some reviews, and even a special issue, on this topic.

For scientists working in analytics, POCT opens up a wide range of possibilities to bring in our expertise in developing methods and instrumentation, to obtain funding for our research, and to be in contact with companies. Nowadays, the requirements for certification have become much more difficult, especially by the US Food and Drug Administration (FDA). The quality of a result from a POCT measurement has to be at the same level as that for data obtained in a central laboratory. Homecare or POCT measurements compete with sampling by experienced personnel, sample preparation by technical personnel, measurements with perfect instrumentation in a laboratory by skilled technicians, referenced data acquisition, and finally the "signature" of a laboratory physician. This is required by regulatory bodies.

This trend towards "decision without involvement of a doctor" will be the next challenge for analytical chemists. It requires care to be taken with representative sampling, adapted sample preparation, better reproducibility, self-control of instruments, validation, use of reference data, checks of trends, control algorithms, and plausibility control, as well as, in principle, only having "one" measurement performed by non-experienced people. The result has to compete with replicates performed by an experienced person with high-level instrumentation and not under time pressure. This is quite an interesting job for analytical chemistry. In the future, can all this make the doctor or analyst interpreting the data redundant?

However, all computer-based data acquisition, storage, interpretation, and analysis require experience and great care by the user. As an old practitioner told me, first, you should be able to read, and second, you should take a look at the patient to use your intuition and experience. As we who are working in analytics know, carefully reading the results, using one's experience to interpret them, performing a plausibility control, and being critical are the basic principles of a good chemical analyst. It is essential not to rely solely on computers and automated analytical devices, and this applies not only to E-Health.

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