EDITORIAL

Nanotechnology and Health Care: What are the opportunities and possible risks?

Dear readers,

As we end the year 2015, you may be wondering the choice of this editorial in a Family Practice journal. The interest stems from a personal visit in mid-2012 to the National Centre for Nano-Structured Materials (NCNSM) located at the grounds of the Council for Scientific and Industrial Research (CSIR), Pretoria South Africa. The NCNSM focuses on the development of new materials using nanotechnology, and on the applications of nanotechnology in the manufacturing, energy and health sectors. This editorial focuses on the opportunities and possible risk(s) of nanotechnology.

Nanotechnology is the study of manipulating matter on an atomic and molecular scale. Generally, nanotechnology deals with developing materials, devices, or other structures possessing at least one dimension sized from 1 to 100 nanometres.[1] Some nanotechnology applications include cars manufactured with nanomaterials, resulting in fewer metals and less fuel to operate them, and cheaper and faster video game consoles / personal computers. It may also make existing medical applications cheaper and easier to use in the doctor's consulting office.[2] Infused bandages with silver nanoparticles are available to accelerate wound healing.[3]

One of the important areas of nanotechnology is "nanomedicine" which, according to the National Institute of Health (NIH) Nanomedicine Roadmap Initiative, refers to highly specific medical interventions at the molecular scale for diagnosis, prevention and treatment of diseases.[4] Current drug delivery systems include microchips, microneedle-based transdermal therapeutic systems, layer-by-layer assembled systems, and various microparticles produced by ink-jet technology. The main problems with the current methods are the low drug loading capacity, low loading efficiency, and poor ability to control the size distribution. Utilizing nanotechnologies, such as nanopatterning, could allow manufacturing of nano/micro particles with high loading efficiency and highly homogeneous particle sizes.[5]

For example in the field of tuberculosis control, the NCNSM has developed a nanotechnology drug delivery system that can administer a single dose that maintains an active drug level for at least a week. Polymeric poly (lactic-co-glycolic acid) nanoparticles of 200–300 nm were synthesized, with a drug encapsulation efficiency of 50–65% for isoniazid and rifampicin.[6] Also, DNA compacted with cationic polymers to produce nanoparticles has exhibited a significant increase in the transfection efficiencies. With nanoparticulate drug/gene delivery systems, specific cells are targeted by functionalising the polymeric nanoparticles with ligands that allow the particles to dock at a specific site of the cell. The latter has applications in the treatment of respiratory diseases and infections.[7] A 2007 study involving comparative cross-national US-UK deliberative workshops on nanotechnologies for health and energy[8] found, consistent with a meta-analysis,[9] that both US and UK participants viewed nanotechnologies as likely to be beneficial, with some more subtle differences regarding issues of distributional justice, government and corporate responsibility, and trustworthiness.

However with any technology, there are potential health risks, most related to nanotechnology have only been demonstrated in lab animal models. For example, a two-year study at UCLA's School of Public Health found lab mice consuming nano-titanium dioxide showed DNA and chromosome damage to a degree linked to cancer, heart disease, neurological disease and aging".[10] There is need to document, if similar health risks occur in humans. In the interim, health specialists should become more knowledgeable on what nanotechnology can offer for the patients especially in the area of reducing pill burden for patients with chronic diseases and infections. The next editorial will focus on the United Nations Framework Convention on Climate Change (COP21/CMP11), which is crucial because the expected outcome is a new international agreement on climate change, applicable to all, to keep global warming below 2°C. Enjoy the festive period and see you in 2016!

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