



Biomedical Devices & Technologies

By Peeyush Prasad, MSc
Contributing Editor



Advances in Medical Devices Offer Exciting Opportunities for Superior Patient Care

The Growth of Global Market for Advanced Medical Devices

When it comes to supporting life, medical devices play huge role. Despite of ambiguous definition, medical device is the system or technology which supports the patient often

indirectly. In general, medical device is any instrument or machine that does not achieve its intended goal by pharmacological or metabolic effect but by providing indirect assistance to patient. From MRI machine to robotic arms for surgery all come under the definition of medical device.

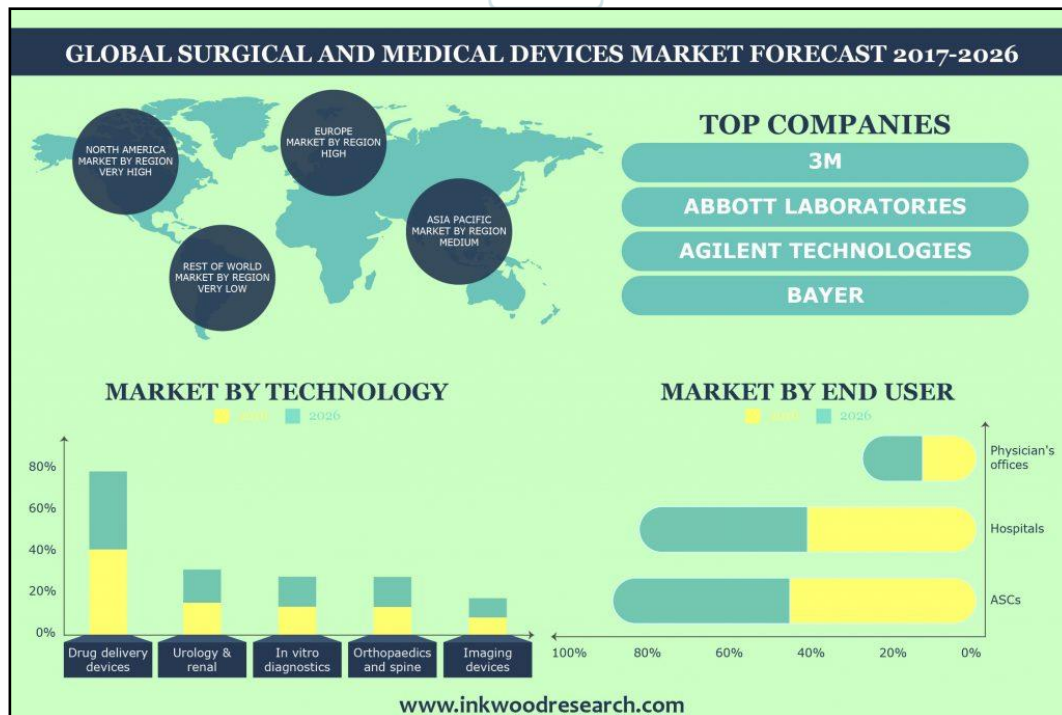


Figure 1: A forecast of the future surgical and medical devices global market [Source: <https://www.inkwoodresearch.com/reports/surgical-and-medical-devices-market/>].

Affordability, accessibility, ease of use and want of experts to handle these devices are few of the major limitations in this area. Medical devices are usually used for diagnosis, monitoring, treatment, for

supporting anatomical processes and for disinfecting medical devices. Figure 1 shows a forecast of the growth of the medical device market size from 2017 to 2026 (1).

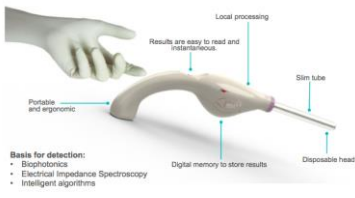
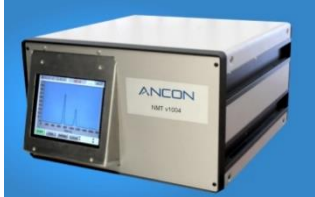



Disease	Device	Product
Cervical Cancer	This is a portable medical device for preventing detecting cancer. Onko Solutions (2).	
Lung Cancer	A product by Ancon for lung cancer early detection (3).	
Diabetes	Abott has developed the Freestyle Libre which a glucose monitoring system for diabetes patients (4).	
ADHD	Monarch eTNS device is made by Neurosigma company. This device is used for treating pediatric attention deficit hyperactivity disorder (ADHD). Device can be used for monotherapy in patients between 7 to 12 years of age (5).	
Sleep apnea	Itamar Medical has made the WatchPAT, a FDA-approved portable diagnostic device for sleep apnea. It uses the finger based physiology and innovative technology for obstructive sleep apnea testing (6).	

Table 1: Innovative medical devices that are used for specific disease.

Some medical devices serve the specific purpose and they are associated with specific disease such as use of dialysis in case of kidney failure. Some of the innovative medical devices for specific disease are mentioned in table 1.

Components in Medical Device Design

Design and development of medical device is a complex process which consists of

regulation, specification and application. There are several factors which control the presence of medical device in market. Some of the key factors are usability, regulatory guidelines and affordability. Developer should keep in mind these factors before designing and manufacturing any medical device. Figure 2 outlines few of the important aspects of medical device design (7).

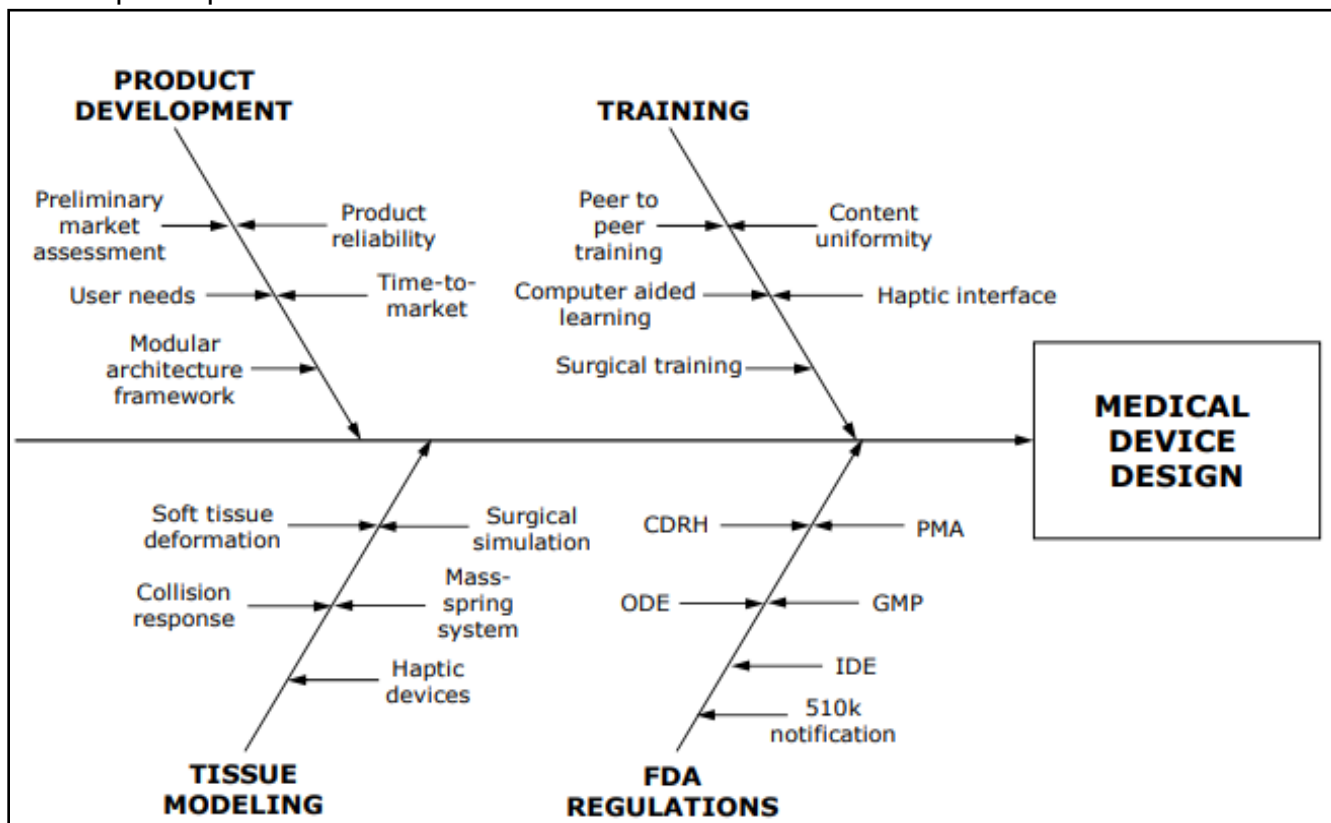


Figure 2: Key components involved in the medical device design [Source: International Journal of Innovation and Scientific Research (2014)].

Top companies which are working in this field are Stryker, Medtronic, Philips, Cardinal Health, Abott, GE Healthcare and Siemens.

Table 2 provides the brief idea about these companies and their product.

Company	Device	Company website
Stryker	Image guided therapy, emergency patient transport, surgical suction & technology (temperature management & other equipment).	https://www.stryker.com/us/en/index.html
Cardinal Health	Products related to anesthesia, cardiovascular, infection control, patient monitoring & durable medical equipment.	https://www.cardinalhealth.com/en.html
GE Healthcare	Advanced visualization, anesthesia, diagnostic ECG & computed tomography.	https://www.gehealthcare.in/
Danaher	Diagnostics and mobile equipment.	https://www.danaher.com/
Abbott	Company works on vascular disease, vision and diabetes. Abbott diagnostics provides integrated automation system, assays and informatics.	https://www.abbott.co.in/
Fresenius Medical Care	Developed the technology for hemodialysis. 6008 CARE system and 5008CorDiax machines are used for dialysis. 4008Sclassix is used for hemodialysis.	https://www.freseniusmedicalcare.com/en/home/
Philips	Advanced molecular imaging, diagnostic ECG, Computed tomography, Fluoroscopy and emergency care.	https://www.philips.co.in/healthcare/solutions
DePuySynthes	Works on orthopedics, surgery and interventional solution. Company manufactures the products associated with bone related problems and fluid management.	https://www.jnjmedicaldevices.com/en-US/companies/depu-synthes

Table 2: Top medical device companies involved in designing and developing the products.

Research and Developments in the Field of Medical Devices

Research and developments are happening at a continuous pace in the field of medical device. In one study, researchers have developed the novel beating heart transapical septal myectomy procedure. This procedure has been shown to reduce the risk associated with surgical myectomy (8). In another study, feasibility of robot-assisted fluoroscopy-guided (RAG) puncture was evaluated by utilizing the novel robotic system for percutaneous renal access with ultra-sound-guided (USG) puncture. Results found that success rates of RAG puncture

was 100% and USG puncture was 70.6%. Needle puncture time was found to be 24% shorter than USG puncture. Study concluded that for renal access, RAG puncture shows comparable results and accuracy with respect to USG puncture (9). Tiny microfluidic based medical devices are developed for various purposes such as diagnostics and therapy. Figure 3 shows microfluidic device for point of care viral analysis (10). Design of microfluidic based medical device is one such area which requires lot of attention. Significant growth has been seen in device design companies in these areas, which are also providing regulatory services.

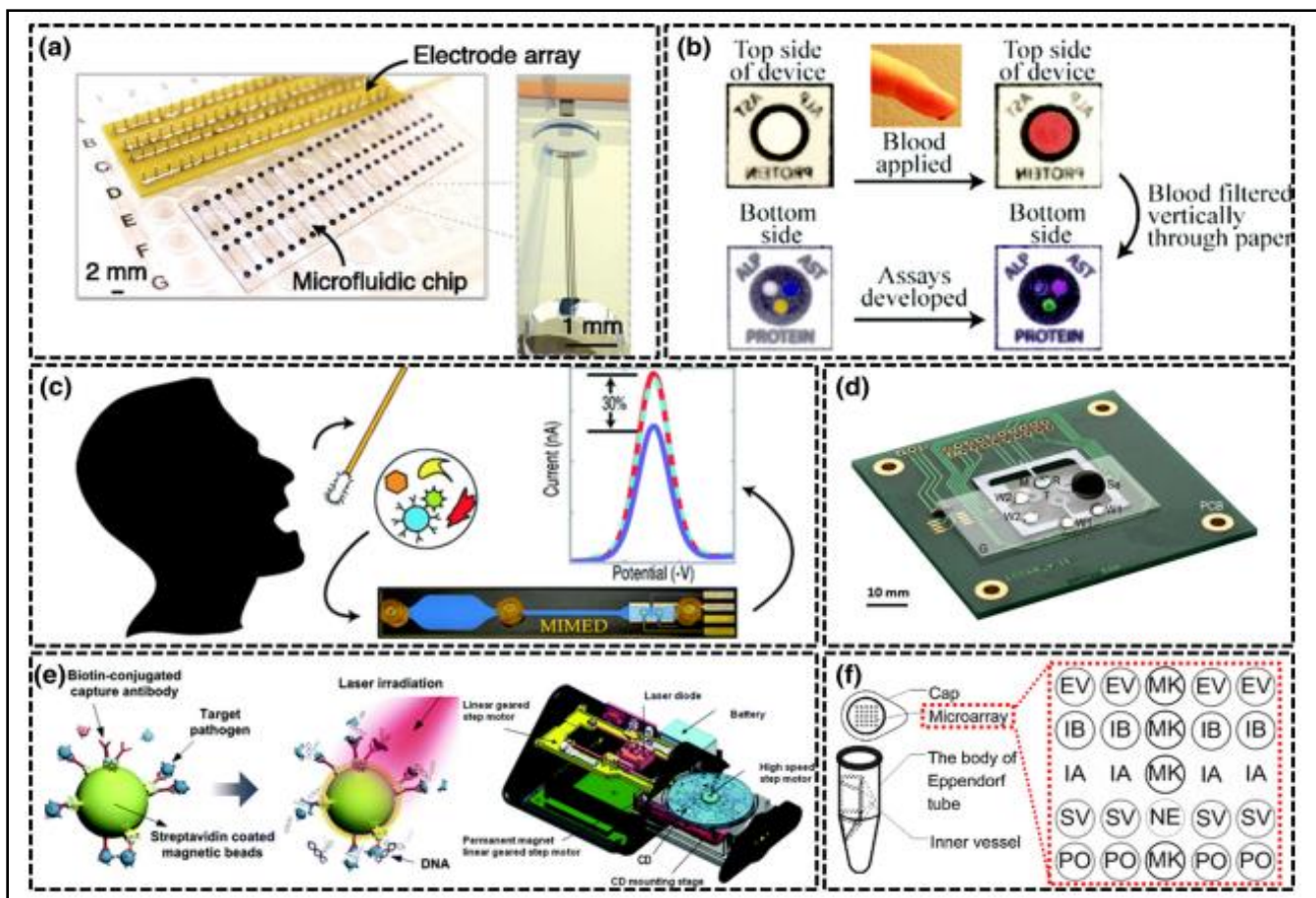


Figure 3: Microfluidic device based point-of-care viral analysis [Source: Yeh YT et al., Ann Biomed Eng. (2014)].

Future of Medical Device Looks Promising

Future of medical device is promising due to new healthcare challenges. 3D printing and

microfluidic device manufacturing is one of the areas which yet be explored extensively. Microfluidic devices are small and complete miniature organ model can be developed on a single chip (Lab on a Chip).

Company	Function
XIMEDICA https://www.ximedica.com/	Leading product development company. Company do research and generate concept and strategy. Also provide services related to process and design validation along with production and commercial support.
JABIL https://www.jabil.com/	Company helps the customer with innovation and technology in the challenging areas such as advanced surgical devices, angiography contrast delivery kits, fluid warming etc.
PLEXUS https://www.plexus.com/en-us/	Plexus works on design and development, new product introduction and manufacturing related to technology such as ultrasound imaging, X-ray imaging and MRI etc.
GLOBAL CENTER FOR MEDICAL INNOVATION https://gcmiatl.com/	Works on early stage product design and biomedical and mechanical engineering along with other services of clinical input and review.
CELESTICA https://www.celestica.com/	Provide services related to supply chain solution (Design and engineering, manufacturing services etc).
ORCHID ORTHOPEDIC SOLUTIONS http://www.orchid-ortho.com/	Works on product design, development and prototyping.

Table 3: Some of the leading medical device design companies involved in developing advanced biomedical technologies and devices for next generation applications.

Although, these devices do not directly assist patients but they can be hugely successful in finding biomarkers and personalized therapeutic target. Table 3 mentions few of the important company involved in design and regulatory services for medical devices.

Design groups of the future can be classified into four groups which may vary in size and scope. These groups are: a) Independent design engineers b) Design bureaus c) Design departments of medical device contract manufacturers and d) Design

departments of non-medical device contract manufacturers which focus on digitization and integration with consumers (11).

Concluding Remarks

We have come a long way in developing and making use of medical device. New innovations and research will pave the way for better device which can alleviate the pain of patients and provide a superior healthcare in the future.

References for Further Reading

1. <https://www.inkwoodresearch.com/report/s/surgical-and-medical-devices-market/>
2. <https://innovationmatchmx.com/announcement/portable-medical-device-to-detect-and-prevent-cervical-cancer-in-women/>
3. <https://lungdiseaseneews.com/2014/12/08/ancon-medical-seeks-funding-for-revolutionary-lung-cancer-early-detection-screening-device/>
4. <https://www.medicaldevice-network.com/projects/freestyle-libre/>
5. <http://www.neurosigma.com/>
6. <https://hitconsultant.net/2017/09/29/40279/#.XbM61ugzblU>
7. Tamsin M and Bach C. The Design of Medical Devices. International Journal of Innovation and Scientific Research. ISSN 2351-8014 Vol. 1 No. 2 May 2014, pp. 127-134
8. Fang J, Wang R, Liu H, Su Yet. al., Transapical septal myectomy in the beating heart via a minimally invasive approach: a feasibility study in swine. Interact CardiovascThorac Surg. 2019 Oct 23. pii: ivz249.
9. Taguchi K, Hamamoto S, Okada A et. al., Robot-assisted fluoroscopy- vs ultrasound-guided renal access for nephrolithotomy: A phantom model bench-top study. J Endourol. 2019 Oct 23.
10. Yeh YT, Nisic M, Yu Xet. al., Point-of-care microdevices for blood plasma analysis in viral infectious diseases. Ann Biomed Eng. 2014 Nov;42(11):2333-43.
11. https://www.mpo-mag.com/issues/2018-11-01/view_columns/the-future-of-medical-device-design-companies/