Confidence on Robotics in the Medical Field

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Abstract

With the advent of modern technology, it is becoming apparent that there is an increasing dependence on robotics for the field of medicine particularly in the surgical aspect of the practice. This dependence has allowed physicians to be able to make more accurate diagnoses and perform more precise operations – it has allowed physicians to be better than they had previously been, and possibly even better than what they could be. However, the question remains, how confident are the health care professionals and patients towards the use of robotics in the field of medicine?

Keyword: Robotics, MedicineTechnology, Nanotechnology, Microchips

1. Introduction

The practice of medicine is a dynamic science. It is a study and a practice that has evolved continuously since the birth of man. Medicine during the early periods consisted of the use of herbs and had a good relation with religion so much so that the presence of disease was interpreted as being possessed by demons or being punished by God (Osler, n.d.). An example of a medical practice at those times was trephining where in holes were drilled or carved out of the skull to treat symptoms of headaches and seizures (Osler, n.d.). As time passed, the practice evolved together with the developing and advancing knowledge of humans. Schools were established to enable practitioners to learn more about anatomy and physiology to better come up with reasons as to why people get sick and as to how symptoms could be cured (Osler, n.d.). Alchemy was developed and even newer practices were created all with the intention of treating the sick (Osler, n.d.). Slowly, newer fields of practice arose such as internal medicine and surgery. While the practices and the methods used by the early physicians of our time differed, one thing that could be related towards the past practices and the practices of today is the fact that in all of those situations where a sick individual was in need of a cure or relative treatment, "man" was always there to offer sanctuary.

The practice of medicine further evolved, machines or robots slowly made its way into the scene. Initially, robots were used in rehabilitative medicine where in individuals with disabilities were enabled to perform independent activities (Dharia, 2005). These are good advancements as it enables individuals with physical disabilities to do things that they would not be able to do otherwise. As time passed and discoveries were made in the field of computer science, engineering and robotics, the use of robots ("a machine in the form of a human being that performs the mechanical functions of the human being but lacks sensitivity") in the field of medicine became even more rampant – with robots now being involved in surgery (Dharia, 2005).

It was noted that the need of robotics in the field of surgery was rather mandatory as certain procedures, such as the removal of very tiny tumors as well as microvascular procedures requires very precise hands that could only be made possible through the use of machines (Dharia, 2005). While it may sound that robots are slowly taking over the practice of medicine, in the example above, it may simply be called an adjunct for physicians to better care for their patients. In addition to therapeutic levels of the use of robotics, its use has also been well known in the areas of diagnostics which enables physicians to make more accurate diagnosis of the disease manifested in their patients.

There may even come a time where in medicine, through robotics, would be able to utilize nanotechnology in order to monitor the vital signs of individuals as well as provide a more effective means of delivering drugs into the system (Woodrow Wilson International Center for Scholars, 2011).

Instead of just being another machine operated by a physician, robots may on its own be programmed to perform surgical procedures without the need for human intervention (Lanfranco, 2004). These are aspects of robotics that are currently being considered and at the same time questioned in the field of modern medicine and surgery.

2. Purpose of the Research

The general objective of this study is to determine the confidence and/or willingness of patients to undergo medical procedures through the use of robotics. Specifically, this paper would determine to what extent the study population is willing to allow robotics to play a role in the diagnosis and treatment of their disease entities while at the same time, determine the belief of the respondents towards the liabilities that may occur with the use of robotics in medicine.

3. Methodology

This is a descriptive study which involved a target population of 300 adults aged 18years old and above regardless of educational attainment and degree of education achieved. The subjects included in the study were chosen via random sampling and were then made to answer a questionnaire. The questionnaires used for the survey were standardized to be understood by majority of the population and answerable within a 5minute time frame. The questionnaire consisted of questions with regards to the following – 1) sex; 2) age group; 3) educational attainment; 4) relation of profession to medicine; 5) field of specialty; 6) willingness to undergo robotic surgery; 7) degree of acceptance of medical robotics; 8) willingness to participate in nanotechnology; 9) willingness to allow implantation of microchips, and; 10) belief with regards to liabilities involved in medical robotics. *Figure 1* below is a sample of the said questionnaire. The results of the survey were then tallied, tabulated, graphed and interpreted.

Questionnaire for the Study on
Confidence of People on Robotics in the Medical Field

1. Gender
   [ ] Male [ ] Female
2. Age Group (in years)
   [ ] 18 or less [ ] 18-24 [ ] 25-34 [ ] 35-54 [ ] 55-65 [ ] 66+
3. Educational Level
   [ ] 12th grade or less [ ] high school [ ] some college [ ] Bachelor's degree
5. Are you a medical professional or a medical technologist or are you interested in robotic technology ?
   [ ] Yes [ ] No
6. (in relation to question #5) in which field?
   [ ] Computer & Engineering [ ] Medicine [ ] Nursing [ ] Medical Technology [ ] Others
7. Would you, as a patient, be willing to undergo robotic surgery in place of surgery by a human doctor?
   [ ] Yes [ ] No
8. What is the acceptable ratio (in %) of sharing between robotic surgery and human surgery?
   [ ]100 [ ]75 [ ]50 [ ]25 [ ]10 [ ]0
9. New nanotechnology has created a micro-device which enters the body through the mouth, makes surgical operations within the digestive system without control of a human doctor, and then exits normally through the anus. Would you be willing to accept this kind of surgery?
   [ ] Yes [ ] No
10. Would you accept the implantation of a microchip in your body to measure vital signs, such as heart rate, temperature and blood pressure, which would then transmit information directly to your doctor concerning any problems?
    [ ] Yes [ ] No
11. In the case of medical or mechanical error regarding robotic surgery, should the doctor or robot designer be held legally responsible?
    [ ] Yes [ ] No

Figure 1. Sample Questionnaire

4. Results and Discussion

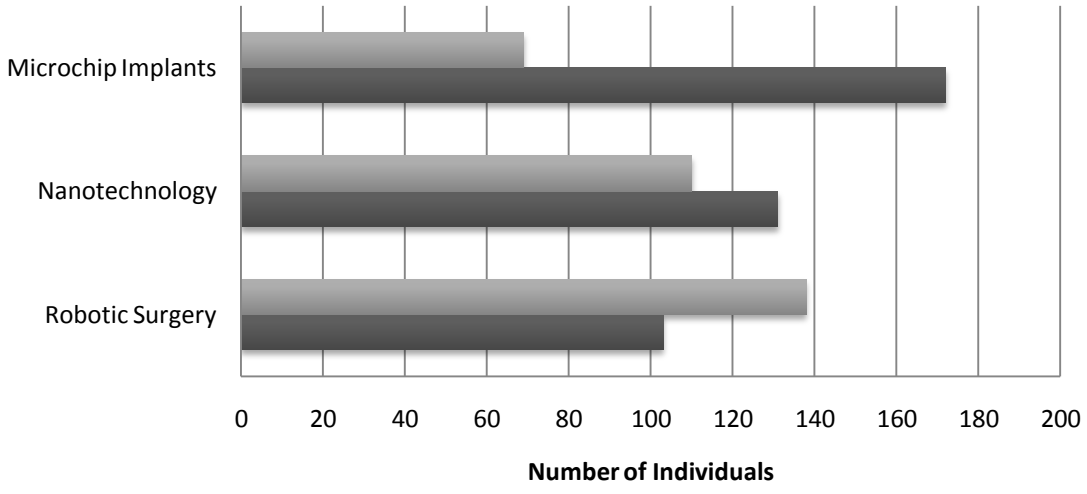
Out of the 300 targeted subjects for the study, a total of 241 participants were able to participate in the survey. Of the 241 subjects, 58 of which were females and the rest were of the male population. Majority (58.92%) of the study population were amongst the 25-34years old age group followed by those in the 18-24 years age range (34.43%). The rest of the population were within the 35-54 year age range with only 3 in the 55-65 year age range and 1 each for those less than 18 years and 66 years old respectively. Of this population, the survey revealed that there were many whom were actually willing to utilize robotics technology in various procedures involved in the field of medicine (*see Table 1*).

Table 1. Distribution of study population according to their confidence to utilize the different robotic applications in the medical field (n=241)

	Number of Respondents	
	Yes *(%)*	**No (%)**
Confident to undergo Robotic Surgery	103 *(42.74)*	138 *(57.26)*
Confident to use Nanotechnology	131 *(54.46)*	110 *(45.64)*
Confident to have Microchip Implants	172 *(71.37)*	69 *(28.63)*

Survey revealed that while there were only 42.74% of the study population were willing to undergo robotic surgery in place of human surgery, more than 50% of the same population were actually willing to utilize nanotechnology for surgical procedures within their system and as well as have microchip implants to facilitate diagnostics. it can be found that majority of those who would allow the use of such technologies on themselves were those who were health care professionals and at the same time interested in the field of robotics. This can be further supported by the fact that those who were willing to undergo the said procedures were those interested in the field of computer and engineering as well as medicine and medical technology. the implication of such findings is that individuals who were more knowledgeable about the benefits that such advances could provide in medical field are in fact, more willing to undergo procedures that involved robotics. So much so that individuals with educational attainment less than a Bachelors degree are much more adamant towards having robots perform operations on them. Figure 2 below provides a graphical representation of Table 1.

Figure 2.
Distribution of Study Population According to Their Willingness / Confidence to Utilize Robotics in the Medical Field



Given such findings, it would appear that people are confident about the use of robotics in the field of medicine. The low "willingness" or confidence of the same population towards robots performing surgery may be related not only to the educational background and base interest of the study population, but probably also towards the desire of individuals to still have contact with human practitioners.

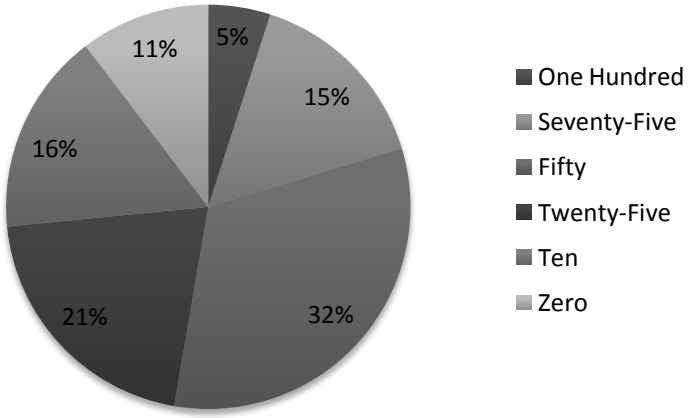
Microchip implants and use of nanotechnology for drug delivery, diagnostics as well as swift microsurgery in human beings would still require the intervention of human physicians as it is them whom would initiate the use of the device while at the same time be the ones whom would interpret the findings or the output from these "machines" (Woodrow Wilson International Center for Scholars, 2011; Bramstdet, 2005). Unlike in robotic surgery (to complete replace human surgeons), there would be less (if not total absence) of humans throughout the procedure (Lanfranco, 2004). Such scenarios remove the physician-patient relationship and the human bond. The study population most probably have more confidence towards robotics manoeuvred by human physicians rather than pure robots performing the job of humans in the medical field.

Additional support for this finding can be found in the response of the study population towards the acceptable ratio of robotic surgery to human surgery where it showed that majority believed that there should be a 1:1 (or 50%) distribution of work between robots and humans when performing surgery (*See Table 2 and Figure 3 below*). There were only 12 respondents who were willing to be operated upon completely by robots while 78 respondents preferred an equal ratio of work between man and machine. This is similar to studies conducted in 2004 which took into consideration the level at which robotic surgery is at today – and that finding supported the fact that robotics in the field of surgery while it holds significant promise, is still at its infancy and that adequate, safe and efficient use of such technology could only be done through the hands of human surgeons (Lanfranco, 2004).

Table 2. Distribution of Study Population According to the Acceptable Ratio of Robotic Surgery to Human Surgery (n=241)

Ratio (in %)	Number of Respondents
100	12
75	37
50	78
25	50
10	39
0	25
Total	***241***

Figure 2.
Distribution of Study Population According to their Accepted Ratio of Robot to Human Surgery



5. Reaction toward Liabilities related to the use of Robotics in the Medical Field

It is of no question that accidents or untoward events may occur with any form surgery including those that involve robotics. Robotics nowadays may be used in microvascular surgery as well as surgeries involving the male and female reproductive organs (Lanfranco, 2004).

In the events wherein there is only the physician involved, such occurrences may be attributed to malpractice or negligence on the part of the surgeon. However, with the advent of new technology and newer procedures in the field of medicine and surgery, there is also the need to determine as to whom the liabilities would fall should problems arise. The survey conducted in this study revealed that majority (56.43%) of the respondents believed that both the physician and the robot designer are liable for any untoward events that may occur with the use of robotics in the medical field. This is likely should there be an interaction between the patient and the physician whom then promoted and utilized robotics for the diagnosis and treatment of the former's disease since there is an existing physician-patient relationship and that the robots (assumed to be guaranteed safe and effective by the designer) was used (Faust, 2007). The same is the case for surgeons performing operations using robotics technology – any mistakes that may occur would be the responsibility of the surgeon (in cases of operative error) and/or the robot designer (in cases of machine failure) (Faust, 2007).

18.25% of the respondents are ambiguous as to whom the blame could be pointed at. Such findings are similar to some studies wherein the lines of responsibility with regards to errors that may occur in the said situations are blurred (Lanfranco, 2004). Doctors may be blamed if the machines were accurate but the operation was botched due to human error while the robot designer may be of liability if the surgeons were doing their part well, but the machine failed to work properly (Faust, 2007). These are things that relate towards those that believe that doctors are liable (14.52%) as well as those that believe that the robot designers are sole responsible (10.79%). Table 3 below shows the distribution of the study population with regards to liabilities in medical robotics.

Table 3. Distribution of Study Population According to whom they believed carried the Liability should errors arise in medical practice

	Number of Respondents
Both the doctor and the robot designer	136
The Doctor only	35
The Robot Designer only	26
Undecided	44
Total	***241***

6. Conclusions

From the data and facts presented above, it can be concluded that the population understudy are confident towards the use of robotics in the field of medicine so long as there is still the involvement or participation of the human physician in any procedure where the machines would be utilized. With that, it can be inferred that the study population is in fact ready for the future of medical practice where robots would most probably play an important role in diagnosing, treating and saving human lives.

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