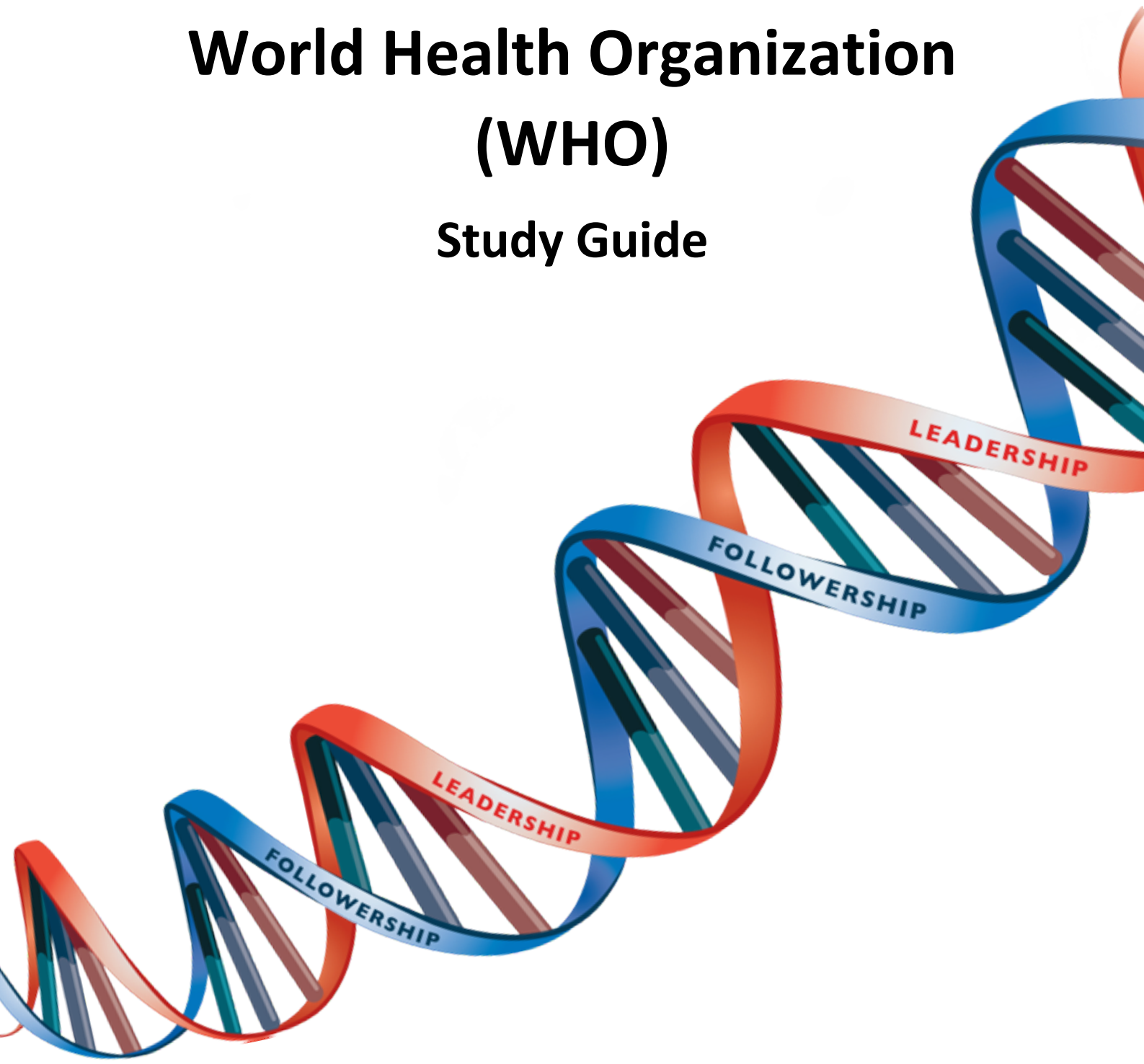
World Health Organization (WHO)

Study Guide



Singularity Model of United Nations

SMUN2030

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Introduction of the Chairs

Dear delegates,

First, a warm welcome to the World Health Organization at SMUN 2030. As your chairs for the time in the conference, we strongly hope that all of you spend a didactic, profitable and entertaining time working by our side.

In order to warm up and put you into context, over a 3-day course you will be delegates in the World Health Organization in year 2030, as you seek for solutions for some of the most challenging problems our world will face in that year related with global health. Further, you will discuss with students from all over the world, as you try to find a solution as fruitful as possible, also considering your nation interests and the global prosperity and well-being.

Whereas we will formally meet you during the committee course, the Chair team would like to introduce itself properly before the MUN takes place:

Jaume is a 2nd Year undergraduate student who is pursuing a Bioengineering degree in the Polytechnic University of Valencia. His first experience in a MUN was three years ago, when he participated as a delegate in the CWMUN, in the UN headquarters in New York. Now, he is honoured to be given his first chairing opportunity in the World Health Organization committee, at the SMUN 2030. Outside the MUNs, he enjoys playing piano and guitar, listening to all kind of music, and playing basketball. He looks forward to a both fruitful and entertaining council session, as you form yourselves and try to construct a better future for all of us. As he was delegate in a previous MUN, he can perfectly relate which are the fears the delegates may feel, and he hopes to be a friendly support for all of you, for this reason, do not hesitate to ask him any doubt you may have during the MUN.

Alba is currently pursuing an undergraduate degree in Philosophy, Politics and Economics at Pompeu Fabra University. Though this year she is living in Madrid, so she is very excited to be able to come back to Barcelona to chair this World Health Organization committee. Since her first experience in MUN only one year ago, she has taken part in several conferences, specializing in crisis committees. She would like to encourage delegates to participate in the debate, exchange different points of view, and be able to merge them in a consensual resolution. She also hopes to support all delegates, so she invites them to

approach her for any questions or concerns they may have. Finally, her best advice is for you to have fun and enjoy the committee. See you there!

As we stated before, the whole Chair team strongly hopes that this experience gets to be as profitably as it can; specially for all those delegates which have its MUN first experience ever.

With this study guide, we aim to introduce you to the MUN's world, and specifically to what is our committee function, and which is the topic that is going to be discussed: "Applications in medical diagnosis and prevention".

Introduction to the Committee

The constitution of the World Health Organization was drawn up by the International Health Conference, held at New York from 19 June to 22 July 1946. Its constitution process ended up in April 7th, 1948, when the committee entered into force. The resolution process was signed by 61 countries (51 member countries and 10 others). Nowadays, the World Health Organization is stablished as the main global organization regarding to social, health, and nutrition issues. Since its creation, the WHO has played a leading role in the eradication of epidemic illnesses, such as the smallpox.

The World Health Organization's constitution states that its objective is "the attainment by all people of the highest possible level of health". This objective gets to be fulfilled through its main functions, defined as well in the constitution: "(a) To act as the directing and coordinating authority on international health work; (b) To establish and maintain effective collaboration with the United Nations, specialized agencies, governmental health administrations, professional groups and such other organizations as may be deemed appropriate; (c) To assist Governments, upon request, in strengthening health services; (d) To furnish appropriate technical assistance and, in emergencies, necessary aid upon the request or acceptance of Governments; (e) To provide or assist in providing, upon the request of the United Nations, health services and facilities to special groups, such as the peoples of trust territories; (f) To establish and maintain such administrative and technical services as may be required, including epidemiological and statistical services; (g) To stimulate and advance work to eradicate epidemic, endemic and other diseases; (h) To promote, in co-operation with other specialized agencies where necessary, the prevention of accidental injuries; (i) To promote, in co-operation with other specialized agencies where necessary, the improvement of nutrition, housing, sanitation, recreation, economic or working conditions and other aspects of environmental hygiene; (j) To promote co-operation among scientific and professional groups which contribute to the advancement of health; (k) To propose conventions, agreements and regulations, and make recommendations with respect to international health matters and to perform."

As of 2012, the WHO has defined its role in public health as: "(a) Providing leadership on matters critical to health and engaging in partnerships where joint action is needed; (b) Shaping the research agenda and stimulating the generation, translation, and dissemination

of valuable knowledge; (c) Setting norms and standards and promoting and monitoring their implementation; (d) articulating ethical and evidence-based policy options; (e) providing technical support, catalysing change, and building sustainable institutional capacity; (f) monitoring the health situation and assessing health trends; […]"

Due to the above, the World Health Organization has divided his current priorities as follows: (1) Communicable diseases; (2) Non-communicable diseases; (3) Environmental health; (4) Life and Course style; (5) Surgery and Trauma Care; (6) Emergency Work; (7) Health Policy.

Since you will pretend to be in 2030, your duty as delegates will be to adapt the seven main topics or priorities stated above, and relate them with the main topic which the committee will be following up: "Applications in medical diagnosis and prevention".

Introduction of the topic

In the same was binary code is used to encode computers functions and predict its responses; humans are codified with the genetic code. However, in contrast to the binary code, the genetic code is much more complex to read and understand. Further, if we think of the 8.5 million people that inhabit our world, every single one with a different code, the process of reading and translating the genetic code to our language quickly becomes a daunting task. Consequently, the symptomatology affecting humans is hyper-variable, and mostly unpredictable.

Current medicine practice guidelines and medicine experience's perspective still does not include this increase of variability. This can lead to suboptimal handling of disease, which makes patient's outcome unpredictable. According to Intramed.net, the percentage of wrong diagnosis raises to the 40% in most hospitals operating in the United States. Moreover, the amount of wrong diagnosis in rare diseases fuels to the 95% of patients. Therefore, up to 35.000 patients die every year due to these types of offences.

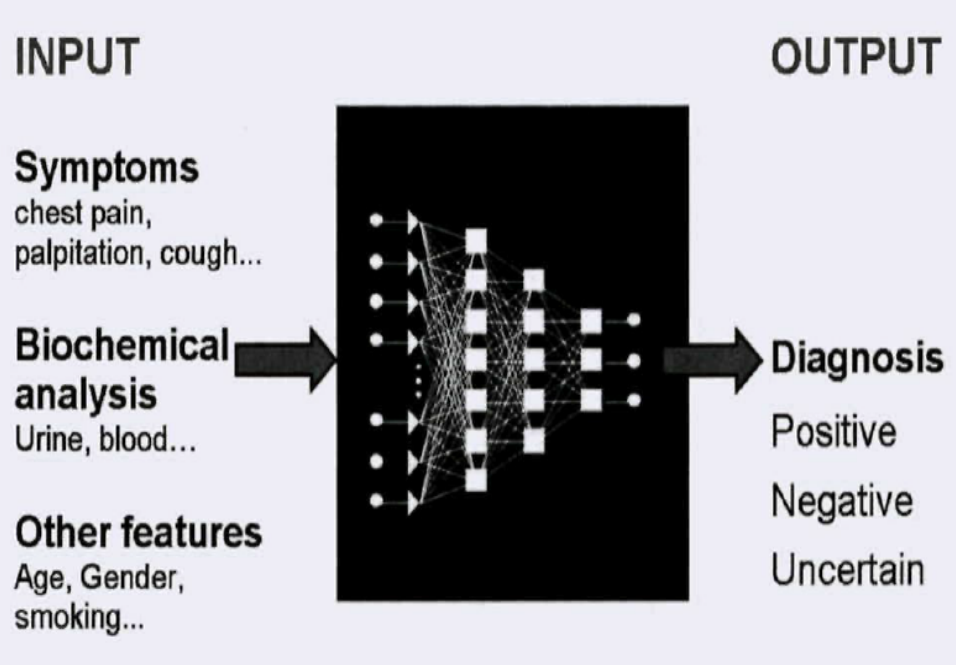
Furthermore, sedentary lifestyle, unhealthy eating and bad nutrition generates a weak response to illnesses, which increases the patient's symptoms. Owing to these circumstances, hospital services and emergency departments quickly get overtasked, and become less effective on their activities.

Comprehending these issues and seeking for solutions has been on the UN's agenda for a while. However, technology improvement and artificial intelligence birth, offers us the possibility of coming through these problems using "machine learning". In "machine learning", machines are taught various parameters, including symptoms, behaviour, and biochemical and pathologic variables among others. This new approach opens a completely different process of gathering medical data at an industrial scale, including DNA processing, without needing face-to-face meeting, and finally use this information to prevent and develop new therapies.

In turn, several ethical and clinical dilemmas have appeared. ¿Whom this information belongs to? ¿Who can use this information? ¿Could genetic information be used by insurance companies, so they can see if its patient susceptible to become ill? ¿Could this lead into a new

concept of discrimination? ¿Are the health professionals ready to include the latest therapies?

[1]The solutions that might be applicable to these problems should be as diverse as the aspects of the problems are, and hopefully as creative as the topic requires.



[1] Image from 198_Artificial_Intelligence, from UN's Niharika Choudhary

History of the topic

Regarding to the current issues mentioned in the paragraphs above, for instance outdated and old-fashioned medicine practice guidelines, unpredictable patient's outcome and wrong diagnosis, must be kept in mind that artificial intelligence can constitute the axis of change the world needs in order to come through the crisis. These problems have been triggered by the overpopulation and its propensity to unhealthy and sedentary lifestyles.

By using machine learning, plus the possibility of sequencing DNA, we can create what is known as personalized medicine. This modern style of medicine uses our genomic information and its derivates to guide medical decisions. For example, we can study if a therapy applied on a patient is going to be effective even before applying it.

Personalized medicine and genetic tests began in the early 20th century by Reuben Ottenberg's hand. He reported the first blood compatibility tests for blood transfusions. Since the 1970s, chromosomes and DNA modifications are being studied in order to predict genetic deformities and mutations, especially with Down's syndrome in pregnant women.

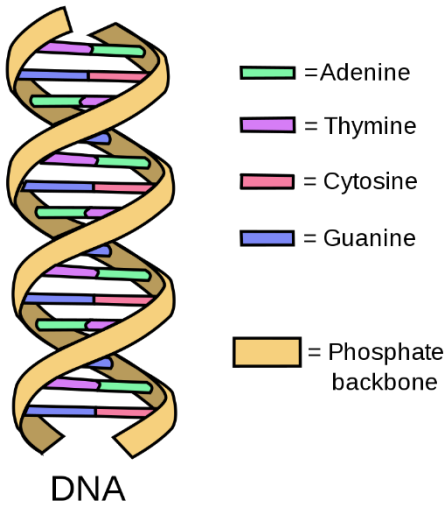
Nevertheless, the real breakthrough took place in 2003, when Francis Crick and Craig Venter, thanks to Rosalind Franklin's experiments and discoveries, gave birth to the first complete version of the complete human genome. Since then, the struggle on decrypting, understanding and interpreting what is encoded in all the 3000 million letters which form the whole genome hasn't ceased. Finishing this task is especially relevant for medicine to evolve, for the reason that we can determinate disease suffering risk, prevent them, and choose the best therapy for our single case.

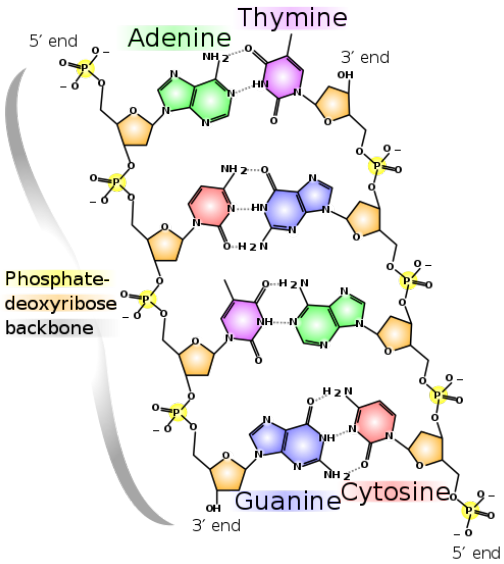
Key Words

Genome: is the genetic material of the organism. It consists of DNA and RNA. The genome includes the complete genetic material, which means that it comprehends codifying and non-codifying regions. In terms of human's genome, it has over 3000 million base pairs.

Chromosome: is the structure in which DNA is organised. Humans have 23 pairs of chromosomes. 22 are used to organise our genome in terms of hereditary information, and 1 chromosome is for our gender (XX in case of females, and XY for males).

DNA sequencing: is the process of determining the base pairs that constitute a DNA sequence. DNA has 4 types of bases: A, T, G, C, which are paired as: A-T, G-C (base pairs). Within sequencing, determining the order is important as well. In other words, it includes any method or technology that is used to determine the order of the four bases: adenine, guanine, cytosine and thymine.





Mutation: it occurs when a DNA gene is damaged or not encoded as it would have to be. For example, when bases are not correctly paired, of they have changed their order. As a consequence, a different characteristic may appear in the organism. Please note: a mutation is not necessarily bad. Every single one of us has mutations on its genome.

Current issues

Diagnosis and prevention

In terms of chronic and degenerative diseases, time constitutes a crucial variable. The longer a patient waits for its therapy, the greater the risk of getting severely affected by the illness, or even dying. For this reason, making the right decision about which therapy or medicine will suit the patient best is the first to prevent wasting time. However, the average amount of wrong diagnostics last decade stood on the 30% (ranked between 4% and 49.8%), via Noble Virtual Library. This means that about a third of the total diagnostics predicted last decade was wrong. It's obvious that this has had an impact in different directions: a significant amount economic resources have been wasted practicing unnecessary medical tests and providing medicine, and several patients may have been affected by this time and resources loss

.

Cause

Although the results indicate that doctors err in their diagnostics in a great higher number than assumed, at no time should this fault be attributed to health professionals. Quite the opposite, it's our fault. World's total population in 2010 was of 6.893 milliards. Since then, this quantity has done nothing but grow, reaching 7.925 milliards in 2020 (via Census.gov). As the UN population report states, around 2030, 8.500 milliards of humans around the globe are foreseen.

This population growth barely achieves an overpopulation level. This increase has a serious consequence, among others, within medical area: important increase of variability. The more humans there are, the more the diversity of symptoms (which means the more variability there will be nor necessary).

An increase in variability makes the symptoms presented more diverse, which in many cases can baffle doctors. For example, in case of hypothyroidism, a disease which has to do with hormone response, the main symptoms a patient will show are fatigue, cold brittleness, constipation, weight gain, goitre, muscular weakness and dry skin. Due to increase of

variability, more DNA mutations reveal, which means that hormones may have a different response before the disease, depending on their structure, and DNA codification sequences. In consequence, an increasing number of patients might show stiff and painful joints, hoarseness, hair thinning, poorer memory, depression, bradycardia, and irregular menstrual periods.

Old-fashioned medicine guides

Following the paragraph's above example, if a patient who is suffering hypothyroidism, and because of his DNA codification, in his medical evaluation only shows symptoms like stiff and painful joints, bradycardia and hair thinning, is going to be difficult for the doctor to deduct what is he suffering of. This fact can easily lead to a false diagnosis, harmful for both doctor and sufferer.

Committing these inaccuracies is partly explained by medicine guidelines followed by doctors. They are outdated, and do not contemplate all the variations mentioned. Once again, misdiagnosis can be committed. Therefore, the misdiagnosed patient can develop a worse condition.

Helpful technologies

Faced with this initiative, artificial intelligence raises up as the most useful instrument or tool to battle this background. Being able to sequence in a short space of time the whole patient's DNA gives the doctor the possibility of recognizing if the patient is the right person to apply the treatment on; if the medical tests used to diagnose are the appropriate ones; and if the patient's outcome will be what he expects. In other words, our doctor is able to know in advance which diseases are we most susceptible to suffer, how to prevent them, and choose the best medicines for our specific issue, all thanks to personalized medicine, fuelled by AI.

Another example of personalized medicine's applications is the detection of breast cancer. Breast tumors grow as a response to specific hormones, that enter into the tumour cells via cell receptors. The hormones which can lead to a tumour growth are mainly oestrogens, progesterone, and Herceptin. Therefore, if a patient has more cell Herceptin

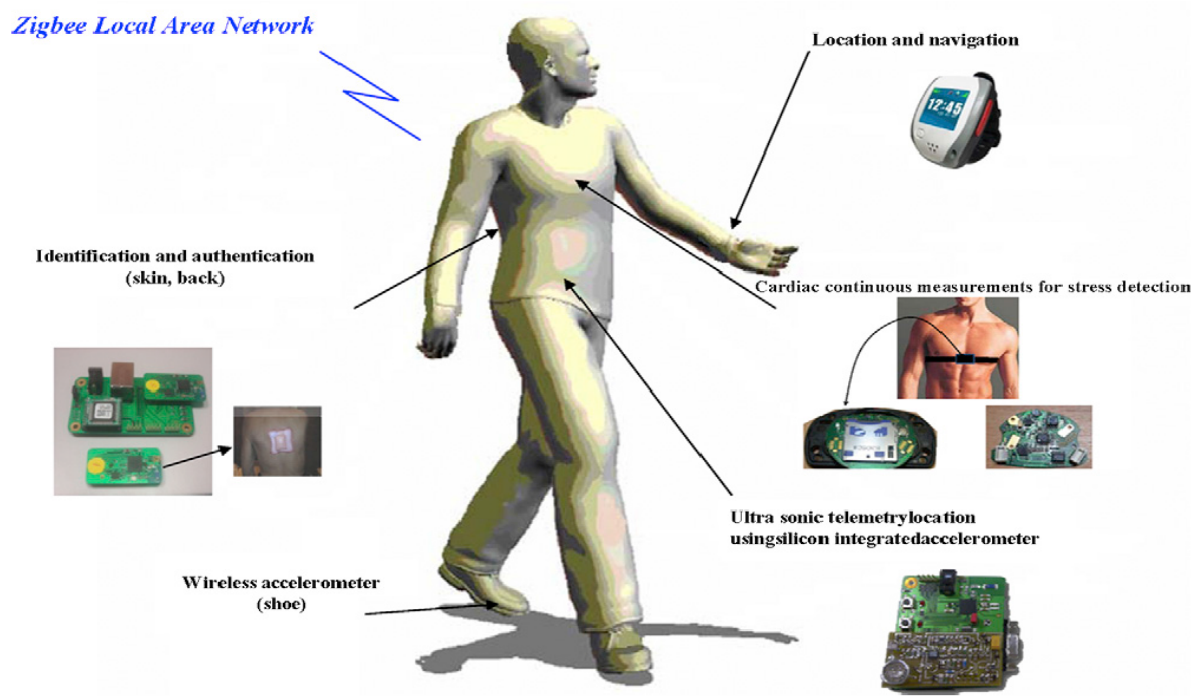
receptors than usual, she will very susceptible to develop breast cancer. Of course, in order to get this information, a genetic data test of the patient is required.

From a scientific and evidential point of view, to apply these new therapies in our daily diagnosis processes is perfectly feasible, keeping in mind that technology has evolved more than necessary for its applying. What's more, any of us can request for a genomic test without the need of moving from home. Autonomous enterprises like 23andMe, MyHeritageDNA, tellmeGen, and GenesLoveMe offer DNA analytic tests which give you information about your ancestry reports, family tree, your disease suffering risk, medicine compatibilities, hereditary diseases, tendency and tolerance to alcohol, drugs, obesity, balding, etc.

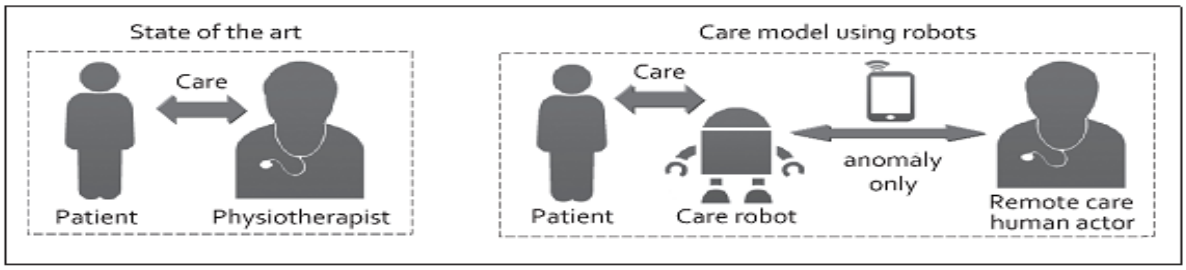
Then, why haven't been this new data bases and methods to gather information applied yet in our society? Technology evolves faster than laws. Many methods aren't being applied because of bureaucracy procedures, legal pitfalls, and ethical dilemmas, like the ones mentioned in the topic introduction.

Besides this, there are other various technologies which can be helpful in medical prevention and diagnosis. An artificial intelligence branch that must be taken into consideration is the physical branch. This new division includes physical objects and gadgets, for example smartwatches, activity wristbands, smart clothes, that create a new way to collect information about our health and vital constants; medical devices, such as new monitoring systems, 3D organ printing, smart inhalers for asthma; and medical sophisticated robots, like brand new surgery robots (e.g. Da Vinci's Surgery Robot), or virtual reality surgery practice.

[2]Examples of healthcare gadgets and innovations:



[3]Implementing these innovations would mean that visiting the doctor would only be necessary in the case of real awful diseases. Thus, our daily healthcare would be monitored and controlled by gadgets and robots, like in the following scheme:



[2] Image from 198_Artificial_Intelligence, from UN's Niharika Choudhary
[3] Images from 198_Artificial_Intelligence, from UN's Niharika Choudhary

What's more, the implementation of these innovations would mean too that medical services would be far lesser crowded, and far more effective.

Past action and articles of interest

- **Diet, Nutrition and the Prevention of Chronic Diseases, report of a joint WHO/FAO expert consultation:** report developed in 2003 about which were the main chronic diseases must be taken into consideration, and how to prevent them.

  https://apps.who.int/iris/bitstream/handle/10665/42665/WHO_TRS_916.pdf;jsessionid=2B1688C3D729213DB6B711E1F8056428?sequence=1

- **UN panel warns against 'designer babies' and eugenics in 'editing' of human DNA:** United Nations report on why genomic editions could be controversial.

  https://news.un.org/en/story/2015/10/511732-un-panel-warns-against-designer-babies-and-eugenics-editing-human-dna

- The First Chinese Edited Babies: A Leap of Faith in Science: report from the National Center for Biotechnology Information of the US about two Chinese twins that were genetically edited with CRISPR-Cas9 (optional).

  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6724388/

- The Legal and Regulatory Context for Human Gene Editing: a first contact to what are the main problems and dilemmas that appear in the legal context of human gene editing published by Issues (optional, highly recommended).

  https://issues.org/the-legal-and-regulatory-context-for-human-gene-editing/

- **The potential for artificial intelligence in healthcare:** a report about which are the main areas and benefits of artificial intelligence in healthcare, published by US NCBI.

  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/

- Ethical, legal and social implications of incorporating personalized medicine into healthcare: a first contact to what are the main problems and dilemmas that appear in the legal context of human gene editing published by US NCBI (optional, highly recommended).

  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4296905/

- **United Nations Activities of Artificial Intelligence (AI):** UN main areas in which artificial intelligence may be useful (not only about healthcare)

  https://www.itu.int/dms_pub/itu-s/opb/gen/S-GEN-UNACT-2019-1-PDF-E.pdf

- **Precision Medicine: Improving health through high-resolution analysis of personal data:** applications of genetic analysis in personalized medicine, published by US NCBI.

  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6526370/

Possible considerations for the future

Currently, technology evolution has reached a point in which its development speed is much higher than the development speed of the legal framework around this evolution. As a consequence, a considerable set of laws are left to be developed, and several law conflicts and legal pitfalls appear. Due to this lack of laws, a large number of healthcare technology advances stay left to be implemented. For this reason, when it comes to tackling healthcare technology development, the message should be addressed more towards legislative and regulatory authorities than towards the scientific community.

However, this doesn't mean in the scientific community there is no need for adaptation. Quite the opposite the scientific community, especially healthcare professionals, must be made aware of the revolutionary advances in their respective areas, and is in their power to put pressure on the authorities to develop the required laws in order to apply brand new, innovative, and tremendous useful methods and therapies.

Measures are needed, and the WHO is destined to lead the approach to all the legal and ethical dilemmas that may appear in conjunction with each scientific breakthrough.

Conclusion

As has been shown along the whole development of this Study Guide, there is no doubt the future is accompanied by the artificial intelligence. The capacity of a machine to learn and manage tons of new data will be the central axis of the solutions for the incoming problems in several (if not every) aspect of our lives.

What is more, artificial intelligence is already solving the main problems that appear within the medicine and healthcare area. Particularly, those related with prevention and diagnosis. As mentioned in the *Current Issues* section, dilemmas such as overpopulation and its consequent over-variability have shown that its solution involves one way or another artificial intelligence.

Big problems require big solutions, and it is in your hands as delegates of the WHO committee to try our best and seek for a suitable solution for each one and all. But not only big solutions have an impact: a simple solution which is able to develop and apply just one new therapy can save thousands of lives. There is not one single solution to the problems that affect medical prevention and diagnosis nowadays, and delegates are welcome to explore all possibilities that lie with WHO's mandate. Therefore, the next step for you to take is more in-depth research. This guide only outlines the topic, it is on you to find more information and possible solutions. One starting point is doing the required readings listed below.

Bibliography

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  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/