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Epidemiology & Biostatistics

○ Slides ● Sheet ○ Handout ○ other.....

Lecture # 3
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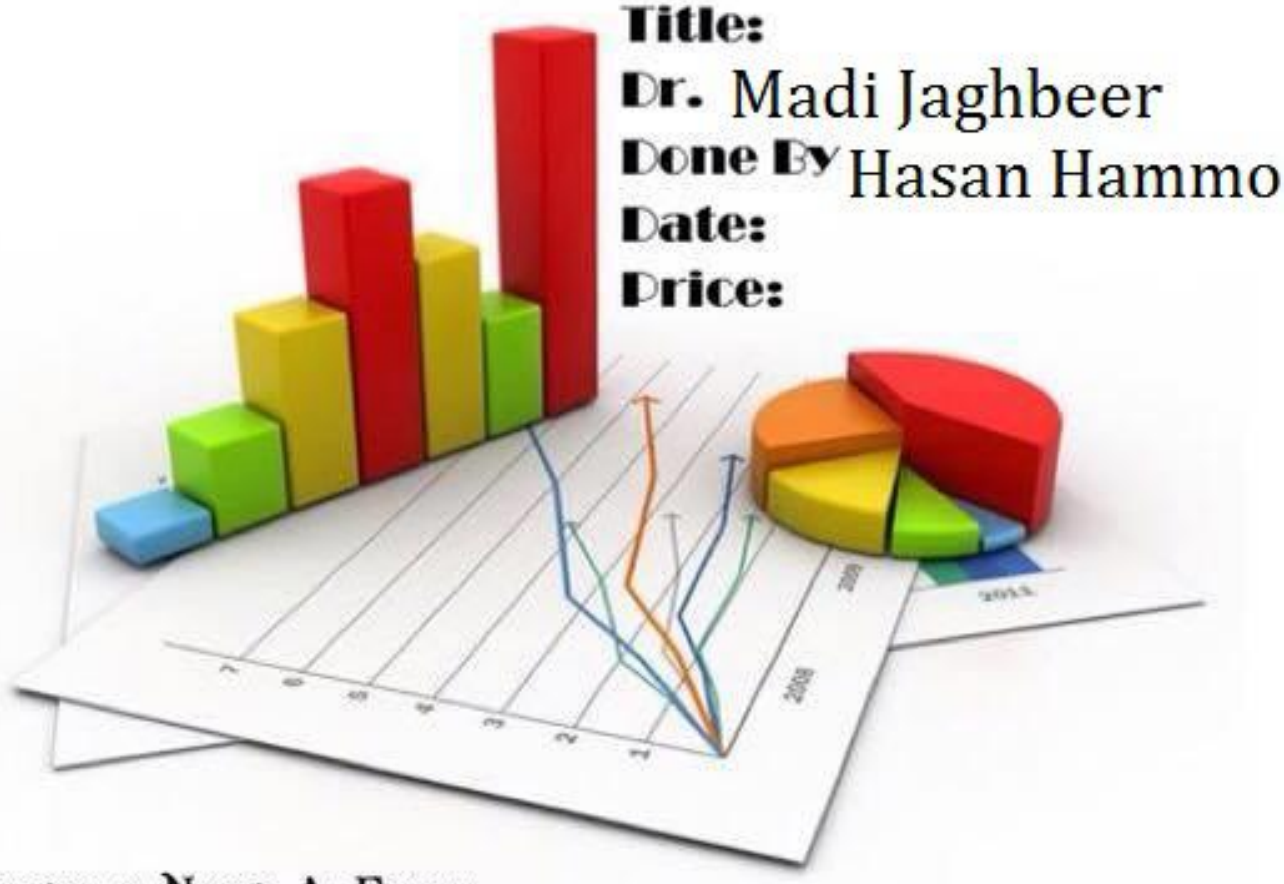


Designed by Nadeen Al-Freihat

Physical Trauma and Radiation

Salam all, if you're like me and a huge procrastinator, then you should be studying this with about two days left for the final. Therefore, Im glad to tell you this 11 page sheet has only about 2 pages worth of actual hard real facts. I've gathered them at the end of this sheet for you to learn if you don't have enough time to actually read the rest. For the other 10% of the duf3a, grab a cup of tea and enjoy!

- please note that the record times are times I couldn't understand what he was saying. You can go back to section 2's record and check it out on your own

Mechanical Accidents

Last time, we talked about occupational health problems, and one of these problems was mechanical accidents. The machines in the workplace can cause different kinds of accidents, and one of the worst accidents to be caused is **in** or **between moving parts** of machines. Some people's work requires them to place a part of their body inside the machine, and in some cases the whole worker may need to be inside the machine. This is called **in, under, or between the parts**. Sometimes (? 01:27) people work (? 01:31) a certain machine they turn off the power and during lunchtime for example and they start to get inside the machine to fix it and someone else might

come accidentally and start the machine (I couldn't understand him clearly here).

Workers might have other kinds of physical traumas as well, and of these that you will be seeing is something called **struck by accident. In these kinds of accidents,** the worker himself is **stationary** (standing still) and all of a sudden a moving part of the machine hits him. For example, when cleaning the workplace by using pressurized air, small particles (ex. Metal, stone, etc.) may hit the worker in the eye or other parts of his body causing him injury. So this is **struck by.**

Now, sometimes, the worker himself is moving, and all of a sudden- oh I don't know perhaps he's in a hurry- there may be a glass separation (like a door). This glass could be over cleaned (meaning it's very clear and difficult to distinguish from real life). This worker may run into the glass. This is a very bad kind of accident. It happens when visitors rush into hospitals to see their relatives, they hurry in and are oblivious to these overly-clean glass doors and so they run into it and break their nose. What's funny is that another person after him will continue moving in the same direction. So this is a kind of struck-by accident, called **struck-against** accident.

So when we talk about the types of struck-by accidents, the first kind we have is due to flying objects or moving parts of a machine. For struck against, we already talked about one kind of occasion. It could also happen in this next scenario, where you know when you have two floors in a

workplace, and the second floor is lower than usual? In these cases, the workers climb up to get to the second floor and **HIT** their heads against the wall, or when you're climbing the stairs trying to reach the second floor, you might hit your head again. This is a very bad kind of accident, because if you're on the stairs and you hit your head at the top then you might fall down backwards. Now you're falling on the stairs, and you could break your back or other injuries. So this is another kind of physical trauma.

Physical trauma could also happen by slippery floors, due to oil spills or water on the surface. It could also happen when you're coming from outdoors where it's all rough street and your legs and feet are used to roughness. So when you step onto the very smooth surface, at that moment you could fall down. It could happen anywhere since we always wash and clean up the place.

DID YOU KNOW (not included in test)

This strange falling sensation and muscle twitch is known as a *hypnagogic myoclonic twitch* or "Hypnic jerk"

As your muscles begin to slack and go into a restful state just as you are falling asleep; your brain senses these relaxation signals and misinterprets them, thinking you are falling down. The brain then sends signals to the muscles in your arms and legs in an attempt to jerk you back upright. This misinterpretation that takes place in your brain may also be responsible for the "falling" dreams that accompany the falling sensation. These "dreams" are not really normal dreams, as they are not produced from R.E.M sleep, but rather more like a daydream or hallucination in response to the body's sensations.

When we previously talked about **falling**, we talked about *falling from upper to lower levels,* like construction or window cleaners. However, again you could *trip or misstep*. A lot of us have dreamt about falling somewhere and then we suddenly wake up. It might have happened with you in your subconscious that you misstep. People walk and because they don't know that the door starts here, they will miss this step and trip. What's funny about workers is that when you ask a worker to move something from one place to

another, he tries to move it in one or two trips and usually carries more than he should. This could obstruct his vision.

For example when a worker carries files, he will stack as many files as he can before he moves. They could be so high that they cover his eyes, and he can't see anymore. He won't remember where the steps start or end. He could also think that the stairs have not finished yet and he thinks there's another stair.

Why should you know what caused the problem?

Because you should be able to do something about it.

Remember that when we talk about risk assessment we say: After you assess all the risk, you have to do something, and you have to be able to prevent and predict it. So this is another kind of accident, **Falling at the same level** like slippery floors, or missteps, or tripping. Any work place could be cluttered and has everything on the floors here and there, so you could trip on any of these things. You could ask a student where his things are in his study room, like his books and book cabinets which are on the floor, and he will tell you he remembers, however even he himself is prone to tripping on them. Anyways so this is another sort of physical trauma.

Another one is like what we've mentioned in **back forces** when we talked about falling down from ceilings. Here, it could also be applied to removing parts of machines that are moving quickly and strongly. Like for example, the machines that type the expiration dates on cans. When we want to stamp the dates on cans, we put the machine at high pressure. This machine has a certain part that moves very quickly and hits the metallic

part with high pressure. This part moves quickly and with very strong force. Another example is when they engrave names and numbers onto coins.

To prevent workers from putting their hands in between while the machine goes down very strongly they use different techniques of safety. One of these methods is to have this machine worked by two knobs. It won't move unless you press it by two fingers. Good workers (the doctors being sarcastic) , thaki zyadeh 3n al luzooom, will stick tape and gum to one of these knobs so that it is always working, and this allows him to use only one hand to work (laziness). He could be talking to his friend, making it easy for him to forget his hand inside the machine, and now it catches his fingers.

Sometimes they put a "magic eye". This sensor controls the machine in such a way that it won't work if you put your hand inside. However, we still have athkiya2 who could cover this magic eye and place certain labels or stamps on it so that it wouldn't work properly. This is the way it is, you keep doing things for the workers and they do something else against what you're doing. So this is what we call **back forces**. All these result in physical trauma.

Other sorts of physical traumas include **vehicle accidents**. You could have vehicle accidents in streets, or in loading and unloading procedures at facilities. During these operations, one of the workers could use fork lifters, and he will lift heavy things using this machine. He will do the same as the man in our previous example whom stacked piles of paper in such a manner that he couldn't see anymore. So this man on the fork lift could push somebody without seeing him and force him into the wall with these

metallic parts. This might kill him or damage him. So vehicle accidents might occur inside the workplace for that reason. We add all of these to physical trauma.

Now, of the physical things inside the workplace, we have something called **radiation**. And now your colleague here will tell us what radiation is. (Turns out he didn't want to ask, he just wanted to point out that this certain student wasn't paying attention.)

Teacher: "Why are certain materials radioactive while others are not? What makes a certain material radioactive?"

Student: "Energy?"

Teacher: "What kind of energy?"

Student: "nuclear energy".

Teacher: "So it has more nuclear energy? What makes this nuclear energy higher?"

Student: "Half-life?", "Neutron?", "Proton?"

Teacher: "Let's go back to the basics."

Any atom is made up of a nucleus in the middle, with the protons being positive, and the neutrons being neutral, and all of them are surrounded by imaginary sub shells containing the moving electrons. Now, let's say this. We know that positive charges repel each other.

Teacher: "What makes protons inside the nucleus sit together in this very tight place?"

Student: "strong forces that convert mass into energy."

Teacher: "What makes them stay there?

Apparently no one answered.

Teacher: "This is what we call **binding energy."**

Each atom has a certain binding energy that keeps these components inside the nucleus together. Otherwise they will move away from each other. When we talk about energy, usually there is a certain amount/limits of energy acceptable to make things stable. If it occurs that this kind of atom has more than it should of this binding energy, it needs to get rid of it. One way to get rid of this extra energy is to release it in the form of energy, in the form of **radiation**. This energy will go out as radiation. And this makes a certain material **radioactive**.

Sometimes you see a child at home. Some doctors mistakenly label some kids as hyperactive. Everyone is sitting on his seat, except him, who's sitting on his head, running and jumping. Everyone is asleep except him; he keeps running until he loses this excess energy. This is exactly what happens with those kinds of atoms. They have to lose this extra energy in order to become stable. They keep losing energy until they reach a stable level (yeah I didn't find wijh al shabah either).

How can we classify them (these radioactive materials)?

Various murmurs among the audience.

Teacher: "Into **Ionizing and non-ionizing**. What else?"

Student: "By length of waves."

Teacher: "This is for some types. But not all. What else?"

Student: "Frequency,"

Teacher: "Yes, for certain kinds."

Student: "Types of particles, alpha beta gamma." (7yoo Abu Alia <3)

Teacher: "Not types of particles, we say either 1) particular matter **OR** something else. *What is this something else?* 2) **Photons or electromagnetic waves**. So they could either be made out of particulate matter (whatever the weight of this particular matter is) versus those which are not. Those not made out of particulate matter, are made out of just waves, and we call them **photons or electromagnetic waves**. So we have two types.

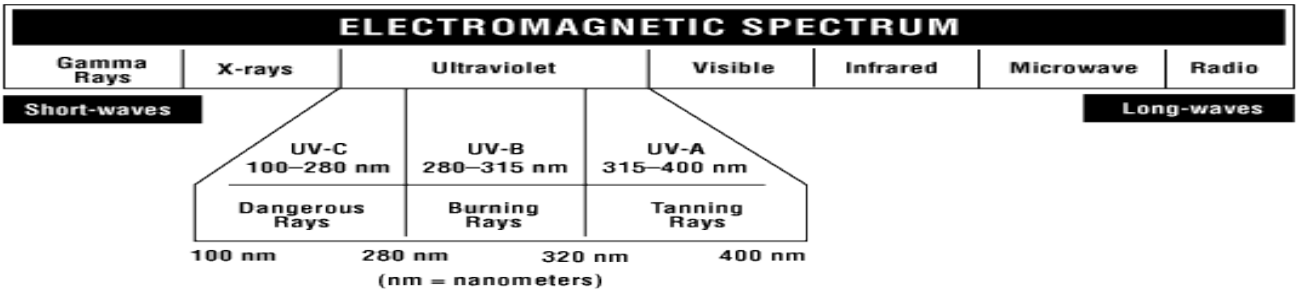
An example of radiation includes the x ray. Some characteristics of x-rays include the fact that they are 1. waves, and they are 2. **ionizing**. It is very dangerous for you in the future not to know whether this radiation is ionizing or not ionizing. Why? Because workers that are exposed to radiating waves include DOCTORS :O . You might order an xray and (? 20:21) Dentists always use x-rays.

X-rays are ionizing waves, or ionizing electromagnetic waves. Again, those who are not going to hear this lecture today (and he stopped the sentence right there)

What about beta? Beta is an electron, so it is 1. particulate matter. Is it ionizing or not ionizing? 2. **It is ionizing**.

What about UV? It is **Half ionzing**. Why half? Because some parts of the waves at the beginning of UV might have some ionization potential. But **majority of UV is non-ionizing**. When you look at the electromagnetic spectrum that shows all kinds of radiation on them, you will find UV between ionizing and non-ionizing, and a bit of it at the beginning might be

ionizing.



What about positron? What is it and where did we get it from?

A student answers: "It's an anti-electron?" (These are all unanswered questions the doctor asked.)

What is the difference between proton and neutron? It is the positron. So neutron plus positron (? Here he said positron but I think he is mistaken) becomes positron. If positron loses its electron then it becomes a neutron. (I am not sure at all from what the doctor said here.) He clearly states that a positron is a neutron plus a positron, although I believe he meant proton, this is what he said, however on wikipedia it is quite different)

Wikipedia on positrons:

"The **positron** or **antielectron** is the antiparticle or the antimatter counterpart of the electron. The positron has an electric charge of +1e, a spin of ½, and has the same mass as an electron. When a low-energy positron collides with a low-energy electron, annihilation occurs, resulting in the production of two or more gamma ray photons (see electron–positron annihilation)."

Teacher: "What gives the atom its identity?"

Student: "Protons give atoms their identity."

Teacher: "**Very good**."

During radiation, those protons are broken down into neutrons and

the atom itself will change its identity. It becomes something else; it depends on where we find it in this chain of reaction. That's why some scientists said that lead is the end of all radioactive? material. So they keep losing this radiation in different forms until they finally become lead. So we have a change in the material from one form, and one identity to another during radiation.

Ionizing means it has the potential to ionize the media through which it passes. **Non-ionizing** means that it doesn't have enough energy to ionize the media through which it passes. Does this mean that ionizing is dangerous and non-ionizing is not dangerous? No, for example, UV has a health effect related to ionizing potential as a carcinogenic, although we previously said that it is non-ionizing waste. But ionizing has a different mechanism; it causes the problem by ionizing the media through which it passes while non-ionizing can cause damage in different ways. Like (? 26:19) or affecting the cells directly. Each radiation is identified into these two categories. (Ionizing versus non-ionizing)

When talking about frequency and wavelength, does this usually refer to particulate matter or to waves? Waves! Because we don't refer to particulate matter in terms of waves and frequency. (Excellent explanation)

When we talk about frequencies, we talk about the radiations which are electromagnetic waves and those radiations … (the dr. didn't complete the sentence >.< (?)

Teacher: "What do you think about the relation between wavelength and energy?"

Several students showed off their smartness mashAllah.

The longer the wave, the less the energy, so inverse relationship. As for frequency, it's the opposite. **As the frequency increases, the higher the energy, and thus direct relationship**. In the electromagnetic spectrum, we start with the ones that have the shortest wavelength (gamma rays → the shortest, also X rays have short wavelength) and end with the longest kinds, which are **radiowaves**. And a bit before that we have **micro waves**. The name microwave is deceiving because you'd think its short when actually it's longer than the others.

RECAP:

-Occupational health problems include mechanical accidents

The accidents include:

1- In or between moving parts

2- Struck by: Human could be stationary or moving. If moving, we call this struck-against.

3- Slipping and falling. Could be from heights or on flat surface.

4- Back forces (Falling off stairs could also be added here)

*We have methods of safety on machines that prevent them from working if humans are in danger, however some workers disable these protective techniques, and thus damaging themselves.

Ex. 2 knobs activation, magic eye.

5- Vehicle accidents like in loading and unloading.

Radiation:

-Another kind of physical material that could cause injury and trauma

-atoms have protons, neutrons, and electrons.

-protons are held together by binding forces

- if an atom has excessive binding forces. This excess is released as radiation and the atom is termed radioactive

-radioactive materials can be classified as:

ionizing vs. non-ionizing

having waves and frequencies vs. not having

being particulate matter vs. being electromagnetic waves (aka photons)

- x-rays are ionizing electromagnetic waves

- Beta particles (basically electrons) are ionizing

- UV is HALF ionizing. The waves near gamma and x-ray are ionizing while the rest aren't

-positrons are particulate matter

-atoms are identified by proton number

- during radiation, protons are broken down and released

-atoms change form, and the final form is lead

Ionizing: the potential to ionize the media it passes through

Non-ionizing: not enough energy to ionize the media through which it passes

HOWEVER BOTH could be dangerous

-frequency and wavelength are characteristics of electromagnetic waves

-As wavelength increases, energy decreases (inverse relationship)

-As frequency increases, energy increases (directly proportional)

- the shortest waves are gamma

-the longest waves are radio waves.

وتوتي توتي خلصت الحتوتي، حلوه ولا منتوتي؟

وإتذكروا أنه لن يهزم أبداً من سعى بإصرار ولن يهزم أبداً من سعى نحو الانتصار

Thank you correction team for doing what you do best :D

Good luck, we're almost done

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