Transcript:
Season 4, Episode 4: Fertility & Sperm: The Lowdown

Maayan Hoffman:

Hello and welcome to the latest episode of Hadassah On Call, New Frontiers in Medicine. I'm your host Maayan Hoffman. We have a very exciting guest today, professor Hagai Levine of the Braun School of Public Health at Hebrew University Hadassah.

I've known Professor Levine for several years. We're going to talk about something you might not expect, sperm count. Now in my day-to-day life, as I said, I'm a journalist, so I've actually spoken to Professor Levine about this subject and his new paper, which looks at the drastic decrease in sperm count and sperm concentration over the last decades.

You can check out my story on Health Policy Watch, but first I hope you'll watch this episode. Anyway, it really drew me in when I saw that this study came out, because there is a more than 50% drop in sperm count over the last decades, and that of course could impact fertility. Now I'm a mother of a blended family of seven, so I think I made my contribution, but of course I worry about the next generation. Anyway, without further ado, let's turn it over to Professor Levine.

We are so fortunate today to have with us Professor Hagai Levine. He has just come out with a very groundbreaking study, a new study, or I should say an updated study of one that was done earlier, looking at sperm count and the impacts potentially though this is not in the study of the external factors like the environment on men's sperm count.

I want to get into that right away. But before we do, I would love it if you could just tell me a little bit about yourself and how you ended up at Hadassah.

Dr. Hagai Levine:

So, both my parents grew up in Jerusalem and were born in Hadassah. I have a family also, I have an aunt who was a physician in Hadassah, and when I was 17, I decided to become a physician and join the program of the military. You first study and then you go to the military as a physician, I chose to study at the School of Medicine at Hadassah at Hebrew University.

So, you can say earlier on for my career, my career started in Hadassah and what I know about medicine is the first ground is from Hadassah. After my service in the Israeli Defense Forces, I was a physician at the power troopers [inaudible] and later on I had my public health endocrinology residency in the Israeli Defense Forces and became the chief epidemiologist of the IDF.

And then I decided to focus on research, and naturally I came to the best school of public health and well known around the world, the Braun School of Public Health at the University Hadassah Medical Center.

And that's where I'm working and studying for the last decade and a bit more. Fortunately, and this is very unique, this is the only school of public health in Israel that is nested within a medical center. Actually, when Hadassah was founded more than 100 years ago, from the beginning it was public health together with community medicine.

And that's the spirit in the school. And I'm very fortunate that nested within Hadassah, I have the opportunity on the one hand to impact communities in Jerusalem, Israel and around the world. But on the other hand, to work very closely with physicians and with scientists who are at the top notch of science and medicine. So, I feel very lucky to be part of the Hadassah family.

Maayan Hoffman:

Incredible. And of course, there's nothing better than being a Hadassah, but at the same time you actually wear another hat, right, with regards to public health in Israel. So maybe just share a line about how important you actually are above and beyond all of your incredible research.

Dr. Hagai Levine:

So, for the last year, I'm the chairman of the Israeli Association of Public Health Physicians. This is the official organization of public health professionals in Israel. Not only physicians, but we have veterinaries and dieticians and nurses, et cetera, et cetera.

And we are the representative of Israel in the European Union of Public Health Physicians or Public Health Associations, not only physicians. I'm also a part of the World Federation of Public Health Associations Policy Committee. And as a scientist, what I'm trying to do is to bring

science to decision makers and see how we can translate the recent scientific advances into promoting public health in Israel and around the world. It's difficult. We are facing other interests, sometime vested interest, commercial interest, political interest, and health is not always a priority, and science-based thinking is not as common as we would want it to be. So, I'm working together with my colleagues, with my partners, with my friends, trying to promote public health, evidence-based public health.

Maayan Hoffman:

Amazing. And I think that really leads into the topic at hand, which is your most recent study, which of course will have a very strong impact on public health. You showed, and correct me if I have this wrong, but about a 50% decrease in sperm counts over the last decades and worldwide, that's in Africa, in Asia, and the United States, the United Kingdom all over the world. For people to understand, just to make sure that we have the numbers clear, can you review sperm count numbers for me? How much sperm are we supposed to have, and what do declining numbers really look like? What are we talking about here?

Dr. Hagai Levine:

I will get to the details, but first I want to say as you ask for the first time, I might say in an interview, someone is actually interested in me that what is surveillance? And that's very important. That's exactly what we are trying to do in public health, is to see what are the trends, who are the susceptible populations to understand. What is epidemiology? Epidemiology is from epi, above, demo, people, and logy, the logic of studying the health of populations, and what we are used to is to look at surveillance of infectious diseases, like COVID, and we heard so much data about COVID and the dashboards, et cetera. But what about other health measures? And here, I found miraculously that sperm count are not only the best indicators that we have for fertility, for male fertility it's not perfect, but that's the best indicators that we have.

But also, an indicator of men's general health, because it was shown that low sperm count is a predictor of early mortality and of morbidity. So, the meaning of what I will now elaborate of the decline in sperm count globally means that there is a problem. It's a public health crisis, public health problem. And that's why it's so interesting. Now, specifically sperm count, it's very simple. You just take the sample, and I will not explain how you get the sample, but put it on a slide, on a grid and then count it. So, it's just counting. It did not change since over 100 years ago when it started. And we only took studies that used the same methods. Right. There are also new methods, computer assisted methods. We did not look for them, because we wanted studies that use the same method. We screened over 10,000 publications.

This is a systematic literature review. And the protocol was published five years ago when we published our first study. And now again, so everyone can repeat the study and checks for themselves according to the protocol. We took all the data point, the estimates from different years, from different populations, from different countries, and we put it on one dataset, and

then we modeled the twins over time. What we found that between 1973 to 2018 globally, there was over 50% decline to be accurate, 52% decline for sperm concentration and 62% decline for total sperm count among men all around the world. We try to understand whether or not the decline is steeper for men from North America, Europe, and Australia than for men from South America, Asia, and Africa. There is not enough data to say whether or not, but the decline is everywhere. We need more data from everywhere, but specifically from Asia, Africa, and South America.

But again, the results are very clear. Even with adjustment to various potential confounders and all kinds of sensitivity analysis, we took out each country, et cetera, et cetera. The most surprising finding was that when we limited the data only to recent period, data that was collected after the year 2000, the decline more than doubled. There was a decline of 2.6% for each year. This is amazing. It means, and actually there was one study that measured that children, when they reached the age of 20, they have much lower sperm count than their fathers at the age of 50. Because of the generation, the court impact that we see a decrease over time. The next question is usually what are the causes? That's what you probably-

Maayan Hoffman:

I want to get into the causes, but before you get into the causes, I actually want to ask you how you would know. So, you are a researcher and you're looking at all of this 10,000 studies in order to understand the trend. But if you're a man, would you be able to somehow feel that your sperm count is declining? Does it happen with age in general? Do you start to feel a lower sex drive? Are there any implications that could tell you, "Oh, maybe I should get my sperm concentration, or my sperm count checked."

Dr. Hagai Levine:

It's a great question. In general, I would say no, you cannot know. Someone can look perfectly fine and feel perfectly fine, but he got low sperm count. It's totally different. But it just remind me the issue of sexually transmitted disease, or being a HIV positive for example, you cannot know from the look of the person whether or not is HIV positive or not. It's something totally different. But I'm just saying because there is a misconception. You see a bodybuilder; it looks very strong. Actually, some bodybuilders take steroids that actually are very harmful to sperm cancer. Sometimes it's even the opposite. In any case, we do know that your potential is determined in fetal life. So as always, blame the mothers, but it's the mothers. That's the important issue. What your mother-

Maayan Hoffman:

I'm sorry it is it the mothers or it is the potentially external forces impacting the mothers when they're carrying the children?

Maayan Hoffman:

On behalf of the whole team at Hadassah On Call, I want to thank you for being a fan of our show. In 2022, our podcast covered everything, from kids in cancer, to Monkeypox, diabetes, and Hadassah's Humanitarian Medical response to the war in Ukraine. If you've been inspired by what you've heard each month from our world-renowned doctors, please consider making a donation to Hadassah today. Your gift will help sustain our hospitals as global leaders in medical care treatments and research. Visit the podcast webpage@hadassah.org/hadassahoncall, that's hadassah.org/hadassahoncall, and click on the blue donate button at the top of the page. Thanks so much for listening and for helping us make a great impact. And now back to our conversation with Dr. Hagai Levine.

Maayan Hoffman:

It is the mothers, or it is the potentially external forces impacting the mothers when they're carrying the children.

Dr. Hagai Levine:

Sure, sure. I don't want to blame the mother; I want to congratulate the mothers. They are the source of all of us. Okay, so the point is that what your mother was exposed, what she ate, how stressed she was when she carried you in a womb, that determined your health in general for life. Because now we know the developmental origins of health and disease, it's a very strong theory, but very strong evidence that whatever you had in your thought, that's the main driver of your health later in life, even more than genetics, your environment of in fetal life is even more important than your genetics. Of course, everything is mixed and specifically, and now I'm getting to the causes, specifically if she was exposed to manmade chemicals such as additives to plastic, what we call phthalates, which were shown to be endocrine disruptors, even one drop in a pool can have a great impact and can disrupt development.

So, you will not see it on the outside, but the testicles would not have perfectly developed and you will have later in life lower sperm count. Sometimes when there are specific syndromes or illness, then you can have micro genitalia and obviously a problem with sperm count, that's another topic, then you can obviously see that there is a problem. But in our study, we focused on unselected general population. We did not look at studies that look for specific populations of sick people or people with kind of disease. So that's something, yes. Get back to your question, sometimes you can see that there is a problem, when the testicles do not descend to the right place, what we call cryptorchidism, it's also linked to endocrine disrupting chemicals to specific exposure. Then you are also at higher risk for low sperm count and testicular cancer.

Maayan Hoffman:

And just on that, you mentioned that there are the side effects of more morbidity, earlier mortality for men who have lower sperm counts. But are there other side effects as well that you might, see? For example, are you also going to have less fertility? Could this impact men's ability to help produce children in the future?

Dr. Hagai Levine:

Okay, sorry, I thought it was clear, but it's good that you made me to be accurate on that. So, as I said, it's the best marker we have for fertility, what was shown in studies and the best way to measure the ability to reproduce is to see in a couple that one to conceive how long it takes them to naturally conceive. And it was shown that when the male sperm concentration is below 40 million per ML, we see a decline in ability, in accountability, in ability to conceive. And it takes a longer time, sometimes forever, but it takes a longer time. So that's a principle of course are also other measures. The number of children is dependent on many other factors, because regular men may have thousands of opportunities to bring life. And actually, in each sample, we are speaking about we get down from 100 million per ML to 50 million per ML and you multiply it by three to four ML.

So, in a normal sample we get more than 100 million sperm. So obviously we got a lot, but when the number is low, it reflects problems in the testicles. So, it means that the chances for each time, the chances of conceiving are lower, the general chances of infertility when there is a low sperm count is higher. Of course, our other measures, also the motility, the morphology, it's also important. But because the methods to test motility and morphology are different in different places and change over time, we cannot assess the trends in this factor. So, I'm not saying that the sperm count is the only factor, but again the count is very linked to the potential from fetal life. And you had one more question I wanted also to answer, go ahead by, maybe I will remember later.

Maayan Hoffman:

So, one comment there I think would be though that it might start with the mothers, but it seems like it could later on be a factor from the fathers in terms of being able to reproduce those kids. But really, I actually want to go back to something that you said before which was the chemicals, the plastics, we're really talking a lot nowadays about climate change, the impact the environment on our lives, pesticides, all kinds of chemicals. And I wonder if you could elaborate a little bit more. I know it wasn't directly in the study, but why you and your team believe that the environment is having this impact, and what can we do about it today? Because some of these chemicals are eternal, long lasting.

Dr. Hagai Levine:

So, from other studies, as you said, not from this study, we know some of the factors that harm sperm and get lower sperm count. For example, where the study here in Hadassah, we studied the exposure to pesticides among men attending fertility clinic in Hadassah. And we find relatively common exposure to pesticides, not necessarily that was the reason for the lower fertility. Again, there are obviously many other reasons, but it's not helpful that they are also exposed to pesticides. We also compared the testosterone concentrations in a very well-designed study in Jerusalem in east and west Jerusalem. We compared testosterone concentrations, and we found some differences. We know that there are socioeconomic disparities in general, but also in testosterone. We also know that marital status is associated with testosterone. There are some studies that when you watch like the Montreal football match and your team wins or loses, it may temporarily affect your testosterone.

So, I'm just saying again all your questions, it's a complex system, okay, it's multifactorial. There are many, many different elements. I also want to say because we spoke about the mothers, we have more and more evidence that the father through the sperm actually also his own exposures, for example, father that takes certain medications or exposed to certain chemicals such as lead, there are higher chances of congenital malformations in the fetus. So, although the mother of course it's the most important also the environment you need to, but also exposures of the fathers impact the developing fetus. And what I want to add to the equation that in adult life, because men, unlike women, who their eggs are produced in fetal life and then they are stayed and released later in life. But that's the exit where manufacture in fetal life. For men, the manufacturer in the factory working all the time and in adult life and it actually was manufactured 80 days ago.

So, exposures in adult life can also impact the semen quality. It may include as you said, pesticides and other chemicals, but also stress and lack of physical activity and diet that is rich in ultra-processed food, and soda drinks specifically were shown all these harms and of course smoking and marijuana and binge drinking. So, the same risky behaviors that harms health in general are usually also harmful to sperm count. As I told you, I was a physician specifically of young men in the power troopers and special forces in the Israeli Defense Forces. And what I saw there and what we know globally that generally young men tend to neglect their health. They don't go to regular checkups. If they have a problem, they don't check it.

Most men, not all of them, and also, they don't attend the fertility. In medical research, women were neglected for many years and there was not enough medical research on women. In Hadassah we always put our minds on women's cells as an important issue. However, and now it's I think more positive ways around the world in medical research on women. But in the field of reproduction the men are neglected. And many times, also in the clinic, couple should come to have fertility checkup. Many times, only the woman is tested. Actually, when I looked at the medical files in different hospitals in Israel, there is no medical file for the potential father. It's just redundant on the medical file of the mother. They also writes something about the father, but in some hospitals there's no specific file for the man for his physical examination, for his semen test, et cetera, and for his general health status. So, I think that's something we need to correct and pay much more attention to reproduction of young men and also potentially to the health and probably you, all of us.

Okay we hear the study. What are your solutions? What do you suggest to do? So, first of all, I must say I think that here in Hadassah, we have wonderful IVF units and research units in genetics and in other fields and in andrology and in epidemiology we are thinking about having the Jerusalem male reproduction or environment and health center. We need funding for that. You know what I'm saying? Unfortunately, there is not enough funding, not for male reproduction and not for environmental health. So, if someone want to invest in something that is very meaningful to the future of mankind and I think that in Hadassah we can be world leaders in this field because there is the joke about the two shoe salesmen that came to a poor

country and one send a letter, "No chances of doing business, everyone is walking barefoot." And the other send, "Wonderful chances of doing business, everyone is walking barefoot."

So, the same with male production. People are not walking on that. So, I think we can do, so we should progress in research and study. We need much more research to better understand what impact male reproduction and what the male reproduction impact on other fields. And in parallel, we need to do what we know that is harmful to reproduction and to health better regulate chemicals. We have a very big problem in many countries about that We need global collaboration which is not working well enough, and we need to improve the lifestyle of everyone actually because it's of young men, but it's also of pregnant or want to be pregnant mothers and it's actually for everyone. We need to live better. I think that we tend to neglect public health in general even during COVID, we are focused on COVID, but we should have looked at health in general. The same obese people for example, died much more from COVID and also, they have much more fertility problems. So, we need to understand how we prevent obesity and always prevention is the best medicine. And that's what I was taught when I started as a medical student in Hadassah. And that's what I'm trying to teach others in our faculty of medicine.

Maayan Hoffman:

If you are enjoying this episode, you'll want to check out our previous episode with Dr. Inbal Reuveni, the director of the Women's Integrated Mental Health Service at Hadassah Medical Organization. She talks about research that she and her team are working on that could help determine which pregnant women might develop prenatal depression and anxiety. Although full results are not expected until late 2023, the team has already seen a connection between childhood trauma and depression and anxiety during pregnancy.

Dr. Inbal Reuveni:

It's actually very interesting because we did a study on pregnant women during COVID-19. We followed them up from the first wave of the pandemic till the fourth, about a year and a half. And actually, we published about the first wave, and we found that women who are pregnant were actually less depressed than women who are not pregnant.

Maayan Hoffman:

And now back to our conversation with Dr. Hagai Levine.

Amazing. So, I think it's a great place to come to an end actually speaking so about what you've learned at Hadassah. So just to know final question, maybe talk a little bit about what makes Hadassah so unique, working there is so special, even today. And with that, where you see beyond the clinic that you spoke about is going of what you're doing now, this unique and where you could be in five, 10 years' time if funded and research continues?

Dr. Hagai Levine:

So, I am the head of the Hadassah IRB Helsinki Committee for Data Research. I think that for many years Hadassah excel tremendously on clinical research and on basic science research. I think that the new frontiers is data research. And I know and I am and many others in Hadassah trying to push forward data research. I think that's something we really need to innovate and to see how, for example, in Israel, everyone got a unique ID adverse. And that's a great advantage because you can link, as I did with data from the military, you can link data from different sources, of course the anonymized with the highest ethical standard, et cetera. But it's our obligation to provide from the data, knowledge to provide better health. And I think also better prevention. And so, what we need to do is to build the platform to link data from the military, from the HMOs in Israel, Hadassah, other hospitals together with clinical data and basic science data from Hadassah.

And people speak about big data. So, the point is that you still need the basic principles of having a hypothesis and test it. And so, we need to combine, okay, its new tools, but we need to be very clever in how we use the tools. Because it's very easy nowadays just to run some analysis and find something. But if you don't know what you are looking for, you will not find it. Now it also goes back to the clinic because we have so much information, but in the end, when you sit with the patient, you don't necessarily have the right data on the right time. I happen to have a family member that is treated in Sharrett Institute in the oncology unit, and I know that they are able to have the patient-centered treatment, specifically made treatment. So, it's mind blowing. We need to find this connection between giving what the individual patient needs, but also to think about the health of populations and it's linked.

So, it's a spectrum that is very complex also we say from the molecule to the community. So, it's a wonderful time to be a physician and researcher in general in Hadassah, in specific. We work together, it's always working in teams, and we have the human resources are essential. We live in a very challenging time. We have political challenges, economical challenges, not easy around. We also now with tensions between populations, although we are proud that we are able to work together in Hadassah, people from different communities, but it's not simple. We need to be sensitive for that. And I think we need to be prepared to be flexible to the changing world. And as always, as I said, to focus on prevention, because once people get sick, it's very, very difficult to treat them. Although we are doing that of course. And also, when someone is already sick with one disease, we can prevent the next disease. So, we tried, for example, smoking cessation during hospitalization. I think that's things we have to do and the pioneers in Hadassah in doing such things.

Maayan Hoffman:

Amazing. Wow. Well thank you so much Professor Levine for coming on today, doing this podcast with us and helping to explain your study to all of our listeners. Very important of course. And hopefully when we do speak in five or well before five or 10 years from now, but another time maybe on this podcast about a similar study, we'll be able to find a reversal and

trends from being able to take some positive steps, as you said, toward better public health and just a healthier society in general.

Dr. Hagai Levine:

I am optimistic Maayan, because once we understand that there is a problem as we did mankind, and also here in Hadassah, we will find the solutions. But the first step is to acknowledge that there is a problem. I hope that our seminal study will help to globally to understand that this is a public health problem that must be addressed.

Maayan Hoffman:

I'm sure it will. Thank you so much. It was great to have you on today.

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