

## THYROID - iTherapy

Soot and dust alters thyroid development in fetuses before they are born in smoggy cities, raising concern about health impacts later in life, new USC research shows.

It means before a doctor cuts the umbilical cord or a parent hugs a baby or a sibling gazes at the newest member of the family, the caress of air pollution already reached the womb's inner sanctum. The timing couldn't be worse, as the researchers found that no matter when they checked, thyroid impacts were evident until the final month of gestation.

This is one of the few studies to monitor air pollution effects on a developing fetus and the first to track pollution changes month by month on thyroid hormones. The newly published research paper appears in *JAMA Network Open*.

"Air pollution is bad for adults and children and this study shows it may be bad for the fetus too, despite being protected in the womb," said Carrie V. Breton, corresponding author of the study and associate professor of preventive medicine at the Keck School of Medicine of USC. "Thyroid function is important for lots of elements of life and tweaking that in utero may have lifelong consequences."

USC scientists have been studying the health impacts of urban air pollution for a generation under the Children's Health Study. It's one of the world's largest ongoing research efforts looking exclusively at how dirty air harms kids. USC is situated in the Los Angeles region, home to historically severe urban smog, an ideal laboratory to study air pollution health effects and environmental change across time.

Since the effort began in 1992, various USC researchers have documented how air pollution contributes to school absences, asthma, bronchitis and lost-lung function. Conversely, as air quality has improved due to regulations and technology innovations, scientists have been able to track improvements in children's health.

In the new study, the research team focused on 2,050 newborns, people who had been enrolled in the Children's Health Study previously. They selected them using birth data from the mid-1990s, when they were elementary school students at 13 Southern California schools.

The participants were included only if they had blood tests taken right after birth and had complete monthly exposure measures for air pollution throughout pregnancy. The scientists checked blood levels for total thyroxine (TT4), a hormone secreted by the thyroid gland.

The researchers found that when exposure to PM2.5 increased by 16 micrograms per cubic meter of air (roughly the volume of a dishwasher), TT4 levels in blood increased 7.5 percent above average levels in babies. When exposure to PM10 increased by 22 micrograms per cubic meter, TT4 levels increased by 9.3 percent, according to the study. They did not see the same increases associated with other air pollutants, such as ozone or nitrogen dioxide.

Moreover, exposures during months three to seven of pregnancy were most significant for PM2.5, which are typically sooty particles 20 times smaller than the diameter of a human hair. PM10 exposure during one to eight months of pregnancy was associated with significantly higher

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newborn TT4 concentrations. PM10 are airborne particles, 10 microns in diameter, which often comes from dirt dust and pulverized road grit.

The findings show that the fetal thyroid gland seems particularly susceptible to airborne particulate, especially during early- to mid-pregnancy, according to the study. It's consistent with previous studies by other researchers that show industrial chemicals, tobacco smoke and indoor air pollution impact the thyroid gland.

However, the study did not assess the health effects of the air pollution exposures. Thyroid hormones are critical for regulating fetal growth and metabolism and play important roles in neurodevelopment. Even subtle changes in maternal thyroid function during pregnancy have been associated with reduced fetal growth and cognitive deficits in children, with detrimental effects observed for both low- and high-levels of thyroid hormones, the study found. Also, the study only looked at one hormonal pathway associated with the thyroid gland, which the authors acknowledge is a limitation.

Nonetheless, the findings underscore that air pollution penetrates deeply within the human body to reach the most vulnerable people of all -- unborn babies. Breton said it's a wakeup call not only for smoggy places like California and the United States, but rapidly industrializing cities around the world.

"There are several places around the world where air pollution is skyrocketing," Breton said. "This is another example of an environmental exposure that affects early development in subtle ways, and we don't know the health consequences."

Thanks to the technology development in last decade, solution for prevention of this problem was developed in Croatian center for innovative technologies – Crystal Idea, Split.

The solution is called iTherapy and particles as PM2.5 and PM10 and also volatile organic compounds are removed significantly already in the first 5 minutes of working in a closed environment, while in 30 minutes they are almost completely (95%) removed and the IAQ-index of air quality returns to healthy.

iTherapy reaches healthy environment parameters in a closed space in an automatic and user-friendly way, continuing to monitor air parameters by sensors. iTherapy reports air quality changes by LED light change, which is important to educate the users and the best example are people who change unhealthy habits and stop using certain pollutants in everyday life in the workplace or home, contributing to their general health condition.

iTherapy technology and its efficiency were tested under worldwide accepted and strict protocol JEM 1467, based on what iTherapy was placed on the market as a high-technology solution for air quality and took some of the most significant awards as the one for The Best European Inventor in Nuremberg, Germany 2018, and the one for the World's Best Innovation, Istanbul, Turkey 2019.

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